

Enterprise Architecture Management Tool Survey 2005

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About sebis

sebis is the chair "Software Engineering for Business Information Systems" at the Institute for Informatics of the Technische Universität München. *sebis* is partially funded by the Ernst Denert-Stiftung and headed by Professor Dr. Florian Matthes. The main research areas of *sebis* are:

- Software cartography: Development of multi-faceted and formal models that help to manage (plan, build, operate, optimize) complex software application landscapes consisting of hundreds or thousands of information systems.
- Innovative technologies and software architectures for information and knowledge management (enterprise solutions, groupware and social software).
- Security for business applications.

sebis is using software engineering methods (model construction & abstraction, analysis & design, construction & evaluation) and is working in close relationship with industrial partners and with organizations from the public sector.

Professor Matthes puts particular emphasis on the knowledge transfer from academia to industry. For example, he is co-founder of CoreMedia AG, of infoAsset AG, and of 20six Web log services AG, which at present employ a total of approx. 150 employees.

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Abstract

The number of information systems supporting various business processes and the geographical and organizational distribution of these systems together with their interdependencies have led to complex structures in today's companies. Enterprise architecture management is coping with these complex structures and is concerned with the *alignment of business and IT*. Enterprise architecture management therefore not only deals with the information technology but also with business processes, organizational structures, strategies, projects, etc.

To manage, plan, and control the enterprise architecture companies started to document the artifacts mentioned above, especially their interaction and dependencies. The high amount of information to be gathered for managing the enterprise architecture increases the need for a tool based approach, enabling a collaborative management process involving users performing different roles. An appropriate tool must not only capture relevant information, it must also process these information, using e.g. reports or visualizations supporting the users when performing different enterprise architecture management tasks.

This survey not only analyzes major players in the emerging market of enterprise architecture management tools, it also gives a brief introduction to typical tasks in enterprise architecture management using a scenario based approach. The scenarios and the list of criteria were built in cooperation with major players acting in different markets.

Each evaluated tool is analyzed by simulating different scenarios and analyzing specific functionalities necessary for enterprise architecture management. The evaluation of the tool is categorized into two parts: One part is dealing with specific functionality, e.g. "configurability of the metamodel", "coverage of enterprise architecture management concepts by predefined metamodel", "richness of predefined visualization techniques". The second part analyzes the tools' enterprise architecture management support, e.g. "landscape management", "project portfolio management", "application architecture management". Using these evaluation structure readers have the possibility to find out how tools fulfill their individual needs.

Acknowledgment

We thank the industry partners of our research project *Software Cartography* for sharing their insights into enterprise architecture management with us, greatly influencing the list of criteria and the scenarios this survey report is based on.

We also thank all participating tool vendors for their support and open information policy. We would like to express our gratitude for their patience and their readiness to provide training and support on short notice.

Last but not least we want to thank Michael Besler, Cristina Dorobantu, and Claudius Hauptmann for their careful and detailed support simulating the evaluation scenarios with the tools provided.

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CHAPTER 1

Introduction

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The complexity of the information technology (IT) used in enterprises has grown during the last decades. IT started as a support function becoming more and more relevant for business by increasing efficiency. Today IT also plays the role of an enabler making it possible to put new strategies and processes into practice, but it may also represent a barrier in the realization of opportunities. This growing role of IT has led to the awareness that business and IT have to be managed as a whole i.e. enterprise architecture (EA). The high number of applications and interdependencies between IT and business makes the EA management process increasingly difficult to execute without tool support.

The market for EA management tools has to be seen as an emerging market; vendors from different areas (e.g. testing, process modeling, and metamodeling) are entering this market. Therefore many different approaches are made use of in EA management, each with its individual strengths and weaknesses.

Introducing an EA management tool represents a major investment, therefore a careful decision which tool is to be used has to be taken. Some of our project partners have already chosen a specific tool and others are in the process of choosing, thus being able to contribute their individual experience to our list of criteria. Furthermore, they have provided us with practical examples for tasks relevant to EA management, which we used to build scenarios for tool simulation. Based on this input and on our research, the survey gives an overview of major players in the emerging market of EA management tools and shows how a particular tool manages to address different areas and different processes related to EA management.



Figure 1.1: Participating partners of our tool survey

Two goals pursued in this survey are first, to provide a structured decision support for companies searching an adequate EA management tool and second, to aggregate practical user requirements for EA management tools. The evaluation does *not* lead to a simple ranking of the tools but to a *scorecard* based on the criteria and the scenarios. Companies can match requirements with the scorecard, in order to find out which tool best satisfies specific needs. Tool vendors will benefit from a comprehensive list of requirements formulated in cooperation with industrial users as well as from the evaluation that might help refining the tool's profile.

1.1 Motivation & Participating Partners

In our research project *Software Cartography* we are developing methods and modeling techniques for documenting, evaluating, and planning application landscapes. We have introduced the concept of *Software Maps* visualizing the application landscape and showing parts of the EA. In this project we cooperate with several industry partners and have been asked on multiple occasions by some of our partners, to provide decision support for choosing an EA management tool.

Firstly, we built an initial version of the list of criteria covering different functionalities EA management tools should have (see section 3.2). Secondly, we developed the scenarios for simulating EA management tasks (see section 3.3). Finally, using the input from project partners, we have refined and consolidated the list of criteria and scenarios during a workshop. After consolidating the updated list of criteria, the tool vendors were given an online questionnaire. In parallel to the vendors filling out the questionnaire, we simulated the scenarios with each chosen EA management tool in our computer lab.

The industry partners participating in this survey are: AMB Generali Informatik Service, BMW Group, Deutsche Börse Systems, Deutsche Post, Kühne + Nagel, Münchener Rück, Siemens, T-Com, TUI.

Name of Vendor	Name of Tool(s)	URL
AB+ Conseil	SOLU-QIQ	http://www.abplusconseil.com
Adaptive, Ltd.	Adaptive EAM	http://www.adaptive.com
Agilense, Inc.	EA WebModeler	http://www.agilense.com
alfabet AG	planningIT	http://www.alfabet.de
ASG, Inc.	ASG-Rochade	http://www.asg.com
BOC GmbH	ADOit	http://www.boc-eu.com
Casewise Ltd.	Corporate Modeler Suite & ITAA	http://www.casewise.com
Flashline, Inc.	Flashline 4	http://www.flashline.com
GoAgile	GoAgile MAP	http://www.goagile.com
IDS Scheer AG	ARIS Toolset	http://www.ids-scheer.com
LogicLibrary	LogiScan & Logidex	http://www.logiclibrary.com
MEGA International SA	MEGA	http://www.mega.com
Mercury Interactive Corp.	IT Governance Center	http://www.mercury.com
Orbus Software iServer for EA	iServer	http://www.orbussoftware.com
process4.biz ^a	process4.biz	http://www.process4.biz
Proforma Corp.	ProVision Modeling Suite	http://www.proformacorp.com
Telelogic AB ^b	System Architect	http://www.telelogic.com
Troux Technologies, Inc. ^c	Metis	http://www.troux.com
Visible Systems Corporation	Visible Advantage	http://www.visible.com

Table 1.1: Vendors and Tools in the Area of EA Management

^aprocess4.biz GmbH was formerly EiTAM, Inc.; product *EiTAM* was renamed to *process4.biz*^bTelelogic AB acquired Popkin Software, Inc.^cTroux Technologies, Inc. acquired the *Metis* product suite from Computas AS

1.2 Overview and Analyzed EA Management Tools

At the beginning of this tool survey we compiled a list of vendors, positioning their tools in the field of EA management. Having compiled this list we began a discussion with our industry partners, in order to concentrate our efforts on those tools that were of major interest. The list of tools identified is shown in table 1.1. The shortened list with the tools, which have been selected for evaluation (with the denoted versions) is shown in table 1.2.

Name of Vendor	Name (Version) of Analyzed Tool
Adaptive, Ltd.	Adaptive EAM (v3.0.306)
alfabet AG	planningIT (v1.0)
BOC GmbH	ADOit (v2.0)
Casewise, Inc.	Corporate Modeler Suite (v9.1) & IT Architecture Accelerator (v3.6)
IDS Scheer AG	ARIS Toolset (v6.2.3)
MEGA International SA	MEGA (v6.1)
process4.biz GmbH	process4.biz (v4.07)
Telelogic AB	System Architect (v10.1.11)
Troux Technologies, Inc.	Metis (v3.6)

Table 1.2: Analyzed EA Management Tools

Also of particular interest was the tool *Mercury IT Governance Center* from Mercury Interactive Corp., which was not evaluated in detail. The reasons for not evaluating the tool and a vendor's profile are given in chapter 10.

During the survey (beginning in December 2004 and lasting until August 2005), changes in the rapidly developing market for EA management tools have taken place, e.g. the purchase of Computas' EA management product *Metis* by Troux Technologies Inc. Two more changes concerning the companies whose tools were participating occurred during the survey: EiTAM Inc. was renamed to process4.biz GmbH, subsequently renaming the distributed tool from *EiTAM* to *process4.biz*. Popkin Software Inc. was acquired by Telelogic AG.

1.3 Structure of EA Management Tool Survey

Chapter 2 provides an executive summary with definitions of the main criteria used for the evaluation. These criteria also make up the kiviatic axes used for high-level graphical representation of the evaluation results. This graphical representation of high-level analysis results, together with a statement of special high- and lowlights of the tools, is also part of the executive summary. Chapter 3 presents our approach for this survey in detail, starting with a description of our understanding of EA management, continuing with an overview of the list of criteria and the EA management scenarios simulated during the evaluation.

In the identically structured chapters 4 to 13 each single tool is analyzed. These chapters consist of descriptions for every kiviatic axis and how the tool evaluated is capable of fulfilling the requirements assigned to the corresponding axis. This leads to the last section of each chapter, the *tool vendor's profile*, written by the tool vendor and representing the tool vendors' own view. Chapter 10 is included to outline the special situation concerning Mercury's product *Mercury IT Governance Center* and to present the tool vendor's profile. This report is concluded by a summary (see chapter 14), recapitulating the *lessons learned* from this survey.

1.4 Scope of the EA Management Tool Survey

The understanding of what EA management is about and what it is not about varies widely. In chapter 3.1 we will introduce our understanding and the understanding of our partners what EA management is about.

What this survey is specifically not(!) about is *business process modeling and management, systems management, testing (functional, coverage, regression, load)*, etc. In general, this survey deals with *architecture management, application management, infrastructure management, multiproject and synchronization management, portfolio management, and strategy management*. In the context of EA management the above areas have to be considered with a high level of abstraction. Project management in EA management means, that the information of projects is linked to other information objects of the EA management process (e.g. linking projects with application systems). Details about people, resources, and activities are not of relevance.

Other parts of the survey deal with criteria about architecture management, impact analysis, and strategy management. Thereby, exemplary questions an EA management tool should be able to help answer are:

- What does my business and IT architecture look like? How will the application landscape look in the future?
- What happens if an object is changed? Which other objects in the EA are affected?
- Which action items and goals are derived from which strategies and how do they affect the EA?

The list of criteria deals with requirements of the above tasks and the scenarios will be the proof of concept for EA management support.

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This chapters briefly summarizes the results of the EA management tool survey. It will introduce the kiviati diagrams¹ and their axes, which we developed for comparing and rating specific functionality and EA management support (section 2.1). Afterwards these kiviati diagrams are used to give an overview of the results of the tool evaluation (section 2.2).

Besides two kiviati diagrams, a short textual description is given for every tool evaluated. Detailed information about the results is provided in an additional chapter for every tool evaluated.

¹Also known as spider diagrams.

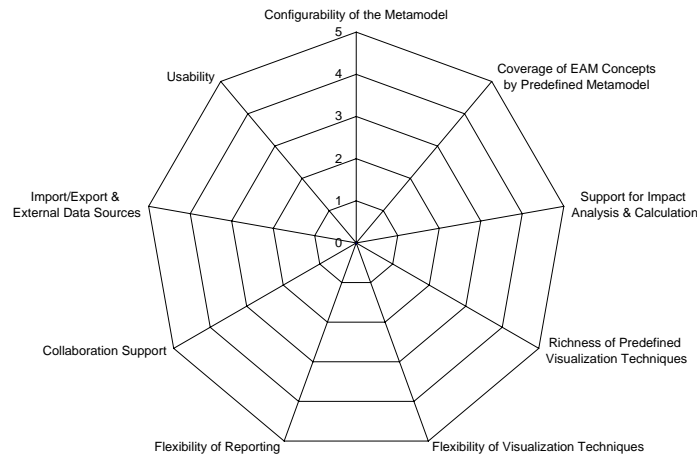


Figure 2.1: Kiviatic diagram visualizing specific tool functionality (see text)

2.1 Introducing kiviatic diagrams for evaluation

Our evaluation focuses on different aspects of the tool’s overall performance. Reflecting this we developed two kiviatic diagrams, each concerned with particular aspects of the tool’s capabilities. Section 2.1.1 will introduce the kiviatic diagram, which evaluates the tool’s specific functionalities like metamodeling support, visualization techniques, import/export, etc. The second kiviatic diagram deals with EA management support e.g. synchronization management, portfolio management and is introduced in section 2.1.2. In both kiviatic diagrams we use a rating between 1 (low capability) and 5 (high capability) for each axis.

2.1.1 Kiviatic Axes for Specific Functionality

The kiviatic axes described in this section (see figure 2.1) are derived from the main concerns addressed in the list of criteria (see section 3.2) and the simulation of the scenarios for analyzing specific functionality (see section 3.3.1).

The axis *Configurability of the Metamodel* reflects the possibility to adapt the supplied metamodel of the tool in order to match the metamodel used for EA management within an enterprise. We evaluate the possibilities to create, edit, and delete entities, attributes, and relationships. Furthermore we evaluate, if it is possible to supply default values for an attribute or to flag it as *mandatory*. Also the richness of the type system supplied is taken into consideration. How these configurations can be performed is also reflected in this axis’ ranking, e.g. if a graphical user interface for performing these changes is available or if a kind of scripting language has to be used. Additionally we consider if the *customer* is provided with the needed functionality to adapt the metamodel to individual needs or if only the vendor is capable of changing the metamodel, which leads to a lower ranking.

The axis *Coverage of EAM Concepts by Predefined Metamodel* is concerned about the metamodel shipped with the evaluated tools. We examine the complexity of this metamodel, e.g. ”Do the metamodel’s artifacts cover all relevant aspects for EA management?” or ”Is the metamodel based on a framework or a standardized methodology?”. Another important part of the evaluation is, if it is possible to map the data of our scenarios to the predefined metamodel, as this is a way of estimating the practical value of the metamodel. Additionally we are interested in the documentation of the metamodel with its extent and quality.

The axis *Support for Impact Analyses & Calculation* mirrors the ability of the tool to perform calculations or impact analysis based on the data contained in the repository. Calculations in this specific case refers to summing up or deriving averages of values of an entity's attributes as well as of a transitively linked entity. Impact analysis employs traversing specific associations and filtering the resulting data according to the particular needs. It is especially of interest with this axis, whether these capabilities are built into the tool's graphical user interface, if they are achievable through a query language, or if they have to be added by the user programmatically.

The axis *Richness of Predefined Visualization Techniques* focuses on the presentation capabilities shipped with the tool. The techniques to be evaluated in this category contain common forms of visualization techniques and diagram types such as *portfolio matrixes* and *software maps* (see appendix A). The tool's built-in ways of visualizing specific relationships between entities, e.g. a *part-of* relationship by using containment also contributes to the evaluation result for this axis. This may also include the convenient support of zooming in and out in the diagrams and the implementation of a principle for optionally hiding complexity, e.g. layering or object containment with closable containers.

On the one hand the axis *Flexibility of Visualization Techniques* refers to the tool's capabilities of defining new visualization templates. In this context *template* means *kind of visualization*, not instance - thus defining a new template creates a new format of diagram with rules defining the entities to be displayed and manners how they shall be displayed. This templating does not necessarily contain capabilities of performing automated layout, although this function would contribute to a positive ranking. On the other hand this axis is about the tool's support for manual adaptations to existing and possibly automatically generated diagrams and its support of persisting such changes. In this context it is also relevant how a tool can consider and not override user layouting when performing automated changes on a diagram. This capability is especially of interest regarding the recognition of structures by the user in the visualization, e.g. by placing the same application system at the same location, even if a more optimal layout would be possible. Additionally this axis covers the question, whether the tool supports a separation between entity and its graphical representation thus e.g. enabling the use of different symbols for the same entity on visualizations of a different kind.

The axis *Flexibility of Reporting* is about the tool's capabilities of creating tabular reports of the repository data. There are several dimensions of configurability which are of interest concerning this ability. First, configurability of the selection of entities reported, whether there is a way to filter the entities by particular criteria or not. These filtering criteria might be of a certain complexity including boolean expressions on values of standard and user-defined attributes. Second, configurability of the projection of the attributes reported. Although it is of a certain interest, if the tool can report all attributes of an entity type including user defined attributes in a convenient manner, it is also important, that this set of attributes can be customized in order to create specially adapted reports.

The axis *Collaboration Support* firstly refers to the collaboration support provided by the tool, whether concurrent working on the same data is possible or not and which limitations to concurrent work exist. It is of interest, if role or user based access control is possible and on which levels of granularity it can be configured, e.g. on model-level, entity-level, attribute-level and which kinds of access rights can be granted. The availability of a web front end with limited or limitable editing capabilities as lightweight input interface or reader also contributes to a positive ranking in this category, as well as the availability of clients for offline working, which means working without having access to the repository. In this context the tool's versioning capabilities for collaborative work on the model elements' level are evaluated, concentrating on features, which help the users to merge independently edited models or parts of them allowing to resolve version conflicts automatically if possible.

The axis *Import/Export & External Data Sources* is about the tool's capabilities of importing and exporting data in different formats. These capabilities are particularly important, as companies often have gathered information prior to introducing an EA management tool. Importing especially is about the tool's support of spreadsheet data formats like Microsoft Excel spreadsheets (XLS) or comma separated values (CSV) files, as well as its support of importing data from XML files.

The functional part of importing regards, if any entity type can be imported or if importing is limited to just a few types, if all attributes of the entity or only a subset of them can be imported. Very crucial for the evaluation are also the tool's capabilities of importing relationships especially from their various representations in tables. Exporting capabilities are about the supported data formats, both tabular and hierarchical formats, but not restricted to formats and their customization. The last part of criteria reflected in this axis refers to the tool's capabilities of making use of data under the control of an external repository without having to copy this data e.g. by using an API.

The axis *Usability* refers to the general user experience. It does not reflect if a specific functional task could be accomplished, but it reflects how simple or complicated it was to use the provided functionality. Qualities in regard to this axis could be, but are not limited to intuitive and well structured menus with articulative names, consistent property editors, that allow editing model data without requiring many different editors or editing dialogs, and a supportive, well indexed help system with a continuous wording and clear examples. This axis reflects the subjective impression resulting from the tool analyses and the scenario simulation. Especially pitfalls are considered in this ranking.

2.1.2 Kiviat Axes for EA Management Support

The kiviak axes described in this section (see figure 2.2) correspond one-to-one to the scenarios in section 3.3.2. The simulation of these scenarios leads to the rating on the axes.

The axis *Landscape Management* considers the future planning and development of the enterprise application landscape. To do so, there has to be the possibility to create scenarios based on the current application landscape. The current, planned, and target landscape should be analyzed using three different views. The current landscape represents the landscape as is; the planned landscape shows the landscape which develops through the projects changing the current landscape up to a specific date. The target landscape as a long term perspective shows the envisioned state of the architecture of the landscape, maybe without projects already defined to reach this state. We evaluate the abilities of the tools to support these concepts.

The *Project Portfolio Management* axis covers the management of projects on an EA management level of abstraction, including their proposal, selection, and approval or cancellation. These projects may be targeting the various parts of the enterprise architecture, thus being connected with several artifacts from all the other EA management layers like business processes, business objects, business applications, architectures, etc. (compare the information model in section 3.1.2). The integrated process of project portfolio management should be facilitated by the EA management tool.

The axis *Synchronization Management* is about the tool's capabilities to support multiproject management after the selection of projects has been finished. Of course, multiproject management in this context has to be seen at EA management level, project dependencies between new and already running projects have to be coordinated and their relationships to other artifacts of the EA must be identified and managed. This is especially one of the major activities, when projects changing the same artifact of the enterprise architecture have to be rescheduled due to the delay of one project. Therefore, this activity is called *Synchronization Management*.

The axis *Traceability and Strategy Management* covers the management of strategies and goals the enterprise pursues. To control the fulfillment of the goals defined, concepts like Balanced Score Cards can be introduced. Additionally it may be desirable to have earlier made decisions documented and traceable. Those functionalities may cover many artifacts of EA management, not limited to projects and should be available in an integrated manner within the EA management tool.

The *Management of Business Objects and Business Services* axis refers to the tools capabilities to manage business objects and their relations to processes and services. A business object is a representation of an artifact or concept of relevance for business life. They are characterized by type, name, description, and attribute values, status, and relationships. A business service provides access to one or more business objects. Application systems using business objects should be linked to those objects.

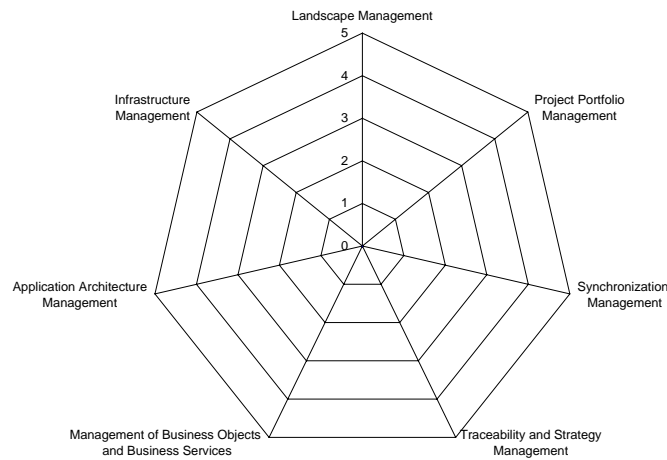


Figure 2.2: Kiviatic diagram visualizing tool support for EA management tasks (see text)

The axis *Application Architecture Management* deals with the technologies and architectures which should be managed by the tool. The concept of an architectural blueprint aggregating abstract technologies and architectural solutions aggregating technologies is evaluated. As an example a *4-tier-thin-client-architectural blueprint* may be made up of a thin client, a web server, an application server, and a database management system; a corresponding architectural solution would realize the blueprint using, e.g. an Apache HTTP-Server as a web server, a BEA WebLogic Server as an application server, etc. Such constructs can then be attached to business applications. The goal of application architecture management is to consolidate and homogenize the used architectures for business applications.

The axis *Infrastructure Management* is about managing infrastructure elements, such as middleware and hardware systems, storage services, etc. used by business applications and services. Infrastructure management is about optimizing IT operations, ensuring infrastructure service quality, and reducing operating and maintenance costs. This may be achieved e.g. by consolidating infrastructure elements for homogenization purposes and consolidating resources for cost reduction. The tool may help to identify a call for action concerning infrastructure elements.

2.2 Tool Evaluation at a Glance

The following sections contain the aggregated and consolidated results of the tool evaluation. For each tool the two kiviatic diagrams *specific tool functionality* and *EA management tasks* show the results of our scenario simulation and information provided by the tool vendors according to the list of criteria. Additionally each section contains a short abstract for each tool giving a brief introduction to the approach the tool takes to support EA management.

For each axis of the kiviatic diagrams the evaluation results in a value from 1 to 5. Nevertheless the values are not interval scaled, we only use an ordinal scaled axis, thus just representing a ranking. Transferred to the kiviatic axes used for evaluation this means that a tool rated 4 on one axis is better than a tool rated 3, but this does not provide information to derive *how much better* the 4 rated tool is.

Finally we want to emphasize that a rating of 5 does not mean that no potential for further improvement is retained. We rate 5 on an axis if the goals are almost achieved and consistency as well as integration are given. For a detailed evaluation please have look at sections 4 to 13.

2.2.1 Evaluation of *Adaptive EAM* from Adaptive Ltd.

Adaptive EAM is a tool based on a MOF 1.4 compliant repository, which provides an infrastructure for documenting and planning enterprise architectures. Centered around the powerful repository, a widely configurable web interface, a Microsoft Visio client, and flexible data exchange capabilities make up an impressive instrument for supporting EA management. According to Adaptive the upcoming version will be compliant with MOF 2.0.

In contrast to many competitors, *Adaptive EAM* does not only see itself as a tool that is meant to support EA management in an organization on its own. It is a software that is able to act as the *glue* between several other tools used in this field, providing additional value by tool integration. With these abilities, making use of the Adaptive repository is not limited to EA management but also reaches into other repository related activities, e.g. model exchange and storage in model driven architecture.

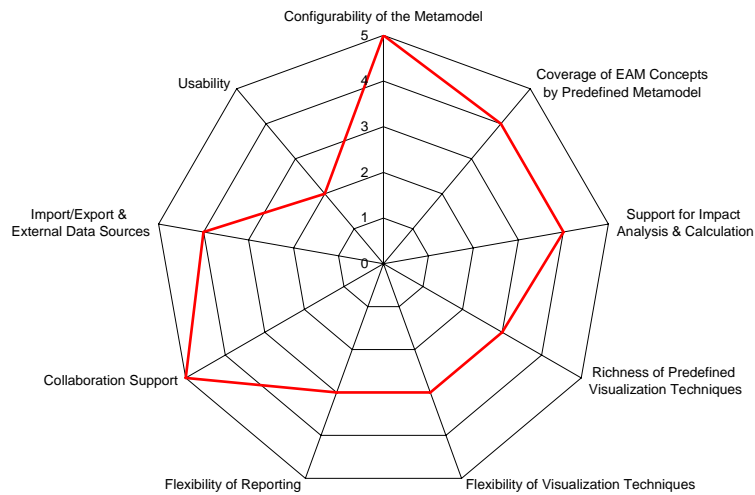


Figure 2.3: *Adaptive EAM*: kiviati diagram for specific tool functionality

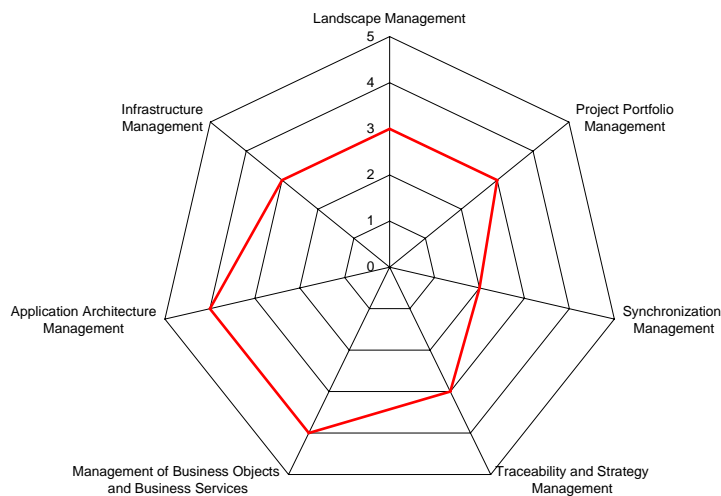


Figure 2.4: *Adaptive EAM*: kiviati diagram for EA management tasks

2.2.2 Evaluation of *planningIT* from alfabet AG

The EA management tool *planningIT* uses a process oriented approach integrating modules for e.g. demand management, EA management, application architecture management, and project portfolio management. The approach of *planningIT* focuses on the integrated planning process of the EA by linking these modules into one application.

planningIT is the only tool evaluated that uses an integrated planning process. This approach leads to numerous out-of-the-box functionalities: a predefined, ready to use metamodel, predefined diagram types, and – as a major point – a given methodology. The tool is designed to support large, multi-functional teams that collaborate in an EA management process striving for a tighter alignment between business and IT. For each EA management task, which can be performed using *planningIT*, users are supported with a predefined process integrating into other supported EA management tasks.

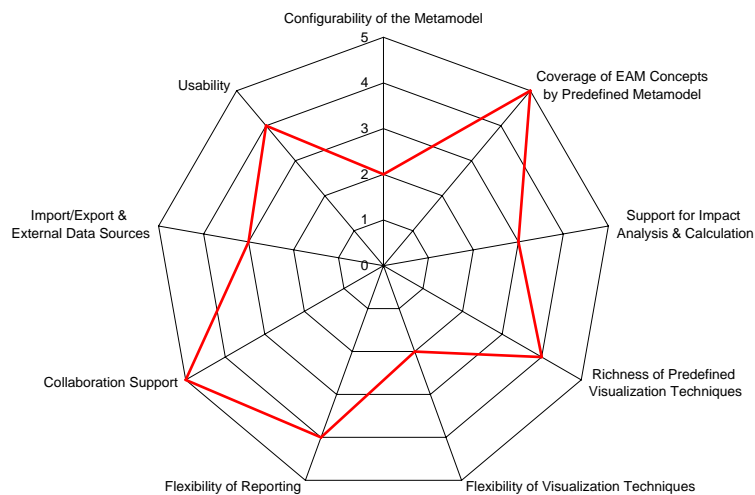


Figure 2.5: *planningIT*: kiviati diagram for specific tool functionality

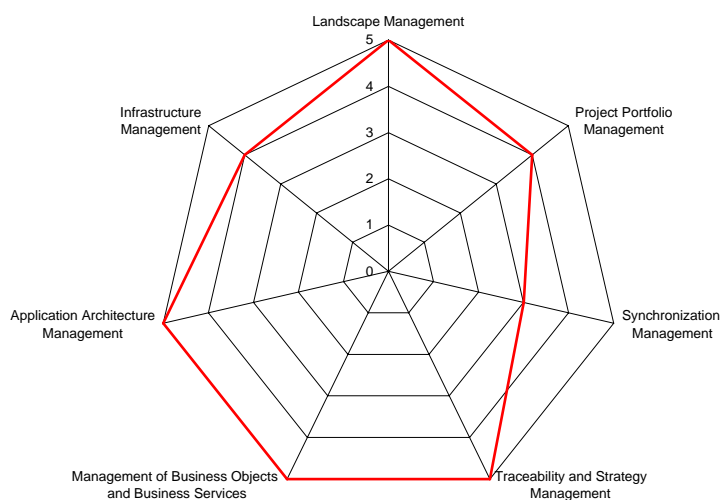


Figure 2.6: *planningIT*: kiviati diagram for EA management tasks

2.2.3 Evaluation of *ADOit* from BOC GmbH

ADOit pursues a methodology driven approach, providing predefined diagram types and a predefined metamodel. For each layer of the metamodel, like e.g. business architecture, application architecture, and software architecture, different diagram types are available, which define the usage of entity and relationship types. Additionally, a set of methods for conducting cross layered impact analysis is predefined and can be extended by BOC.

ADOit is based on BOC's metamodeling platform. The change of the underlying metamodel by metamodeling functionalities such as creation of new object types, relations, and attributes are done by BOC consultants. Other adaptations (e.g. changes to existing attributes) of the existing metamodel can be done by the customer himself. BOC further offers add-ons especially designed for meeting EA management demands that can be used to tailor and augment *ADOit* in a customer specific way.

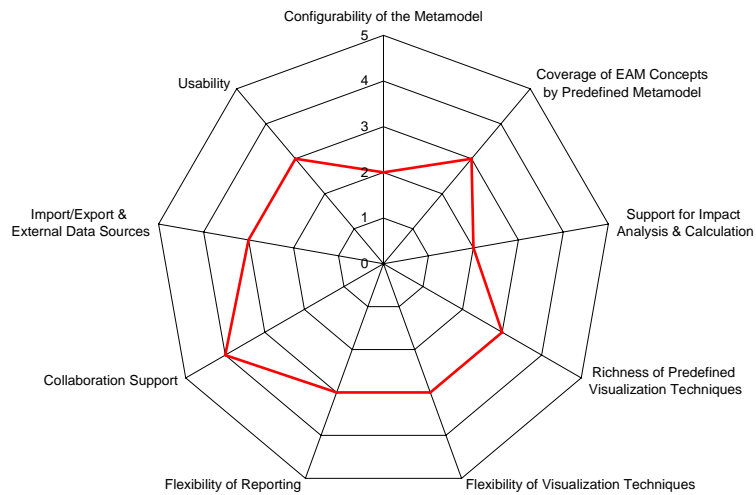


Figure 2.7: *ADOit*: kiviati diagram for specific tool functionality

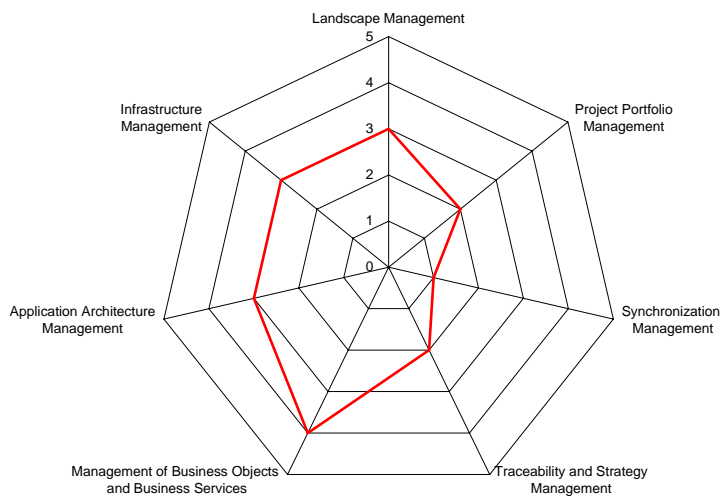


Figure 2.8: *ADOit*: kiviati diagram for EA management tasks

2.2.4 Evaluation of *Corporate Modeler Suite* and *ITAA* from Casewise Ltd.

The *Corporate Modeler Suite* and the *IT architecture accelerator (ITAA)* pursue a model driven approach toward EA management. This approach focuses on an *easy to learn, easy to use* graphical interface for editing model data and providing a similarly interface for applying changes to the metamodel. Additionally the browser based editing and reading capabilities enhance the multiuser support.

The lightweight metamodel shipped, leverages the user to quickly put the *Corporate Modeler Suite* into action. The flexibility of the visualizations and of the metamodel offers the possibility to define and roll out an individual methodology for the EA management process.

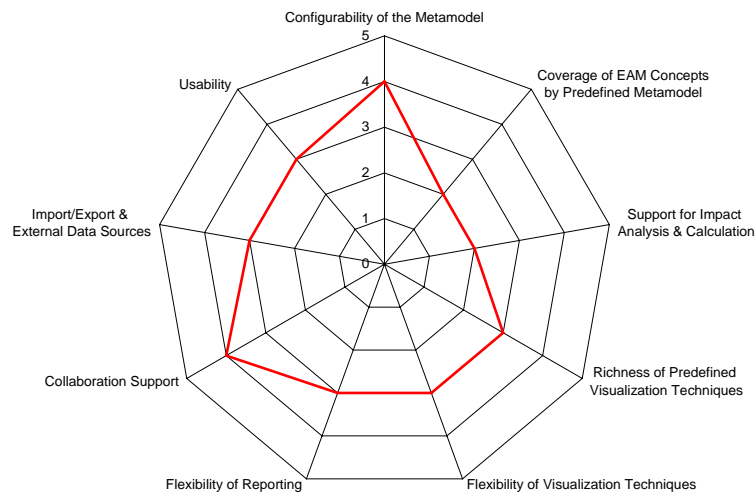


Figure 2.9: *Corporate Modeler Suite* and *ITAA*: kiviati diagram for specific tool functionality

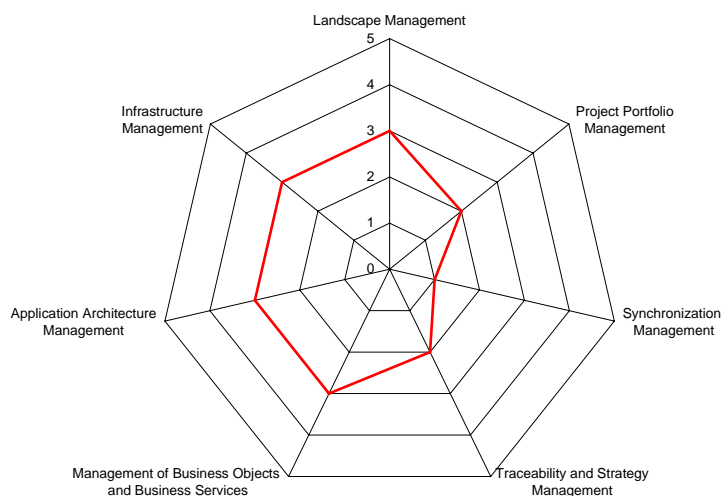


Figure 2.10: *Corporate Modeler Suite* and *ITAA*: kiviati diagram for EA management tasks

2.2.5 Evaluation of *ARIS Toolset* from IDS Scheer AG

The *ARIS Toolset* pursues a methodology driven approach, providing predefined diagram types and a ready to use metamodel. For each diagram type the methodology defines the usage of entity and relationship types as well as the concerns addressed. A generic diagram type and various configuration capabilities provide additional flexibility to model scenarios, arising from demands not covered by the given methodology.

Originating from the field of business process management the *ARIS Toolset* additionally provides functionality to fulfill EA management tasks. Due to the integration of process- and IT-information in one repository *ARIS* offers the possibility to create a coherent view in the meaning of an EA.

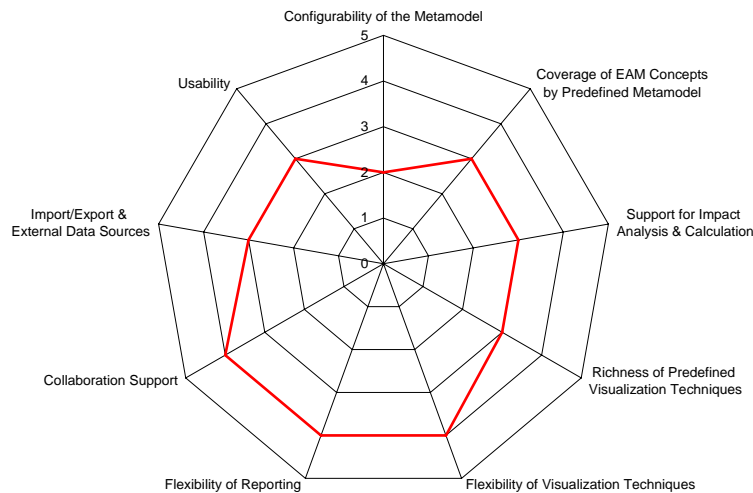


Figure 2.11: *ARIS Toolset*: kiviati diagram for specific tool functionality

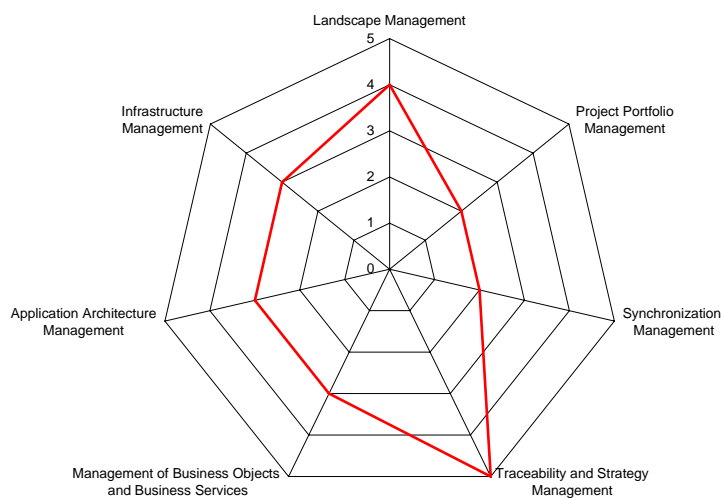


Figure 2.12: *ARIS Toolset*: kiviati diagram for EA management tasks

2.2.6 Evaluation of *MEGA* from MEGA International SA

MEGA pursues a metamodel driven approach toward EA management by providing a highly flexible metamodel further complemented by modelling guidelines. Both metamodel and guidelines can be adapted to completely fit customer demands arising from their EA management approach. The tool additionally offers the possibility for customizing parts of the graphical user interface, as well as the diagram types available for creating visualizations.

Working with *MEGA* the customer is supported by an *easy to use* graphical user interface, which is mainly handled via tree structures. This approach is supplemented by highly flexible visualizations, resulting in diagrams and reports illustrating the information needed to perform EA management.

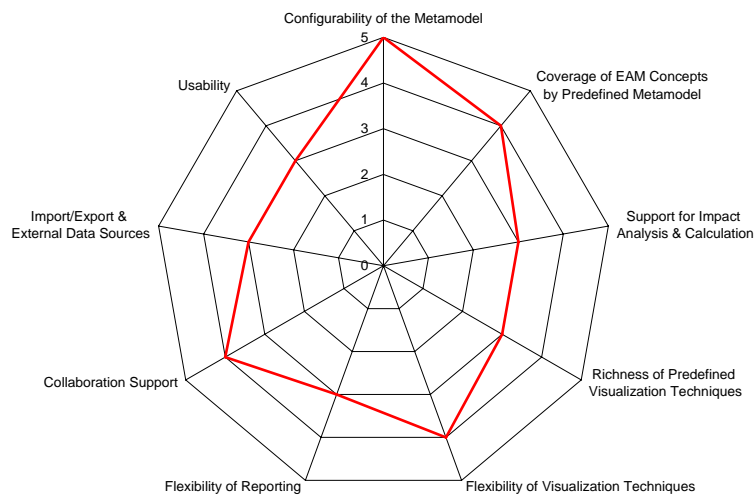


Figure 2.13: *MEGA*: kiviati diagram for specific tool functionality

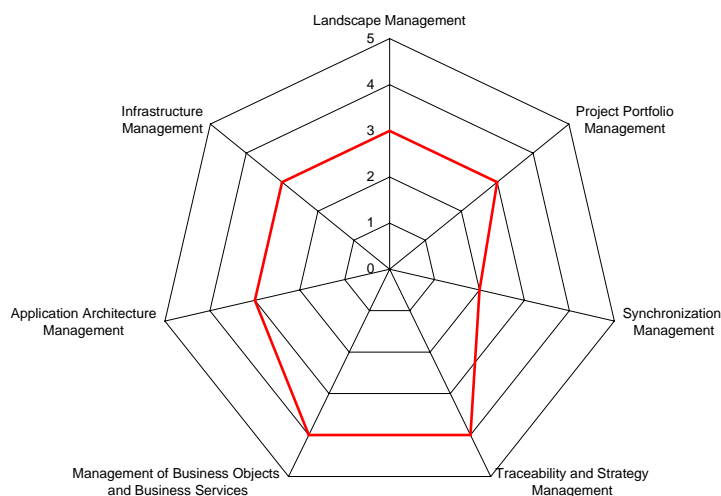


Figure 2.14: *MEGA*: kiviati diagram for EA management tasks

2.2.7 Evaluation of *process4.biz* from process4.biz GmbH

process4.biz is a lightweight tool, which is heavily rooted in the Microsoft World and built around Microsoft Visio as the main component of the graphical user interface together with a Microsoft SQL Server as the repository. The Microsoft Visio based diagramming capabilities provide high flexibility for creating visualizations. These diagramming capabilities paired with a lightweight approach for supporting EA management, also result in a tool, which is easy to deploy and easy to learn.

With its features for collaboration and distributed repository access, *process4.biz* goes beyond being a mere modeling tool but provides a platform for supporting EA management in an organization.

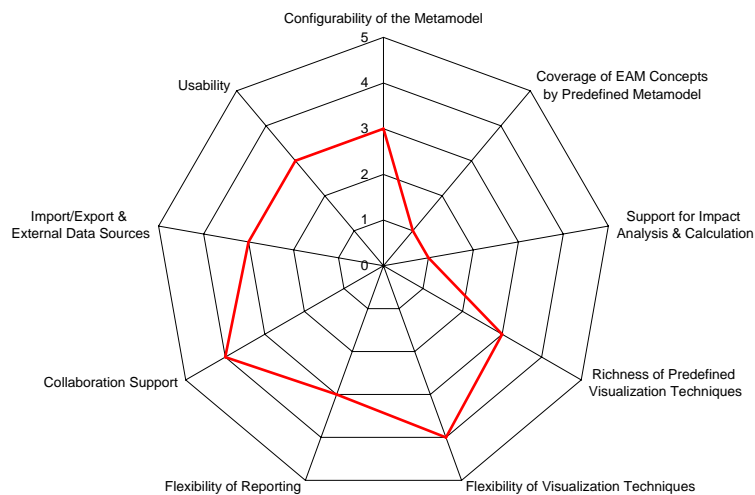


Figure 2.15: *process4.biz*: kiviati diagram for specific tool functionality

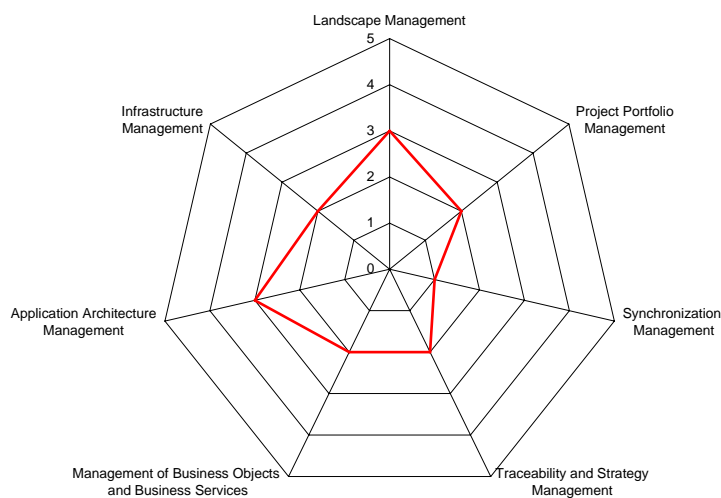


Figure 2.16: *process4.biz*: kiviati diagram for EA management tasks

2.2.8 Evaluation of *System Architect* from Telelogic AB

System Architect pursues a metamodel driven approach, supported by an easy to use, customizable graphical user interface. Besides being shipped with a large metamodel conforming to standard frameworks, *System Architect* additionally offers the possibility to adapt the metamodel according to customer demands. Metamodel adaptations may also change available diagrams and symbols used for visualizing the EA.

Impact analysis is a major strength of *System Architect*. A SQL-like query language is able to create graphical, as well as textual reports, enabling the customer to analyze important aspects of the EA.

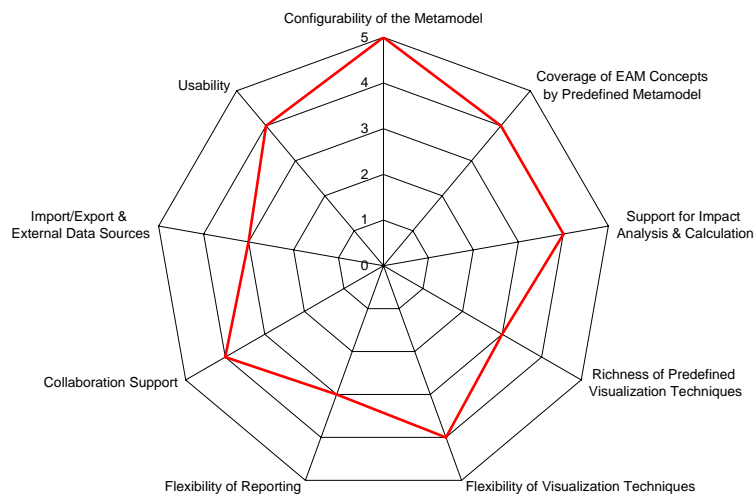


Figure 2.17: *System Architect*: kiviati diagram for specific tool functionality

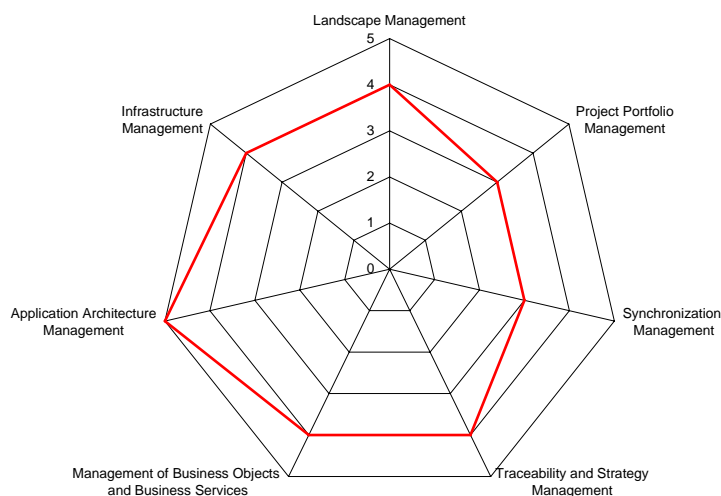


Figure 2.18: *System Architect*: kiviati diagram for EA management tasks

2.2.9 Evaluation of *Metis* from Trous Technologies Inc.

Metis pursues a visualization centric approach in performing EA management, strongly focusing on graphical representations of the repository data. These representations serve as the main interface for user interaction, enabling the user to utilize the same view for perceiving and editing complex relationships in the repository.

Most of the EA management tasks can be performed on the diagrams, including but not limited to a convenient way of executing graphical impact analysis. A stakeholder with profound knowledge of the EA metamodel is thereby put in the position to create ad-hoc queries satisfying unusual information demands. Metamodeling is further an essential part of *Metis*' strategy, thus users are provided with the possibility to augment the EA model to meet individual needs using the shipped metamodel as a comprehensive basis.

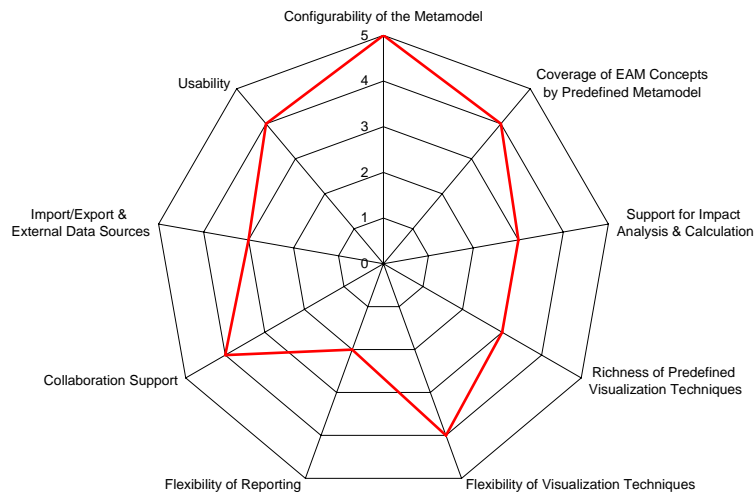


Figure 2.19: *Metis*: kiviat diagram for specific tool functionality

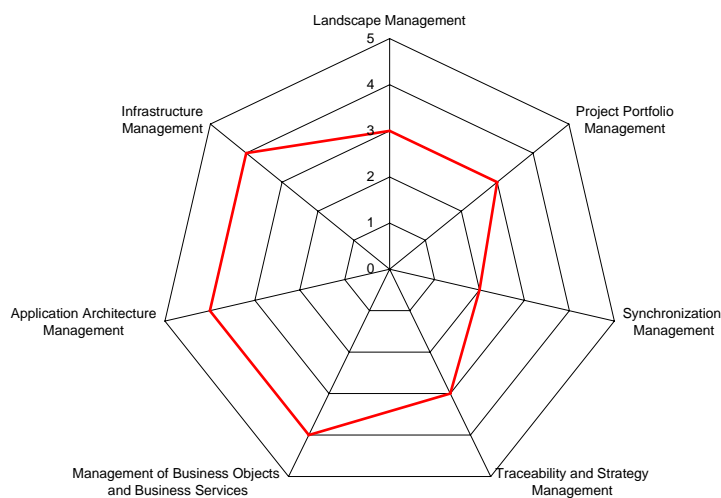


Figure 2.20: *Metis*: kiviat diagram for EA management tasks

Approach to EA Management Tool Survey

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The EA management tool survey is based on the knowledge we gained the last years during our research and our discussions in the research project *Software Cartography* with project partners. In chapter 3.1 we give a brief introduction to EA management consisting of EA requirements and tasks, the need for a holistic, integrated information model and the interaction of EA management and other management processes.

The evaluation of the analyzed EA management tools is based on two distinct survey parts, the list of criteria (section 3.2) and the scenario simulation (section 3.3), which both were developed in cooperation with the partners named in section 1.1. The questions in the list of criteria were answered by the tool vendors and the scenarios were simulated by sebis using tool installations in sebis' Computer Lab at the Technische Universität München.

3.1 Introduction to EA Management

Enterprise architecture management is a continuous and iterative process controlling and improving the existing and planned IT support for an organization. The process not only considers the information technology (IT) of the enterprise, also business processes, business goals, strategies etc. are considered in order to build a holistic and integrated view on the enterprise.

Goal is a common vision regarding the status quo of business and IT as well as of opportunities and problems arising from these fields, used as a basis for a continually aligned steering of IT and business.

EA management is the discipline of managing the whole enterprise architecture and the artifacts building the enterprise architecture. On the one hand the EA management should be driven by and adjusted to the business strategy and on the other hand IT should play the role of an enabler for the business strategies and goals: One of the main efforts of EA management is the "Alignment of business and IT".

This is achieved through a common vision, alignment and standardization not only at the level of strategies but also regarding all activities governed by them: "Typically, strategy is the only discipline that is cultivated at the enterprise level. Strategy generates direction for the other disciplines, but then these are executed at the project level, leading to both duplication of effort and a lack of overall coherence. Now planning and implementation functions are being extended across the enterprise as well, including IT. EA provides the means to apply basic business disciplines within the IT organization. It must align enterprise activities and priorities with business strategy." [MET02]

This alignment of business and IT concerning the IT architecture is also discussed and analyzed by Ross [Ros03], who developed a model consisting of the four architectural stages *application silo*, *standardized technology*, *rationalized data* and *modular* during which the alignment of IT and business grows: "The payback for enterprise IT architecture efforts is strategic alignment between IT and the business. Alignment will generate a higher return on the firm's IT investments and focus the firm's project portfolio on initiatives likely to have strategic impact." [Ros03]

3.1.1 Information gathering for EA management

In the area of EA management it is not sufficient to collect the information ad hoc and try to use it later: Information may be outdated shortly after collecting and then an analysis would reside on outdated information. The main problem - prohibiting the availability of up-to-date information - arises due to the different information suppliers needed for a consistent set of information objects. As EA management concerns different functions from both IT and business areas, business process modelers, IT systems owners, IT architects, project managers, etc. must supply the EA management process with the information needed for addressing the concerns of different stakeholders.

The figure 3.1 shows that the needed information for the EA management process is already partially present in existing information systems in organizations. Of course unification of the information into an abstracted model is necessary in order to create a coherent view.

- The information about business processes, their process flows, process steps, etc. already resides in business process modeling tools like ARIS Toolset (from IDS Scheer AG), Corporate Modeler (from Casewise Inc.), MEGA Process (from MEGA), etc.
- The information about applications, their components, interfaces, etc. resides in software modeling tools like Rational Rose (from IBM), Together Control Center (from Borland), etc.

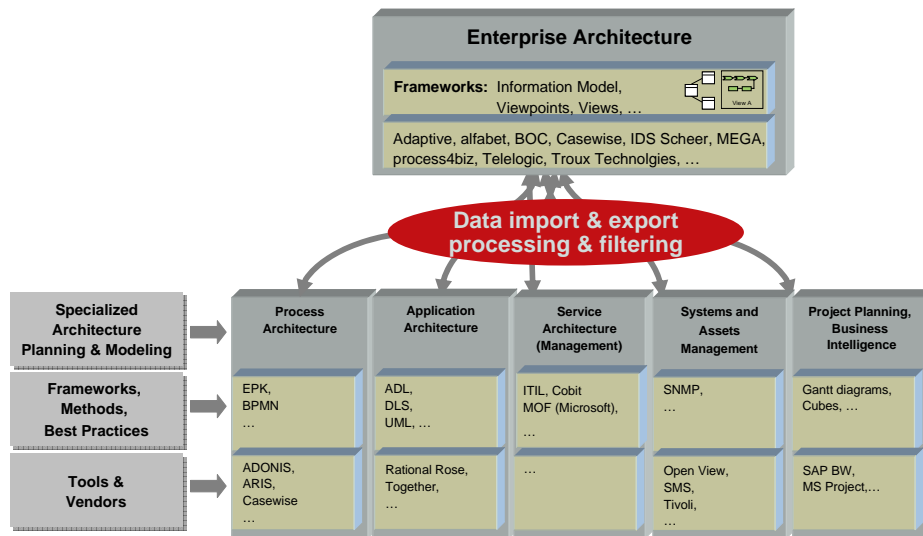


Figure 3.1: Information filtering & processing (Siemens, CIO, 2005)

- The information (infrastructure) services, their service level agreements, service user, etc. are available in a database corresponding to frameworks like ITIL [OGCO00] from OGC, MOF [Mic05] from Microsoft, etc.
- The information about assets and systems, connections between hardware systems and information systems, up- and down-times, etc. is collected in systems like Open View (from HP), Tivoli (from IBM), SMS (from Microsoft), etc.
- The information about project planning and business intelligence is available in SAP Business Warehouse (from SAP), MS Project (from Microsoft), etc.

A continuous EA management process must ensure that the process itself is linked to existing management processes as well as the data, EA management is backed on integrated, already existing data pools. Using the data abstracted and unified from the areas described above, the EA management process develops the coherent vision and uses it to steer IT and business in an aligned way.

3.1.2 Information Model

An *information model* is a model, which models the relationships and attributes of information objects (entities) using the concept of information classes (entity types) and associations (relationship types) between information classes. An information object (entity) is an abstraction of a real existing object (e.g. "Accounting:Business Process", "BMW 318i:Product", "Accounting system:Business application") aggregating the relevant information.

An information model for EA management consists of the relevant information classes, their attributes, the associations between information classes, and an additional glossary collecting specialized terms and their meanings.

Many EA frameworks (Zachman [ZIF05], TOGAF [TOG05], DoDAF [DoD4], ...) are making suggestions for *organizing an enterprise architecture, establishing an EA management process, and connecting*

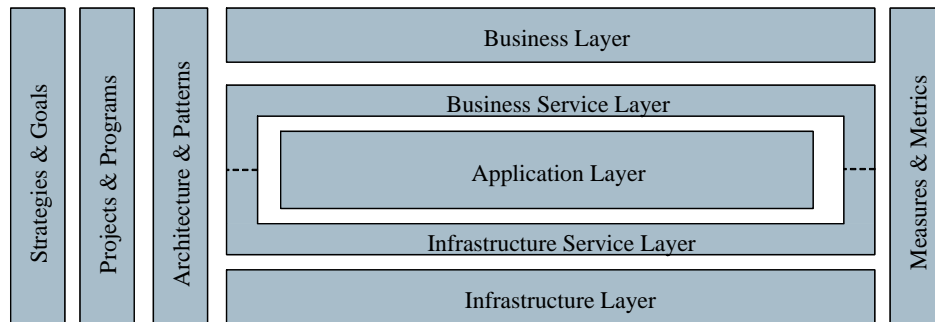


Figure 3.2: Layers & cross functions of an information model

the artifacts into one framework. But none of the frameworks mentioned does provide an integrated information model connecting the different layers and cross functions of EA management. Therefore sebis is building an information model which

- integrates the layers and cross functions (detailed below) into one model,
- is built on a modular basis, and
- distinguishes between optional and mandatory information.

The figure 3.2 shows the different horizontal layers and vertical cross functions.

Layers

The *Business Layer* deals with products, business processes, organizational units, etc. Exemplary question to this layer are: "Which products are produced and which are the business processes for purchasing, production, distribution, etc.?", "What are the organizational and functional units executing these processes and how are they linked?" and "Which primary and secondary business processes are supported by IT?".

The *Business Service Layer* links the business layer with the application layer and uses business services as well as their connected service level agreements (SLAs) and business objects, etc., answering questions like: "Which business services are used by which business processes?", "Which business objects are created, read, updated, or deleted by which services?" and "What are the business service level agreements (SLAs)?".

The *Application Layer* describes the business applications, their components, the interfaces linking applications, etc. Possible questions in this layer are: "Which applications provide which business services?", "Which applications use which infrastructure services?", "How are the applications connected/linked?" and "What are the components building an application?".

The *Infrastructure Service Layer* connects the application layer with the infrastructure layer. Infrastructure services, their dependencies, and service level agreements (SLAs) are considered: "Which infrastructure services are provided?", "Which application uses which infrastructures services?" and "What are the infrastructure service level agreements (SLAs)?" are possible in this context.

The *Infrastructure Layer* describes infrastructure components (e.g middleware and hardware systems) used to provide infrastructure services or directly used by the applications: "Which infrastructure (e.g. middleware or hardware systems) are used and needed by which application?" and "Which locations are used for hosting which infrastructure component?".

Cross Functions

The cross function *Strategies & Goals* deals with business and IT strategies, their goals, and derived action items: "Which goals can be derived from which strategy and which action items are resulting from it?" "Which strategies & goals do exist and which are the resulting projects & programs?" "Which strategies & goals have effects on which layers and which are the affected items?"

The cross function *Projects & Programs* links the strategies & goals with the resulting projects & programs implementing the strategies & goals: "Which action items have created projects?", "Which project changes which layers and which items are affected?", "Are the projects consistent with the strategies & goals?", and "What are the dependencies between the projects?"

The cross function *Architecture & Patterns* controls the consistency of the projects & programs with the architecture and its patterns: "What is the reference model of the enterprise?", "Which services (business and infrastructure) are consistent with the architecture?", "What does the application landscape look like today?", "What is the application landscape going to look like in the next planning period?", "What should the application landscape look like in long-term?", "Are the planned and ongoing projects consistent with the architecture and defined patterns?", and "Which architectural patterns for applications do exist and which applications are consistent with these patterns?"

The cross function *Measures & Metrics* measures certain aspects of the entities described by the information objects in the different layers and other cross functions as a base for managing them: "Which measures & metrics do exist for which information objects?" and "Who is interested in the measures for what reasons?"

3.1.3 EA Management Integrating existing Management Areas

EA management uses different other management, controlling, and planning functions describing and developing the lifecycle of the artifacts of an enterprise:

- Strategy management
- Portfolio management
- (Multi-)project- and program management (or synchronization management)
- Architecture management
- Controlling

Figures 3.1 and 3.3 show two different views for integrating various tasks. Figure 3.1 from Siemens focuses on the integration of existing resources into an EA view, while Figure 3.3 from BMW Group shows how different modules can be linked into a continuous, integrated process.

3.2 List of Criteria

The list of criteria consists of a comprehensive catalog of questions about functional (section 3.2.1), technical (section 3.2.2), and additional (section 3.2.3) criteria, covering different aspects that characterize EA management tools. The list consists of approximately 400 questions and is not fully printed in this survey. The whole list and the answers can be requested from sebis or from the tool vendors that have participated in the survey.

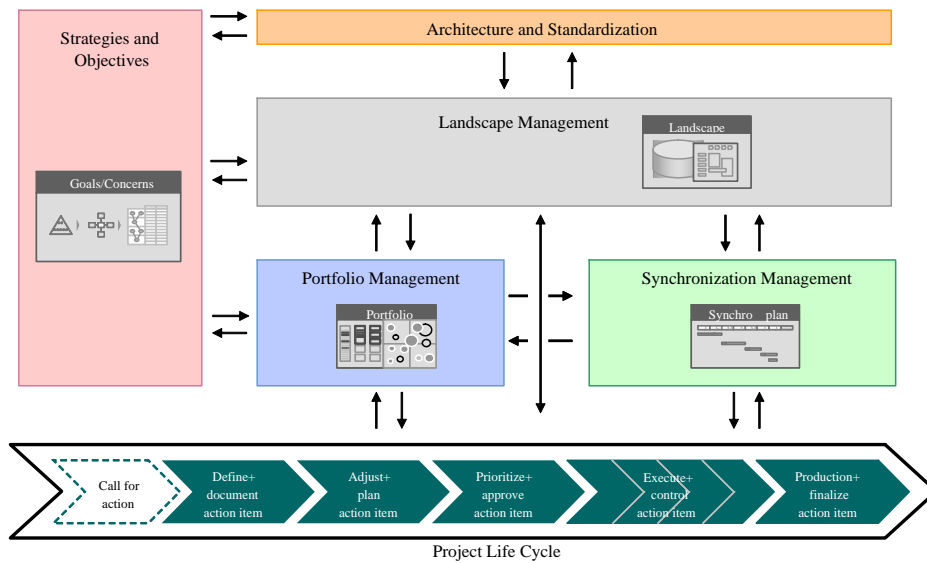


Figure 3.3: Integrating management modules (BMW Group, 2004)

3.2.1 Functional Criteria

Functional criteria are concerned with the functionality of the tool from a requirements point of view. It is abstracted both from the realization of the features and the use of the features in the context of specific EA management tasks or processes. The functional criteria for EA management tools are decomposed into the sections *Methodology*, *Visualization*, *Integration with related Domains*, *Integration with other tools*, *Reporting*, *Collaboration support*, *Metadata for Architectural Description*, *Internationalization/Localization* and *Navigation in the Model*.

The *Methodology* section is about the tool's metamodel, metamodeling capabilities and audit & control. It is concerned about the scope of preconfigured metamodels and their relationship to existing frameworks for enterprise architecture management, like the Zachman framework [ZIF05] or DoDAF [DoD4]. The questions about metamodeling capabilities are about features that can be used to create user-defined metamodels, e.g. whether different relationship types and cardinalities (e.g. 0..* vs. 1..2) are supported, and if the tool supports versioning of elements in the model and metamodel.

Further, *Methodology* is concerned with the tool's support for metrics and their automated calculation from the data in the repository and for impact analysis queries.

The criteria about *Visualization* cover the tool's capabilities of creating visual artifacts displaying the modeled data in a convenient way. Beyond a simple tabular and textual report, the tool's support of Boston Square Diagrams (BCG Matrixes), cluster maps (see appendix A.1.1), process support maps (see appendix A.1.2), interval maps (see appendix A.1.3), etc. are evaluated. Possibilities of filtering as well as ways of visualizing values of metrics are other examples of topics *visualization* is concerned with.

Integration with related domain evaluates if the tool provides functions outside of but considered as bordering to EA management:

- UML modeling, with the supported types of diagrams, the version of the UML standard the tool is compliant with, and the capability to create code or reverse engineer diagrams from code.
- Database modeling, with its specialized forms of notation, such as E/R-modeling or UML-

Profiles for database modeling and the tools ability of creating DDL scripts or reverse engineering database models from DDL scripts.

- Process modeling, with notations like Event driven Process Chains (EPCs) [Sch01] or modeling languages like Business Process Modeling Language (BPML) [Ark02].

Integration with other tools is concerned with the integration into existing corporate information portals based on frameworks as the Java Portlet API, the Oracle Portal Server, or the Microsoft Windows Sharepoint Services.

Reporting is about the tool's capabilities of creating tabular reports and enhancing them with configurable diagrams, as bar charts, kiviad diagrams, or other forms of diagrams which are for example known from Microsoft Excel.

EA management often is not a job for a sole person but a corporate function with different users working concurrently on the same data. *Collaboration support* asks for functionality supporting the users in their concurrent working on the data. Important in this case are locking mechanisms as well as conflict resolution for concurrent changes. Versioning and branching are also evaluated in this section. Ways of granting user or role specific rights and their interaction, also clients for offline working, working via internet, and terminal server usage are addressed here.

Metadata for architectural description is based on the IEEE 1471 [IEE00] and deals with the support for the main concepts of the standard like stakeholders, their concerns, and the views they are interested in. Utilizing a standard that defines a vocabulary about architectural descriptions and introduces some basic paradigms for this area could improve mutual understanding and the benefit gained from EA Management.

Internationalization/Localization is about support for multiple languages and cultural conventions (internationalization) and the possibilities of making the tool linguistically and culturally appropriate to the target locale (localization).

Finally *Navigation in the model* focuses on the ways of navigating the repository's content, especially using groupings and tree-views.

3.2.2 Technical Criteria

EA management tools have to be deployed into the existing IT infrastructure of enterprises providing the users with the capabilities of accessing and modifying EA management data through suitable interfaces. The tools further should address security concerns and should be able of integrating with wide-spread sign in infrastructures.

Additionally issues of the technical administration are evaluated here. Finally, as EA management is often not starting "from scratch", the tools are evaluated concerning their capabilities to use data previously governed by other tools - distinguishing between copying and referencing such data. Other features evaluated here are of rather technical interest regarding e.g. supported image formats and printing capabilities.

In detail, this section of the questionnaire covers requests for information about:

- Hardware-, network-, and software-infrastructure necessary for the tool
- Software architecture, the tool is based on
- Data transmission using secure channels
- Integration options for integrating the tool into sign in infrastructures
- Backup and restore capabilities for both data and user profile information

- File formats for visualizations supported by the tool
- Printing capabilities of the tool
- Import and export formats supported by the tool
- Interfaces for accessing data in other applications

3.2.3 Additional Criteria

EA management must be seen as a long-term challenge for the enterprise and thus the EA management tools supporting this ongoing task have to stay reliable and continuously maintained by the tool vendors and their consulting partners. Therefore we introduced this chapter with its criteria not regarding the currently available tool itself, but regarding the tool vendor and its network of partners.

In this section of the questionnaire we are requesting information about the tool vendor's general characteristics (e.g. annual revenue, number of employees), reference installations, reselling and consulting partners, support levels provided, training offered, future release plans, and the company development vision in a middle- to long-term perspective.

The information gathered in this part of the list of criteria is not reflected in the overall evaluation of the tool in the following chapters, but is partially included for convenience in the tool vendors profile.

3.3 Scenarios

Besides evaluating the tools against our list of criteria, we try to validate the existence of both the specific functionality of the tool and the support the tools offer for EA management tasks by simulation of scenarios. These scenarios are structured into two groups. The scenarios in section 3.3.1 are analyzing specific functionality of the tools, e.g. visualization techniques, metamodeling capabilities. The second group of scenarios in chapter 3.3.2 are analyzing the support the tools offer for specific EA management tasks and processes like architecture management, synchronization management, or portfolio management.

Each scenario will be described using the concerns relevant to EA Management which are addressed by the scenario, the questions derived from these concerns, the tasks which are executed during scenario simulation in our evaluation environment and the deliverables which should be created in the scenario simulation.

The employed information model for the scenario simulation is shown in figure 3.4 using the notation of an UML class diagram [OMG04a]. This model constitutes a simplified information model for EA management, it was designed during the elaboration of the scenarios and does not claim to be complete. For the purpose of providing test data, we invented a fictitious department store *SoKaKauf* and described it according to this information model (see figure 3.1.2). The *SoKaKauf* example is used in all scenarios in order to provide a coherent example for the scenarios.

3.3.1 Scenarios for Analyzing Specific Functionality

The following paragraphs describe the scenarios used to analyze specific functionality.

Visualization of the Application Landscape

This scenario describes a main entry point for tool supported EA management, as it might be found in a company. Data, previously gathered with a spreadsheet tool or already present in one or more

3. Approach to EA Management Tool Survey

databases, has to be imported into the EA management tool. For scenario simulation, the information about the EA is contained in various Microsoft Excel Spreadsheets.

The concerns of this scenario are:

The department store *SoKaKauf* wants to get an overview of its application landscape and its EA. This should be accomplished through the creation of three software maps visualizing different aspects of the application landscape: A cluster map, a process support map, and an interval map. Details about these different software map types can be found in chapter A.

The simulation of the scenario should take the following steps:

- The metamodel of the EA management tool has to be checked, whether it can handle the data of the SoKaKauf landscape, which is, as stated above, organized according to the information model from figure 3.2. If this is not the case, adaptations to the metamodel may have to be made.
- The data has to be imported from various Microsoft excel spreadsheets, containing e.g. business processes, organizational units, business applications and the relationships between them. Import may be directly or through conversions to other formats either performable by the tool itself or by Microsoft Excel (such as conversions to CSV or XML formats).
- The manipulation of the repository data through a graphical user interface, e.g. deleting entities and reentering their data.
- Creation of specific visualizations such as a cluster map as depicted in figure 3.5, a process support map as depicted in figure 3.6, or an interval map as depicted in figure 3.7. These visualizations shall be *generated* by the tool as far as possible, in order to proof their visualization strengths and weaknesses – regarding layouting techniques. Later manual adaptations of the user, e.g. resizing shall be executed in order to evaluate, if the tool is capable of maintaining these user updates during the automated layouting processes.

Visualization of Measures

This scenario deals with depicting measures, that characterize elements of the application landscape, in this context business applications. Preferably, this should be accomplished in one of the previously generated visualizations. This can be achieved, e.g. by color-coding applications in regard to their availability, or adding symbolic signatures such as the traffic lights symbol in figure 3.9 to the visualizations of systems affected by specific changes. The concerns of this scenario are described as follows:

Analyze the application landscape by highlighting systems that produce high costs or experience availability problems.

In detail the following deliverables have to be created:

- Import or enter information about the business applications of SoKaKauf concerning their *availability, conformity to architectural standard, maintenance/operating costs*, etc.
- Visualize the applications' standards conformity e.g. by changing the background color of the symbolic representation of the application (see figure 3.8).
- Visualize the availability of each application using a threshold e.g. by adding a red/yellow/green traffic light to the symbolic representation of the application (see figure 3.9).

3. Approach to EA Management Tool Survey

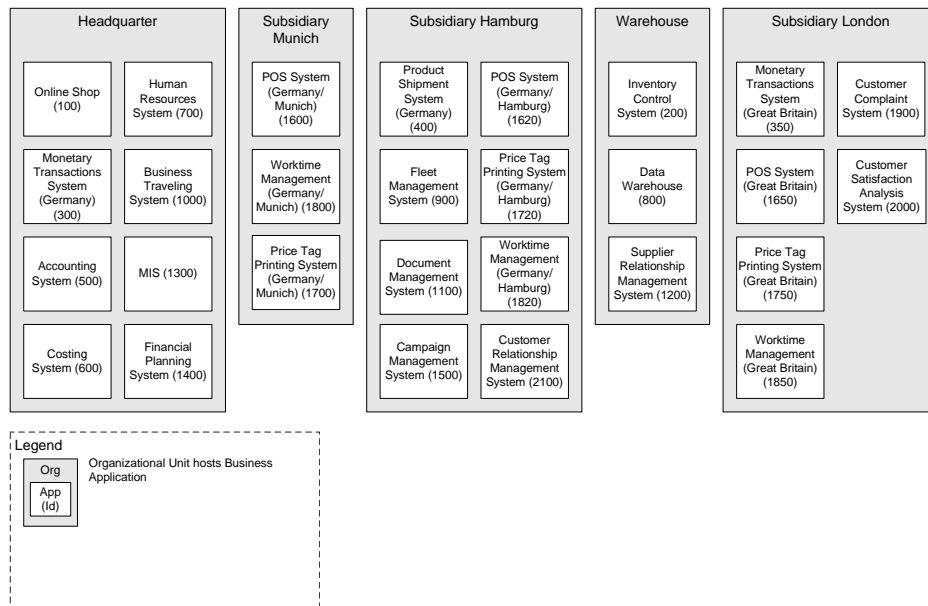


Figure 3.5: Scenario visualization of the application landscape: cluster map

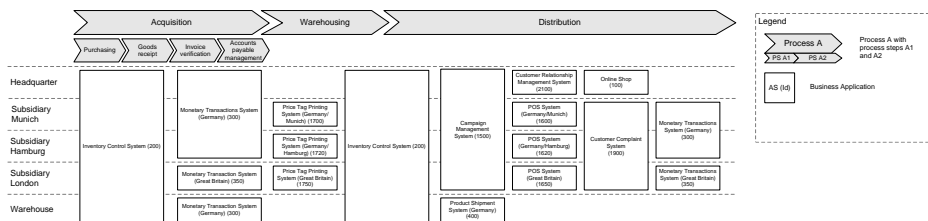


Figure 3.6: Scenario visualization of the application landscape: process support map

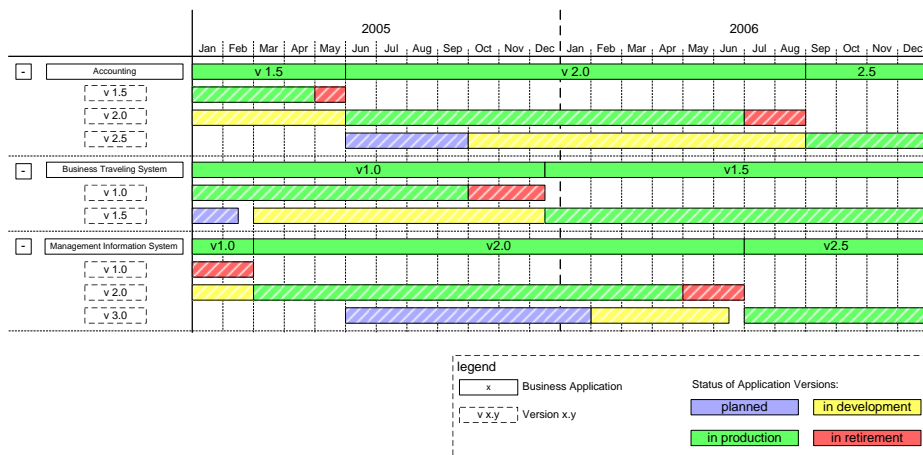


Figure 3.7: Scenario visualization of the application landscape: interval map

3. Approach to EA Management Tool Survey

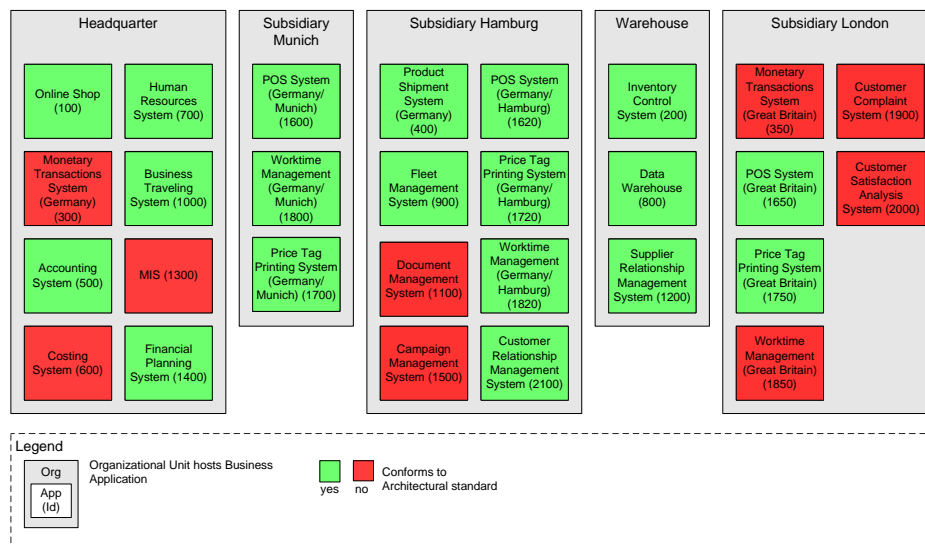


Figure 3.8: Scenario *visualization of measures*: cluster map with conformance to architectural standard

- Visualize the maintenance costs for each application e.g. using the background color (see figure 3.10).

Further this scenario evaluates if the tool is capable of creating a tabular report similar to that in figure 3.11 showing the measures of each application.

Simplified access for readers

This scenario deals with the task of providing different access channels to the tool's data. It addresses following concerns:

In order to promote the enterprise architecture effort and increase awareness of it among the employees, the software maps created in the scenario *Visualization of application landscapes* and the scenario *Visualization of Measures* should be made accessible for the employees. Beside facilities for publishing existing diagrams for a wider audience, this calls for the possibilities to make the published diagrams easy to use, hiding most of the features available to the modeler, and to forbid any data input and modification. The output should be either created with every request based on real time data (preferred) or by batch export every night.

Especially the question whether a simplified way of reading access is provided by the tool, is evaluated here. In detail the tool is analyzed regarding its ability to provide the following features:

- Provide convenient reading access to previously generated visualizations - including the capabilities of showing/hiding layers of the visualization and zooming.
- Prevent manipulations of the visualization or its underlying data through a limitation to reading access.
- Access to *real-time* data is preferred to access on exported and *disconnected* data.

3. Approach to EA Management Tool Survey

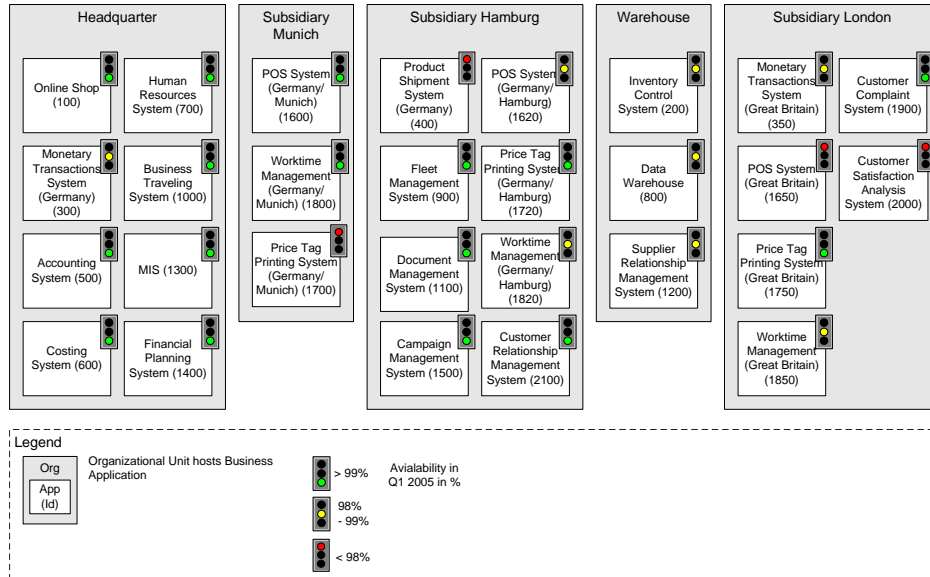


Figure 3.9: Scenario *visualization of measures*: cluster map with availability of the applications)

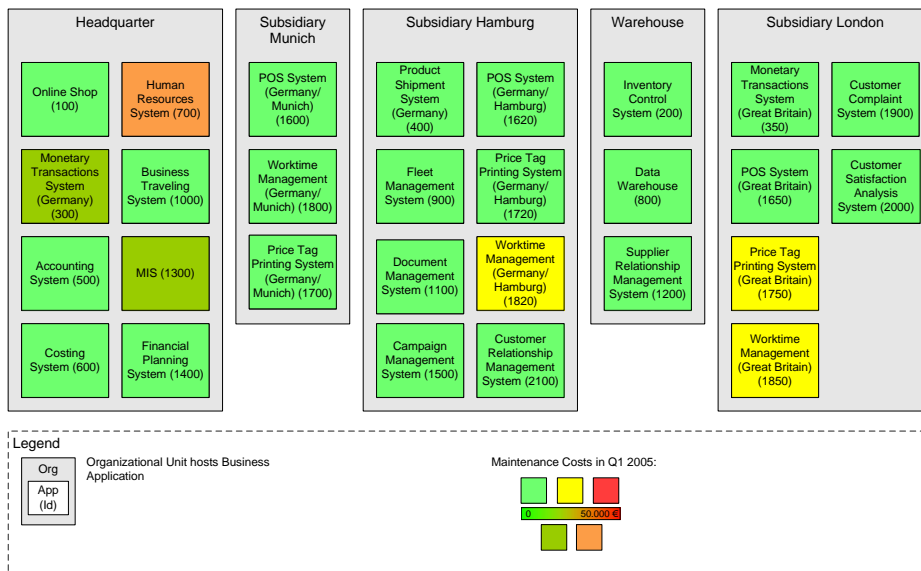


Figure 3.10: Scenario *visualization of measures*: cluster map with maintenance costs

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Nr	Name	Avialability in Q1 2005 in %	Conforms to architectural standards	Number of Transactions in Q1 2005	Quota of standard software in%	Number of changes in Q1 2005	Maintenance costs in Q1 2005	Operating costs in Q1 2005
100	Online Shop	99,2	yes	1.450.132	20%	10	4.000 €	34.221 €
200	Inventory Control System	99,0	yes	68.687	40%	0	2.322 €	421 €
300	Monetary Transactions System (Germany)	98,0	no	234.545	100%	13	10.032 €	1.213 €
350	Monetary Transactions System (Great Britain)	98,1	no	21.342.134	90%	4	1.344 €	3.223 €
400	Product Shipment System (Germany)	97,7	yes	234.534	30%	15	3.131 €	999 €
500	Accounting System	99,9	yes	432.432	100%	4	4.552 €	132 €
600	Costing System	100,0	no	23.232	40%	2	0 €	4.423 €
700	Human Resources System	99,4	yes	4.532.451	90%	0	31.344 €	12.331 €
800	Data Warehouse	98,9	yes	1.243.213	100%	1	2.300 €	3.231 €
900	Fleet Management System	99,4	yes	151.234	3%	1	231 €	2.321 €
1000	Business Traveling System	99,1	yes	7.345.621	0%	3	0 €	4.322 €
1100	Document Management System	99,5	no	123.465	100%	0	0 €	1.331 €
1200	Supplier Relationship Management System	99,0	yes	352.563	87%	0	1.234 €	2.332 €
1300	MIS (Management Information System)	99,1	no	32.556.658	94%	2	13.441 €	2.311 €
1400	Financial Planning System	99,9	yes	1.235.456	100%	1	0 €	3.223 €
1500	Campaign Management System	99,8	no	3.245.247	100%	4	324 €	32.434 €
1600	POS System (Germany/Munich)	99,4	yes	3.452.346	50%	2	0 €	3.453 €
1620	POS System (Germany/Hamburg)	98,4	yes	2.532	50%	1	0 €	8.765 €
1650	POS System (Great Britain)	97,5	yes	432.645	60%	0	4.322 €	4.548 €
1700	Price Tag Printing System (Germany/Munich)	97,3	yes	3.452.365	100%	0	324 €	6.564 €
1720	Price Tag Printing System (Germany/Hamburg)	99,3	yes	243.626	90%	1	2.342 €	6.463 €
1750	Price Tag Printing System (Great Britain)	99,1	yes	4.573.657	80%	4	23.432 €	9.855 €
1800	Worktime Management (Germany/Munich)	99,5	yes	1.345.234	100%	4	533 €	564 €
1820	Worktime Management (Germany/Hamburg)	98,3	yes	45.656	100%	2	23.422 €	4.654 €
1850	Worktime Management (Great Britain)	98,2	no	256.245	100%	8	23.423 €	6.454 €
1900	Customer Complaint System	99,1	no	4.324.262	0%	3	0 €	454 €
2000	Customer Satisfaction Analysis System	97,1	no	2.434.534	30%	1	0 €	8.643 €
2100	Customer Relationship Management System (CRM)	99,9	yes	4.325.423	4%	0	0 €	4.345 €

Figure 3.11: Scenario *visualization of measures*: report showing measures of the applications

Editing Model Data using an External Editor

This scenario reflects the rather common need of having the possibility to use office software, like Microsoft Excel, for editing the EA management data instead of using the tool's built in manipulation capabilities. This is especially of interest in the context of several types of offline-working as well as in cases, where the EA management tool does not provide strong support for *batch* editing in tables instead of editing in dialogs. Another feature of the tool evaluated in this scenario is the resolution of conflicts between data that has been changed both by the tool itself and also by an external editor in exported data. In detail following steps have to be executed:

- Export data for editing to a format accessible to an office tool.
- Edit data in the EA management tool as well as in the exported file using an office tool.
- Re-Import the data from the office tool and use the EA management tool's capabilities to detect and resolve conflicts.

In context of the scenario, also the EA management tool's locking capabilities and locking granularity should be evaluated by finding out if there is a way of locking specific models or elements of them and thus preventing them from being changed.

HTML Export

This scenario is the possibility to export to a webserver without the need to support server side code. The concerns addressed here are:

Information collected in the EA management tool should be published to the intranet using (X)HTML-Pages in order to distribute the information to all organizational units. These static (X)HTML-Pages should be adapted to the corporate design (corporate logo, styles, colors, etc.).

This scenario is testing the tools capabilities to export these HTML-Pages and if it is possible to embed links to external data sources into the files. The exported files should possess the following properties:

- The (X)HTML pages should be adapted to a corporate design according to the given example.
- The exported files should be W3C HTML 4.0.1 compliant (<http://www.w3.org/TR/html4/>).
- The exported file should be W3C XHTML 1.0 compliant (<http://www.w3.org/TR/xhtml1/>).
- The user should be able to navigate between different views via hyperlinks.
- The user should be able to follow links to external documents.
- The user should be able to navigate by clicking on elements of the visualization.

Metamodel Adaptation

In addition to using the predefined metamodels it may be desirable to adapt the metamodel. Therefore specific requirements of the enterprise architecture of the SoKaKauf department store in respect to the information model used to capture the data should be considered. After ascertaining that the tool allows the adaptation of the metamodel, the scenario tries to answer the following questions by adapting the metamodel in respect to following criteria:

- Concerning entity types it is of interest, whether new entity types can be introduced and existing types can be adapted and deleted.
- Concerning attributes it is of interest, if new attributes can be introduced, predefined attributes can be changed or deleted, and if mandatory attributes as well as default values for attributes are supported. Further, the data types that can be chosen for attributes are of interest here.
- Concerning relationship types it is of interest, whether new relationship types can be introduced, existing types can be adapted and deleted, and whether it is possible to add attributes to a relationship type as well as to set cardinality constraints for relationship ends.

Large scale application landscape

In order to test the tool's capabilities to cope with large application landscapes containing thousands of application systems and interconnections between them, we try to import generated data representing such a large application landscape. The specific steps to be executed are:

- **Data Import:**
Import the data describing an application landscape consisting of business applications from a Microsoft Excel file into the repository of the tool.
- **Visualization:**
Create a cluster map as a visualization of this application landscape including all applications and the interconnections between them.

3.3.2 Scenarios for Analyzing EA Management Support

The following sections describe the scenarios used to analyze EA management support offered by the tools. These scenarios are introduced, as gathering only specific functionality (section 3.3.1) is insufficient for gaining a holistic view of the approach a tool takes to support EA management.

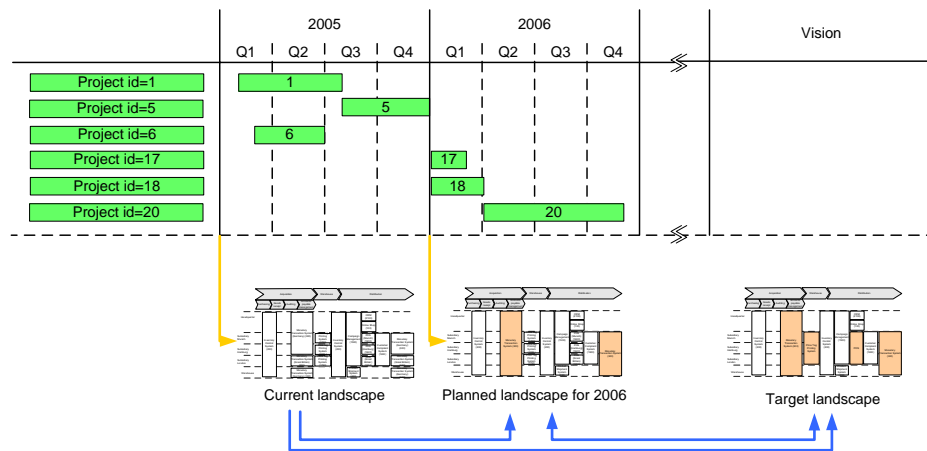


Figure 3.12: Scenario *landscape management*: relationship of current, planned, and target landscape

Landscape Management

The scenario *Landscape Management* simulates tasks relevant to managing the evolution of the application landscape and is concerned with the cross function *Projects & Programs* and the layers *Business* and *Applications* of the information model (see section 3.1.2). The concerns of this scenario are:

In order to keep information about the future development of the application landscape in the tool there has to be the possibility to create scenarios¹ based on the current application landscape.

The current, planned, and target landscape should be analyzed using three different visualizations (see figure 3.12). The current landscape represents the landscape as is; the planned landscape shows the landscape as it develops through the changes performed by projects up to a specific date. The target landscape as a long term perspective shows the envisioned architecture of the landscape, there is no need to have projects defined transforming the current or planned landscape into the target landscape.

The questions, which should be answered, are:

- How does the application landscape look like today (current landscape)?
- What is the application landscape going to look like in January 2006 (planned landscape)?
- How does the target landscape look like?
- What are the differences between the current and the planned landscapes?
- What are the reasons for the differences between the current and the planned landscape?
- What projects have to be initiated in order to change from a current to a target landscape?

The needed information about SoKaKauf to simulate this scenario are the business processes, the business applications, the organizational units, the projects, and the relationships between these information objects. The first deliverable is a graphical visualization of the current application landscape

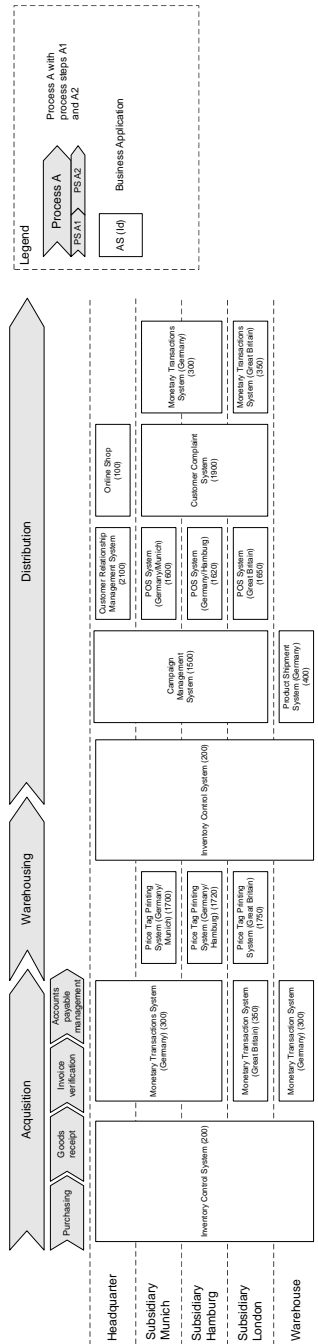


Figure 3.13: Scenario Landscape Management: Current Landscape

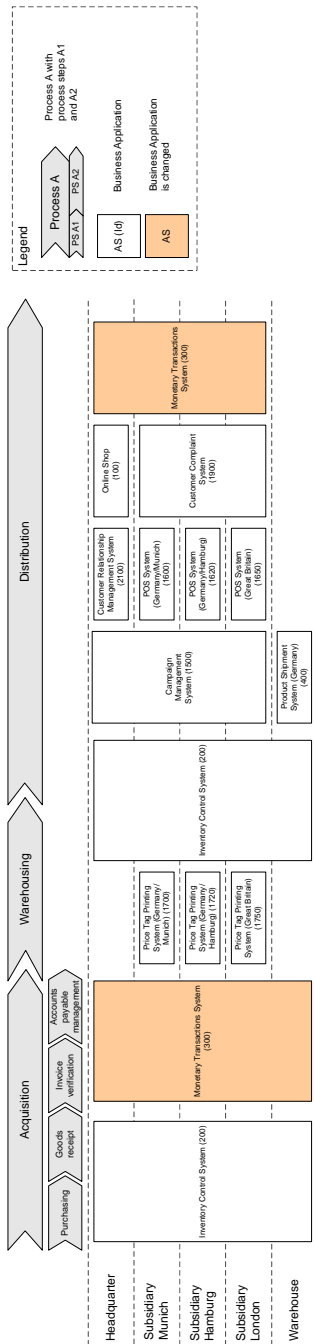


Figure 3.14: Scenario Landscape Management: Planned Landscape

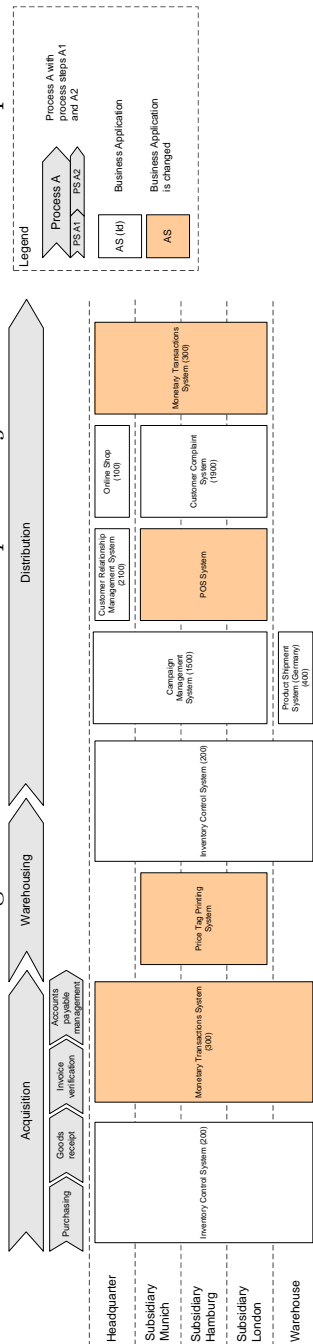


Figure 3.15: Scenario Landscape Management: Target Landscape

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Nr	Name	Current 2005-01-01	Planned 2006-01-01	Target
100	Online Shop			
200	Inventory Control System			
300	Monetary Transactions System (Germany)		x	x
350	Monetary Transactions System (Great Britain)		x	x
400	Product Shipment System (Germany)			
1500	Campaign Management System			
1600	POS System (Germany/Munich)			x
1620	POS System (Germany/Hamburg)			x
1650	POS System (Great Britain)			x
1700	Price Tag Printing System (Germany/Munich)			x
1720	Price Tag Printing System (Germany/Hamburg)			x
1750	Price Tag Printing System (Great Britain)			x
1900	Customer Complaint System			
2100	Customer Relationship Management System (CRM)			

x - changed

Figure 3.16: Scenario *landscape management*: report for current, planned, and target landscape

using a process support map (see figure 3.13).

Further on, the project *Consolidation of Monetary Transaction Systems* will retire the application *Monetary Transaction System (Great Britain)* and the application *Monetary Transaction System (Germany)* will take over its functionality. Figure 3.14 visualizes the planned application landscape highlighting these differences from the current landscape.

Finally the target landscape developed by SoKaKauf's architects, which want to increase the vertical integration² over the different subsidiaries, should be visualized (see figure 3.15). In the target landscape the *Price Tag Printing Systems* and the *POS Systems* are unified. The report (see figure 3.16) summarizes the differences between the current, the planned, and the target landscape.

Project Portfolio Management

The scenario *Project Portfolio Management* simulates the management process concerned with proposing and selecting projects. This process consists of gathering project proposals, determining the affected applications and costs produced by them, of conducting different kinds of analysis on the portfolio made up by the proposals, and finally of selecting several projects to be actually executed. This scenario concerns the cross function *Projects & Programs* while being likely to affect artifacts on all different layers of the information model (see section 3.1.2). The concerns of this scenario are:

The IT-Department of the "SoKaKauf" department store has received numerous project proposals. In consideration of the processes, organizational units, and applications affected by the projects, a selection of the projects should be made. The available budget for projects is 5 Mio EUR.

The questions, which should be answered, are:

- Which project proposals have been received?
- Which costs are created by which project?
- Which application systems are modified/created by the individual projects?
- Which processes/organizational units are affected by the changes as they use the application systems modified by the projects?

¹These scenarios are not to be mixed up with the scenarios of the tool survey as a whole. Here scenario means a potential future state for the application landscape.

²In this context an increase of the vertical integration means that a business application is used by more organizational units to support a specific process; increase of horizontal integration means that a business application supports more processes at a specific organizational unit.

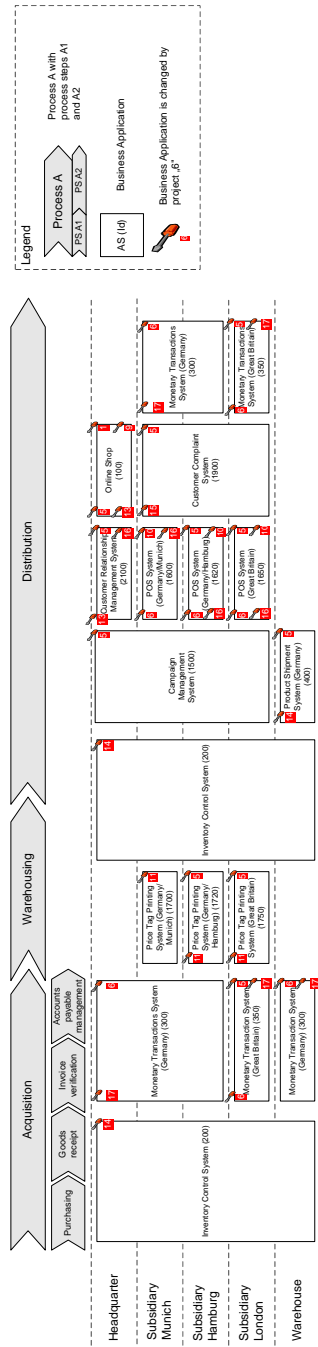


Figure 3.17: Scenario Project Portfolio Management: Process Support Map showing which Projects affect which Applications (all Projects)

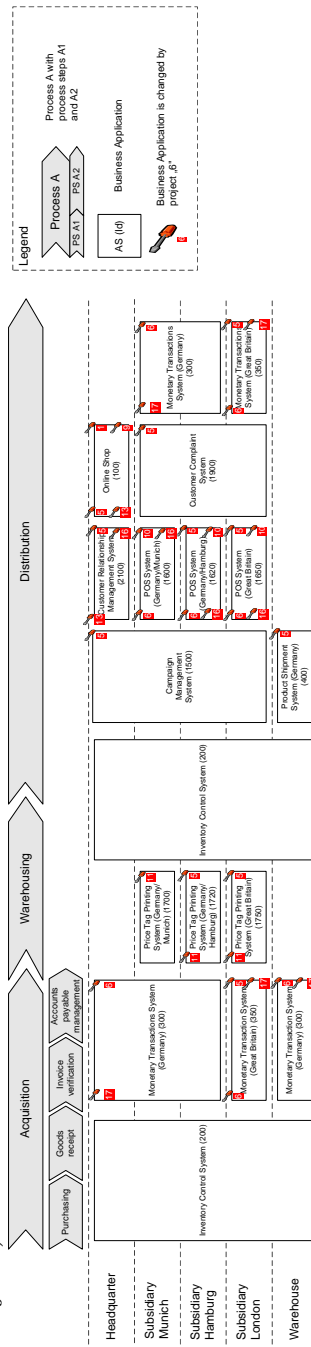


Figure 3.18: Scenario Project Portfolio Management: Process Support Map showing which Projects affect which Applications (selected Projects only)

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	Project id	1	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
Project id	Project name																
1	Integration of an auctioning platform into the online shop	x				x					x						
5	Database Consolidation		x				x	x	x		x	x	x	x	x	x	x
6	Consolidation of Monetary Transaction Systems							x						x	x		
7	VAT change in accounting system									x		x					
8	VAT change in costing system									x							
9	VAT change in online Shop										x						
10	VAT change in POS System													x			
11	VAT change in Price Tag Printing System																
12	Connection of Costing and Accounting System											x					
13	Reliability Improvement of the Online Shop																
14	Introduction of RFID in the Warehouse																
15	Replacement of the Customer Satisfaction Analysis System by the Data Warehouse														x		x
16	Introduction of a Bonus Card for Customers																x
17	Optimization of Monetary Transaction System																
18	Introduction of a new Management Information System																
20	Introduction of Knowledge Management																

x conflict

Figure 3.19: Scenario *project portfolio management*: report showing possible conflicts of projects

- Which projects have to be accomplished in any case?

The needed information for this scenario are the different projects, including attributes like urgency, benefit, costs, start date, and end date, as well as information about the criticality and size of business applications.

An impact analysis shall be performed transitively traversing the relationships between business applications, business processes, and organizational units. Thus depicting which of these entities are transitively affected by which project. It should depict

- which organizational units are affected by a project as they use a business application affected by it.
- which business processes are affected by a project as they are supported by a business applications modified by it.

The result might be a visualization similar to figure 3.17.

Additionally reports should be created, that show possible conflicts between projects arising from the concurrent modification of the same application (see figure 3.19), showing cumulated costs (see figure 3.20), showing business processes (see 3.21) and organizational units (see 3.22) transitively affected by projects.

As several business applications are highly critical for the SoKaKauf Department store they should show a certain stability, which means that they should not be affected by too many projects. A *portfolio matrix* shall be created displaying the following information: business applications as bubbles, business application size as the bubble radius, business application criticality rating on the y-axis, number of projects affecting the business applications on the x-axis - the visualization might look like figure 3.23. Finally the accepted proposals should be visualized in the same manner as figure 3.17 which could result in a diagram like in figure 3.18.

Synchronization Management

The scenario *Synchronization Management* is addressing issues of synchronizing projects, according to their interdependencies derived from the objects (e.g. applications, services) a given project is likely

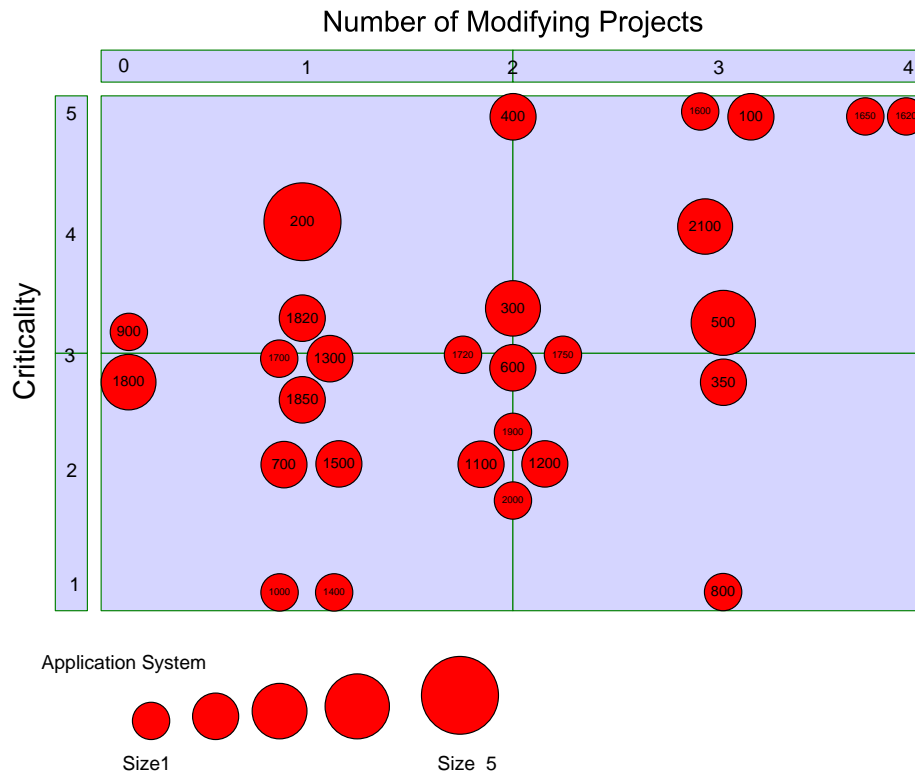


Figure 3.23: Scenario *project portfolio management*: portfolio matrix showing the affected applications with their criticality and number of modifying projects

to change. In this case, two projects that modify the same business application at the same time is a conflict that is deemed worth avoiding. Thus this scenario is concerned with the cross-functional domain *Projects & Programs* and all layers, as entities on every layer may be subject to changes executed in a project (see section 3.1.2). The concerns of this scenario are described as follows:

To support planning of future projects there has to be the possibility to model and manage project interdependencies or to derive them from the affected entities on different layers. It should be possible to analyze the project timeline using Gantt diagram-like views. This timeline shall than be updated and annotated to reflect delays of a single project as well to identify projects, that depend on it and might also be delayed.

The questions are:

- Which projects affect the same organizational unit?
- Which dependencies exist among projects?
- What happens, if a particular project is delayed? Which schedules have to be adapted in which way?

The information needed to accomplish this scenario are the *Projects & Programs* to be executed with their start and end time, as well as their relationships to the business applications they affect. Using an analysis transitively traversing relationships a visualization shall be created showing which

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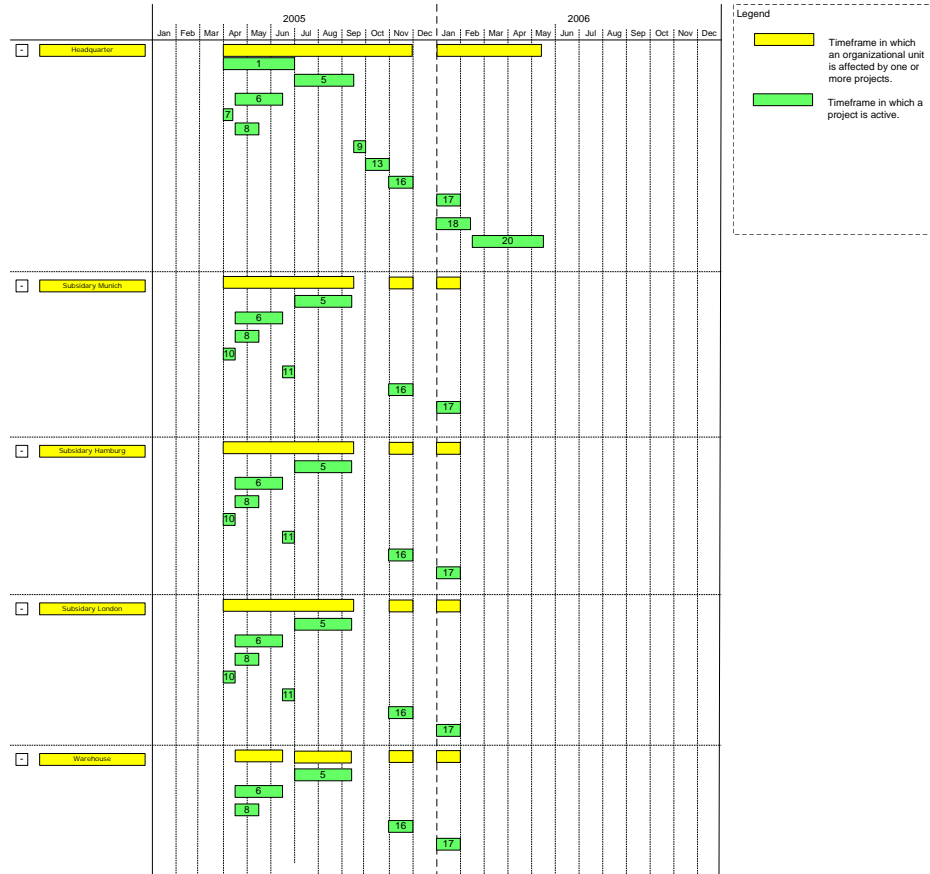


Figure 3.24: Scenario *synchronization management*: interval map connecting projects to affected organizational units

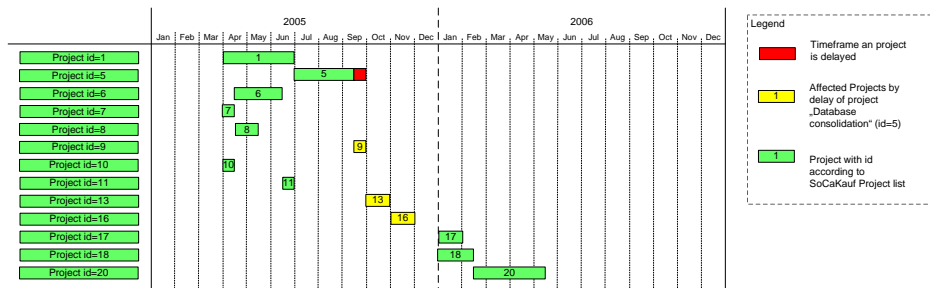


Figure 3.25: Scenario *synchronization management*: interval map displaying projects affected indirectly by the delay of another project

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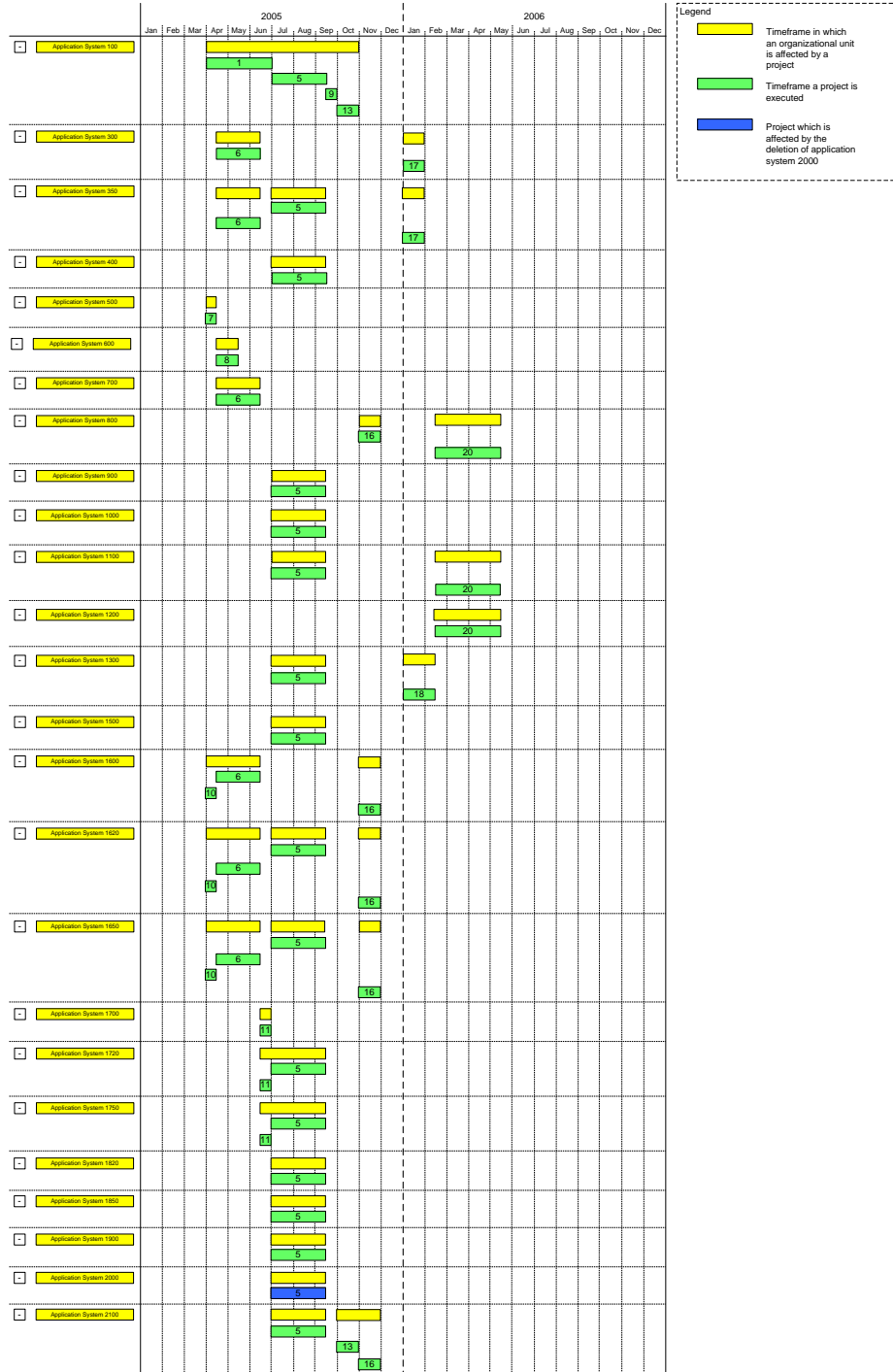


Figure 3.26: Scenario *synchronization management*: interval map displaying projects affected by the deletion of an application

Id	Name	Planned Start	Planned End	Delayed Start	Delayed End
9	VAT change in online shop	15.09.2005	01.10.2005	01.10.2005	15.10.2005
13	Reliability Improvement of the Online Shop	01.10.2005	31.10.2005	15.10.2005	15.11.2005
16	Introduction of a bonus card for customers	01.11.2005	01.12.2005	15.11.2005	15.12.2005

Figure 3.27: Scenario *synchronization management*: report of the projects affected by a project delay

organizational units are affected by which projects. The data needed therefore can be derived from the already imported data by traversing the repository from projects to affected business applications and from there to the organizational units where these applications are *used at*. A possible visualization of that kind might look like figure 3.24.

Further a project delay shall be simulated, delaying the project *Database consolidation* to end two weeks late. A visualization shall be created displaying the projects indirectly affected by this delay under the assumption that no business application should be modified by two projects at the same time. Such a visualization could look like figure 3.25. Also a tabular report containing information about the delay shall be created (see figure 3.27).

A last management task to be accomplished here is an impact analysis showing projects that are affected by the retirement of the application system *Customer Satisfaction Analysis System* to a given date. A visualization of this information might be achieved by color-coding the affected projects in a visualization like figure 3.26.

Traceability and Strategy Management

The scenario *Traceability and Strategy Management* is addressing issues of aligning the EA management activities to the organization's strategies and goals. It is analyzed whether the tool supports that a strategy is transferred through the organizational hierarchy by decomposing it into smaller and more detailed pieces. Traceability also includes tracing back the decomposition process, making it possible to trace from a specific action item on a fine grained level view of the organizational hierarchy to the strategy it has been derived from. The cross function that is concerned here is *Strategy & Goals* according to the information model (see 3.1.2). All layers may be equally affected by a scenario of this kind. The concern of this scenario are described as follows:

As part of the implementation of a balanced scorecard at the "SoKaKauf" department store the *customer perspective* will be considered. The strategies and goals will lead to different projects and changes in the EA. These changes should be traceable to the previously defined strategies and goals.

The questions derived from this concern are:

- Which strategy leads to which goals?
- Have all goals been reached?
- Which organizational units haven't reached their goals?
- Which projects serve which goals?

The information needed in accomplishing this scenario is information about the enterprise's strategies and goals as well as the relationships to each other and to the projects planned and executed. Further, information about metrics operationalizing the goal should be added, while the metrics themselves

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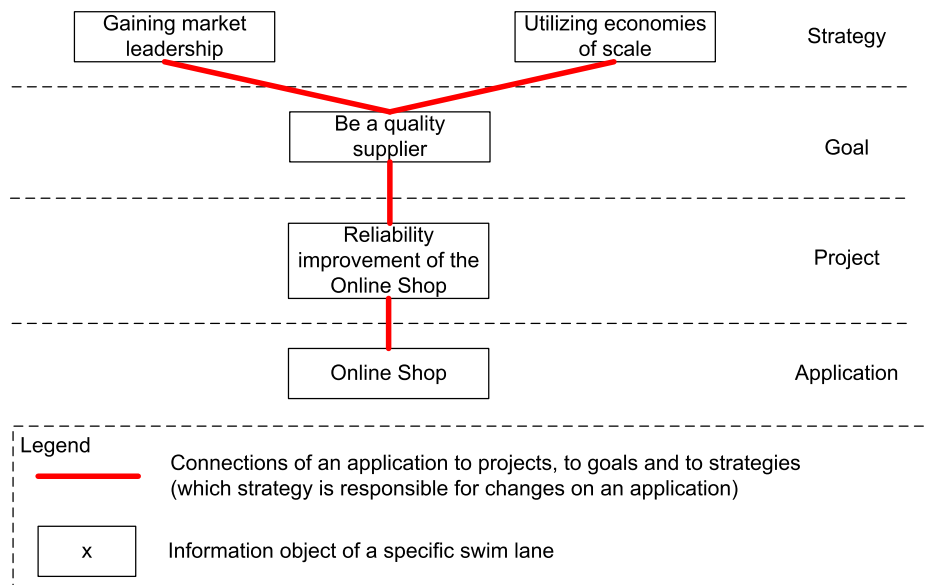


Figure 3.28: Scenario *traceability and strategy management*: impact analysis starting with a business application

Strategy	Goal						
	Be cost effective (X1)	Be a quality supplier (X2)	Reduce storage time (A1)	Reduce time to delivery (B1)	Increase number of purchases (C1)	Reduce complaints (D1)	Increase customer satisfaction (D2)
Gaining market leadership (1)		x	x	x	x	x	x
Utilizing economy of scale (2)	x	x	x	x	x		

Figure 3.29: Scenario *traceability and strategy management*: report with strategies and goals

take different values for different entities at different times. The role (current value or target value) and the validity, time at a measure is given by the measure assignment.

A visualization showing one potential path of tracing a project affecting a particular business application up to the strategies this project has been derived from is shown in figure 3.28.

A tabular report (see figure 3.29) should show the goals contributing to pursuing a specific strategy. The fulfillment of a specific goal up to the current date can be derived from the metrics it is operationalized by and the target values defined for them. Showing the current state of a goal's fulfillment is also very important in keeping track of the companies' strategies and goals. A tabular report containing this information is given in figure 3.30.

Management of Business Objects and Business Services

The scenario *Management of Business Objects and Business Services* simulates the tools capabilities to handle business objects, business services, and information flows exchanging the business objects between applications. The layer *Business Service* is mainly concerned here, also the layers *Business* and *Applications* are of interest. The concerns of this scenario are described as follows:

Business objects, their relations to processes, services and applications should be collected

Goal	Organizational Unit	Metric	2005-05-01	2005-08-01	Target	Fulfillment	Indicator
Be cost effective (X1)	SoKaKauf	Sum of personnel, material and capital cost (1)	30000000	42001471	45000000	159.97%	
Be a quality supplier (X2)	SoKaKauf	Average customer satisfaction according to a performed survey (2)	6	7	7	100.00%	
Reduce storage time (A1)	Warehouse (5)	Average time in storage (for an article) in days (3)	10	8	9	200.00%	
Reduce time to delivery (B1)	Warehouse (5)	Maximum delivery time in days (4)	30	25	21	55.56%	
	Warehouse (5)	Average delivery time in days (5)	5	5	4.5	0.00%	
Increase number of purchases (C1)	Subsidiary Munich (2)	Number of purchases per day (6)	14000	15000	15400	71.43%	
Reduce complaints (D1)	Subsidiary Munich (2)	Number of complaints per day (7)	10	9	8	90.00%	
Increase customer satisfaction (D2)	Subsidiary Munich (2)	Average customer satisfaction according to a performed survey (8)	6	7	7	100.00%	

Figure 3.30: Scenario *traceability and strategy management*: report with goals, metrics, and measures

in the EA management tool. Application systems using transformations of business objects should be linked to these objects.

The questions in this context are:

- Which business objects are modified by which applications during the execution of which processes?
- Which applications work on which business objects?
- Which are the relationships between processes, services, objects, and applications?

Needed in simulating this scenario is information about *Business Applications* offering *Business Services* for supporting *Business Processes* via *Connectors*. Further information about *Interconnections* linking business applications as well as the *Business Objects* exchanged over these links are needed.

The information flow represented by exchanged business objects should be visualized for a specific depicted business process at a specific organizational unit (see figure 3.31). The connectors of the business applications may additionally provide information about the connection type.

A matrix and a report showing which applications communicate with each other and what business objects are exchanged (see figure 3.32 and figure 3.33).

Application Architecture Management

The scenario *Application Architecture Management* deals with the introduction and the implementation of blueprints standardizing the architecture of the specific business applications. This means introducing architectural standards applications should be based on and current applications should be adapted to. In terms of the information model outlined in section 3.1.2, the affected cross function is *Architecture & Patterns*, among the layers mainly *Applications* is affected. The concerns of this scenario are described as follows:

SoKaKauf regards its heterogeneous application landscape as a problem. The high number of technologies used in different architectures calls for a high number of experts. A homogenization may reduce operating costs, e.g. consolidation of used software licenses, and maintenance expenses, e.g. reducing administrative efforts.

The questions of relevance in this context are:

- Which architectures are used within SoKaKauf?
- Which of the existing architectures should be maintained, which should be replaced?
- Which technologies are used within SoKaKauf?

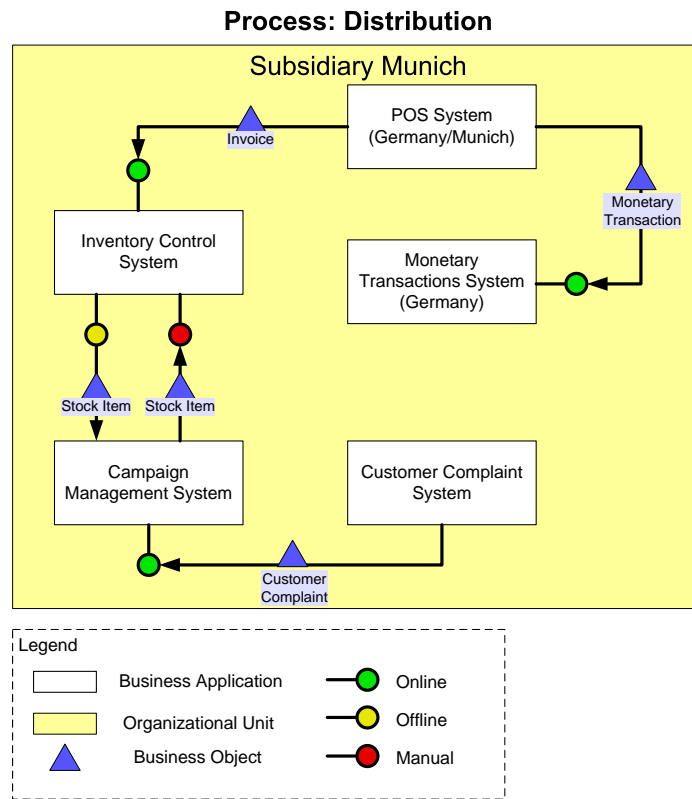


Figure 3.31: Scenario *management of business objects and business services*: cluster map showing information flows between business applications

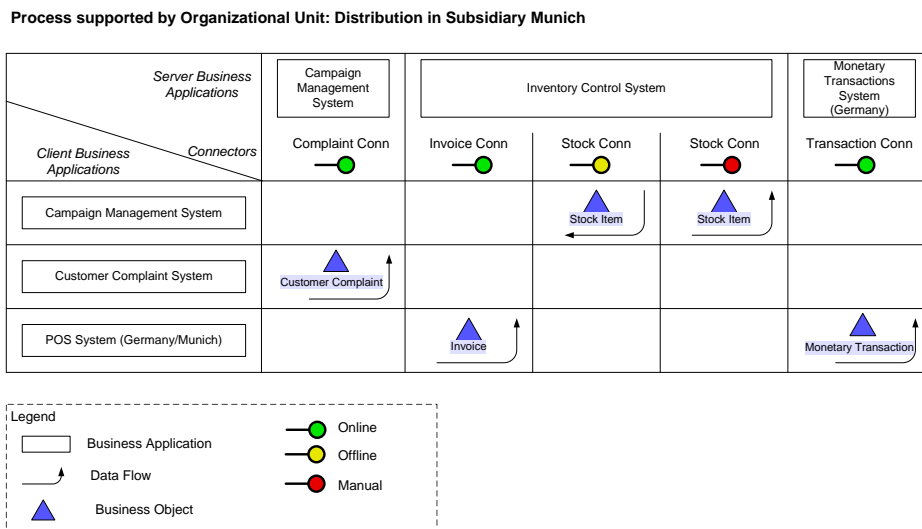


Figure 3.32: Scenario *management of business objects and business services*: matrix map showing information flows between business applications

3. Approach to EA Management Tool Survey

Server Application		Server Application				
		Inventory Control System		Monetary Transactions System (Germany)	Campaign Management System	
Connector		Stock Conn (200)	Stock Conn (300)	Invoice Conn (100)	Transaction Conn (500)	Complaint Conn (400)
Connector Type		Offline	Manual	Online	Online	Online
Client Application	Campaign Management System	Stock Item (s->c)	Stock Item (c->s)			
	POS System (Germany/Munich)			Invoice (c->s)	Monetary Transaction (c->s)	
	Customer Complaint System					Customer Complaint (c->s)

Figure 3.33: Scenario *management of business objects and business services*: report showing information flows between business applications

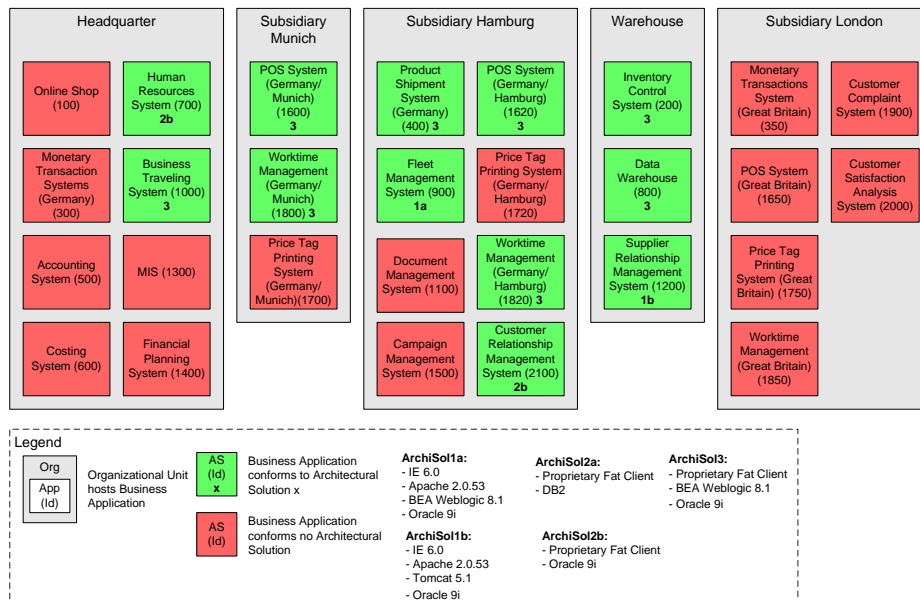


Figure 3.34: Scenario *application architecture management*: cluster map showing business applications and their conformance with architectural solutions

3. Approach to EA Management Tool Survey

Id	Name	Used Architectural Solution (id)	Used Technologies (id)
100	Online Shop		
200	Inventory Control System	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
300	Monetary Transactions System (Germany)		
350	Monetary Transactions System (Great Britain)		
400	Product Shipment System (Germany)	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
500	Accounting System		
600	Costing System		
700	Human Resources System	ArchSol2b (400)	Oracle 9i (200); Proprietary Fat-Client (1200)
800	Data Warehouse	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
900	Fleet Management System	ArchSol1a (100)	Oracle 9i (200); Bea Weblogic 8.1 (900); Apache 2.0.53 (700); IE 6.0 (1000)
1000	Business Traveling System	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
1100	Document Management System		
1200	Supplier Relationship Management System	ArchSol1b (200)	Oracle 9i (200); Tomcat 5.1 (800); Apache 2.0.53 (700); IE 6.0 (1000)
1300	MIS (Management Information System)		
1400	Financial Planning System		
1500	Campaign Management System		
1600	POS System (Germany/Munich)	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
1620	POS System (Germany/Hamburg)	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
1650	POS System (Great Britain)		
1700	Price Tag Printing System (Germany/Munich)		
1720	Price Tag Printing System (Germany/Hamburg)		
1750	Price Tag Printing System (Great Britain)		
1800	Worktime Management (Germany/Munich)	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
1820	Worktime Management (Germany/Hamburg)	ArchSol3 (500)	Oracle 9i (200); Bea Weblogic 8.1 (900); Proprietary Fat-Client (1200)
1850	Worktime Management (Great Britain)		
1900	Customer Complaint System		
2000	Customer Satisfaction Analysis System		
2100	Customer Relationship Management System (CRM)	ArchSol2b (400)	Oracle 9i (200); Proprietary Fat-Client (1200)

Figure 3.35: Scenario *application architecture management*: report showing business applications and their conformance with architectural solutions

- Which of the existing technologies should be kept, which should be replaced?
- Which applications use which technologies?
- What actions have to be derived if architectures/technologies will be replaced?

The information needed to accomplish this scenario consists of information about the *abstract technologies*, classes of technologies, such as "Webserver" or "Database", the *technologies* realizing them, such as "Apache 2.0" or "Oracle 9.2i", the *architectural blueprints*, such as "4-tier-thin-client-architecture", making use of abstract technologies, and the *architectural solutions* realizing a specific architectural blueprint by utilizing concrete technologies.

A first visualization is a cluster map, showing by color-coding which business application is compliant with which architectural solution (see figure 3.34). Further a report shall be created giving information about the relationships of the business applications with the architectural solutions they are based on and the concrete technologies used to realize the given architectural solution (see figure 3.35).

In order to get information about the degree of homogenizations of the application landscape it is also of interest to analyze how often an architectural solution is used. Figure 3.36 visualizes the number of usage for each architectural solution.

Infrastructure Management

The scenario *Infrastructure management* deals with issues of the IT infrastructure of the company that contains but is not limited to database and middleware systems. Thus, in the terms of the information model outlined in section 3.1.2, the affected cross function is *Architecture & Patterns*, the affected layers are mainly *Infrastructure*, *Application*, and *Business*. The concerns of this scenario are described as follows:

The department store SoKaKauf intends to consolidate its database systems to decrease the costs for maintenance and licences. Also, expected support periods offered by the database vendors should be considered.

3. Approach to EA Management Tool Survey

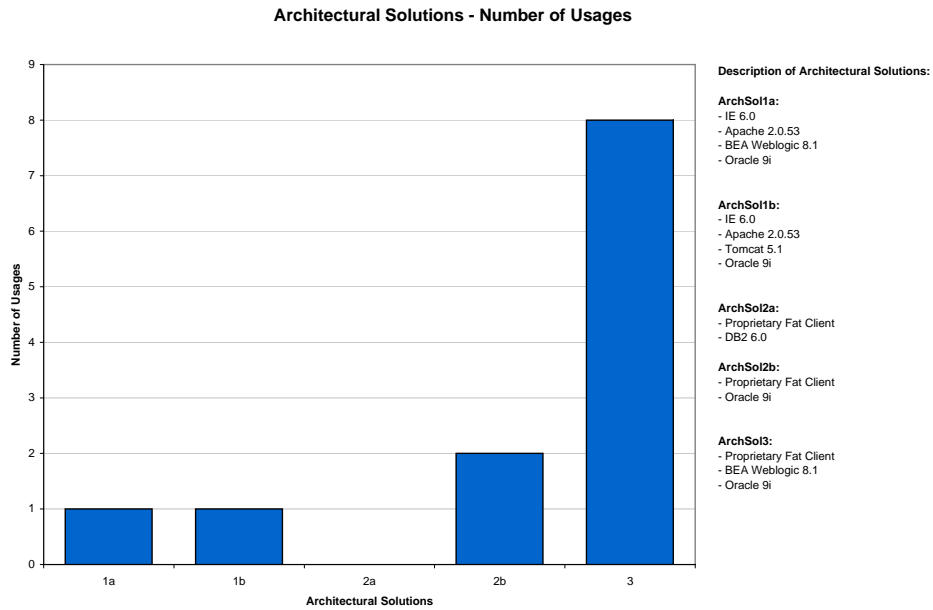


Figure 3.36: Scenario *application architecture management*: report showing number of usage of architectural solutions

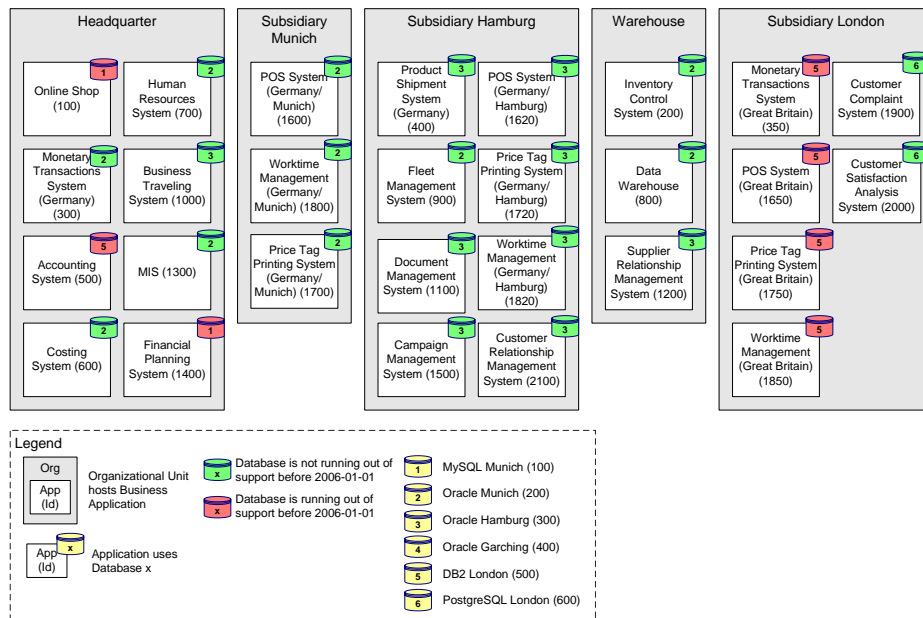


Figure 3.37: Scenario *infrastructure management*: cluster map visualizing databases running out of support and the applications using them

3. Approach to EA Management Tool Survey

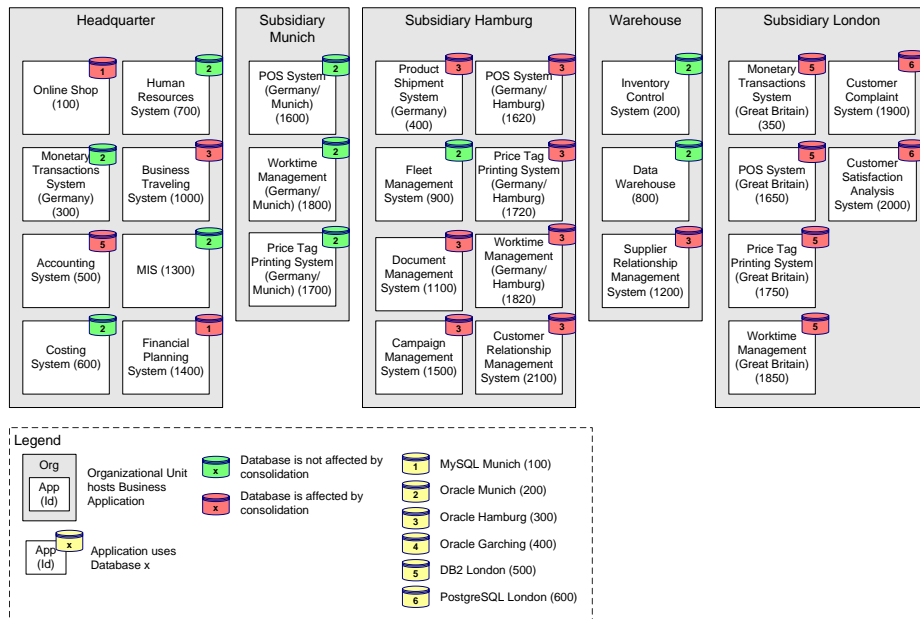


Figure 3.38: Scenario *infrastructure management*: cluster map visualizing applications and databases affected by consolidation

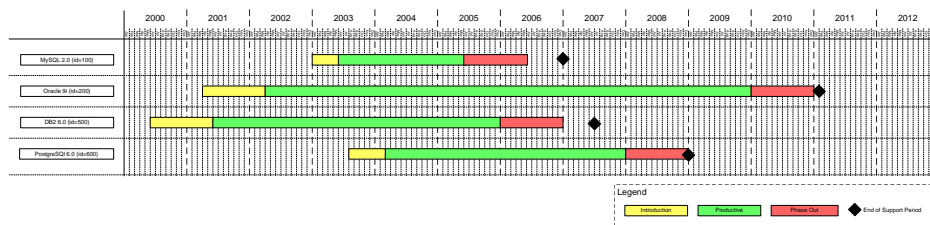


Figure 3.39: Scenario *infrastructure management*: interval map visualizing the lifecycle stages of the database technologies

The questions in this context are:

- What databases (DBs) are in use?
- Which DBs are in danger of running out of support?
- Which application system uses which DBs?
- What are the costs for operating and licensing of which DB?
- Which DBs are to be replaced and which applications systems are affected by that?

The information needed for simulating this scenario consists of information about the infrastructure elements and their relationships of type *hosted at* to the organizational units, the technology - entities containing the database version and lifecycle information, and the relationships between business applications and infrastructure elements. The first visualization to be created depicts the use of

3. Approach to EA Management Tool Survey

App Id	App Name	DB Id	DB Name	Affected
100	Online Shop	100	MySQL Munich	x
200	Inventory Control System	200	Oracle Munich	
300	Monetary Transactions System (Germany)	200	Oracle Munich	
350	Monetary Transactions System (Great Britain)	500	DB2 London	x
400	Product Shipment System (Germany)	300	Oracle Hamburg	x
500	Accounting System	500	DB2 London	x
600	Costing System	200	Oracle Munich	
700	Human Resources System	200	Oracle Munich	
800	Data Warehouse	200	Oracle Munich	
900	Fleet Management System	200	Oracle Munich	
1000	Business Traveling System	300	Oracle Hamburg	x
1100	Document Management System	300	Oracle Hamburg	x
1200	Supplier Relationship Management System	300	Oracle Hamburg	x
1300	MIS (Management Information System)	200	Oracle Munich	
1400	Financial Planning System	100	MySQL Munich	x
1500	Campaign Management System	300	Oracle Hamburg	x
1600	POS System (Germany/Munich)	200	Oracle Munich	
1620	POS System (Germany/Hamburg)	300	Oracle Hamburg	x
1650	POS System (Great Britain)	500	DB2 London	x
1700	Price Tag Printing System (Germany/Munich)	200	Oracle Munich	
1720	Price Tag Printing System (Germany/Hamburg)	300	Oracle Hamburg	x
1750	Price Tag Printing System (Great Britain)	500	DB2 London	x
1800	Worktime Management (Germany/Munich)	200	Oracle Munich	
1820	Worktime Management (Germany/Hamburg)	300	Oracle Hamburg	x
1850	Worktime Management (Great Britain)	500	DB2 London	x
1900	Customer Complaint System	600	PostgreSQL	x
2000	Customer Satisfaction Analysis System	600	PostgreSQL	x
2100	Customer Relationship Management System (CRM)	300	Oracle Hamburg	x

Figure 3.40: Scenario *infrastructure management*: report showing applications and databases affected by the consolidation

Id	Name	Start Introduction	End Introduction	Start Production	End Production	Start Phase Out	End Phase Out	End of Support Period
100	MySQL 2.0	01.01.2003	01.06.2003	01.06.2003	01.06.2005	01.06.2005	01.06.2006	31.12.2006
200	Oracle 9i	01.04.2001	01.04.2002	01.04.2002	01.01.2010	01.01.2010	31.12.2010	31.01.2011
500	DB2 6.0	01.06.2000	01.06.2001	01.06.2001	31.12.2005	31.12.2005	31.12.2006	30.06.2007
600	PostgreSQL 6.0	01.08.2003	01.03.2004	01.03.2004	01.01.2008	01.01.2008	31.12.2007	31.12.2007

Figure 3.41: Scenario *infrastructure management*: report showing databases running out of support

DBs by the application systems. The same information should be exported as a tabular report (see figure 3.41).

The database consolidation shall take into consideration the support periods offered by the database vendors. Especially, we focus on the databases running out of support before January 2006. This information shall be represented in a visualization (similar to figure 3.37) as well as in a tabular report (see figure 3.40).

In order to consider the planned support periods for the database systems more information about the lifecycle status and the expected future development of the databases is needed and shall be displayed in a diagram (see figure 3.39 for an example). In a last step the databases to be removed during the consolidation process are selected (through an external process, e.g. a management decision). The repository should be updated with this information and the adapted information shall be displayed by annotating one of the visualizations above (as done in figure 3.38) as well as by a tabular report.

3.4 Scenario Simulation

In order to ensure the consistency of evaluation for all tools the procedure for simulating scenarios is described in detail. For every scenario the following information is gathered:

Achievement of objectives: Was it possible to create the deliverables the scenario was aiming at (or comparable deliverables)?

Tool handling: How many pitfalls and shortcomings in the user interface, etc. contributed to a high effort in producing the deliverables?

Procedure consistency: Does the procedure for creating the deliverables correspond to the methodology the tool is relying on or have parts of the tool's model be *misused* to simulate a scenario?

Procedure integration: Does the tool provide an integration of the activities and objectives in respect to other relevant activities and objectives of EA management and other simulated scenarios, etc.?

The results of scenario simulation are finally consolidated by the evaluation team in a workshop leading to an order of the tools reflected in the ordinal scaled values for the tools that are shown on the kiviatic axes.

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Adaptive Ltd. provides the EA management tool *Adaptive EAM* which is based on a MOF 1.4¹ compliant repository, providing an infrastructure for documenting and planning enterprise architectures.

Centered around the repository a widely configurable web interface, a Microsoft Visio client, and various data exchange capabilities make up *Adaptive EAM*. These exchange capabilities leverage the approach to integrate other tools contributing to the EA management process.

Adaptive EAM is strongly based on standards, leveraging standards not only in regard to the repository infrastructure, but also where available in the predefined metamodels. It suits this picture, that the tool's manufacturer, Adaptive, Inc. is an OMG member, taking part in shaping some of these standards.

4.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

4.1.1 Configurability of the Metamodel

Adaptive EAM provides two distinct methods of performing metamodel changes, one geared to simple, lightweight changes, the other one designed to provide utmost flexibility and configurability in tailoring the tools's metamodel.

First, full scale metamodeling is possible e.g. via an import of metamodels, e.g. from Microsoft Visio *Rational Rose*, or other tools that support XMI². Thereby the concepts of MOF 1.4 are supported together with some extended data types like *date*, *timestamp*, or *blob*, leading to a repository that not only supports basic features of metamodeling like entity and relationship types, but also advanced features like multiplicity of association ends, inheritance or abstract classes.

After adapting the metamodel the respective change can be made visible on the web client of *Adaptive EAM*. This has to be achieved via the *Adaptive Designer* tool, a standalone fat client. This tool consists of three parts, the *Views Manager* (see figure 4.1), the *Forms Manager* (see figure 4.2) and the *Process Manager* (see figure 4.3).

The Adaptive Views Manager provides functionality to create and configure item types and the web pages that display information about them, also providing functionality to create and modify predefined reports. Besides this, it provides functionality for the configuration of user groups and roles.

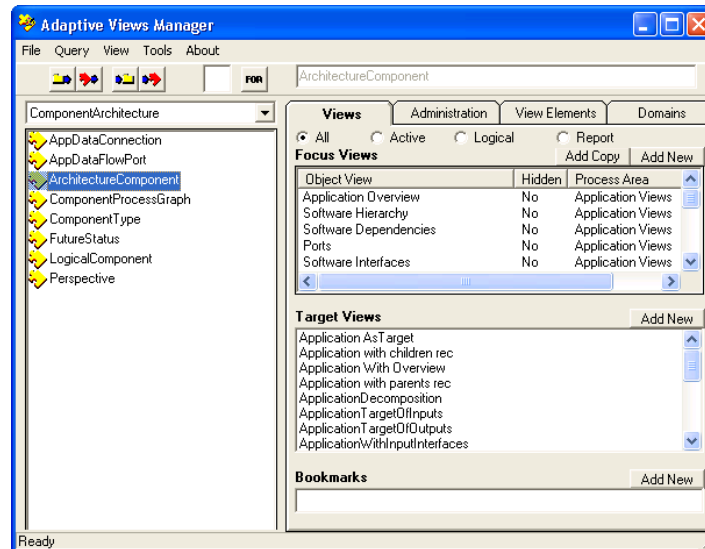
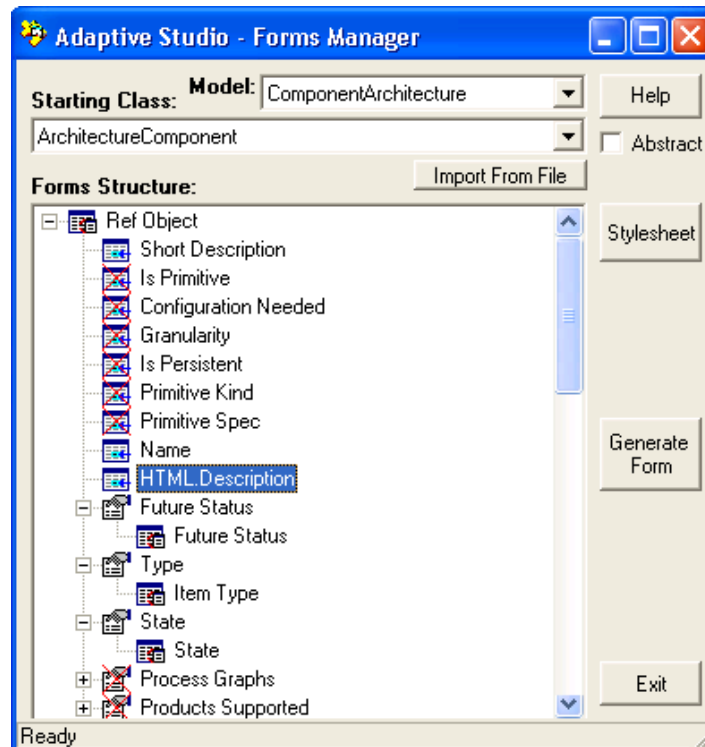
The forms that are used to edit the data in the metamodel are created and modified via the Forms Manager. Thereby, a plethora of functionality is available: making attributes mandatory or read-only, creating validation expressions for attributes, or setting default values for them. Thereby, it has to be noted that changes performed in the Forms Manager always affect a certain form. Another form, used when users with a different role access a certain entity, might have very different settings established in the Forms Manager.

The Process Manager enables the user to define page flows, e.g. sequences of the forms (both edit and read only forms) that have to be filled out/viewed by a user in order to carry out a specific task. This is done by drawing workflow diagrams in a Microsoft Visio based client.

It has to be noted that these tools are not intended to be used by an unexperienced user. The user should at least have a minimum of training with *Adaptive EAM* and the Adaptive Designer.

¹According to Adaptive, release 3.1 which is due in September 2005 is going to support MOF 2.0.

²XMI is an XML format for model and metamodel interchange.

Figure 4.1: *Adaptive EAM*: the views managerFigure 4.2: *Adaptive EAM*: the forms manager

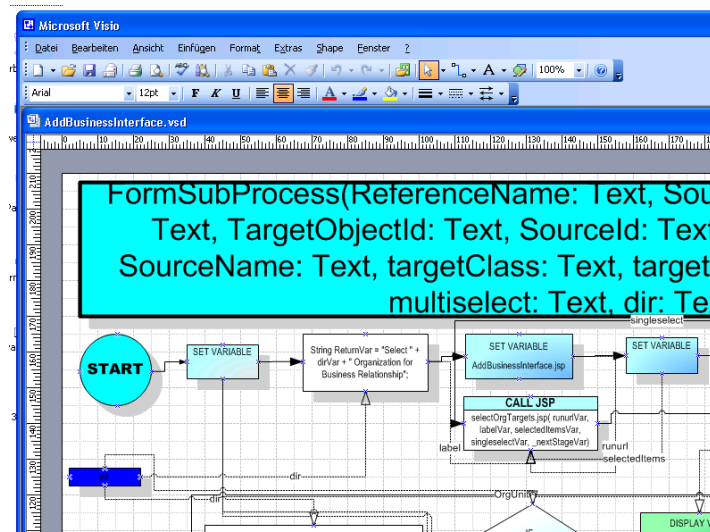


Figure 4.3: Adaptive EAM: excerpt from the process manager



Figure 4.4: Adaptive EAM: classification created to add necessary variables to software component

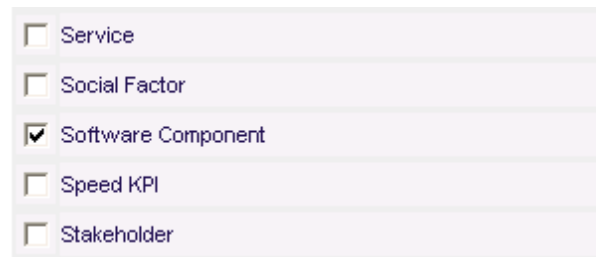



Figure 4.5: Adaptive EAM: attachment of classifications to item types

 **Software Component** *Accounting System*

Overview

Description: Buchführungssystem (Accounting)
 This item has no Future Status

Creation Time: 17.06.2005 18:20:32 **Modification Time:** 15.07.2005 18:32:40

Classifications

Application Metrics	
Application size	Size 4
Criticality Rating	Criticality 3
Availability	99.9

Figure 4.6: Adaptive EAM: classification in use

Second, a less powerful but more easy way to perform metamodels changes are the *classifications*, accessible via *Adaptive EAM*'s web client. A classification constitutes a set of attributes (see figure 4.4), which can be attached to item types³ (see figure 4.5 and figure 4.6). Data types that can be used via this mechanism are text (string) and choice items.

Rating: 5 points for configurability of the metamodel.

4.1.2 Coverage of EA Management Concepts by Predefined Metamodel

Adaptive EAM comes with a collection of several rich metamodels, some of them being standards-based, others being proprietary developments of Adaptive. These metamodels are meant to be used in combination. Together, they contain about 900 entity types, having a short description available specifying the meaning for each of these classes. The concepts available in the predefined metamodels support a wide range of activities relevant to EA management.

The metamodels have been constructed under consideration of standards like Zachman [ZIF05], TO-GAF [TOG05], CIM [DMT99], ITIL [OGCO00], and OMG metamodel standards. Of course, not all parts of the predefined metamodels are compliant to a standard as there are areas covered that are not addressed by a major standard.

In order to be able to simulate scenarios, a mapping from the classes shown in figure 3.4 to similar item types has to be devised. According to Adaptive, this is also the standard approach to customer projects.

For simulating the scenarios as described from section 4.2.1 to section 4.2.7, it was only necessary to add some attributes to certain entity types, which could always be achieved via the classifications mechanism described in section 4.1.1. Regarding all other cases, the respective concepts could be mapped to similar concepts in the predefined metamodel, although in some cases it was necessary to make these parts of the metamodel visible on the web client of *Adaptive EAM* in a way suitable for the scenario simulation. These modifications, which involved the *Adaptive Designer*, were sometimes a bit demanding.

Rating: 4 points for coverage of EA management concepts of the metamodel.

4.1.3 Support for Impact Analyses & Calculation

The most important feature regarding the support *Adaptive EAM* offers for performing impact analyses and calculation is the querying language supplied by the tool. These queries are built stepwise: starting from an entity type that is selected as a starting point for the query (see figure 4.7), it is possible to navigate to other entities via relationships (see figure 4.8), where it is also possible to establish a filtering over certain attributes of entity types in each step (see figure 4.9).

Thus, the queries can be used to perform impact analyses that are neither limited regarding to the number of traversed relationships nor conceal the relevant facts in unnecessary pieces of information as the traversed relationship types can be restricted, based on their type and the attribute values of the entities referenced by them.

The results of a query are presented in textual form. In order to show these results also in a graphical way, the respective query has to be constructed via the *Adaptive Designer* and then made public as a view. It is hardly imaginable to make this procedure available to ordinary users: the *Designer*, as mentioned in section 4.1.1, is a fat client and therefore not accessible via the *Adaptive EAM* web

³Using Adaptive's terminology *item types* are subtypes of classes that are, according to Adaptive, intended to represent the things that users are interested in managing.

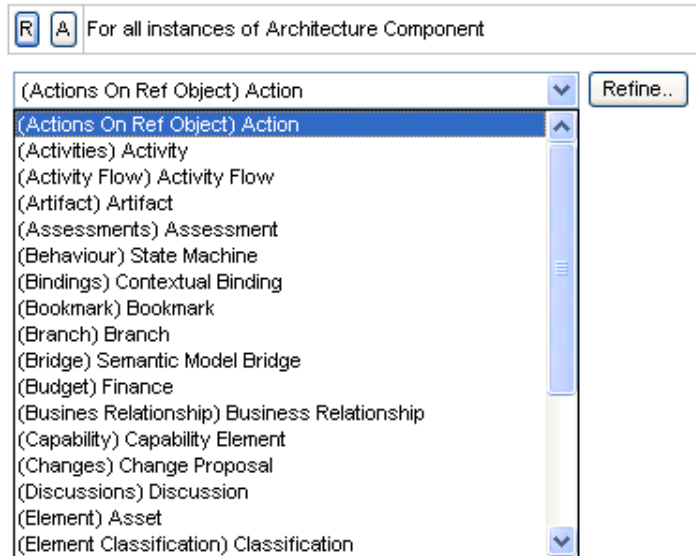


Figure 4.7: *Adaptive EAM*: selecting the starting entity for a query

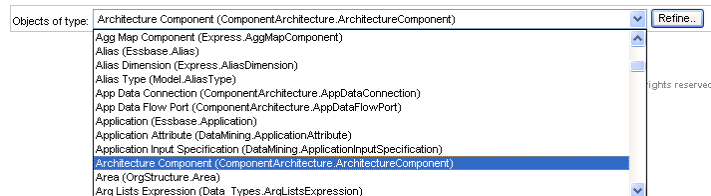
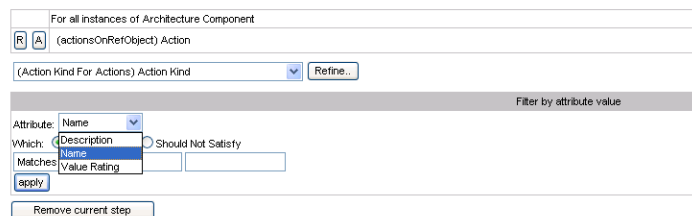


Figure 4.8: *Adaptive EAM*: navigating a metamodel relationship in building a query



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Figure 4.9: *Adaptive EAM*: adding an attribute-based filter to a query

General KPI			
Name	Description	Type	State
Employee Work Ability	How well is the focus item contributing to the well-being of the organization?	Gen_Performance-SubMetric	

General Assessments					
Assessment	Date Of Assessment	Description	Owner Name	Rating	Qualitative Rating Comment
17.08.2005	Assessment	Administrative	2.00	rather good	

Figure 4.10: *Adaptive EAM*: adding an assessment to an entity

interface. Furthermore its use might not be possible without the user receiving some training first. Therefore such queries are most likely to be created by a user filling an administrator role.

Of course, the views created as sketched above can be easily viewed by arbitrary users, which have to be granted specific rights via the access control features of *Adaptive EAM*. The results of the respective queries can then be presented either in textual or in graphical form, leading to the automatic generation of graph visualizations in the fashion of e.g. figure 4.13.

It has to be noted that for each entity type there are already several predefined views that show relationships considered important by the tool vendor.

Arithmetical operations on the result set of a query (e.g. summing up or building averages) are not supported via functionality available on the web interface of the tool. Nevertheless, by changing the XSLT⁴ stylesheet that is utilized by a certain view, such operations can be customized into the tool. A more easy to use way of performing calculations is provided by an optional add-on to *Adaptive EAM* for calculating TCOs⁵. This component is able to sum up the values metrics of type *cost* take up for a specific component, also taking into consideration certain timespans. Furthermore, there are concepts in the predefined metamodel, the so called *assessments* that offer the possibility to store metrics information for the entities in the repository in a quite flexible manner (see figure 4.10).

Rating: 4 points for support of impact analyses & calculation.

4.1.4 Richness of Predefined Visualization Techniques

The standard approach of visualizing data in *Adaptive EAM* are the fully automatically generated SVG-based visualizations the tool can provide via its web interface. These visualizations depict information about entities and their visualizations as graphs, where the entities are symbolized by nodes with a symbol indicating the entity type and edges between the nodes representing relationships between the entities, with an edge description showing the kind of relationship (see figure 4.11). Moving the mouse pointer over a node brings up a pop up containing information about the represented entity. Such visualizations can be created for every relationship, which is also visible textually on the web client of *Adaptive EAM*.

Besides the layout type shown in figure 4.11, also other layouts like tree, tier, hierarchical, spring, fixed-tree, and balloon are available, of which the spring layout is shown in figure 4.12. Other layout types are available for special diagrams, as e.g. data lineage diagrams or UML class diagrams, although *Adaptive EAM* is not meant to be a full scale UML modeling tool. The layout algorithms always affect all nodes shown in the diagram. Of course, the diagrams support the zooming and navigation features common for SVG-based graphics. Additionally, the layout type can be chosen interactively.

Using these capabilities, it is possible to create visualizations that show a subset of the information available on the software maps described in section A. Basically, this is achieved by selecting a cer-

⁴XSLT is a XML based language to describe XML transformations in a declarative way.

⁵Total Cost of Ownership

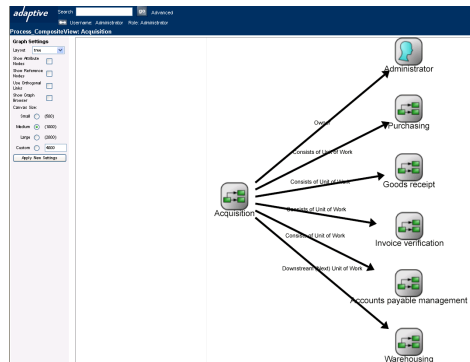


Figure 4.11: *Adaptive EAM*: graph-based visualization

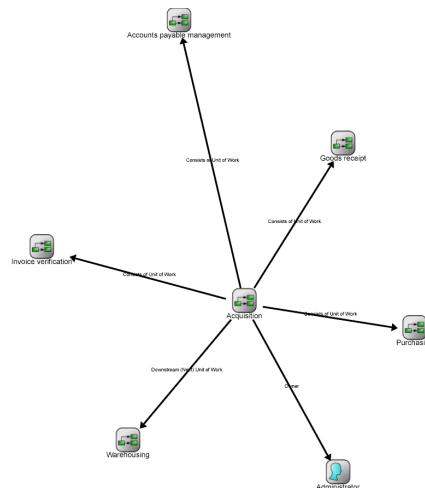


Figure 4.12: *Adaptive EAM*: graph-based visualization (spring layout)

tain entity type, going to a view containing the needed information and displaying this information graphically.

For example, when selecting a business application and displaying the information, which business processes are supported in which organizational units, the user can create a visualization like the one shown in figure 4.13 by switching to graphical view. Of course, this visualization covers only one business application and the graphical representation differs widely from a process support map. Employing a similar procedure, the visualization in figure 4.14 was created to show a part of the information displayed by an interval map. Especially regarding the interval map, there is a disadvantage to this approach, as the visualizations created hereby do not reveal any information about the lengths of the time spans during which the versions existed.

Utilizing the *bookmark* capabilities of *Adaptive EAM* it is possible to create visualizations of arbitrary queries. Thus it is possible to create visualizations targeting more than just one starting object. These capabilities allow for example displaying the information, which business application support which business processes at which organizational unit, as exemplified in figure 4.15. These visualization contains the same information as a business support map (see figure A.2 in section A.1.2), but

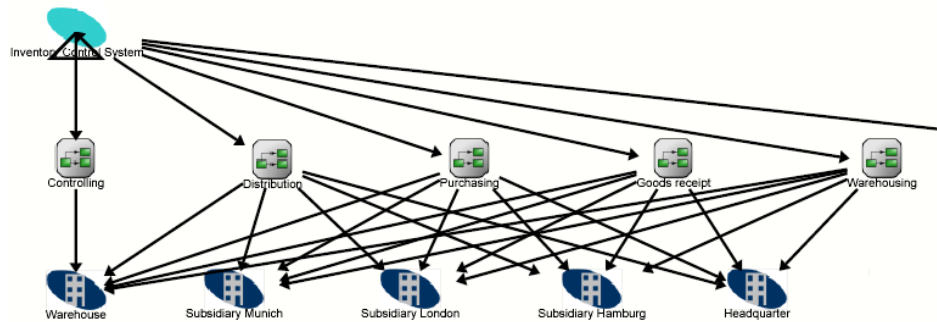


Figure 4.13: *Adaptive EAM*: graph-based visualization showing which business processes are supported by a business application in which organizational unit

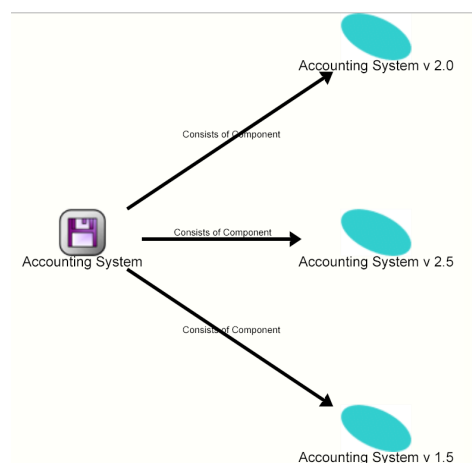


Figure 4.14: *Adaptive EAM*: graph-based visualization showing the versions of a business application

differs widely if the graphical representation is considered. Bookmarks are created using the *Adaptive Designer*.

More sophisticated diagrams can be created via the so called *techniques* in *Adaptive EAM*. In this respect, a *technique* is a specific diagram type, made up by a collection of entities and their relationships and their representation via mastershapes in a Microsoft Visio stencil⁶ (see figure 4.16). According to Adaptive, other tools can be supported in a similar way via customer specific projects. As the respective capabilities are built on the *OMG Diagram Interchange* standard, it might be expected that future modeling tools support this integration out-of-the-box.

It has to be noted that connecting elements by lines is not the only possibility to represent relationships. The *IDEF3 Flow* diagram, for example, uses the graphical relationship *is contained in* in order to express that a *formal organization* owns a *Unit of Work*. The techniques are implemented via special Microsoft Visio stencils, which contain macros that access the *Adaptive EAM* repository via a web

⁶A *stencil* is a collection of *mastershapes*. A *mastershape* is the generic shape that is instantiated if it is dragged on the canvas.

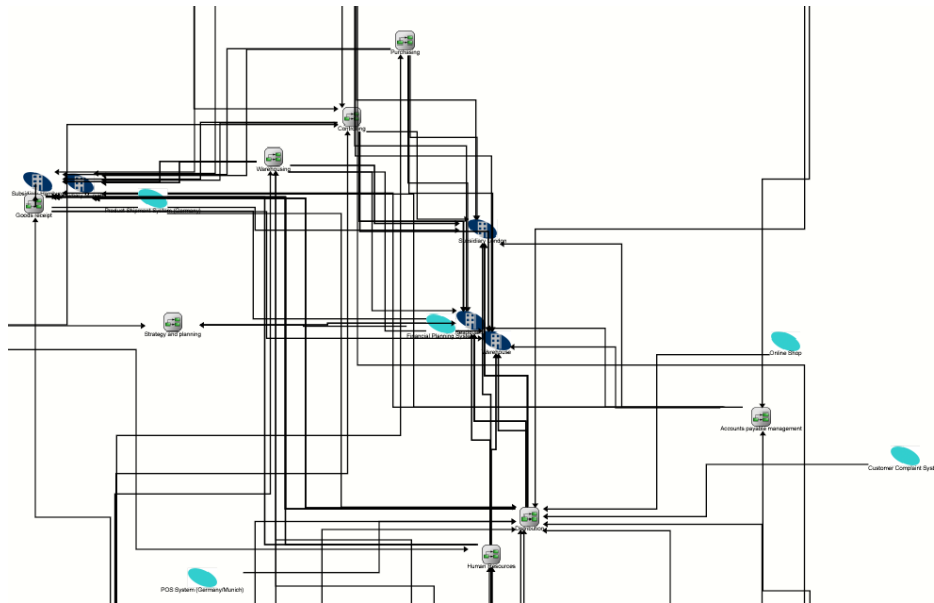


Figure 4.15: *Adaptive EAM*: excerpt from a graph-based visualization showing which business applications support which business processes at which organizational units

service. Thereby, the most important features are:

load entities: entities (and relationships) that are present in the repository can be imported and linked into the Microsoft Visio diagrams

create new entities and relationships: these entities are saved in the repository

save diagram to repository: the diagrams can then be viewed as SVG-based visualizations via the *Adaptive EAM* web interface (see figure 4.17)

load diagram from repository: saved diagrams can be loaded into Microsoft Visio for editing

When creating the diagrams, only mastershapes which are available in the respective stencils may be used, while using e.g. the ordinary Microsoft Visio shapes like the rectangle or circle is not deemed advisable, as these shapes do not enter the repository and are therefore not present in the SVG-based representation of the respective diagram⁷.

Adaptive EAM provides about 20 different techniques (i.e. diagram types), as for example for process modeling (*IDEF 3 Flow*, *Unit of Work Decomposition*, etc.), SWOT assessment, formal and informal organizations charts, key performance indicator decomposition, or deployment patterns.

The software maps, as described in appendix A, are not among these diagram types, although the concept of clustering as used by the cluster map (*is contained in*) is employed in the Microsoft Visio-based techniques, as for example in the *IDEF3 Flow-Diagram* described above. This *is contained in*-relationship also has a semantics in regard to the repository, as the respective relationship is created, when an element is placed inside of another one.

Rating: 3 points for richness of predefined visualization techniques.

⁷*Adaptive EAM* shows this behavior in order to enforce modeling standards.

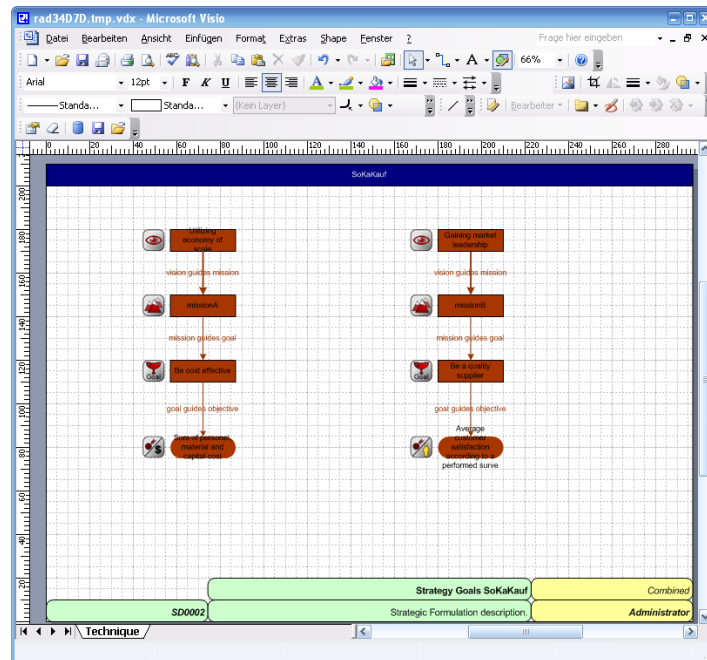


Figure 4.16: Adaptive EAM: diagram creation using the Microsoft Visio client

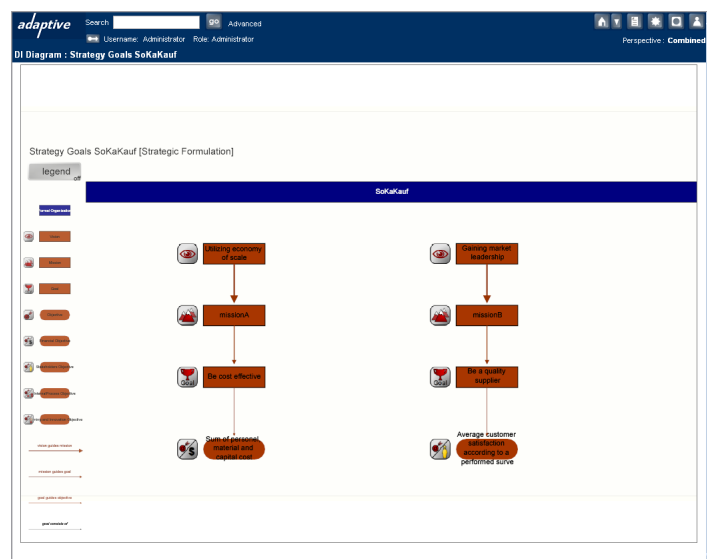


Figure 4.17: Adaptive EAM: diagram created using the Microsoft Visio client shown as SVG file in the web browser

4.1.5 Flexibility of Visualization Techniques

When describing the functionalities that add flexibility to the process of constructing or generating visualizations, the two kinds of visualizations in *Adaptive EAM* described in section 4.1.4 (the graph-based visualizations and the Microsoft Visio stencil-based techniques) have to be distinguished. As mentioned in section 4.1.4, the techniques can be extended to other tools.

Regarding the graph-based visualizations, the flexibility available to the user is, besides selecting what predefined view to visualize, choosing a layout algorithm from the set described in section 4.1.4. Of course, this functionality is complemented by the zooming and navigation capabilities, which are common to SVG graphics. The predefined views mentioned above can be defined via the *Adaptive Designer*, which can be expected to be available for users filling an administrator role. Hereby it is possible to create views that are based on queries that navigate arbitrary entities and relationships, although this powerful functionality is not always easy to use. By changing images in a server directory of the web application, the representation of the entities in the visualizations can be adapted. If the graphic should also be changed in the respective Microsoft Visio stencil, the change also has to be performed here. This can be done via standard Microsoft Visio stencil manipulation functionality. Manipulation of XSLT files that carry out transformations leading to diagram generation can further be utilized to change graphics to reflect repository content, although this might be difficult without some experience in *Adaptive EAM*.

More flexibility is available in the Microsoft Visio based diagrams. Here, a rather free positioning of the symbols is possible, of course restricted by positioning rules that are employed to express certain relationships in the repository. These positions are then saved in the repository and are reflected in the SVG representations of the respective diagrams that are available via the web interface of *Adaptive EAM*. Admittedly, free drawing in these Microsoft Visio diagrams is not supported, although the respective shapes (e.g. the rectangle or the circle) may be used, they are not stored in the repository, thus they also do not appear in the SVG representations of the diagrams. A special feature of the SVG representations of the diagrams is an automatically added legend, which highlights the entities of certain type when the user moves the cursor on legend entry concerned with the respective entity type.

Definition of new techniques can be done by customizing *Adaptive EAM* which in this case can be achieved via the *Adaptive Designer* and a *stencil generator* which is shipped with the tool. Thus, it is for example also possible to support the cluster map, which has been done in a customer project carried out by Adaptive consultants.

Rating: 3 points for flexibility of visualization techniques.

4.1.6 Flexibility of Reporting

In the context of reporting, two features of *Adaptive EAM* are of importance, the reports and the custom queries, which have already been described in section 4.1.3.

The strong point of the reporting capabilities of *Adaptive EAM* lies in the expressiveness of the querying language used to construct the reports. These capabilities, provided via the *Adaptive Designer* are actually the same as the ones used to construct the views on the objects (which can then also be visualized as graphs, as described in section 4.1.5). Thus, the reports are by far not limited to showing attributes of a specific entity type but can draw their information from arbitrary entities of the metamodel. It adds to the usability that reports can be created out of views, which means that the report is based on the same query as the view, which is then not only carried out for one entity, but for all entities of the respective type. An additional functionality useful in this context is that when displaying the report, it is possible to create a preselection of the entities that are taken as starting points for the query behind the report in order to restrict the number of entities included

Application Overview

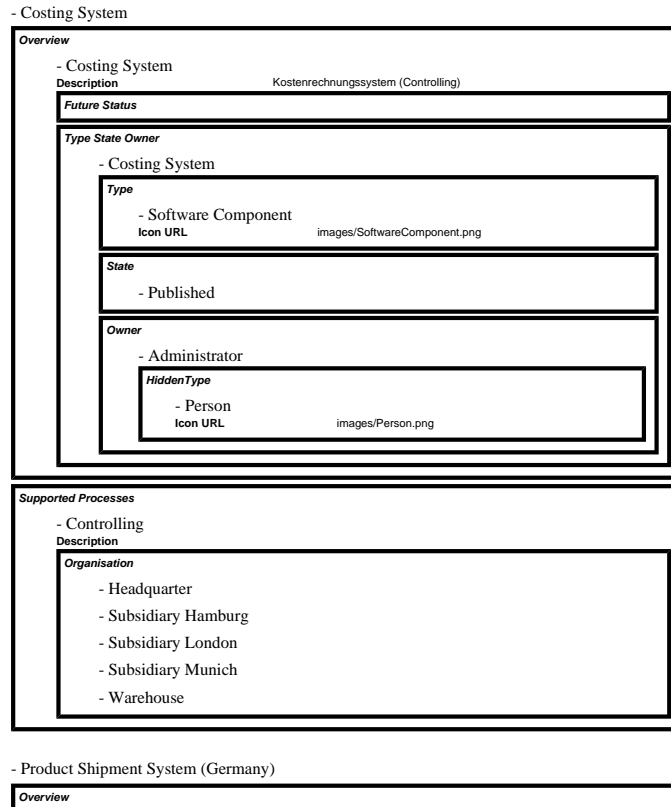


Figure 4.18: *Adaptive EAM*: report showing which business processes are supported by which business application at which organizational units

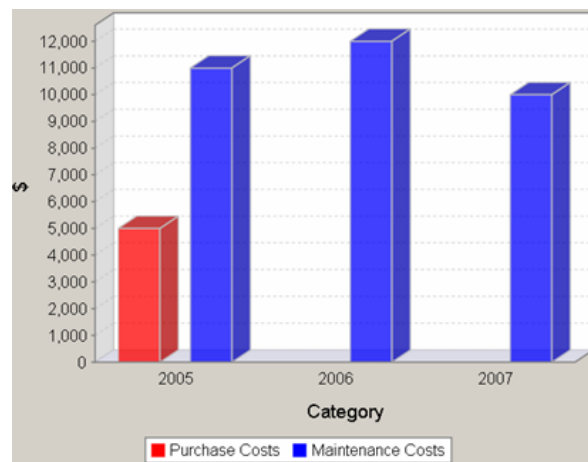


Figure 4.19: *Adaptive EAM*: example bar chart (image provided by Adaptive

therein. The custom queries, as described in section 4.1.3 can be used to create similar queries against the metamodel. The differences are that the custom queries can be build via the web interface and they provide slightly reduced functionality. Thus it is imaginable to provide the capability of query building also to ordinary users. Possible output formats for reports are html or the *Adobe Portable Document Format (PDF)*, it has to be noted that different output formats can be chosen by the user, one of them exemplified in figure 4.18.

A possibility to use *Adaptive EAM* repository data in tools belonging to the Microsoft Office suite is the CSV export, a format understandable by Microsoft Excel. Such an export can be implemented based on the XSLT transformation architecture.

Adaptive EAM contains a component that provides functionality for *business graphics* as for example bar charts (see figure 4.19) and pie charts. These capabilities are not available without prior configuration, a situation that is going to be improved in version 3.1 due in september 2005 according to Adaptive. Customization of the business graphics component to adapt the produced visualizations is possible by manipulating XSLT stylesheets.

Rating: 3 points for flexibility of reporting.

4.1.7 Collaboration Support

Adaptive EAM provides several rather advanced features for supporting the collaboration of the multiple users carrying out EA management relevant activities. Most important in this respect are the very far-reaching capabilities in respect to access rights management and customizing the appearance of the web client to different users.

In this respect it has to be noted that all functionality of *Adaptive EAM* is accessible via web technologies, i.e. a web interface or web services. The clients thus connected to the server-side repository of *Adaptive EAM* are:

- the web client, the main interface of *Adaptive EAM*
- the Microsoft Visio client, probably the only client that is used by ordinary users beside the web client; used in the context of the stencil based techniques
- the Microsoft Excel based importer
- the *Adaptive Designer*, used for creating item types and customizing the web client

An offline client is not directly available.

The web client, which provides much of the functionality that might be of importance to ordinary users of the tool, provides utmost flexibility in configuring its appearance. This flexibility is based on the three main classes of considerable building blocks of *Adaptive EAM*:

views, which show certain aspects of the entities in the metamodel; views are created and modified via the views manager (see figure 4.1)⁸

forms, which are used to input data for entities; forms are created and modified via the forms manager (see figure 4.2)

processes, that arrange views and forms into pageflows; processes are created and modified via the process manager (see figure 4.3)

groupware functionality, as discussion groups, subscriptions to change events, and notes

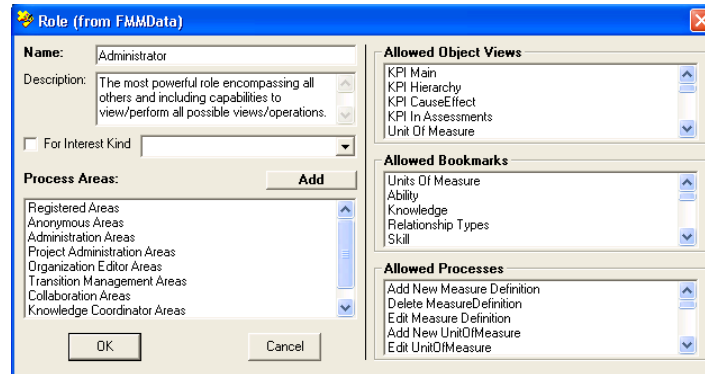


Figure 4.20: *Adaptive EAM*: assignment of views, forms, and processes to roles

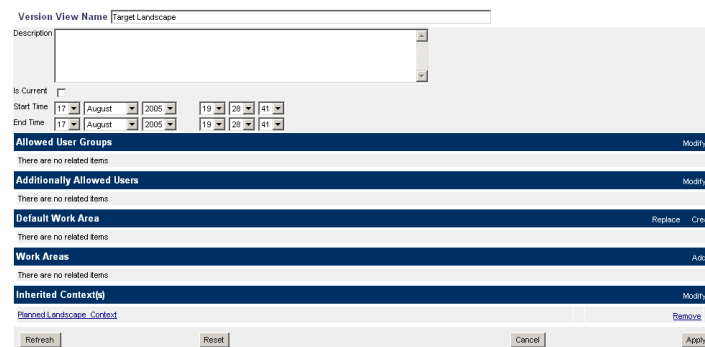


Figure 4.21: *Adaptive EAM*: creating the target view, a branch of the planned view using the *perspectives* mechanism

These elements can be assigned to the roles that are available to the users, as it is shown in figure 4.20, determining the elements of the web client available to a certain user. The processes can also be assigned to process areas, these process areas can then be assigned to roles, determining which views and processes are shown on which pages in the web client for a specific user. These capabilities offer the possibility to perform very advanced configurations of the access to the repository via the web client, not only to restrict, but also to enable via providing users with a more simple interface that contains exactly the functionalities needed by them.

The versioning capabilities of *Adaptive EAM* provides capabilities for the existence of several branches of the repository. Thereby, it is possible to create new branches (see figure 4.21) based on already existing branches. This means that the new branch first of all contains the contents of the branch it is based on, except where modifications have been performed in the new branch. This functionality could, for example, support modeling of different planning scenarios. A quite useful feature in this context is the automated comparison of different branches.

Rating: 5 points for collaboration support.

⁸Views may be further utilized in *bookmarks*.

4.1.8 Import/Export & External Data Sources

Adaptive EAM provides a rather powerful Microsoft Excel importer that is based on macros, which use web services in order to access the repository. This approach enables the user to import data for all metamodel constructs into the repository, including relationships. Thereby, all access rights are properly considered: when connecting to the web service, one has to submit its login name and password and to choose an available perspective on the repository. Access to the repository is then handled according to this data.

The mapping of columns in Microsoft Excel to data fields in the repository is accomplished via comments in the top cell of the respective columns, as it is shown in figure 4.22. While being rather powerful as mentioned above, the language used to achieve this does not always reach the usability of an automated wizard. It is often necessary to delve into documentation of the metamodel (see e.g. figures 4.23 and 4.24) in order to find out how to map the columns.

The Microsoft Excel importer constitutes not the sole possibility to import mass data into the repository of *Adaptive EAM*. There is also a XML import, enabling the user to create arbitrary mappings of the XML elements to the metamodel, both regarding the import of entities and relationships. Also CSV and Microsoft Visio files are supported as import file formats. Tools supported by the import capabilities of *Adaptive EAM* include *Borland Together* and *Rational Rose*. Regarding System management tools as data supplier, *Peregrine Asset Center* has been integrated. As *Adaptive EAM* embeds (as an option) the *Meta Integration Model Bridge* provided by *Meta Integration Technologies, Inc.*, data exchange with other tools supported by this product is possible.

1	UUID	Name (deutsch)	Name (english)	Availability
2	TuM_Application_Online-Shop	Online Shop	Online-Shop	Availability
3	TuM_Application_Warenwirtschaftssystem	Inventory Control System	Warenwirtschaftssystem	Availability
4	TuM_Application_Zahlungsverkehrsystem (Deutschland)	Monetary Transactions System	Zahlungsverkehrsystem	Availability
5	TuM_Application_Zahlungsverkehrsystem (Grossbritannien)	Monetary Transactions System	Zahlungsverkehrsystem	Availability
6	TuM_Application_Artikelversandsystem (Deutschland)	Product Shipment System	Artikelversandsystem	Availability
7	TuM_Application_Buchfuehrungssystem (Accounting)	Accounting System	Buchfuehrungssystem (Accounting)	Availability
8	TuM_Application_Kostenrechnungssystem (Controlling)	Costing System	Kostenrechnungssystem	Availability
9	TuM_Application_Personalwesen	Human Resources System	Personalwesen	Availability
10	TuM_Application_Data Warehouse	Data Warehouse	Data Warehouse	Availability

Figure 4.22: *Adaptive EAM*: specifying the mappings of excel data to the metamodel before an import

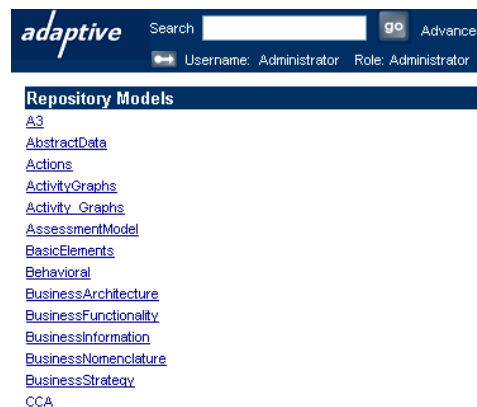


Figure 4.23: *Adaptive EAM*: overview of sub-models in the active metamodel

The screenshot shows the 'Adaptive' web interface with a search bar and user information (Username: Administrator, Role: Administrator). Below the navigation bar, there is a section titled 'Repository Models: ComponentArchitecture.ArchitectureComponent'. This section contains two tables: 'Attributes' and 'References'.

Attributes		
Name	Type	ID
configurationNeeded	String	ComponentArchitecture.ArchitectureComponent.configurationNeeded
description	String	ModeManagement.PackageContent.description
granularity	Enum	CCA.ProcessComponent.granularity
isPersistent	Boolean	CCA.ProcessComponent.isPersistent
isPrimitive	Boolean	ComponentArchitecture.ArchitectureComponent.isPrimitive
name	String	ModeManagement.PackageContent.name
primitiveKind	String	CCA.ProcessComponent.primitiveKind
primitiveSpec	String	CCA.ProcessComponent.primitiveSpec
shortDescription	String	ComponentArchitecture.ArchitectureComponent.shortDescription

References			
Name	Card	ID	Target Class
actionsOnRefObject	MV	ProcessArchitecture.ActionItem.actionsOnRefObject	ProcessArchitecture.Action
activities	MV	ComponentArchitecture.ArchitectureComponent.activities	ProcessArchitecture.Activity
activityFlow	MV	ComponentArchitecture.ArchitectureComponent.activityFlow	ProcessArchitecture.ActivityFlow
artifact	MV	A3.ObjectArtifact.artifact	RES.AssetPackageStructure.Artifact.Artifact
assessments	MV	AssessmentModel.ObjectAssessed.assessments	AssessmentModel.Assessment
behaviour	SV	A3.ObjectBehaviour.behaviour	SPM.State.Machines.StateMachine
bindings	MV	CCA.Composition.bindings	CCA.ContextualBinding
bookmark	MV	ODFFMM.BookmarkFocusInstance.bookmark	ODFFMM.Bookmark
branch	SV	ODFFMM.BranchObject.branch	Versioning.Branch
...

Figure 4.24: *Adaptive EAM*: description of a metamodel class

Export features of *Adaptive EAM* include a XML export, which, similar to the XML import, features capabilities to establish flexible mappings of metamodel elements to XML structures. Further export formats of the tool are similar to the import formats described above. Regarding capabilities to include external data without importing it into the repository, *Adaptive EAM* supports direct file access.

The flexible architecture of the import/export capabilities allows to reuse present importing, exporting and, transformation capabilities in new customization projects.

Rating: 4 points for import/export & external data sources.

4.1.9 Usability

Basically, a user working with *Adaptive EAM* will be mostly handling user interfaces he is probably familiar with, as the tool is totally accessible via a web interface. The same effect can be expected regarding to the Microsoft Visio client.

More contributing to the cognitive load placed on the user during tool handling might be the sheer richness of the web client (used in a rather unrestricted perspective) together with the richness of the metamodel, which sometimes also make it difficult to get an overview and find the right concepts. Examples in this context are:

- The large number of classes in the metamodel aggravates getting an overview of it and finding the right constructs for a specific modeling requirement; efficient handling of the predefined metamodels requires some pre-knowledge.
- The powerful language used for specifying import mappings (see figure 4.22) might not be as usable as a wizard.
- The number of views available for an item type might be a little overwhelming for a novice user, although it can be expected that one acquires orientation within the menus quite fast when using the tool.

Problems connected to an overwhelming client interface can be reduced for most ordinary users by providing them with a role that hides the features not needed by them in their daily work. Thus, it is possible to create a rather lean surface, sparing the user from navigation possibilities, which are not necessary for him. In this context, the powerful configuration possibilities regarding the perspectives and the forms and views used by them to provide access to the repository are very helpful.

The situation is different for somebody needing full access to the repository, as handling the tool with its unrestricted features efficiently requires at least some proficiency of *Adaptive EAM*. This is especially true regarding the *Adaptive Designer* (see e.g. figures 4.1, 4.2, and 4.3). Prospective users of the *Adaptive Designer* should receive at least some training, as the tool might not turn out to be self explanatory to all users.

Rating: 2 points for usability.

4.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

4.2.1 Landscape Management

The shipped metamodel of *Adaptive EAM* already offers the concepts needed for simulating the scenario *landscape management*. The following mapping to entities of this metamodel has been used. *Business application* is mapped to the item type *software component*. In order to import the metrics data given for the Business Applications, a classification schema was created. *Organizational unit* is mapped to *formal organization*, the *hosted at* relationship between business application and organizational unit is mapped to a relationship of *software component* to *formal organization*. *Business process* is mapped to *process*, existing relationships for capturing super processes and process sequences are used. The three-valued relationship *supports* between business application, business process and organizational unit is mapped to a more indirect construct evolving around class *action* in the metamodel of *Adaptive EAM*.

Most of the data needed for this scenario has already been imported during the simulation of scenario *visualization of the application landscape* (see section 3.3.1). The data, which is still left to be captured in the repository describes the changes in the monetary transaction system (*planned landscape*), the price tag printing and POS systems (*target landscape*).

The *perspectives* of *Adaptive EAM* provide a suitable functionality for representing the planned and target landscapes with their intended changes as branches of the repository data, as it has already been suggested in section 4.1.7. Thus, two new perspectives are created. One, called *planned landscape*, is created as inheriting (based on) the *Combined* perspective, which represents the current landscape. The other one, called *target landscape*, is based on the *planned landscape*. This is done to reflect that the target landscape builds on the planned landscape and not the current landscape.

In order to enter the changes of the planned landscape into the repository, the perspective *planned landscape* is chosen (see figure 4.25). When doing so, one gets a planned landscape, which firstly looks exactly like the target landscape. Then, the data in the planned landscape-*perspective* is changed to reflect the respective changes. To achieve this, all data editing capabilities of *Adaptive EAM* are available, for the scenario simulation, the changes have been entered via the web client. The same mechanism enables the user to capture the changes the target landscapes envisions based on the planned landscape.

Due to the fact that the software maps as described in appendix A are not among the visualization types directly supported in *Adaptive EAM* alternative ways of visualization, based on the capabilities outlined in section 4.1.4 have to be devised. A visualization probably of interest in this respect is one that shows the business applications that support a certain process, as shown in figure 4.26. Using the *bookmark* capabilities of *Adaptive EAM* it is possible to create comprehensive graphical overviews of the different versions of the landscape, as exemplified in figure 4.15 for the *current landscape*.

Adaptive EAM supports automated comparisons of entities in different perspectives. When a certain

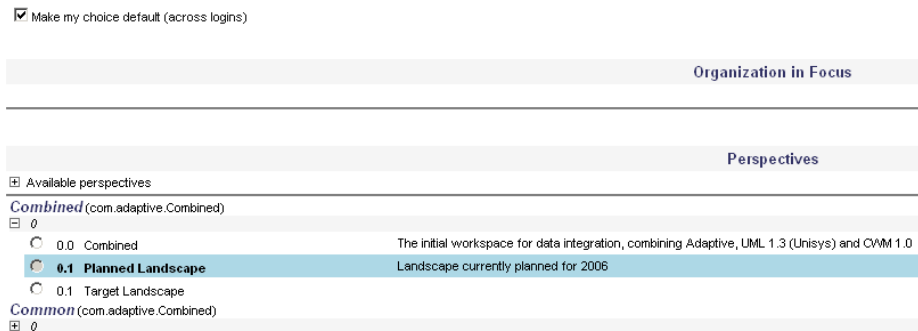


Figure 4.25: *Adaptive EAM*: choosing a perspective to work in for scenario landscape management

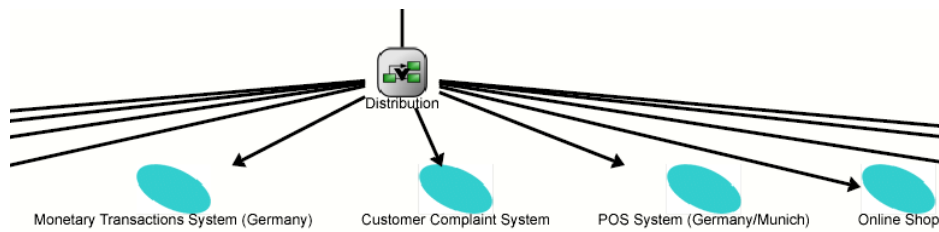


Figure 4.26: *Adaptive EAM*: business applications that support the process *Distribution* for scenario landscape management (excerpt)

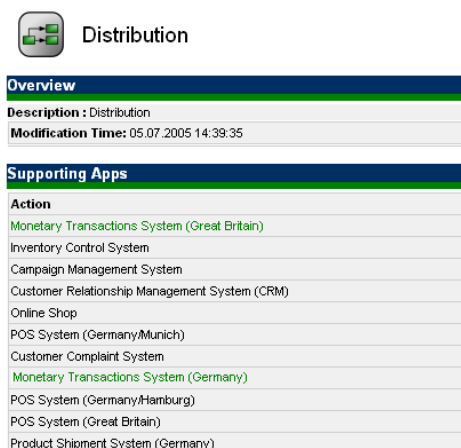


Figure 4.27: *Adaptive EAM*: results of automated comparison of an entity for scenario landscape management

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entity is shown in a view, the comparison function lets one select a perspective, against which the comparison is to be performed. Then the differences between the two variants of the entity are automatically determined and presented in textual form (see figure 4.27). The entities shown in green text are the ones where differences have been detected.

The tool handling is easy when relying on out of the box functionality, as for example the perspectives or the comparison mechanism. When making adaptations to the views, for example to be able to show the applications supporting a certain process as in figure 4.27, the functionality necessary (delivered by the *Adaptive Designer*) is not always intuitive to use.

The achievement of objectives is partially given, visualizations that show the information depicted by the exemplary deliverables can be created automatically (see figure 4.26). A report showing differences between entities of the planned landscape and the application landscape can be automatically generated for every entity (see figure 4.27).

The procedure consistency is given. Only concepts present in the predefined metamodel are used. The perspectives and comparison mechanism can be used without making any customizations.

The procedure integration is given, as the data already present in the repository can be reused without further effort.

Rating: 3 points for landscape management.

4.2.2 Project Portfolio Management

Adaptive EAM ships with a metamodel already including concepts for project portfolio management, like e.g. projects, which influence business applications. For simulating this scenario the entity type *project* has been mapped to the entity type *project task*. Measures, like e.g. *costs*, *benefit*, etc. are modeled as classifications. Using this configuration all information for simulating the scenario can be entered.

Adaptive EAM includes an *eventing mechanism* offering the possibility to create a simplified project management workflow. This could be, after a new project has been created an event is generated

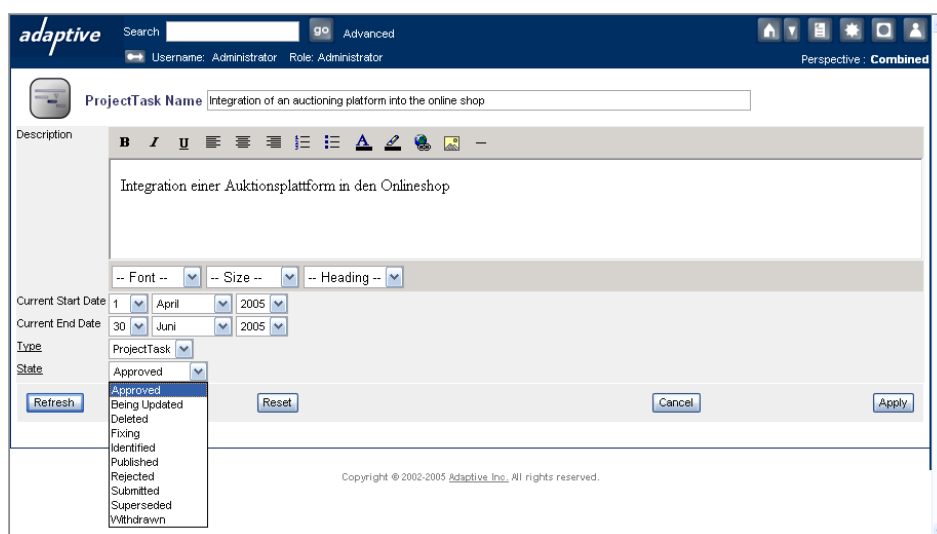


Figure 4.28: *Adaptive EAM*: selecting a project for scenario project portfolio management

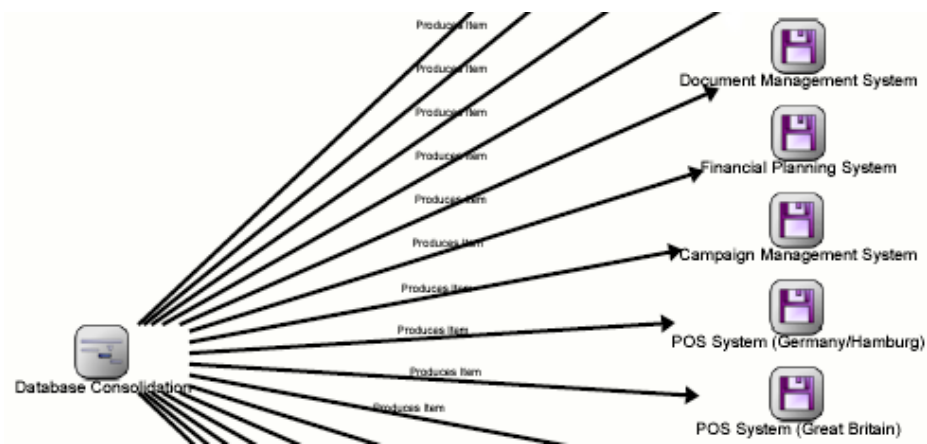


Figure 4.29: *Adaptive EAM*: extract of a visualization showing the impact of the project *database consolidation* on business applications for scenario project portfolio management

- Integration of an auctioning platform into the online shop	
Overview	
- Integration of an auctioning platform into the online shop	
Description	Integration einer Auktionsplattform in den Onlineshop
Task Dates	
- Integration of an auctioning platform into the online shop	
Current Start Date	01.04.2005
Current End Date	30.06.2005
Type State Owner	
- Integration of an auctioning platform into the online shop	
Type	
- ProjectTask	
Icon URL	images/ProjectTask.png
State	
- Approved	
Owner	
Classifications	
- Project Metrics Integration of an auctioning platform into the online shop Descriptors	
Conforms To Schema	
- Project Metrics	
Descriptors	
- 1	
Descriptor	
- urgency	
Identifier	10032
- 100	
Descriptor	
- costs	
Identifier	10031

Figure 4.30: *Adaptive EAM*: tabular report of the project portfolio for scenario project portfolio management

informing the responsible person, that a project has to be approved. This is supported by an attribute representing the state, like e.g. submitted, approved, rejected, etc., which may be used for searching and filtering of projects (see figure 4.28).

For visualizing the relationships of business processes, organizational units, business applications, and projects, according to the process support map demanded by the scenario description (see figure 3.17) a view was created that shows the respective information for a selected project (see figure 4.29). Using *bookmarks*, the respective information can be visualized for all projects in one graphic. This would involve the *Adaptive Designer*.

Creating a visualization conforming to a portfolio matrix (see figure 3.23) is not possible, as the web interface is restricted to graph visualizations (see figure 4.29). According to Adaptive, this is going to change in version 3.1, which is due in september. Using the Microsoft Visio client would require a new *technique stencil*, which can be created by the tool vendor. The same applies to the interval maps (see figure 3.17 and figure 3.18) demanded for the simulation of the scenario.

Reports demanded for the scenario can be achieved as e.g. HTML files (other output formats are described in section 4.1.6) after the reports have been added to the repository utilizing the *Adaptive Views Manager* (see figure 4.30).

The tool handling for this scenario is intuitive. All data can be entered and the tasks needed can be executed.

The achievement of objectives is mostly given. Reports (see figure 4.30) can be created, together with a graph based visualization showing the relationships of projects to other entities of the repository. A view like figure 3.23 cannot be created.

The procedure consistency is mostly given, as some metamodel adaptations, e.g. adding classifications have to be performed.

The procedure integration is given, as data previously entered can be reused for this scenario.

Rating: 3 points for project portfolio management.

4.2.3 Synchronization Management

For the scenario *synchronization management*, entering or importing new data into the tool was not necessary, as it is able to use the data previously imported for scenario *project portfolio management*.

In order to get an overview during which time spans organizational units are affected by which projects it is possible to navigate through the data in the repository manually. Another possibility is to use the *Adaptive Designer* to create a query that displays this information automatically. This is best carried out by an user with advanced experience in using and customizing *Adaptive EAM*, as for example an Adaptive consultant. Such a query provides the capability to show for every project, which organizational units it affects together with the time span of the project, as shown in figure 4.31. This information can also be displayed as a graph-based visualization. The *Adaptive Designer* provides the possibility to making the respective view a report, resulting in a document showing this information for every project.

Automated generation of a visualization like the exemplary deliverable shown in figure 3.25 is not out of the box supported by *Adaptive EAM*, but part of the information contained in the report shown in figure 3.27 can be automatically retrieved from the repository via a *custom query* like the one shown in figure 4.32. Entering the query as shown in figure 4.32 retrieves project *VAT change in online shop*, applying the query recursively after determining the necessary delay of the projects provides the desired information completely.

Name	Type	State	ActionsForSoftComp Action	Is owned by Organization
Accounting System	Software Component	Published	Buchhaltungssystem (Accounting) Support Controlling by Zentrale	Headquarter
Costing System	Software Component	Published	Kostenrechnungssystem (Controlling) Support Controlling by Zentrale	Headquarter
			Kostenrechnungssystem (Controlling) Support Controlling by Filiale Muenchen	Subsidiary Munich
			Kostenrechnungssystem (Controlling) Support Controlling by Filiale Hamburg	Subsidiary Hamburg
			Kostenrechnungssystem (Controlling) Support Controlling by Filiale London	Subsidiary London
			Kostenrechnungssystem (Controlling) Support Controlling by Lager	Warehouse

Figure 4.31: *Adaptive EAM*: showing the organizational units (transitively) affected by a project for scenario synchronization management

Figure 4.32: *Adaptive EAM*: entering the query to retrieve the projects affected by a project delay for scenario synchronization management

Figure 4.33: *Adaptive EAM*: retrieving the projects affecting the business application *adaptiveDeletionQuery* for scenario synchronization management

When visualizing all projects dealing with the Customer Satisfaction Analysis System, as exemplarily shown in figure 3.26, the situation is similar as described above. The visualization capabilities of *Adaptive EAM* make it difficult to create an interval map (see appendix A), but a custom query is quite a suitable instrument to retrieve the information in textual form, leading to a result as shown in figure 4.33.

The tool handling requires some experience with *Adaptive EAM* as building custom queries and using the *Adaptive Designer*, makes up most of the tasks required for simulating this scenario.

The achievement of objectives is partially given. The interval maps have not been created, but the information represented by them can be retrieved in reports and partially in alternative visualization after putting some effort into customizing the tool. Retrieving the information shown exemplarily in figure 3.27 requires a partially manual task.

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The procedure consistency is mostly given. There are no metamodel adaptations necessary, but some customizing of the web interface of *Adaptive EAM*.

The procedure integration is given, data contained in the repository can be reused, making further data entry or import unnecessary for this scenario.

Rating: 2 points for synchronization management.

4.2.4 Traceability and Strategy Management

Strategy management can be performed with integrated functionality utilizing *Adaptive EAM*. The entity type strategy has been mapped to *vision*, goal to *goal*, and metric to *objective* in order to simulate the scenario. As different types of objectives are available it has to be differentiated between *financial objective*, *stakeholder objective*, *internal process objective*, and *learning & innovation objective*. Values of an objective have been modeled by additional classifications. A diagram visualizing the relationships between the described entities can be seen in figure 4.17.

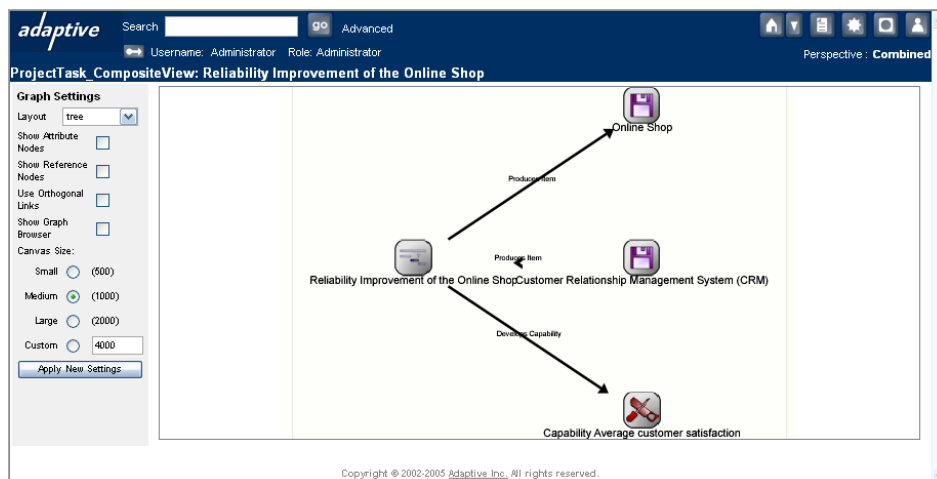


Figure 4.34: *Adaptive EAM*: relationship between business application, project and capability for scenario traceability and strategy management

The demanded relationship between a project and a business application can be established by using *capabilities* as a connector to objectives (see figure 4.34). Intermediaries used to establish relationships, like e.g. *capabilities* or *mission* may be hidden in the web interface by customization using the *adaptive views manager*.

Evaluating strategies and the fulfillment of goals *SWOT*⁹ analysis can be applied, using the shipped metamodel. Adapting the metamodel additionally offers the possibility to integrate the concepts needed to use balanced score cards.

Reports showing the relationships between visions, goals and objectives can be created using the *adaptive designer* as already described in section 4.1.6. Figure 4.35 shows an excerpt of a listing of the objectives, together with their values.

The tool handling is adequate, as the procedures needed to perform traceability and strategy management can be executed utilizing the web interface.

⁹SWOT in this context means a technique for analyzing *strengths*, *weaknesses*, *opportunities*, and *threats* involved in a project

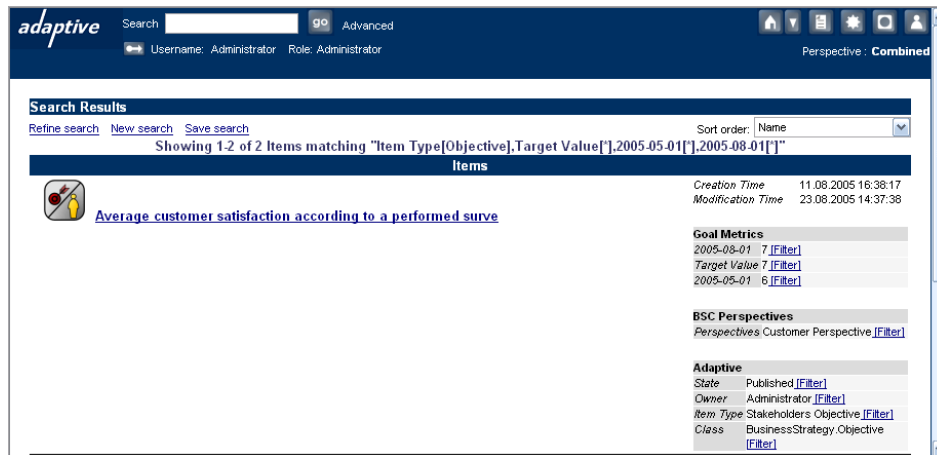


Figure 4.35: *Adaptive EAM*: listing of objectives and their metrics for scenario traceability and strategy management

The achievement of objectives is partially given. Reports showing the relationships between visions, goals, and objectives can be created, as well as reports showing the values of the objectives (see figure 4.35). Graphical representations of the relationships can be created (see figure 4.34 and figure 4.17). A balanced score card cannot be created as *Adaptive EAM* supports SWOT, as a different approach for strategic analysis.

The procedure consistency is mostly given as some metamodel adaptations, e.g. adding classifications have to be performed.

The procedure integration is given, as data previously entered can be reused for this scenario.

Rating: 3 points for traceability and strategy management.

4.2.5 Management of Business Objects and Business Services

Adaptive EAM supports the management of business objects and business services using the shipped metamodel. Business service has been mapped to *activity*, business process to *process*, business application to *software component*, connector to *port*, interconnection to *interface*¹⁰, business object to *entity* and the attributes of a business object to *attributes* of the entity (see figure 4.36). The entities and their attributes have been modeled utilizing Microsoft Visio and a shipped shape sheet, called *Entity-Relationship-Model*, which offers the possibility to import the data into the *Adaptive EAM* repository.

Elements needed for business object management have been connected to each other using the web interface, resulting in visualizations shown in figure 4.37. This visualization has automatically been created utilizing information stored in the repository, but only shows parts of the information demanded by the deliverable in figure 3.31. Business applications offer connectors and transfer business objects over an interconnection. A diagram showing the relationships for a complete business process, as demanded by the scenario description cannot be created.

A report as shown in exemplary deliverable (see figure 4.37) can be created by building a bookmark based on the query behind the view shown in visualization in figure 4.37. Figure 4.37 shows the

¹⁰Connecting two business application, using an interface is possible by using one port connected to each business application which serve as source and destination for the interface.

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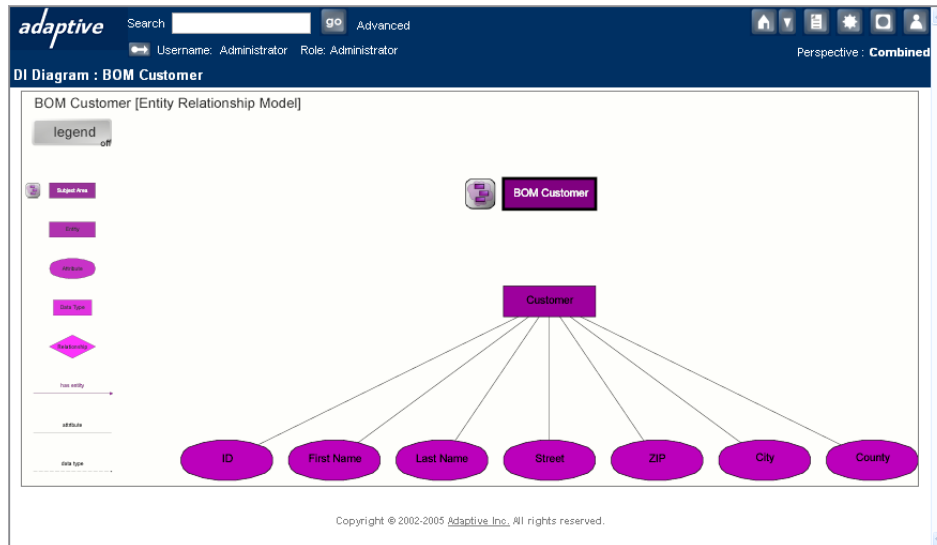


Figure 4.36: *Adaptive EAM*: SVG created utilizing Microsoft Visio to import data needed to model business objects for scenario management of business objects and business services

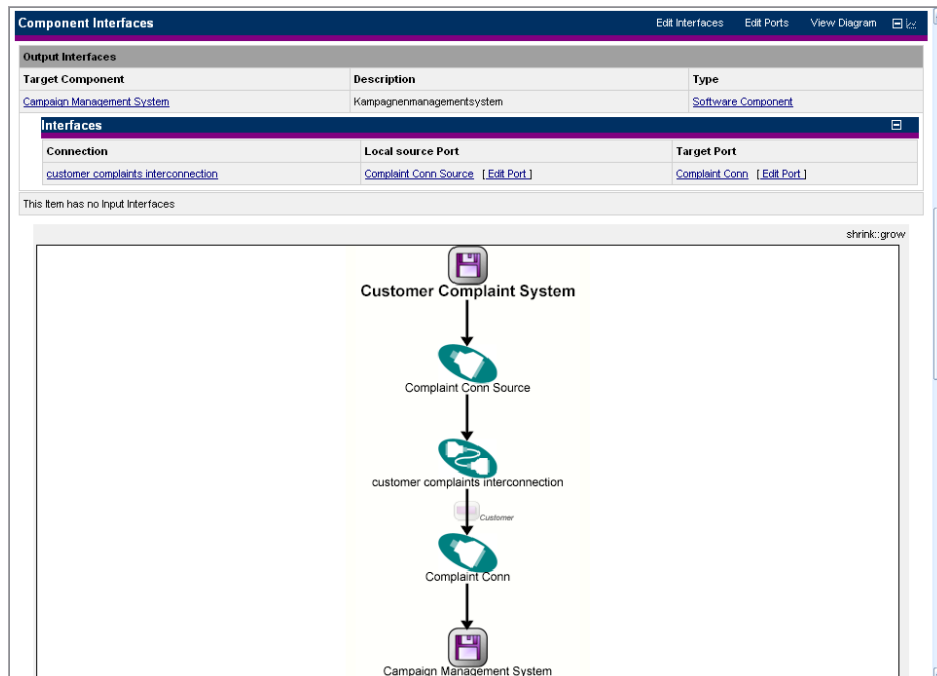


Figure 4.37: *Adaptive EAM*: SVG showing the interconnection of two business applications for scenario management of business objects and business services

respective information for one selected business application. A matrix based report as shown in figure 3.32 cannot directly be created.

The tool handling is adequate. The adaptive designer and the web interface can be used to perform traceability and strategy management.

The achievement of objectives is partially given. Reports showing the interconnections between business applications can be created. A visualization of these interconnections can automatically be created (see figure 4.37). Business objects can be modeled and visualized using Microsoft Visio (see figure 4.36). A matrix showing the relationships between business applications for a business process (see figure 3.32) cannot be created.

The procedure consistency is given as concepts to perform management of business objects and business services are available.

The procedure integration is given, as data previously entered, e.g. business applications can be reused for this scenario.

Rating: 4 points for management of business objects and business services.

4.2.6 Application Architecture Management

The concepts behind the scenario *application architecture management*, mainly the classes *abstract technology*, *technology*, *architectural blueprint* and *blueprint architecture* in the UML diagram shown in figure 3.4, are not directly reflected in *Adaptive EAM*, although related concepts are available. In order to be able to capture the relevant data in the repository, four new item types *AbstractTechnology*, *Technology*, *ArchitecturalBlueprint*, and *ArchitecturalSolution*, are created based on the class *Compliance Item*, called *Governance Item* in the Adaptive House. Adding item types requires the use of the *Adaptive Designer*. In order to store the time spans that reflect the life cycle stages of the technologies, a classification, which features start and end date for every interval and the date value that marks the end of the support period (as freetext attributes), is added to the *Technology* item type. Importing the respective entities can be achieved via the Microsoft Excel importer.

The relationship (*compliance item*) *hierarchy* is used to reflect the relationships (as seen in figure 3.4) between the item types introduced above. This is possible, as (*compliance item*) *hierarchy* connects a compliance item to a compliance item and all the item types introduced above are of this type. A graphical representation of the entities of the types elaborated on above can be created using the Microsoft Visio stencil based technique *compliance item hierarchy*, as done for part of the blueprint architectures in figure 4.38. The entities imported into the repository above can be reused in the diagram construction, the relationships between the entities were captured during the diagram construction.

In order to indicate, which business application conforms to which architectural solution, the relationship *applies to* between *compliance item* (as the supertype of *Architectural Solution*) and *Software Component* is used. Figure 4.39 shows a view that is able to indicate what architectural solution a certain business application conforms to. This view can be turned into a report by using the *Adaptive Designer*, leading to a report that gives an overview of the *architectural solutions* used by the different application systems. This information can also be presented the other way round, as figure 4.40 exemplifies. This view might be a suitable base for a graph-based visualization showing what business applications conform to a certain architectural solution. A complete graphical overview of which business application conforms to which architectural solution can be created by building a bookmark based on one of the queries described above.

The creation of a bar chart would be possible via configuring the business graphics component (see section 4.1.6) shipped with *Adaptive EAM*. Summing and calculations, while not directly present in the tool can be performed via adequate modifications of XSLT stylesheets. What can be achieved

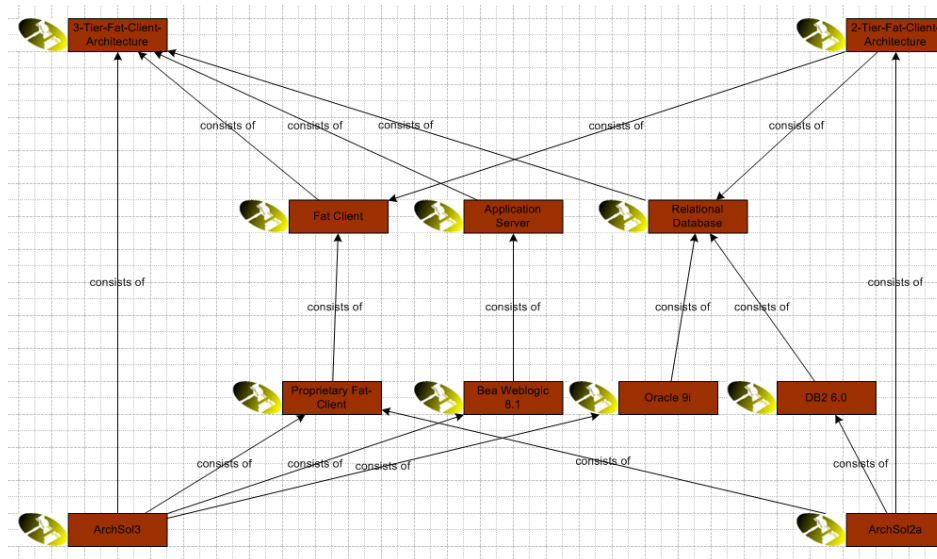



Figure 4.38: *Adaptive EAM*: modeling architectural solutions using a Microsoft Visio stencil based technique for scenario application architecture management

 **Software Component** *Accounting System*

Complies with Compliance Item

Name	Description	Type	State	Classifications Descriptor Group
ArchSol2b		ArchitecturalSolution	Published	

Figure 4.39: *Adaptive EAM*: view showing the architectural solution the accounting system complies with for scenario application architecture management

 **ArchitecturalSolution** *ArchSol2b*

Name
Accounting System
Customer Relationship Management System (CRM)
Human Resources System
Price Tag Printing System (Great Britain)

Figure 4.40: *Adaptive EAM*: business applications conforming to the architectural solution *ArchSol2b* for scenario application architecture management

without far-reaching customization is a query listing all business applications that do not comply to an architectural solution. Such a query can be built as a custom query.

The tool handling is basically intuitive, except for the creation of the new item types, which might be only achievable in an efficient way with some experience in *Adaptive EAM*.

The achievement of objectives is basically given, although some of the deliverables, as for example a graphical representation about the conformance of business applications to architectural solutions or the bar charts demand some customization.

The procedure consistency is partially given. While new item types had to be introduced, it has to be noted that they readily fitted into the predefined metamodel.

The procedure integration is given. Information already in the repository could be reused. The information about technologies imported during the simulation of this scenario was reused during the simulation of scenario 4.2.7.

Rating: 4 points for application architecture management.

4.2.7 Infrastructure Management

In order to simulate scenario *infrastructure management*, the information about the databases, which are modeled as *infrastructure elements*, has to be imported into the repository. Therefore, an item type *infrastructure element*, based on the item type *software component* is used. The relationship connecting *infrastructure elements* to software components is the *Depends on Software Component* relationship. For the infrastructure elements to be able to store the available information, a classification called *DatabaseCost* is created with custom variables for licensing and operating costs. Due to the limited data types of classifications, these variables are of type *string*. As an alternative to the classifications the *Assessment* functionality of *Adaptive EAM* could be used. Importing the respective data via the Microsoft Excel importer is possible.

The *Technologies*, which characterize the infrastructure elements, like i.e. databases have already been entered during the simulation of scenario *application architecture management* and can be reused here.

In order to show, which business application uses which database, it is possible to visualize the systems that use a specific database, as shown in figure 4.41. This relationship can also be visualized the other way round, as depicted in figure 4.42. A comprehensive graphical overview could be created via a *bookmark*.

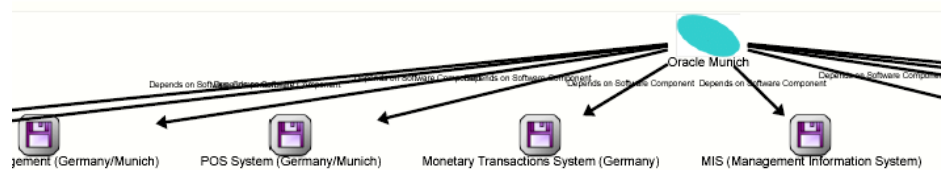


Figure 4.41: *Adaptive EAM*: business applications using the database *Oracle Munich* (excerpt) for scenario infrastructure management

A report easily created based on the view *Software Component inter-dependencies* makes the automatic generation of a report that indicates the databases used by the individual business applications possible, as shown in figure 4.43.

Giving an overview of the costs created by the databases is most easily achieved via a textual report showing the licensing and operating cost of the databases. Such a report can be created by searching

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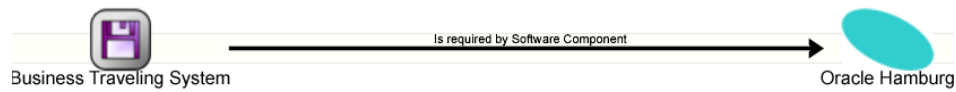


Figure 4.42: *Adaptive EAM*: database used by the *Business Travelling System* for scenario infrastructure management

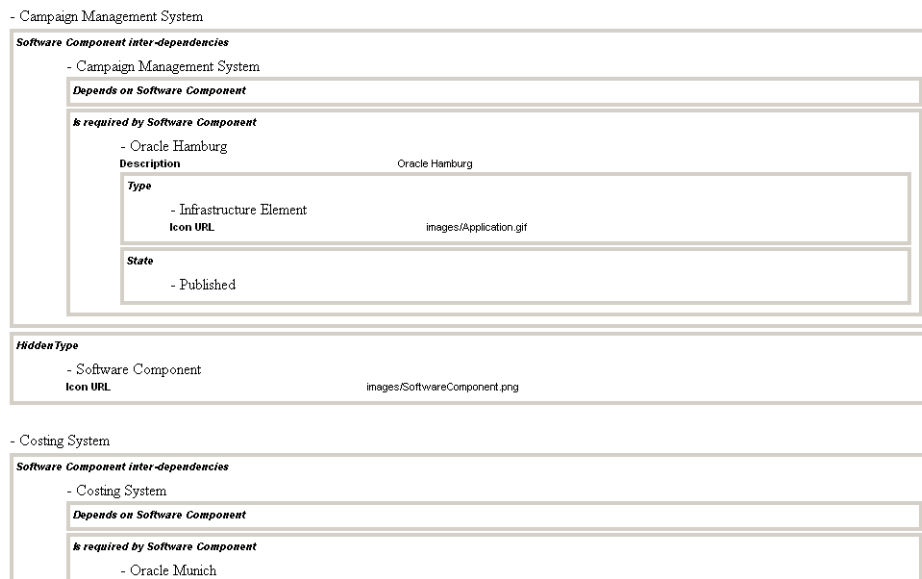


Figure 4.43: *Adaptive EAM*: report showing the business applications with their databases (excerpt) for scenario infrastructure management

for all *infrastructure elements*, like i.e. databases, the search results are displayed together with their classifications, among them also the ones used for the operating and licensing costs (see figure 4.44).

More difficult is the graphical representation of these costs. Manipulating the appearance of graphical elements, like e.g. their size or color, to reflect the respective attributes, is only supported via customizing the respective XSLT stylesheets. What can be achieved without rather extensive customizing is a graph-based visualization that connects a node for each type of cost with the amount as the name to the respective database. Manipulating XSLT stylesheets would also enable the user to perform automatic calculations of sums, although the add-on component for deriving TCOs, as described in section 4.1.3, would also be an adequate solution here.

Querying for the databases running out of support before January 2006 would be possible, if classifications had not been chosen as the way to represent the dates establishing the life cycle phases. As the classifications do not offer a *date* data type, comparisons regarding these date values become difficult. Adding these date attributes directly to the respective class in the metamodel, which is supported by *Adaptive EAM* would make such a query possible, e.g. as a custom query. The output would be a textual enumeration of the respective databases. Using the *Adaptive Designer*, a variant of the query used to create the visualization shown in figure 4.42 could be created, which could be restricted to show only databases running out of support, or, depending on the preferences of the user, not running out of support before January 2006.

Showing 1-6 of 6 Items matching "Item Type[Infrastructure Element]"



Items		Creation Time	23.08.2005 18:22:40
 DB2 London <small>description</small> DB2 London		Modification Time	24.08.2005 18:20:27
	Adaptive State Published [Filter] Owner Administrator [Filter] Item Type Infrastructure Element [Filter] Class ComponentArchitecture.ArchitectureComponent [Filter]		
		DatabaseCost Operating 3000 [Filter] Licensing 5000 [Filter]	
 MySQL Munich <small>description</small> MySQL Munich		Creation Time	23.08.2005 18:22:39
		Modification Time	24.08.2005 18:20:56
		Adaptive State Published [Filter] Owner Administrator [Filter] Item Type Infrastructure Element [Filter] Class ComponentArchitecture.ArchitectureComponent [Filter]	
		DatabaseCost Operating 40000 [Filter] Licensing 0 [Filter]	

Figure 4.44: *Adaptive EAM*: search results showing the databases with their licensing and operating costs for scenario infrastructure management

Infrastructure Element **MySQL Munich**

Complies with Compliance Item Edit Co

Name	Description	Type	State	Classifications Descriptor Group	Conforms To Schema	Descriptors Descriptor Value
MySQL 2.0		Technology	Published	TUM_TechnologyMySQL 2.0- VersionHistory-Descriptors	VersionHistory	01.01.2003 IntroStart 10044 31.05.2003 IntroEnd 10045 01.06.2003 ProdStart 10046 31.05.2005 ProdEnd 10047 01.06.2005 OutStart 10048 31.05.2006 OutEnd 10049 01.01.2007 EndSupportPeriod 10050

Figure 4.45: *Adaptive EAM*: technology life cycle for different databases for scenario infrastructure management

Giving a comprehensive overview of the life cycle information of the different databases is easily achieved in textual form by adding the relevant classification to the information given about *Compliance Items* (the super type of *Technology*) an infrastructure element *complies with*. This leads to views as shown in figure 4.45.

It is more difficult to convey this information in a graphical visualization, an interval map, as shown in the exemplary deliverable in figure 3.39, is not directly supported in *Adaptive EAM*.

After creating a classification, which can store whether an *infrastructure element* is to be replaced or not, a query can list the business applications that are affected by the project *database consolidation*, as they use a database (i.e. *infrastructure element*) that is going to be retired. A custom query that starts with all *infrastructure elements* that are to be retired and selects the business applications that use these infrastructure elements leads to a list as shown in figure 4.46. Creating a visualization of this information is more difficult, with searching for the databases that are to be replaced and successively creating a visualization like the one shown in figure 4.41 perhaps being a feasible way.

The tool handling is intuitive, except for building custom queries and using the *Adaptive Designer*, which sometimes requires some experience in *Adaptive EAM*.

AffectedApplications
Accounting System (ComponentUsage)
Business Traveling System (ComponentUsage)
Campaign Management System (ComponentUsage)
Customer Relationship Management System (CRM) (ComponentUsage)
Document Management System (ComponentUsage)
Financial Planning System (ComponentUsage)
Monetary Transactions System (Great Britain) (ComponentUsage)
Online Shop (ComponentUsage)
POS System (Germany/Hamburg) (ComponentUsage)
POS System (Great Britain) (ComponentUsage)
Price Tag Printing System (Germany/Hamburg) (ComponentUsage)

Figure 4.46: *Adaptive EAM*: business applications affected by the database consolidation (excerpt) for scenario infrastructure management

The achievement of objectives is partially given. Sums of operating and licensing costs have not been created due to the lack of the respective functionality in the query language, although deriving the sums would be possible by XSLT customizing or an add-on component. Also difficult is the creation of some visualizations, partly due to the lack of a functionality for visualizing an interval map. The visualization of the life cycle stages, as shown in the exemplary deliverable in figure 3.39 has not been created.

The procedure consistency is basically given. Although some parts of the metamodel have been used slightly different than intended, such adjustments cannot really be viewed as contradictory to the metamodel.

The procedure integration is given. No information entered during the simulation of the scenarios described from section 4.2.1 to section 4.2.6 had to be re-entered.

Rating: 3 points for infrastructure management.

4.3 Tool Vendor's Profile

Adaptive - www.adaptive.com

Ylva Barker, Adaptive Ltd.

Adaptive is a global company, with European headquarters located in the United Kingdom and offices elsewhere in Europe and North America. Adaptive works with partners to enhance its offerings and to sell, deliver and support its suite of products in different geographies and vertical markets.

Adaptive's products and services enable organizations to maximize the value of their enterprise architecture initiatives, through exceptionally capable and feature-rich support for the full scope of Enterprise Architecture planning and implementation. By providing a *big picture* view - and with its unique capability to leverage disparate data sources into a holistic enterprise architecture framework - Adaptive provides management, in both business and IT, with the ability to plan, organize, lead and monitor change in a much more rigorous and effective manner.

Adaptive and Model Management

One of Adaptive's key distinctions is its emphasis on **model management** and indeed it is the only vendor focusing on model management today. This is achieved through an integrated web based environment for capturing, storing, visualizing, sharing, reusing and managing models in a single, reliable, secure and collaborative repository environment. Adaptive integrates with both modeling tools and Microsoft[®] Office tools. It has a web-based user interface for maintaining information where a specialist tool is not needed. Adaptive has a general and customizable capability applicable to any sort of model: and has used this customization capability to build a specific solution for Enterprise Architecture: Adaptive Enterprise Architecture Manager[™].

The Adaptive Technology

Adaptive's technical architecture is 3 tier, using a web browser thin client and making use of best-of-breed application server and database technology for scalability. Through its active participation in standards bodies, Adaptive's metamodels, APIs and architecture are all fully standards-based.

Adaptive's application server uses common web standards where possible - including JSP, HTML, XML, XSL, SVG - in order to maximize customizability at all levels. It has a separate tool for customization, Adaptive Designer[™], which allows users to select objects, attributes and relationships from the metamodel to create logical views which are the basis of the browser views and reports: and will automatically generate the JSP and XSL code from these; the views can span information from many metamodels and tool sources to form 'big pictures' which can be associated with different user roles.

Adaptive has a very broad set of metamodels (over 900 classes in total), including many OMG standards, as well as Adaptive-specific metamodels. Its visualization capability supports both dynamically generated views (a model tells a thousand pictures) and has the ability to capture diagrams from modeling tools and render them, via a browser, without requiring the original tool.

Adaptive's products are enterprise-oriented which includes scalability, access control, and versioning, in addition to its collaboration capability amongst users via discussion groups, assessments and notifications.

Adaptive Tool Integrations

Adaptive Integrator™ uses metamodeling standards to interoperate with over 50 tools, both to import, transform and integrate data and diagrams (through the use of the Diagram Interchange standard from OMG), and to export them. It provides full support for a number of out-of-the-box integrations, as listed on our web site at: www.adaptive.com/homelinks/toolintegrations.html

In addition to the standard interfaces with these other tools, enabling Adaptive to rapidly adapt to support most flavours of XML or CSV, Adaptive Integrator can be configured to create custom imports, which can be used to very quickly adapt to variations in the level of tool support for XMI: these can be tied into a sophisticated Transformation Component infrastructure, which allows parameterized components (7 different types currently including XSL) to be pipelined into end-to-end transformation processes. Adaptive provides a Web Services API for integration purposes, in addition to browser-based import; and a remote command line (which allows for automatically scheduled imports).

Further, it provides an optional module called Adaptive Integrator Metadata Module which embeds technology from Meta Integration Technologies, Inc., a recognized leader in bridging to most leading modeling tools; Adaptive also includes capabilities for directly importing relational databases (mapped to metamodel).



Adaptive Logo

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5. alfabet AG (planningIT)

The alfabet AG provides the EA management tool *planningIT* which is the successor of the tool *SITM - Strategic IT Management*. In the following sections the evaluation sketched in chapter 2.2.2 is described in detail. The evaluated version of *planningIT* is the "Version 1.0".

The tool *planningIT* is developed for managing the IT life cycle, using an approach which links different EA processes into one integrated EA management process, going beyond other approaches which only provide loosely linked modules. Figure 5.1 shows the different modules of *planningIT* and the *Logical IT Inventory* which is the repository of *planningIT*.

The process which links the different modules from figure 5.1 is shown in figure 5.2. This survey does not fully cover the functionality of all modules and only partially uses the process integrated into *planningIT*, because the functional criteria do not cover the integration and interaction of different modules. But during the scenario simulation each module has at least been partially used and the evaluation also considers if a process integration for each scenario is given.

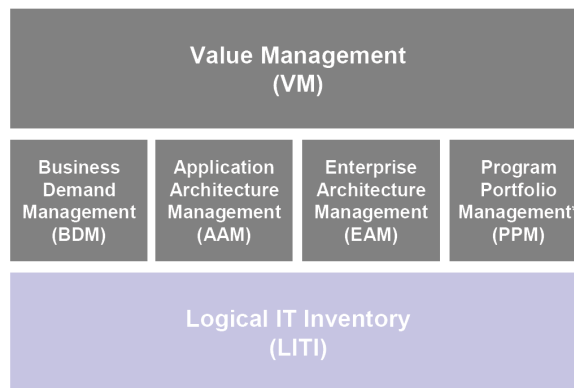


Figure 5.1: *planningIT*: Modules

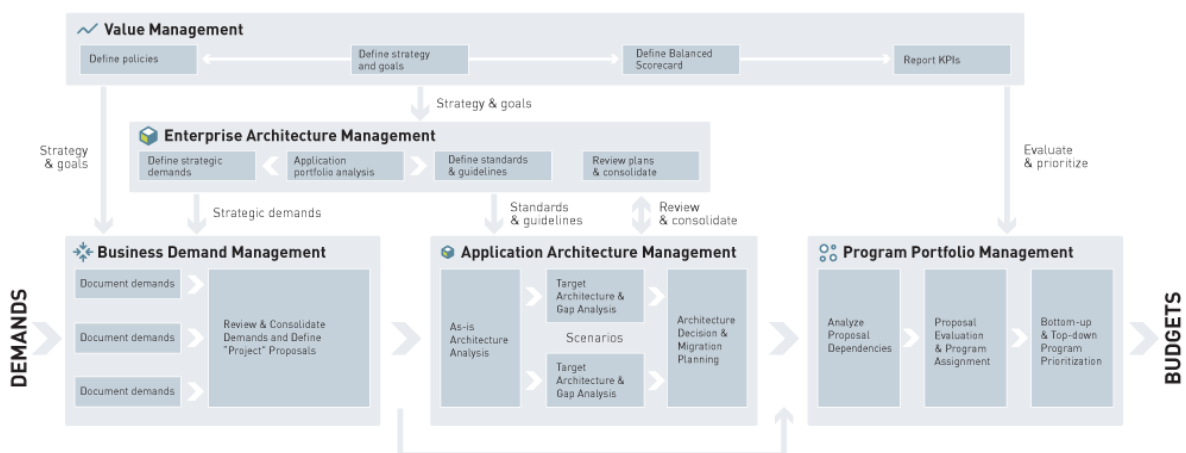


Figure 5.2: *planningIT*: integrated planning process

5.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

5.1.1 Configurability of the Metamodel

planningIT focuses on the collaborative process of planning the IT architecture. A prerequisite of a common, cross-functional process is a shared methodology. This in turn requires a comprehensive metamodel. Therefore *planningIT* comes with a fully configured metamodel which has been developed by alfabet and development partners, aiming to cover all relevant aspects for EA management. *planningIT* uses a process oriented change management approach and does not follow the typical metamodeling paradigm, which would mean that customers are able to adapt the whole metamodel.

The software development kit (SDK) of *planningIT* for customers, which is going to be released as part of the next release in October 2005, is going to offer the capability to adapt the existing metamodel by adding attributes. Adding new entity types, attributes, or relationships would require support through alfabet certified consultants.

The metamodeling tool alfabet uses for creating and adapting the metamodel of *planningIT* is designed in an object oriented way, different cardinalities (0,1, 0..*, 0..1, n..m) for relationship ends and optional vs. mandatory attributes are supported. To provide flexibility in the metamodel, without having to adapt it, generic entity types are added to *planningIT*. The concept of *evaluations* as a generic way to define measures, metrics, etc. individually and to associate those to existing artifacts of the metamodel is promoted. Costs can be freely defined by the customer via a similar construct.

The process and the metamodel which are integrated into *planningIT* has been designed to fit into the EA management process respectively the IT planning processes of every company, therefore alfabet uses the approach not to adapt the metamodel to individual needs. As stated above, concepts like evaluations are introduced to implement user specific requirements into the metamodel.

Rating: 2 points for configurability of the metamodel.

5.1.2 Coverage of EA Management Concepts by Predefined Metamodel

The predefined metamodel of *planningIT* offers a wide range of different entities typically used in EA management. All layers and cross functions of the information model diagram introduced in chapter 3.1.2 are addressed. The information model of *planningIT* is not directly based on enterprise frameworks like Zachman [ZIF05] or DoDAF [DoD4] but according to alfabet these frameworks can be integrated on customers' demand.

During the scenario simulation the main effort was to understand the models, concepts, and processes of *planningIT* in order to be able to map the exemplary model of SoKaKauf to *planningIT*. The model of SoKaKauf was not mapped 1:1 to the model implemented in *planningIT*, but almost all entities and relationships could be entered into *planningIT* (see also section 5.2). Only the relevant data for simulating the scenario *Synchronization Management* (see section 5.2.3) could not be entered into *planningIT*, but according to alfabet this could be covered through a simple customization.

Rating: 5 points for coverage of EAM concepts by predefined metamodel.

5. alfabet AG (planningIT)

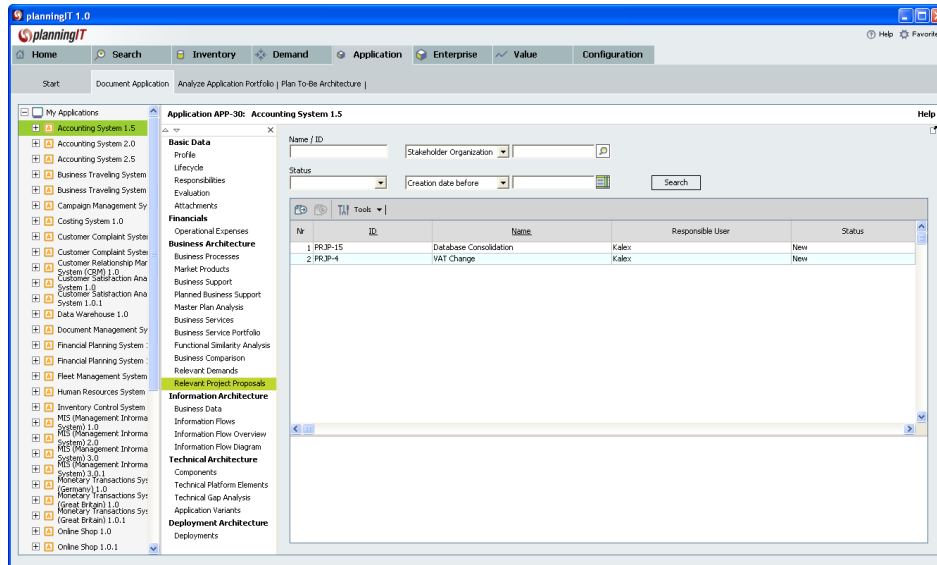


Figure 5.3: *planningIT*: report showing project proposals associated to an application

5.1.3 Support for Impact Analysis & Calculation

planningIT provides about 700 predefined reports for analyzing the EA. E.g. affected architecture elements can be analyzed in respect to demands and project proposals. Figure 5.3 shows an impact analysis starting at a certain application asking for project proposals affecting this application.

User defined queries for impact analysis can be build using the *alfabet Administrative Tool* (see figure 5.4) by defining queries in a descriptive way. Arithmetical operations on the result set of a query (e.g. summing up or building averages) are not possible. However, a large number of standard reports is provided using such arithmetic operations. Additionally, the tool supports a mechanism to use evaluations in *prioritization schemes*¹ and ultimately *portfolios*² (see e.g. figure 5.18 in section 5.2.2). According to alfabet an aggregation method for evaluations, e.g. from applications to application groups, will be added with the next release.

Graphical visualizations highlighting objects due to an impact analysis are possible using portfolio matrices (see above). Graph layouts or swim lanes (see e.g. figure 3.28 in section 3.3.2) for visualizing the results of an impact analysis are not supported.

Rating: 3 points for support of impact analysis & calculation.

5.1.4 Richness of Predefined Visualization Techniques

planningIT provides different visualization techniques for editing and viewing information in the repository. *Cluster Maps* (named *application diagrams* in *planningIT*) can be used to edit and view application systems relating to e.g. organizational units and application groups. The cluster map in figure 5.5 was generated semi-automatically using the *alfabet Modeller*, which comes with *planningIT*.

¹Prioritization schemes in *planningIT* are aggregating one or more evaluation types, allowing to weight these evaluation types to a total of 100%.

²Portfolios in *planningIT* assembly two prioritization schemes, building the x- and y-axes of a portfolio matrix.

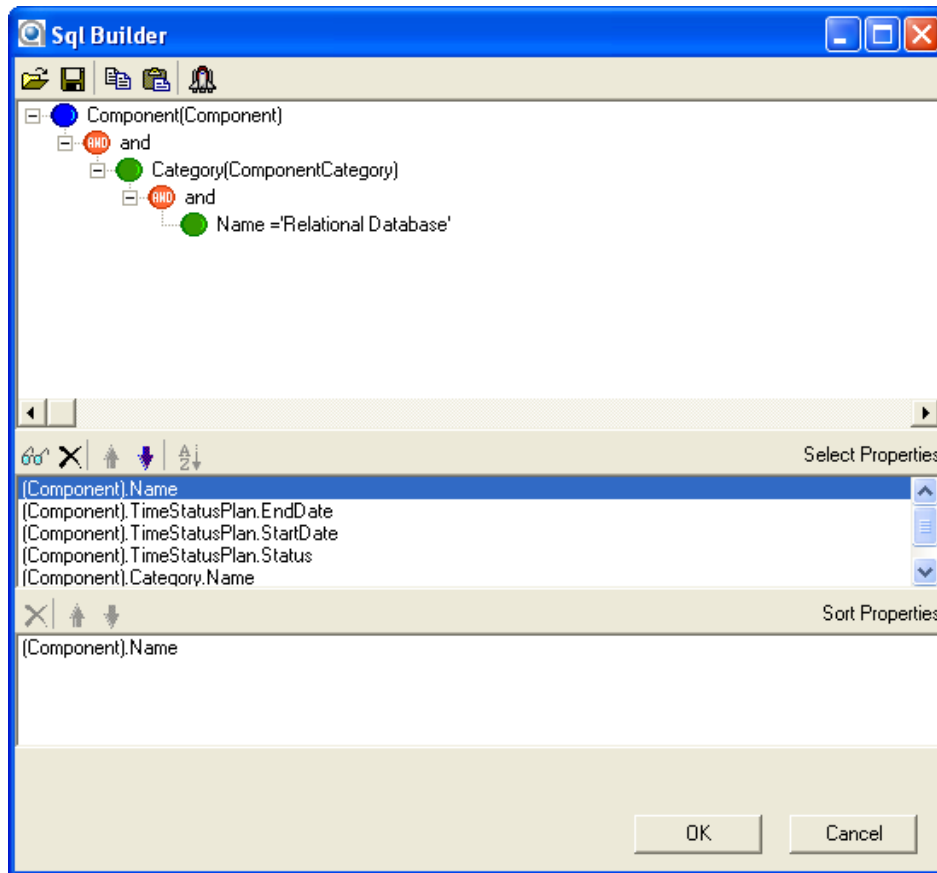


Figure 5.4: *planningIT*: query builder in the *alfabet Administrative Tool*

Each map symbol has a corresponding object in the repository and also the position in the map has a semantic meaning. If an object is moved from one cluster to another an update in the repository is performed.

The *alfabet Modeller* provides the possibility to define a *base object* for the diagram and to automatically retrieve objects from the repository associated to the base object. In figure 5.5 the boxes for grouping the applications are *application groups*. For showing the applications associated to each application group the function *actualize group* was used, which automatically shows sub groups and associated applications if this function is used on an application group.

The application diagrams also provide the functionality to display or hide additional information. Depending on the used objects e.g. lines for interconnections and the name of business objects (see section 5.2.5) may be displayed.

Process support maps are supported in editing and in read-only mode. The editable variant in *planningIT* is called a *business support map* and is used for building planned and target landscapes (see section 5.2.1). Figure 5.12 in section 5.2.1 shows an example for a business support map used to define an *IT master plan*. Other process support maps³ in read-only mode are also using the horizontal or vertical enlargement of the rectangles that depict applications are included in section 5.2.1. Whereby a horizontal enlargement of the rectangle (the map symbol for an application) means that more than

³Here meaning the concept of a *process support map* as introduced in appendix A.

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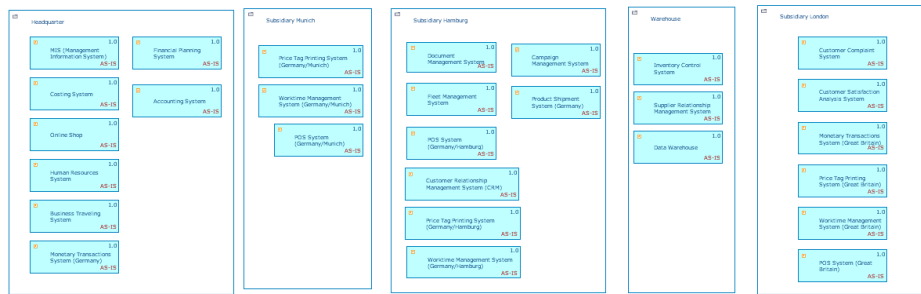


Figure 5.5: *planningIT*: cluster map visualizing application groups and applications

one business process is supported by the depicted application; a vertical enlargement of the rectangle means that more than one organizational unit or product is using the depicted application.

Interval maps are used in *planningIT* to visualize the life cycle of applications including the different statuses of applications. Figure 5.6 visualizes the life cycles of all applications in one application group. The time scale can be set to monthly, quarterly, or yearly in order to size the diagram to specific needs.

For visualizing information flows *planningIT* provides an additional diagram type which is similar to the application diagram, but is fully automatically generated and not editable. In the scenario *Management of Business Objects and Business Services* this diagram type is used to visualize the flow of business objects between different applications (see section 5.2.5).

All visualization types introduced above do provide the possibility to zoom in/out and can be exported to graphical formats or HTML depending on the specific diagram.

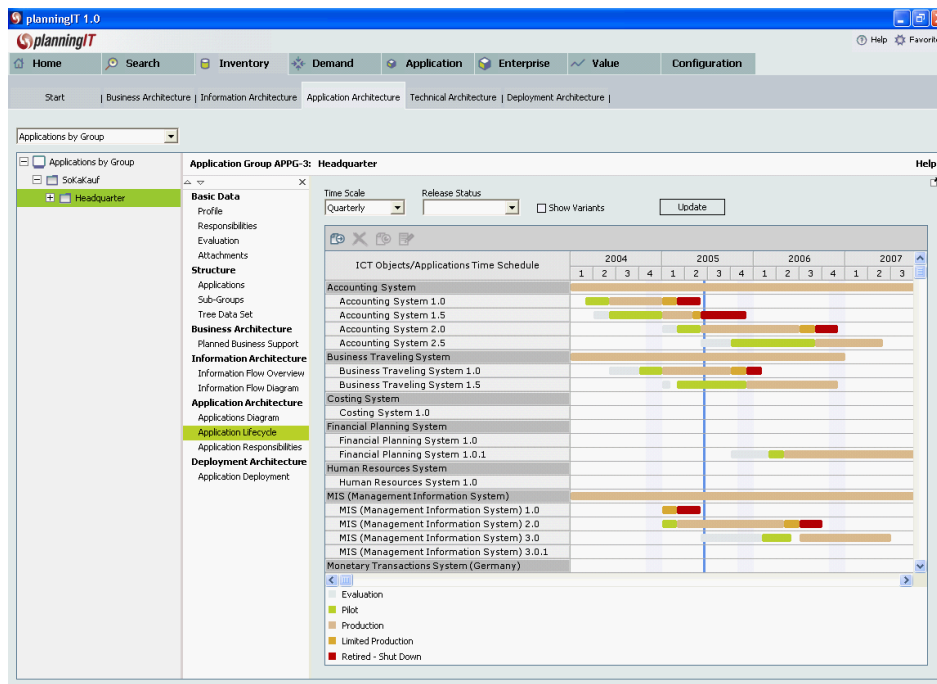


Figure 5.6: *planningIT*: interval map visualizing life cycle statuses of applications

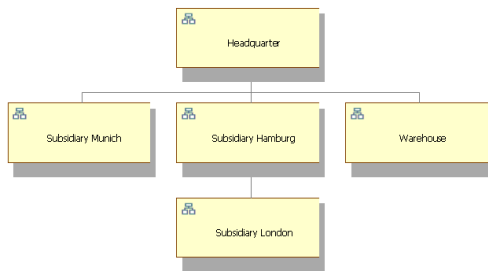


Figure 5.7: *planningIT*: organization chart

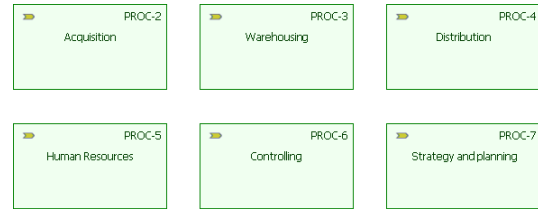


Figure 5.8: *planningIT*: process diagram

Other diagram types supported are organization diagrams as shown in figure 5.7 or process diagrams shown in figure 5.8. Nevertheless *planningIT* is not a full scale business process modeling tool which supports business process modeling languages such as BPML [Ark02] or EPC [Sch01].

Diagram types like pie charts, line charts, bar charts, bubble diagrams (used for portfolio matrixes) are also provided and are partially analyzed in section 5.2.2 during scenario simulation for *Project Portfolio Management*.

Rating: 4 points for richness of predefined visualization techniques.

5.1.5 Flexibility of Visualization Techniques

The flexibility of the predefined visualization techniques in *planningIT* differs from diagram type to diagram type. The application diagram and the information flow diagram provide functionality for highlighting elements using different life cycle statuses (see figure 5.9) and for displaying additional information (see figure 5.28 in section 5.2.5 showing names of business objects). Layout algorithms for e.g. spring or sugiyama layout for the information flow diagram do also exist.

Additionally the application diagram can be edited by the *alfabet Modeller* as described in section 5.1.4. The upcoming *software development kit (SDK)* will also allow to define the set of entity types and associations which can be used in application diagrams providing more flexibility.

The business support map and the business support diagram provide functionality for filtering applications according to their statuses, relevance⁴, and time frames. Additionally the business support diagram uses the vertical or horizontal enlargement of the symbols for applications (see section 5.2.1) and is able to aggregate information about business support to super processes and super organizations.

The diagram showing the application life cycle (see figure 5.6 in section 5.1.4) can be changed by adjusting the time scale or hiding applications with specific release statuses.

planningIT provides various capabilities to adjust the different diagram types as described above. Colors are used e.g. for the distinction of different statuses of objects in business support analysis diagrams or in portfolio matrixes etc. Symbols are used to annotate rectangles for the differentiation of e.g. ICT objects and applications. The support of using colors for properties like standard conformity (see figure 3.8 in section 3.3.1) or symbols like traffic lights (see figure 3.9 in section 3.3.1) in application diagrams or business support diagrams is not given yet.

Rating: 2 points for flexibility of visualization techniques.

⁴Relevance in *planningIT* is a predefined attribute of applications.

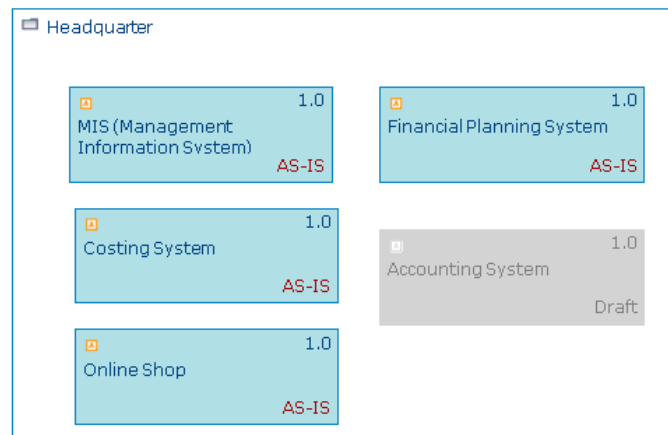


Figure 5.9: *planningIT*: highlighting life cycle statuses in an application diagram

5.1.6 Flexibility of Reporting

Creating user defined reports in *planningIT* is performed using the *alfabet Administrative Tool* by building queries in a descriptive way (see also section 5.1.3). The query reports that are created by the *alfabet Administrative Tool* are available to any user of the system using either the fat or thin client. According to alfabet these query reports will be incorporated into the permissibility framework in subsequent releases.

Joining and filtering the selection⁵ of elements is possible, the projection only allows sorting on the main object⁶ not on derived objects.

Graphical reports with charts (bubble, pie, etc.) can be created based on portfolios, an example is shown in figure 5.10. These reports are based on user defined or predefined *portfolios* which use *evaluations* with an editable weighting scheme. In the example in figure 5.10 the maintenance and operating costs have been defined as evaluation types and the portfolio aggregates these evaluations mapping them to the x- or y-axis.

Rating: 4 points for flexibility of reporting.

5.1.7 Collaboration Support

planningIT is designed to operate in a collaborative scenario with large numbers of users. A role based access control provides the capability to define user groups and assign responsibilities to the different groups (see figure 5.11). The granting of access is possible on object level and can be performed for each object individually.

The *alfabet Administrative Tool* provides the capability to create different profiles and assigning different editing or viewing capabilities on a predefined set of functionality packages. E.g. a profile with

⁵SQL queries are divided into a selection and a projection. The selection determines the elements of the result set (in SQL typically the **FROM** and **WHERE**) and the projection operates on the result set by e.g. selecting and calculating on the elements (in SQL typically the **SELECT**).

⁶The main object is the starting point of a query. All other elements are selected by traversing a hierarchical object tree.

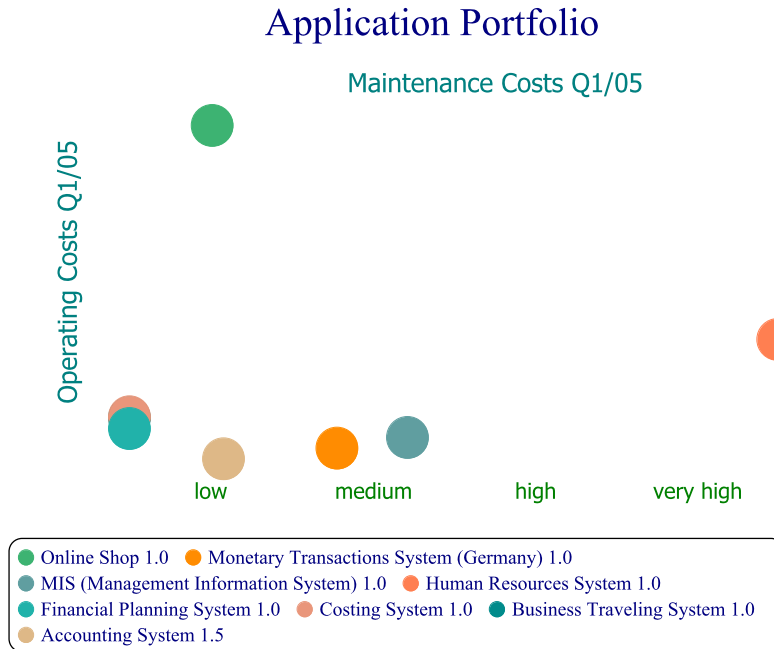


Figure 5.10: *planningIT*: report using a bubble chart

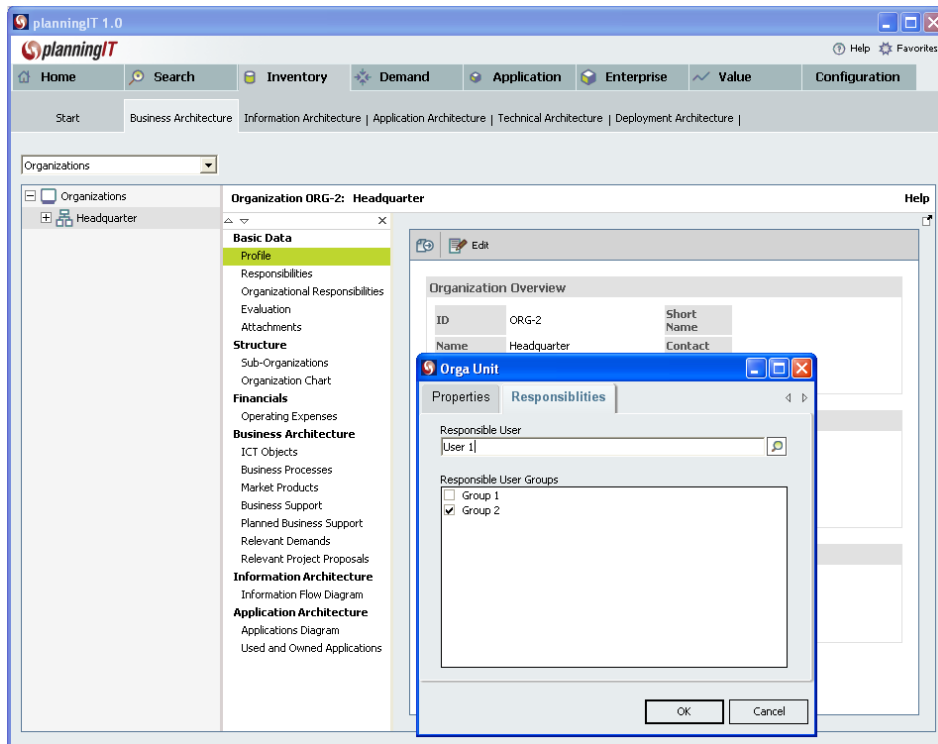


Figure 5.11: *planningIT*: assigning responsibilities to objects

a read-only mode can be created for users only viewing information without having the possibility of editing.

planningIT uses the approach to always edit *live-data*, meaning that all users are editing online data in the same repository, locking mechanism for the repository or for parts of it are not provided (see also section 5.1.8). However, specific planning activities can be carried out separated from the description of the current landscape (*as-is architecture* in *planningIT*). These are added to the inventory through a specific check-in process including a validity check.

The fat client, implemented using the *.NET* framework and the thin client using Microsoft Internet Explorer 5.5 or higher are the two GUIs provided for *planningIT* and nearly have equivalent functionalities. The difference is that only the fat client offers the *alfabet Modeller* which provides editing capabilities for cluster maps (see e.g. figure 5.5).

Rating: 5 points for collaboration support.

5.1.8 Import/Export & External Data Sources

For initially loading data into *planningIT* different import sources like Microsoft Excel, Microsoft Access, XML, etc can be used. This first import into the repository of *planningIT* is typically done by alfabet certified consultants using the *alfabet Administrative Tool* for mapping the structure of an Microsoft Access database to the corresponding tables of *planningIT*. This is due to the typical incompatibility of the data formats of the customer with the metamodel of *planningIT* which may require temporary adjustments of the metamodel in *planningIT*. In case these transformations are conducted outside *planningIT* the import can be run from the *alfabet Administrative Tool* by any trained user.

After the initial import of data into the repository external data sources can be integrated using the *Web Service Interface* of *planningIT* which was not tested during this survey. Scheduled or ad hoc importing of data into *planningIT* is possible, but due to the logical dependencies of entities in *planningIT* the data for import must conform with these structures to avoid data corruption. According to alfabet different importing scenarios (e.g. SAP R/3, ARIS Toolset or Microsoft Project) have been realized for customers.

The *alfabet Administrative Tool* also offers the capability to import and export XML Files containing instances of one or more entity types. Similar to the use of the *Web Service Interface* this interface should be used *carefully* to sustain data integrity especially concerning the various relationships between entities.

The capability for graphical exports differs from diagram type to diagram type. Business support diagrams and application diagrams can be exported to Microsoft PowerPoint (embedding the diagram as an image), PNG, EMF, JPG, TIF, and BMP. Business support maps can be exported to Microsoft PowerPoint embedding the diagram as an image or as an object, HTML, and Microsoft Excel.

The different interval maps (application life cycle diagram, business support time schedule diagram) can be exported to HTML. The different chart diagrams are generated using SVG⁷ technology.

Exporting of reports is possible to HTML using *planningIT* and also to Microsoft Excel using the *alfabet Administrative Tool* which is also used for building user defined queries.

Rating: 3 points for import/export & external data sources.

⁷SVG - Scalable Vector Graphics [W3C03]

5.1.9 Usability

planningIT is a complex EA management tool providing many functionalities for EA management integrated in one tool with an integrated process. The structure of the menus of *planningIT* is derived from the different modules (see figure 5.1) with the additional menus *Home*, *Search*, and *Configuration*. The substructure of the *Inventory* is divided in the areas *Business Architecture*, *Information Architecture*, *Application Architecture*, *Technical Architecture*, and *Deployment Architecture*. Each substructure element of the inventory allows the user to create, update or delete specific artifacts of the EA.

The substructure of the other modules (*Application*, *Demand* and *Enterprise*) are built task oriented, e.g. the module *Enterprise* has the menu points *Plan Target Architecture* for planning the target landscape⁸.

Starting with *planningIT* might result in an overflow of functionality and information for the user, if all modules are activated. Therefore alfabet supports the customer to tailor the profiles for the individual roles contributing to the IT planning process to their specific needs. On the one hand *planningIT* is a tool for specialists in the field of EA management, such as enterprise architects, landscape planners, etc. As such an everyday user will have no problems navigating through the menus and using the specific functionality. On the other hand, the IT planning process (and thus *planningIT*) requires continuous contribution from occasional users, such as application managers or portfolio managers. Occasional users are less likely to use the more complex functionality. Using the role configuration the appearance of the tool can be tailored to their specific needs (e.g., to document a small set of applications a user has responsibility for). A beginner may need some training to comprehend the full wealth of functionality provided, which may be placed in pop-ups or sub menus. A number of base capabilities, such as bookmarks, personal and recent items have been included to allow quick navigation to areas of regular or present interest.

Taking all this into account the GUI of *planningIT* is well structured. The documentation of *planningIT* covers the specific functionality and an additional user manual (built like a training handbook) is a good starting point to understand the modules of *planningIT*.

Rating: 4 points for usability.

5.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

5.2.1 Landscape Management

The *planningIT* module *Enterprise Architecture Management* provides functionality to analyze, plan, and define the enterprise architecture considering processes, products, organizational units, applications, and application groups. *planningIT* distinguishes between applications and ICT objects⁹, whereby ICT objects act as an abstraction or container for applications, components, or standard platforms. Applications, components, and standard platforms can be versioned, whereas ICT objects are not versioned.

planningIT uses the concept of master plans to plan the evolution of IT landscapes in time. There can be multiple plans to allow a breakdown of the plan along organizational or business process structures.

⁸Architecture would correspond to the wording of *planningIT*, in this survey we use the term target landscape

⁹ICT - Information and Communication Technology

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Planned Landscape	1.1 Purchasing	1.2 Goods receipt	1.5 Invoice verification	1.7 Accounts payable management	3 Warehousing	5 Distribution
Headquarter	Inventory Control System 1.0	Inventory Control System 1.0	Monetary Transactions System (Germany) 1.0	Monetary Transactions System (Germany) 1.0	Inventory Control System 1.0	Inventory Control System 1.0 Campaign Management System 1.0 Customer Relationship Management System Online Shop 1.0
Subsidiary Hamburg	Inventory Control System 1.0	Inventory Control System 1.0	Monetary Transactions System (Germany) 1.0	Monetary Transactions System (Germany) 1.0	Inventory Control System 1.0 Price Tag Printing System (Germany/Hamburg) 1.0	Inventory Control System 1.0 Campaign Management System 1.0 POS System (Germany/Hamburg) 1.0 Customer Complaint System 1.0 Monetary Transactions System (Germany) 1.0
Subsidiary London	Inventory Control System 1.0	Inventory Control System 1.0	Monetary Transactions System (Germany) 1.0	Monetary Transactions System (Germany) 1.0	Price Tag Printing System (Great Britain) 1.0 Inventory Control System 1.0	Inventory Control System 1.0 Campaign Management System 1.0 POS System (Great Britain) 1.0 Customer Complaint System 1.0 Monetary Transactions System (Germany) 1.0
Subsidiary Munich	Inventory Control System 1.0	Inventory Control System 1.0	Monetary Transactions System (Germany) 1.0	Monetary Transactions System (Germany) 1.0	Inventory Control System 1.0 Price Tag Printing System (Germany/Munich) 1.0	Inventory Control System 1.0 Campaign Management System 1.0 POS System (Germany/Munich) 1.0 Customer Complaint System 1.0 Monetary Transactions System (Germany) 1.0
Warehouse	Inventory Control System 1.0	Inventory Control System 1.0	Monetary Transactions System (Germany) 1.0	Monetary Transactions System (Germany) 1.0	Inventory Control System 1.0	Inventory Control System 1.0 Product Shipment System (Germany) 1.0

Figure 5.12: *planningIT*: planned application landscape for scenario landscape management

Typically there is a single master plan for the entire enterprise.

Any master plan comprises a set of master maps that describe the planned support of business processes in organizations by existing or planned applications in a specific time frame. It allows further, to compare the current, planned, and target landscape. Figure 5.12 shows a master map. The master maps pertaining to the same master plan are cross-synchronized, i.e. any change to an IT support (for an organization and a business process) on one master map is visible in every master map containing the same organization and business process. The IT master plan represents the evolution of the IT landscape across time.

The planned landscape is build graphically using the visualization of figure 5.12, the creation processes starts with selecting the supported processes and the consuming organizational units for which the IT landscape should be planned.

The existing applications which support the selected processes/organizational units can initially be loaded automatically into the master maps. These elements of the master map can later be modified (e.g. changing the status of an element: draft, under review, approved, retired) or deleted manually by the user. The user can filter the visualization of the master map elements using a specific time period.

The target landscape is created manually using ICT objects in nearly the same manner as creating the planned landscape and can be used to evaluate IT master plans concerning their accordance to the target landscape. Figure 5.13 shows a screenshot of a business analysis visualizing the current, planned, and target landscape starting 2005-07-01. For analyzing purpose additional business support diagrams can visualize the business support using vertical or horizontal enlargement of the boxes representing applications (see figure 5.14 and 5.15).

Planning and analyzing different periods in time by using different maps as a basis or visualizing the differences between two points in time is not supported. But for each planning scenario a *solution*

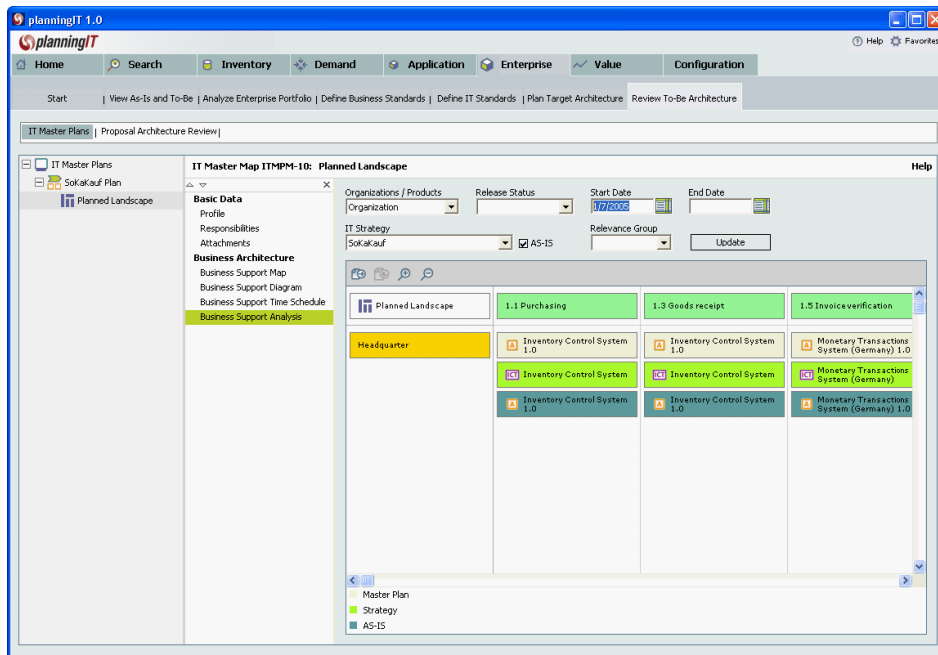


Figure 5.13: *planningIT*: current, planned, and target application landscape for scenario landscape management

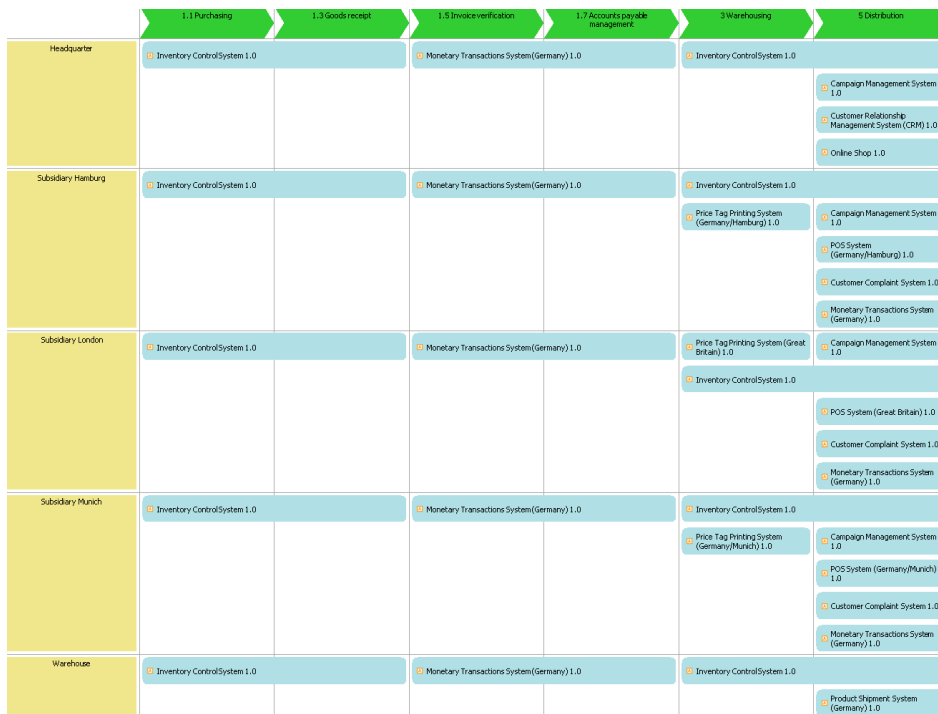


Figure 5.14: *planningIT*: process support map using horizontal integration for scenario landscape management

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Figure 5.15: *planningIT*: process support map using vertical integration for scenario landscape management

which can be attached to a project proposal can be defined to analyze and simulate differences resulting from the project proposals.

The tool handling for this scenario is good but not always intuitive. The linkage between the solution planning from the project proposals and the landscape management is not obvious.

The objectives defined for this scenario are almost achieved, but the visualization of the target landscape may become quite complex, as unchanged applications are represented with three different boxes (current, planned, and target - see figure 5.13); the use of symbols annotating the different statuses or a use of color coding might increase readability. The report (see figure 3.16 in section 3.3.2) matching the intended behavior is no predefined report, but can be achieved using the query builder from the *alfabet Administrative Tool* and subsequently be used by any permissible user of the tool.

The procedure consistency is completely given. *planningIT* uses nearly the same concepts which are described in the scenario documentation. Additionally different (customer specific) statuses for planned support *draft*, *under review*, etc. are provided.

The procedure integration is very good, e.g. the application support already entered can be used to initially fill the planned landscape.

Rating: 5 points for landscape management.

5.2.2 Project Portfolio Management

For simulating this scenario initially a set of *demands* has to be created. In a demand the affected architecture elements, supported goals, etc. are documented. In the next step demands can be reviewed, may be changed, and the status for each demand can be set. Impact analysis for finding similar demands affecting the same architectural elements or business functions is natively supported.

Demands are grouped into *project proposals* which can be prioritized and classified before each proposal is analyzed in detail. This detail analysis and evaluation may consist of a business case calculation, impact analysis, etc. An example providing a dependency analysis of different proposals in conjunction with work items¹⁰ is shown in figure 5.16.

Costs can be entered using evaluations or during the business case calculations, assigning costs to each affected application can be performed on the level of work items using evaluations.

A report showing each proposal with the affected architecture elements can be build using the *alfabet Administrative Tool* and is depicted in figure 5.17. Impact analysis using the existing business support of an application to derive the business processes affected by project proposals is not possible¹¹ (see figure 3.21 in section 3.3.2). Graphical impact analysis (see figure 3.17 in section 3.3.2¹²) is not supported.

¹⁰Work items are according to *planningIT* used to plan migration steps for a project proposal.

¹¹According to alfabet this report can be provided by a simple extension on customer request.

¹²According to alfabet this approach has historically led to scalability problems in the visualization for large

Nr.	This Project Proposal	Project Proposal	Work Item
1	APP-10 Customer Relationship Management System (CRM)		
2	WKIT-29 Update Customer Database System (CRM) 1.0		WKIT-39 Update Customer Database System (CRM) 1.0
3		PRJP-8 Reliability Improvement of the Online Shop	WKIT-50 Update Customer Database System (CRM) 1.0
4	APP-11 Document Management System 1.0	PRJP-11 Introduction of a Bonus Card for Customers	
5	WKIT-18 Update Document Management System 1.0		WKIT-55 Update Document Management System 1.0
6	APP-12 Fleet Management System 1.0	PRJP-14 Introduction of Knowledge Management	
7	WKIT-16 Update Fleet Management System 1.0		
8	APP-13 POS System (Germany/Hamburg) 1.0		
9	WKIT-21 Update POS System (Germany/Hamburg) 1.0		
10		PRJP-4 VAT Change	WKIT-7 Update POS System (Germany/Hamburg) 1.0
11		PRJP-6 Consolidation of Monetary Transaction Systems	WKIT-34 Update POS System (Germany/Hamburg) 1.0
12		PRJP-11 Introduction of a Bonus Card for Customers	WKIT-48 Update POS System (Germany/Hamburg) 1.0
13	APP-14 Price Tag Printing System (Germany/Hamburg) 1.0		
14	WKIT-23 Update Price Tag Printing System (Germany/Hamburg) 1.0		
15		PRJP-4 VAT Change	WKIT-10 Update Price Tag Printing System (Germany/Hamburg) 1.0
16	APP-15 Product Shipment System (Germany) 1.0		
17	WKIT-15 Update Product Shipment System (Germany) 1.0		
18		PRJP-9 Introduction of RFID in the Warehouse	WKIT-41 Update Product Shipment System (Germany) 1.0
19	APP-16 Worktime Management System (Germany/Hamburg)		
20	WKIT-25 Update Worktime Management System (Germany/Hamburg) 1.0		
21	APP-23 Business Traveling Systems 1.0		
22	WKIT-17 Update Business Traveling System 1.0		
23	APP-29 Online Shop 1.0		
24	WKIT-12 Update Online Shop 1.0		
25		PRJP-4 VAT Change	WKIT-6 Update Online Shop 1.0
26		PRJP-8 Reliability Improvement of the Online Shop	WKIT-38 Update Online Shop 1.0
27	APP-3 Customer Complaint System 1.0		
28	WKIT-37 Update Customer Complaint System 1.0		
29		PRJP-10 Replacement of the Customer Satisfaction Analysis System by the	WKIT-44 Update Customer Complaint System 1.0
30			
31			

Figure 5.16: *planningIT*: dependency analysis for scenario project portfolio management

Nr.	Name	ArchitectureElements.Name
1	Integration of an auctioning platform into the online shop	
2	VAT Change	Online Shop Accounting System POS System (Germany/Munich) POS System (Germany/Hamburg) POS System (Great Britain) Price Tag Printing System (Germany/Munich) Price Tag Printing System (Germany/Hamburg) Price Tag Printing System (Great Britain) POS System (Great Britain) Price Tag Printing System (Great Britain) POS System (Germany/Hamburg) Price Tag Printing System (Germany/Hamburg) POS System (Germany/Munich) Price Tag Printing System (Germany/Munich) Costing System Online Shop Accounting System
3	Database Consolidation	Customer Complaint System Customer Satisfaction Analysis System Monetary Transactions System (Great Britain) POS System (Great Britain) Price Tag Printing System (Great Britain) Worktime Management System (Great Britain) Campaign Management System Customer Relationship Management System (CRM) Document Management System POS System (Germany/Hamburg) Price Tag Printing System (Germany/Hamburg) Product Shipment System (Germany) Worktime Management System (Germany/Hamburg) Supplier Relationship Management System Business Traveling System Financial Planning System Online Shop MIS (Management Information System)
4	Consolidation of Monetary Transaction Systems	Monetary Transactions System (Great Britain) Monetary Transactions System (Germany)
5	Connection of Costing and Accounting System	Accounting System Costing System Costing System Accounting System
6	Reliability Improvement of the Online Shop	Online Shop Customer Relationship Management System (CRM) Customer Relationship Management System (CRM) Online Shop

Figure 5.17: *planningIT*: report showing project proposals and affected architecture elements for scenario project portfolio management

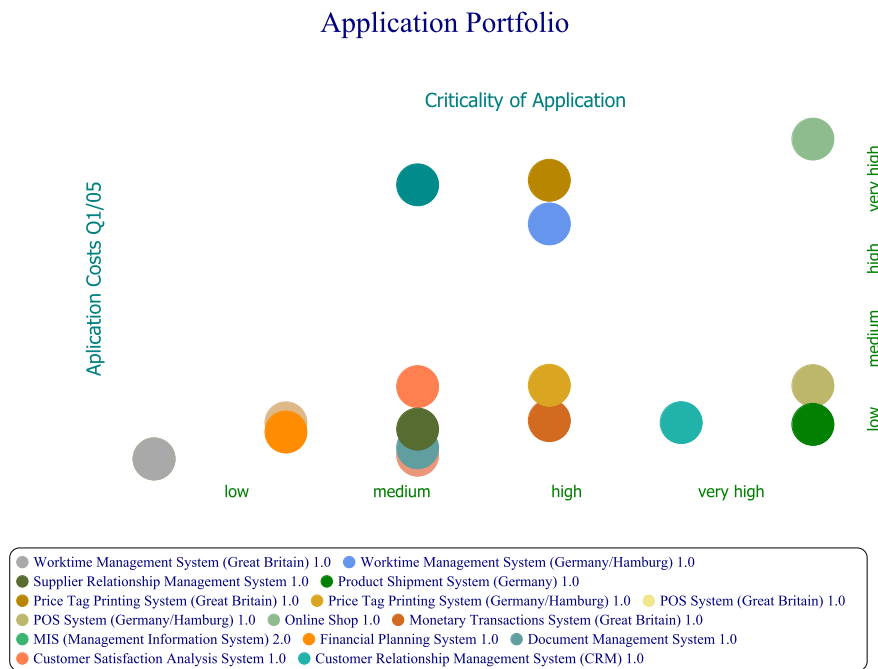


Figure 5.18: *planningIT*: portfolio matrix showing criticality and costs of applications for scenario project portfolio management

The selection process of a project proposal from this scenario can be performed by changing the status of a proposal from *new* to *described* or *discarded*. The query used for the impact analysis in figure 5.17 can be easily modified to hide discarded proposals.

The portfolio matrix for this scenario (see figure 3.23 in section 3.3.2) can partially be achieved (see figure 5.18), only the size of the bubbles cannot be used for showing the number of modifying projects. These portfolio matrices can be created for each proposal individually or e.g. for application groups.

The tool handling is intuitive, but the simulation of this scenario has to be done strictly aligned to the process of *planningIT*.

The achievement of objectives is partially given. The tabular reports already exist or can easily be built, graphical impact analysis is not supported.

The procedure consistency is given.

The procedure integration is partially given. Impact analysis which also uses e.g. existing business support relationships (see figure 3.21 in section 3.3.2) or relationships of organizational units to applications (see figure 3.22 in section 3.3.2) are not possible. As stated above, these reports can easily be achieved through a simple extension.

Rating: 4 points for project portfolio management.

IT landscapes with thousands of applications and hundreds of projects or project proposals to be managed. Hence, alfabet has opted to stop providing such a report and rather meet the requirement by providing specific reports that make the potential impact of projects or demands to individual objects of the IT landscape transparent.

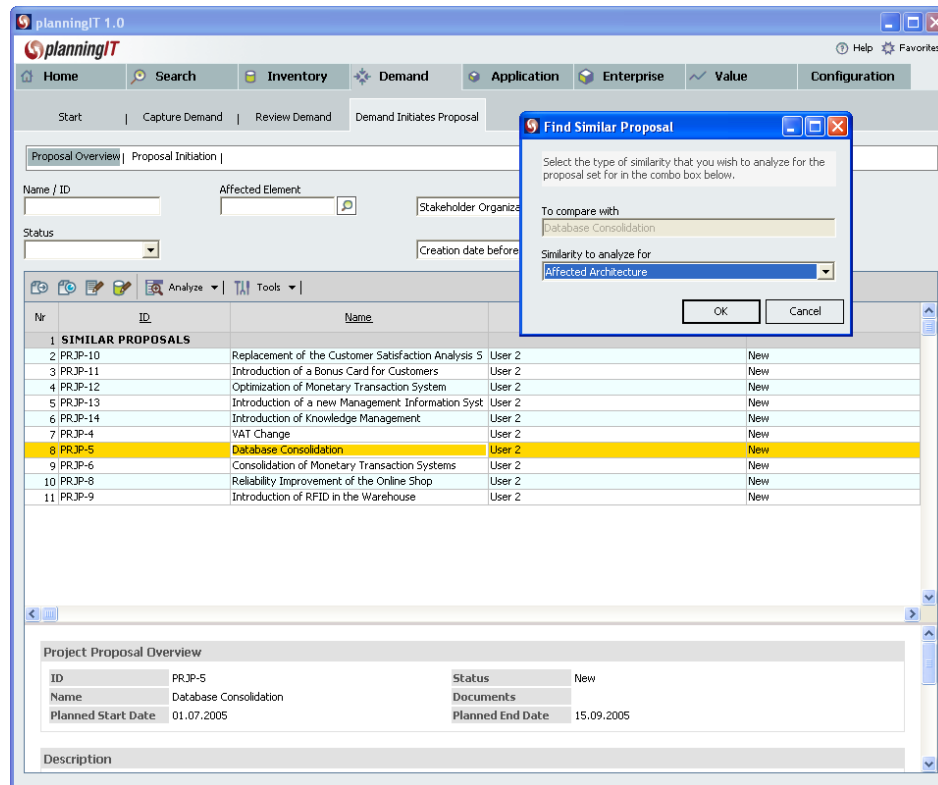


Figure 5.19: *planningIT*: impact analysis for scenario synchronization management

5.2.3 Synchronization Management

Support for synchronization management is not built-in in version 1.0 of *planningIT*, but according to alfabet it will be supported in the upcoming release. For simulating parts of this scenario the project proposals are used, which do have a planned start and end date. Project delays cannot be entered by now.

For analyzing project proposals *planningIT* provides the functionality to find similar proposals e.g. affecting the same architecture elements (see figure 5.19). Because no projects delays can be entered, impact analysis for identifying other projects affected by a delay of another project cannot be identified.

The tool handling is intuitive, but not all parts of the scenario could be simulated.

The achievement of objectives is partially given. The deliverable (see figure 5.19) showing projects affecting the same objects can be achieved. Interval maps (e.g. see figure 3.25 in section 3.3.2) could not be achieved.

The procedure consistency would be complete, if projects having delays, therefore affecting other projects, could be entered.

The procedure integration would be given, if the missing functionality is implemented and is linked to the procedure of the module *demand management*.

Rating: 3 points for synchronization management.

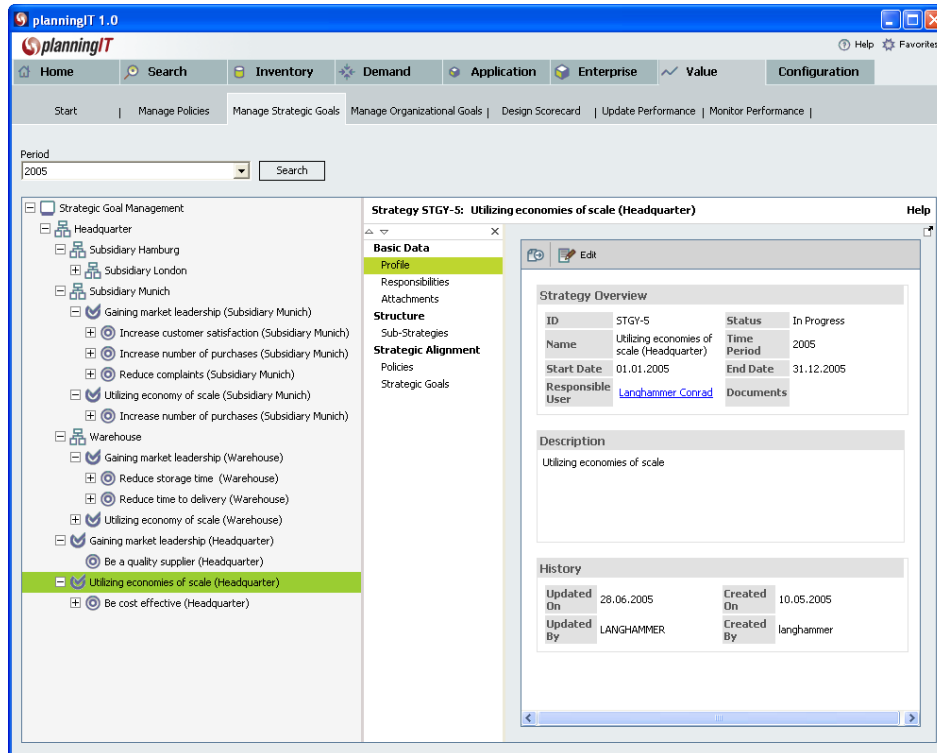


Figure 5.20: *planningIT*: defining strategies and goals for scenario traceability and strategy management

5.2.4 Traceability and Strategy Management

planningIT provides the concepts of strategies and goals which can be defined for each planning period and attached to organizational units (see figure 5.20). Additionally *planningIT* distinguishes between *strategic goals* and *organizational goals*¹³, for simulating this scenario only strategic goals are used.

For evaluating the achievement of each goal one or more indicators¹⁴ can be used, whereby deviations to be shown in red or yellow, the measuring unit, etc. are assigned to each indicator.

The current value, the forecast and the target value can be entered for each indicator of each goal for the analyzing period, which is assigned to each goal individually. The performance of the goals and indicators can be monitored using a balanced scorecard, perspectives for the scorecard can be defined by the user and the goals can be attached to the different perspectives. Figure 5.21 shows the monitoring of the scorecard for an organizational unit including a detail view for a selected goal. Before the monitoring is available the corresponding goal evaluation, which also defines the status (red, yellow, green) for the current and forecast light, must be publicly visible.

The demanded connection between projects (proposals) and goals from this scenario can be achieved by either defining the corresponding goal for a demand or a project proposal. Figure 5.22 shows the associated project proposal for a specific goal. The report in figure 5.23 extends this impact analysis by showing strategies, goals, project proposals and affected applications, the requested graphical

¹³*Strategic goals* are associated to strategies which are associated to organizational units; *organizational goals* are directly linked to organizational units without strategies.

¹⁴In the scenario description in section 3.3.2 the corresponding term for indicator is metric.

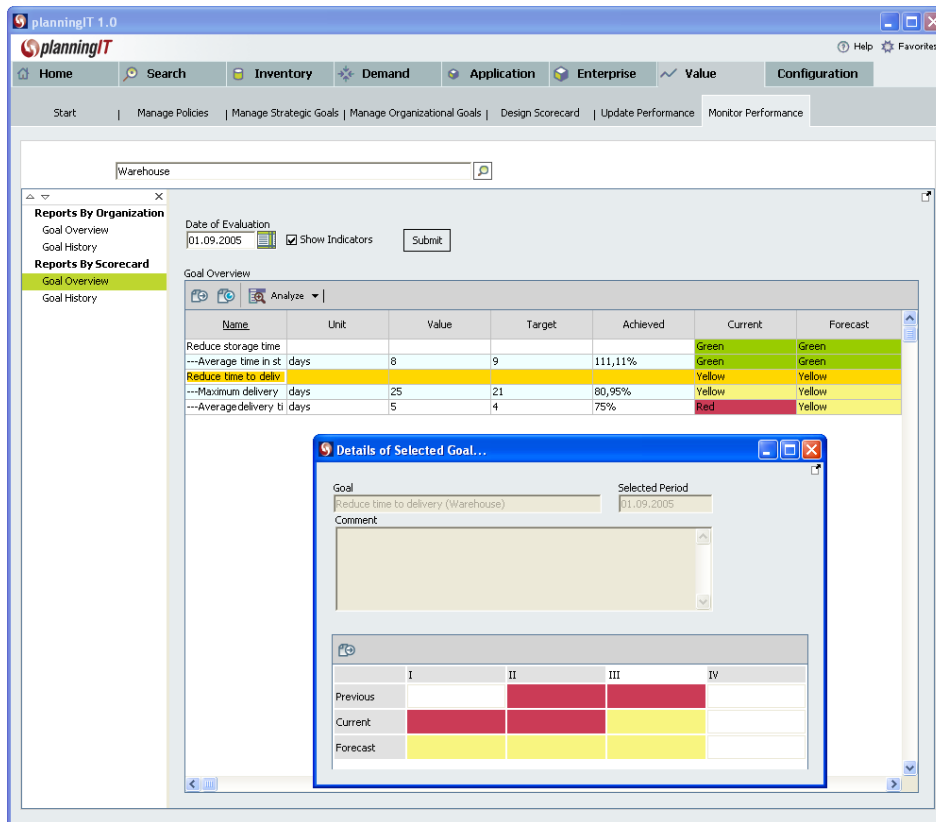


Figure 5.21: *planningIT*: monitoring goals for an organizational unit for scenario traceability and strategy management

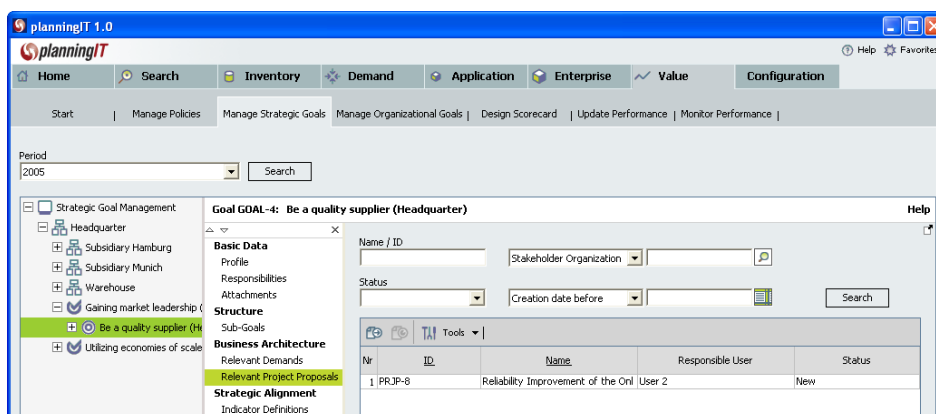


Figure 5.22: *planningIT*: analyzing related project proposals for a goal for scenario traceability and strategy management

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Nr.	Name	Goals.Name	Goals.Strategy.Name	ArchitectureElements.Name
1	Reliability Improvement of the Online Shop	Be a quality supplier (Headquarter)	Gaining market leadership (Headquarter)	Online Shop Customer Relationship Management System (CRM) Customer Relationship Management System (CRM) Online Shop

Figure 5.23: *planningIT*: report showing strategies, goals, project proposals, and applications for scenario traceability and strategy management

representation (see figure 3.28 in section 3.3.2) cannot be generated.

The tool handling is intuitive, the publication mechanism for goal evaluation (see above) is concealed.

The achievement of objectives is nearly given, the graphical report for the impact analysis (see figure 3.28 in section 3.3.2) cannot be achieved, but the required information is present in the repository.

The procedure consistency is given, all objects of this scenario could be entered conforming to the methodology of *planningIT*.

The procedure integration is given, goals can be related to existing demands or project proposals.

Rating: 5 points for traceability and strategy management.

5.2.5 Management of Business Objects and Business Services

The business services, business objects, and interconnections can be entered by conforming to the methodology of *planningIT*, the concept of connectors exporting/importing functionality is mapped to the concept of *local components*¹⁵. Using these components the associations between interconnections – in *planningIT* named information flows – and business objects/services are created by entering this information between interconnections and either applications or components. As local components are used in a generic way, the information whether a connector provides online, offline or manual access to an application is entered directly to the information flow instead of the connector¹⁶.

Figure 5.24 shows the business data tab of an information flow between the *Campaign Management System* and the *Inventory Control System*. Figure 5.25 shows all information flows of the *Campaign Management System*.

The deliverable in figure 3.31 (see section 3.3.2) from this scenario, which should visualize the interconnection and flows of business objects between applications supporting the process *Distribution* at the organizational unit *Munich* is created by using the application diagram provided for the process (see figure 5.26). Using as small customization by alfabet, which defines a predefined query for this diagram all applications which support a specific process at a given organizational unit can be automatically placed onto the diagram from the repository.

Figures 5.27 and 5.28 show that *planningIT* also provides the functionality to visualize properties of the information flow. In figure 5.27 the interconnection types are shown, figure 5.28 visualizes the names of the business objects transferred.

¹⁵ *Local components* in *planningIT* can be used to represent e.g. technical or logical components of an application.

¹⁶ For increasing readability the name of a component is extended by the connection type, e.g. "online".

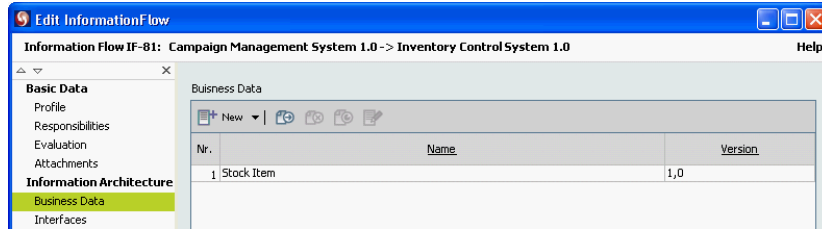


Figure 5.24: *planningIT*: business objects associated with an interconnection for scenario management of business objects and business services

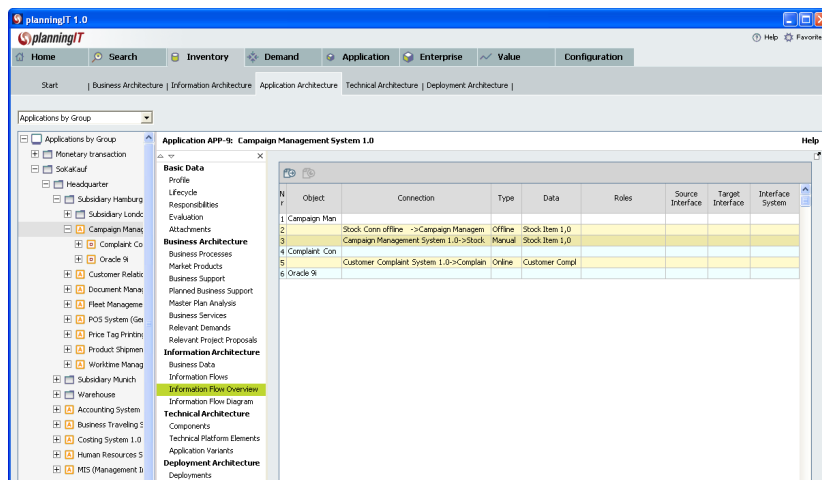


Figure 5.25: *planningIT*: information flows of an application for scenario management of business objects and business services

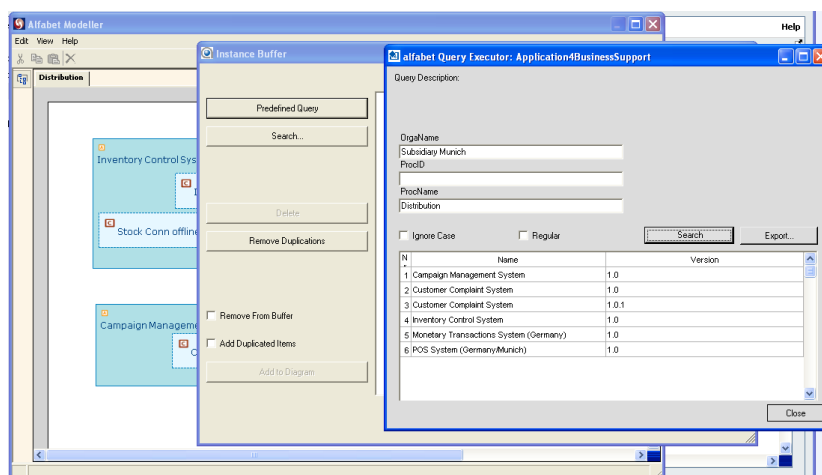


Figure 5.26: *planningIT*: use of *alfabet Modeller* for scenario management of business objects and business services

5. alfabet AG (planningIT)

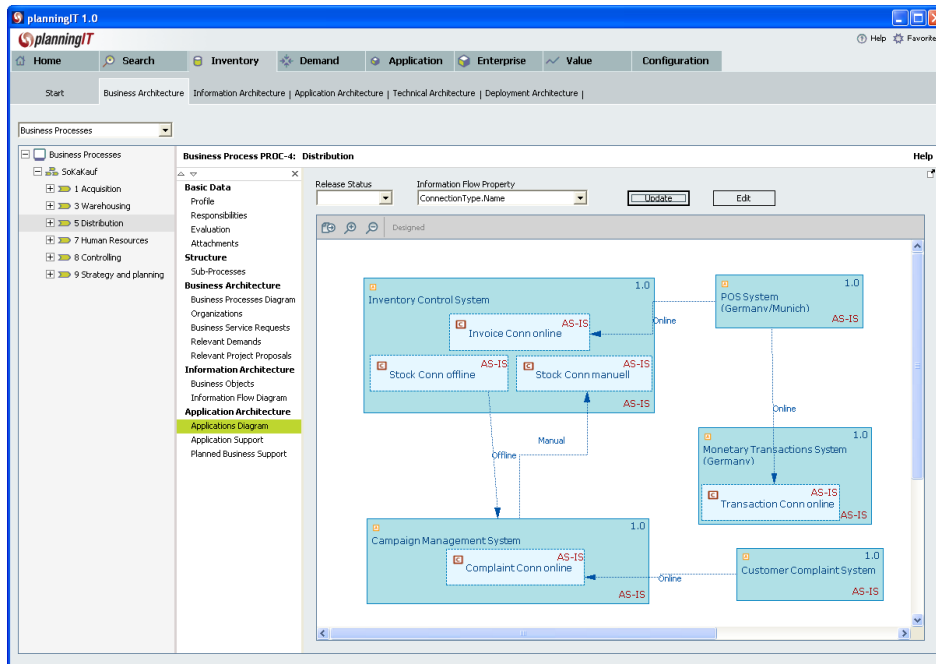


Figure 5.27: *planningIT*: information flow with interconnection type for scenario management of business objects and business services

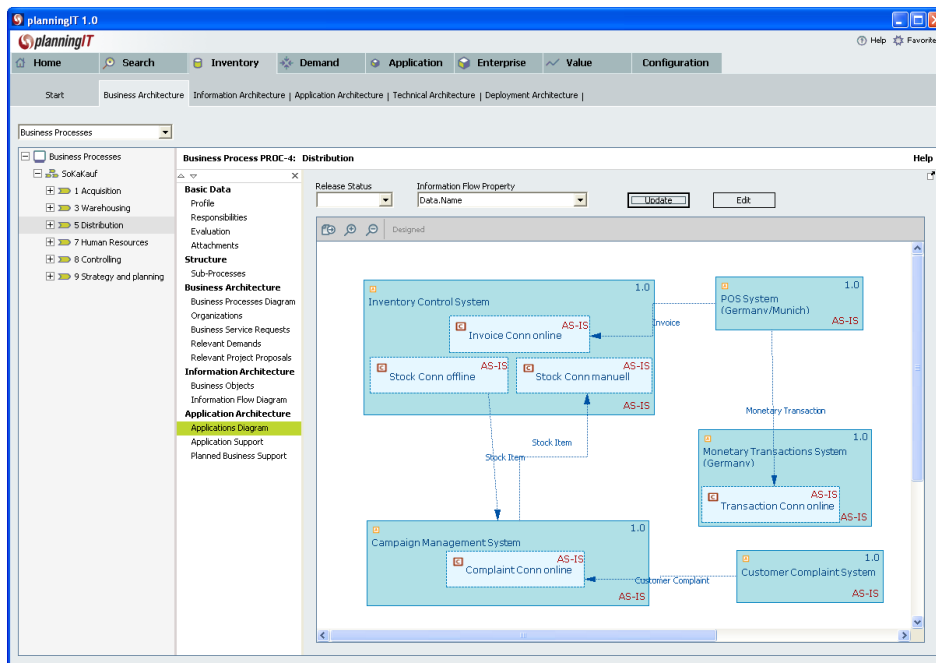


Figure 5.28: *planningIT*: information flow with business objects for scenario management of business objects and business services

The deliverable in figure 3.32 (see section 3.3.2) which visualizes a matrix map with applications and business objects cannot be achieved, as well as the deliverable in figure 3.33 (see section 3.3.2) containing nearly the same information is also not a standard report in *planningIT*. However, according to alfabet such reports could be provided as a simple customization upon customer request.

The tool handling is intuitive, only the use of the *alfabet Modeller* and its capabilities to import existing objects may need some introductory training.

The achievement of objectives is nearly given. The deliverable from figure 3.31 is almost achieved, the deliverables in figure 3.32 cannot be achieved, the report in figure 3.33 can be provided upon customer request.

The procedure consistency is given, the concepts of *planningIT* widely correspond with the concepts of the scenario.

The procedure integration is also given, the objects entered are linked to existing objects from other scenarios.

Rating: 5 points for business object/service management.

5.2.6 Application Architecture Management

The module *Enterprise Architecture Management* of *planningIT* using the concepts of platforms and components realizes the functionality needed for the simulation of scenario 3.3.2 which deals with blueprint architectures and architectural solutions for business applications.

planningIT distinguishes between components, master platforms, platform templates, and standard platforms. For scenario simulation components are used to map the technologies (see figure 5.29),

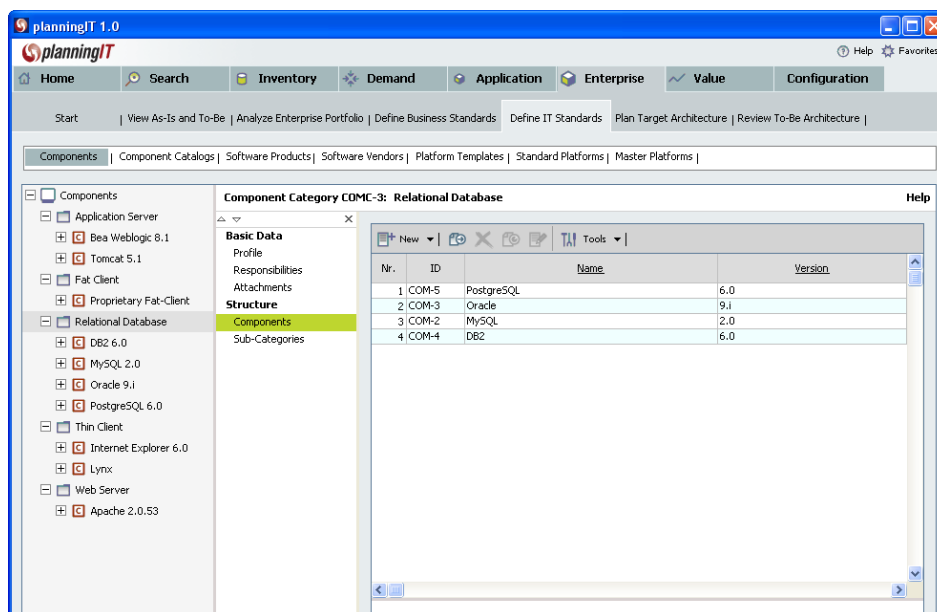


Figure 5.29: *planningIT*: components and component categories for scenario application architecture management

5. alfabet AG (planningIT)

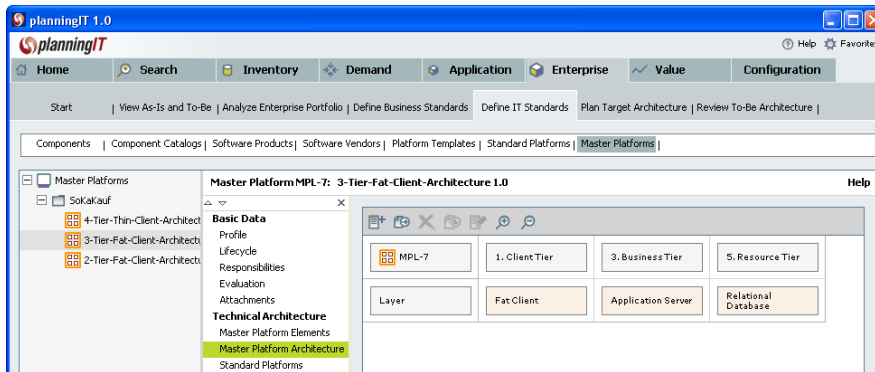


Figure 5.30: *planningIT*: blueprint architecture for scenario application architecture management

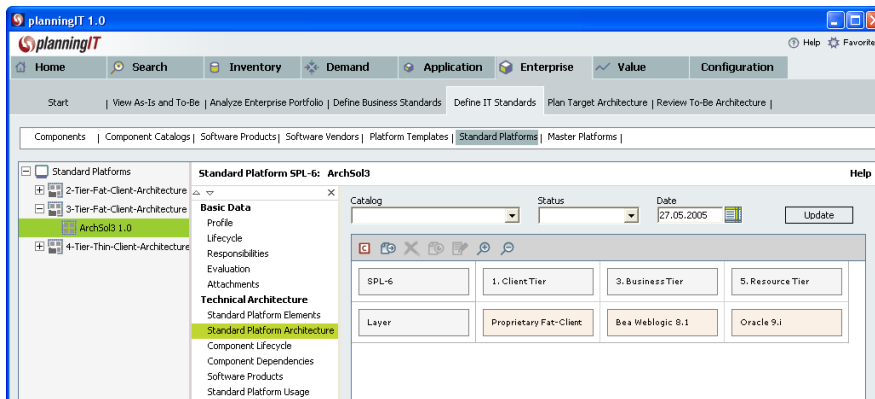


Figure 5.31: *planningIT*: architectural solution for scenario application architecture management

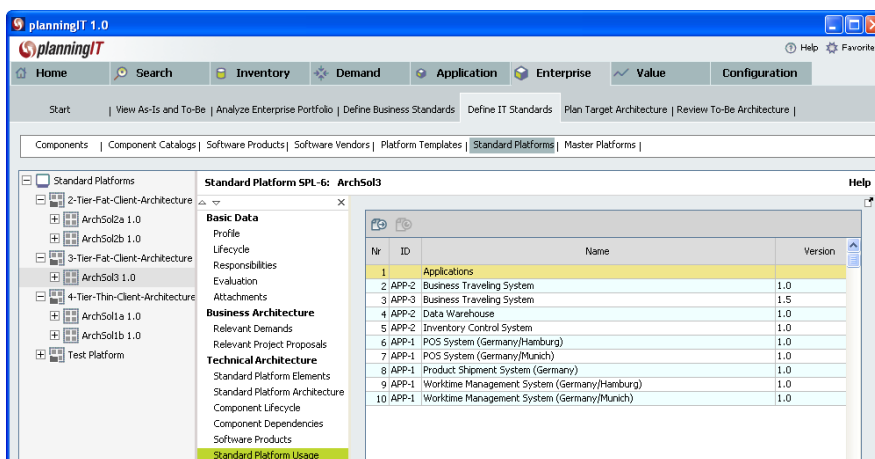


Figure 5.32: *planningIT*: usage of standard platforms for scenario application architecture management

Nr.	Name	Platform.ConsistsOf.Name
1	Customer Complaint System	
2	Customer Satisfaction Analysis System	
3	Monetary Transactions System (Great Britain)	
4	POS System (Great Britain)	
5	Price Tag Printing System (Great Britain)	
6	Worktime Management System (Great Britain)	
7	Campaign Management System	
8	Customer Relationship Management System (CRM)	ArchSol2b
9	Document Management System	
10	Fleet Management System	ArchSol1a
11	POS System (Germany/Hamburg)	ArchSol3
12	Price Tag Printing System (Germany/Hamburg)	

Figure 5.33: *planningIT*: report showing the use of architectural solutions for scenario application architecture management

component groups for abstract technologies, master platforms are used to represent blueprint architectures (see figure 5.30) and standard platforms build the architectural solutions (see figure 5.31) in *planningIT*.

The platform templates have been configured analog to SUN's tiered approach [Dai01] distinguishing between client, presentation, business, integration, and resource tier. Figure 5.31 shows the standard platform *ArchSol3 1.0* from the simulated scenario. Additionally for each standard platform a report can be generated which shows the usage of the specific standard platform (see figure 5.32).

A visualization of the whole application landscape using either a cluster or a process support map in conjunction with the attribute *conforms to architectural solution* is not possible (see figure 3.34 in section 3.3.2). The report shown in figure 5.33 is not a predefined report, it can be built programmatically using the query builder from the *alfabet Administrative Tool*. A bar chart showing the number of usage (see figure 3.36 in section 3.3.2) is not possible yet, but reports for the usage of each architectural solution do exist.

The tool handling for this scenario is very intuitive, the artifacts of this scenario can be easily mapped to the approach *planningIT* uses.

The achievement of objectives is almost given, as not all objectives can be achieved: the architecture landscape can be visualized similar to the layout of figure 3.34 (see section 3.3.2), but it is not possible to highlight conformance with architectural solutions in *planningIT* version 1.0. According to alfabet superimposition of evaluations onto application diagrams will be supported in subsequent releases. System generated information of each application with regard to the use of architectural solutions can be assessed on the application itself.

The procedure consistency is given.

The procedure integration is given, information entered in this scenario is directly linked to the existing applications.

Rating: 5 points for application architecture management.

5.2.7 Infrastructure Management

For simulating this scenario different concepts of *planningIT* are used. *Deployments* are used for entering the information which application is hosted at which location and which database is used and

5. alfabet AG (planningIT)

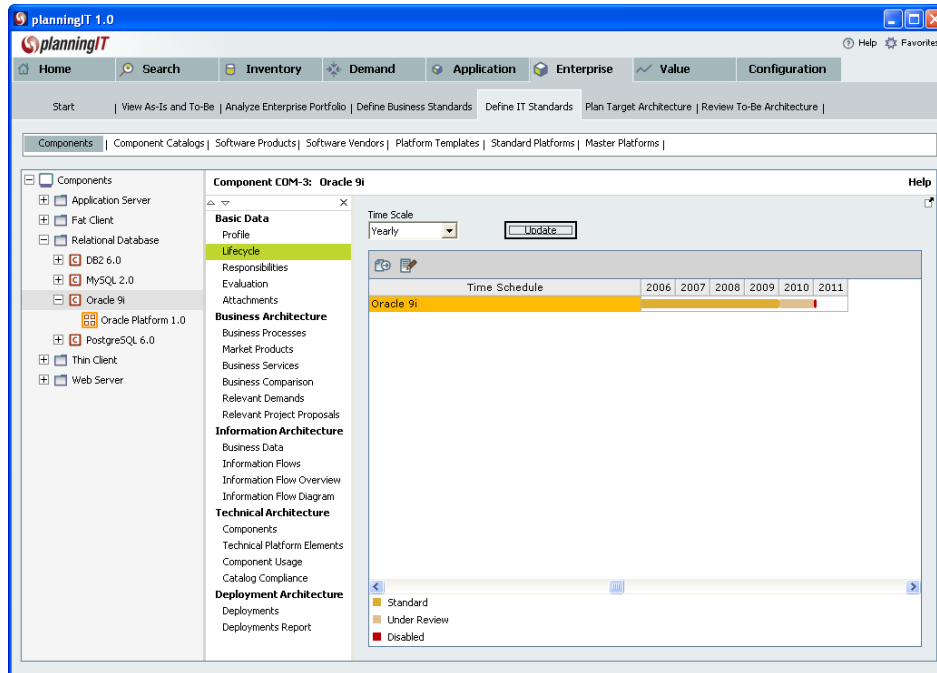


Figure 5.34: *planningIT*: screenshot showing the life cycle of a technology for scenario infrastructure management

where it is located. In that sense *deployments* are providing the link between the *logical* and *physical* representation. The information already entered in the scenario *Application Architecture Management* (see section 5.2.6) can be reused by using the information about databases belonging to architectural solutions.

Figure 5.34 shows the life cycle of the technology *Oracle 9i* mapped to a component in *planningIT*. The life cycle of all relational database management systems is shown in a report in figure 5.35. This report is built using the query builder of the *alfabet Modeller*. A holistic view in a cluster map like figure 3.37 in section 3.3.2 is not supported.

The license and operating costs of the database for the different deployments can be entered using *Evaluations* (see also section 5.2.2). The report in figure 5.37 shows these costs for each deployment.

For the planned consolidation of databases, a demand and a resulting project proposal is created. Figure 5.36 shows the demand with the affected architecture. *Migration steps* which can be created in the project proposal cover the steps for consolidating the databases from this scenario.

The tool handling is intuitive but may appear a bit twisted. To achieve the required results for this scenario multiple dialogs have to be used, while the cross links of these dialogs may confuse an untrained user, the expert may appreciate the depth of information detail and consistency.

The achievement of objectives is largely given. The required reports can be created, only holistic views (e.g. figure 3.37 in section 3.3.2) cannot be achieved.

The procedure consistency is given. The infrastructure elements can be entered and deployed to the different locations and the project proposal covers the needed activities for this scenario.

The procedure integration is given, information already entered in other scenarios can be reused.

Rating: 4 points for infrastructure management.

Nr.	Name	TimeStatusPlan.EndDate	TimeStatusPlan.StartDate	TimeStatusPlan.Status	Category.Name
1	MySQL	01.06.2005 00:00:00,01.06.2006 00:00:00,01.06.2007 00:00:00	01.01.2003 00:00:00,01.06.2005 00:00:00,01.06.2006 00:00:00	Standard Under Review Disabled	Relational Database
2	Oracle	01.01.2010 00:00:00,01.01.2011 00:00:00,01.01.2012 00:00:00	01.04.2001 00:00:00,01.01.2010 00:00:00,01.01.2011 00:00:00	Standard Under Review Disabled	Relational Database
3	DB2	31.12.2005 00:00:00,31.12.2006 00:00:00,31.12.2007 00:00:00	01.06.2000 00:00:00,31.12.2005 00:00:00,31.12.2006 00:00:00	Standard Under Review Disabled	Relational Database
4	PostgreSQL	01.01.2008 00:00:00,01.01.2009 00:00:00,01.01.2010 00:00:00	01.08.2003 00:00:00,01.01.2008 00:00:00,01.01.2009 00:00:00	Standard Under Review Disabled	Relational Database

Figure 5.35: *planningIT*: report showing the life cycle of all technology for scenario infrastructure management

Nr.	Class	ID	Name	Comments
1	Application			
2		APP-10	Customer Relationship Management System (CRM)	Migrate to Oracle Munich
3		APP-11	Document Management System	Migrate to Oracle Munich
4		APP-13	POS System (Germany/Hamburg)	Migrate to Oracle Munich
5		APP-14	Price Tag Printing System (Germany/Hamburg)	Migrate to Oracle Munich
6		APP-15	Product Shipment System (Germany)	Migrate to Oracle Munich
7		APP-16	Worktime Management System (Germany/Hamburg)	Migrate to Oracle Munich
8		APP-22	Supplier Relationship Management System	Migrate to Oracle Munich
9		APP-23	Business Traveling System	Migrate to Oracle Munich
10		APP-25	Financial Planning System	Migrate to Oracle Munich
11		APP-29	Online Shop	Migrate to Oracle Munich
12		APP-3	Customer Complaint System	Migrate to Oracle Garching
13		APP-30	Accounting System	Migrate to Oracle Garching
14		APP-4	Customer Satisfaction Analysis System	Migrate to Oracle Garching
15		APP-5	Monetary Transactions System (Great Britain)	Migrate to Oracle Garching
16		APP-6	POS System (Great Britain)	Migrate to Oracle Garching
17		APP-7	Price Tag Printing System (Great Britain)	Migrate to Oracle Garching
18		APP-8	Worktime Management System (Great Britain)	Migrate to Oracle Garching
19		APP-9	Campaign Management System	Migrate to Oracle Munich

Figure 5.36: *planningIT*: report showing the effected applications for scenario infrastructure management

Nr.	Name	Locations.Name	Indicators.Name	Indicators.Value	Object.Name
1	DB2 (London)	Subsidiary London (London)	License Cost Operating Costs	5000,3000	DB2
2	MySQL (Munich)	Headquarter (Munich)	License Cost Operating Costs	0,40000	MySQL
3	Oracle (Munich)	Subsidiary Munich (Munich)	License Cost Operating Costs	10000,20000	Oracle
4	PostgreSQL (London)	Subsidiary London (London)	License Cost Operating Costs	0,3000	PostgreSQL
5	Oracle (Garching)	Warehouse (Garching)	License Cost Operating Costs	5000,20000	Oracle
6	Oracle (Hamburg)	Subsidiary Hamburg (Hamburg)	License Cost Operating Costs	5000,20000	Oracle

Figure 5.37: *planningIT*: report showing the costs of all technologies for scenario infrastructure management

5.3 Tool Vendor's Profile

planningIT: from demand to budget

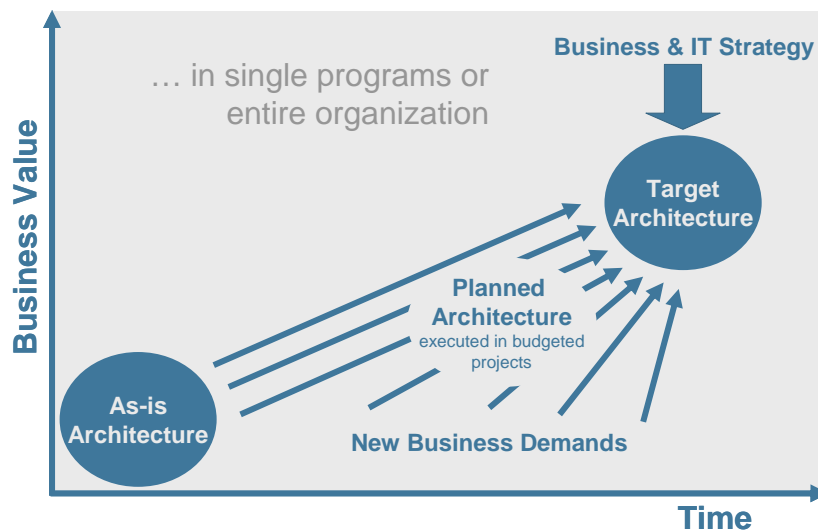
alfabet AG

Solution overview

planningIT™ comprises a Logical IT Inventory and focused modules that support Business Demand Management, Enterprise Architecture Management, Application Architecture Management, Program Portfolio Management and Value Management. Consistent GUI navigation and easy to use data collection prompts minimize training time (approx. 3 hours for most users, 3 day train the trainer program). A browser client configuration supports widespread user communities, while a windows client version with identical look and feel supports power users.

Strategic planning approach

planningIT is purpose-built to support all components of the strategic IT planning process: documentation of the as-is architecture, design and publication of a target architecture that reflects business objectives as well as architectural standards, and management of planned transformations from as-is to target in (sub)organizational and program specific initiatives. planningIT strongly endorses business function libraries and the definition of services provided by an application and requested by business processes, thus making it the perfect platform for transition planning to a service-oriented architecture. By contrast, conventional EA tool providers tend to focus on design and publication of target architectures by technical experts.



IT planning: front-end to align business & IT

Transparency

The Logical IT Inventory in planningIT can capture relationships between every layer of the architecture – (business, information, application, technical and deployed architectures) – with sufficient detail to support any IT planning task including consolidation and optimization of demands, proposals and scenarios. The Logical IT Inventory is designed to support different organizational maturity levels, so the level of data gathering required is proportionate to the scope of the planning task. The solution incorporates a rich, pre-configured meta-model to accelerate roll-out and ensure that customers benefit from product upgrades. Initial data upload can be realized with a low risk service package "See IT &

Save”, which fills the inventory for a fixed price. Ongoing maintenance of a current, end-to-end view of the IT Landscape is supported by the user community in streamlined data collection procedures in each of the discrete planning modules.

Collaborative system

Many organizations struggle to create and execute the strategic IT planning function because this work involves tight coordination of a large number of stakeholders with diverse interests, budgets and reporting lines, especially between the IT organization and business divisions. Typically, several hundreds or even thousands of people contribute to the documentation and planning process in large IT organizations, among whom are application owners responsible for a small number of applications in the enterprise; cluster planners responsible for the business support provided by a group of applications to a specific set of business processes and organizations; business analysts who focus on a specific procedural, organizational or application architecture aspect; enterprise architects who define the IT architecture strategy as well as various aspects of standard setting and enforcement; project managers of large IT projects; IT executives who set the strategy and goals; balanced scorecard managers who define and manage the balanced scorecards for individual organizations; IT investment board members and so forth. planningIT uses a role based system that configures access rights, information views and planning tools to suit every stakeholder from power users in need of rich functionality to the occasional user requiring simple interactions.

Integrated planning process

planningIT integrates technical know-how from the architecture management arena with business process and business services aspects as well as portfolio management techniques to achieve a collaborative IT planning process from demand to budget. See figure 5.2 planningIT: an integrated planning process.

Demands can be captured, consolidated and reviewed in the context of their business motivation; detailed architectural proposals and cost estimates are devised prior to budget approval; and business, technical and strategic compliance can be assessed at any point in the process. In short, by contrast to conventional EA tools that help IT experts publish as-is and target architecture, the alfabet solution helps these experts to plan the transformation towards improved alignment of the IT architecture with IT and business strategy and to communicate this to all stakeholders. In turn this is culminated in the portfolio management process which supports general management decision making.

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The BOC GmbH provides the EA management tool *ADOit*, which mainly focuses on IT service and architecture management. Besides IT architectures, service management concepts, and the management of IT processes are focal points. The generation of IT continuity plans, by means of linking IT processes with IT services and the underlying IT architectures is one important example of combining these concepts.

ADOit comes out-of-the-box with an own metamodel and procedure model for IT service and architecture management. These models support standards like ITIL, COBIT, and BS 15000 for the management of IT processes. Typical applications for *ADOit* are the definition of service catalogues, SLA-definition and management, business impact analysis, quality improvement via ITIL-compliant IT service and process management, standardization for both the ITSM processes and IT architecture and time and cost savings when using the ITIL Best Practices as *ADOit* reference models.

The metamodeling concepts of *ADOit* allow customer specific extensions of the standard metamodel and procedures. Examples of these extensions are a UML 2.0, BPMN 1.0, the customization of reports and automatically generated diagrams from information in the *ADOit* repository, specific EA extensions and more.

Furthermore *ADOit* is part of BOC's management office, a tool suite of model-oriented management tools for strategy, process, and IT-service and architecture management. The management office covers methods like Balanced Scorecards implemented in ADOScore, process (re)engineering implemented in ADONIS, supply chain management after the SCOR model in ADolog and IT architecture and service management in *ADOit*.

In the following sections the evaluation sketched in chapter 2.2.3 is described in detail. The evaluated version of *ADOit* is "ADOit 2.0".

ADOit uses a *model driven* approach, meaning that all information is stored in one or more models. The model types define, which entity types can be used in a specific model. The metamodel defines, which entity types exist, which attributes are available, and how entities can be linked. The underlying repository of *ADOit* stores all models, entities, and relationships.

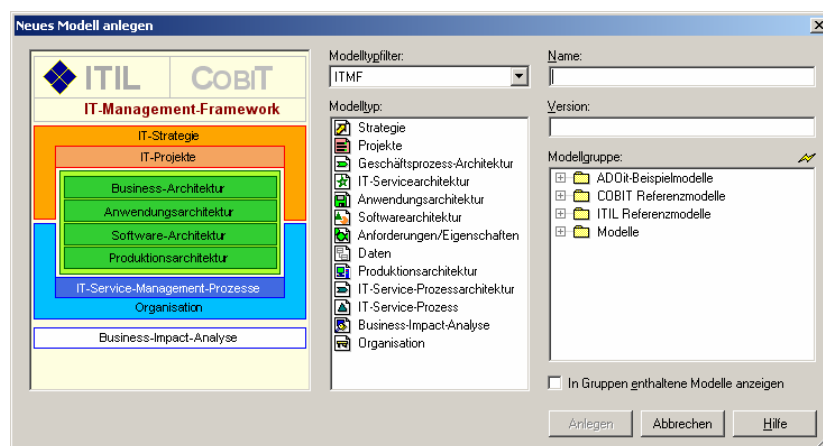
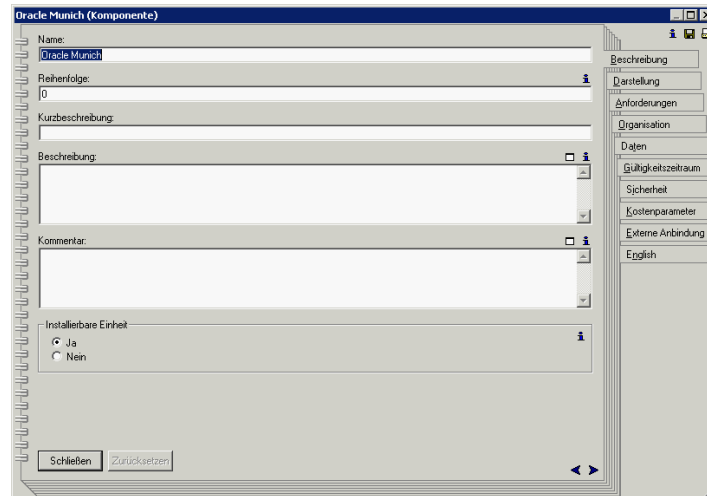


Figure 6.1: *ADOit*: creating a new model

Figure 6.1 shows how models can be created and how they are stored in model groups, organized in a customizable, hierarchical structure. The user can shorten the list of available models by applying a model type filter.

The entities in a model can be accessed and edited utilizing a *notebook* containing all attributes and relationships in an editable way (see figure 6.2).

Figure 6.2: *ADOit: notebook* used for editing an entity

6.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

6.1.1 Configurability of the Metamodel

ADOit ships with a predefined metamodel, which can be adapted to customer needs by consultants or consulting partners of BOC. Due to the fact that the adaption of the predefined metamodel is not done by customers directly, the configurability is not analyzed from the perspective of the modeler. Therefore only the general concepts and modeling capabilities are introduced briefly.

The graphical metamodeling tool of *ADOit* is designed in an object oriented way, concepts of entity types and relationship types are known and each end of a relationship type can be assigned with a cardinality, like 0..1, 1..*, 4..5, etc. Furthermore a distinction between optional and mandatory attributes is given and rules for alerting and notifying the user entering data not compliant with e.g. a cardinality can be defined.

BOC pursues the strategy of adapting the metamodel to customer needs, using the predefined metamodel as a starting point. The concepts needed and the resulting entity types, relationship types, etc. are identified in cooperation with the customer.

Rating: 2 points for configurability of the metamodel.

6.1.2 Coverage of EA Management Concepts by Predefined Metamodel

The predefined metamodel of *ADOit* covers different aspects and is mainly based on ITIL [OGCO00]. Other frameworks, which influenced the metamodel of *ADOit* are Zachman [ZIF05], TOGAF [TOG05], etc.

The metamodel of *ADOit* consists of approximately 45 entity types, which are categorized using the so called model types (*IT strategy, IT projects, business architecture, application architecture, software architecture, deployment architecture, IT service management processes, and organizations*).

During the scenario simulation the main effort was to understand the models, concepts, and processes of *ADOit* in order to be able to map the exemplary model of SoKaKauf to *ADOit*. The model of SoKaKauf was not mapped 1:1 to the model implemented in *ADOit*. Concepts needed for simulating the scenarios in section 6.2 are basically present in *ADOit*. Especially when concerning *business objects* and *business services* (see section 6.2.5) the predefined metamodel provides a comprehensive set of entity types. In particular concepts for managing the lifecycle of an EA, which are needed for simulating the scenarios in sections 6.2.1, 6.2.2, and 6.2.3, are only basically provided. Further limitations can be uncovered concerning a more abstract view on the software infrastructure layer, as concepts like *technologies* (e.g. middleware) are not part of the shipped metamodel (see sections 6.2.6 and 6.2.7).

Rating: 3 points for coverage of EA management concepts by predefined metamodel.

6.1.3 Support for Impact Analyses & Calculation

ADOit provides three predefined queries for graphical impact analysis: *business impact analysis – service*, *business impact analysis – application*, and *business impact analysis – infrastructural element*. These analyses are capable of creating swimlanes diagrams showing the impact the entity in charge has on other layers of the enterprise architecture modeled (see figure 6.3). The results of these impact analyses are stored as independent models, wherein each element is referencing the element from its origin model. The definition of the impact analyses is done using AdoScript. If a user might need similar new impact analyses or change existing ones, *ADOit* provides the functionality to adapt or create these analyses utilizing AdoScript. The script for new impact analysis can be integrated into the menus of *ADOit* by changing the metamodel, which can be also done by the user.

Furthermore *ADOit* ships with an own query language for defining analysis on the concepts modeled. Utilizing the concepts provided, some predefined queries are available in the user interface of *ADOit*. The users can additionally create queries using a wizard, creating statements in the query language

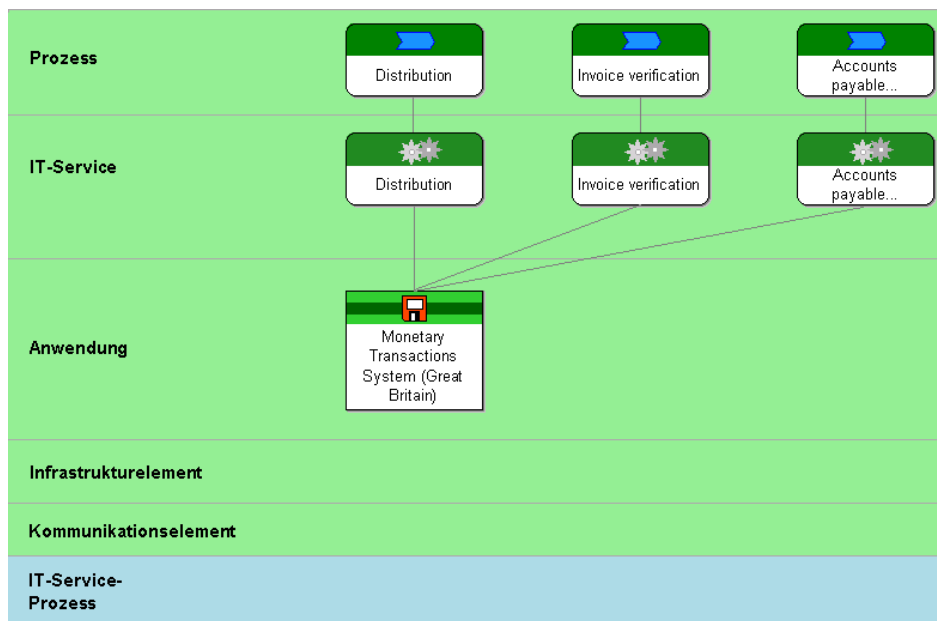


Figure 6.3: *ADOit*: result of a *business impact analysis - application*

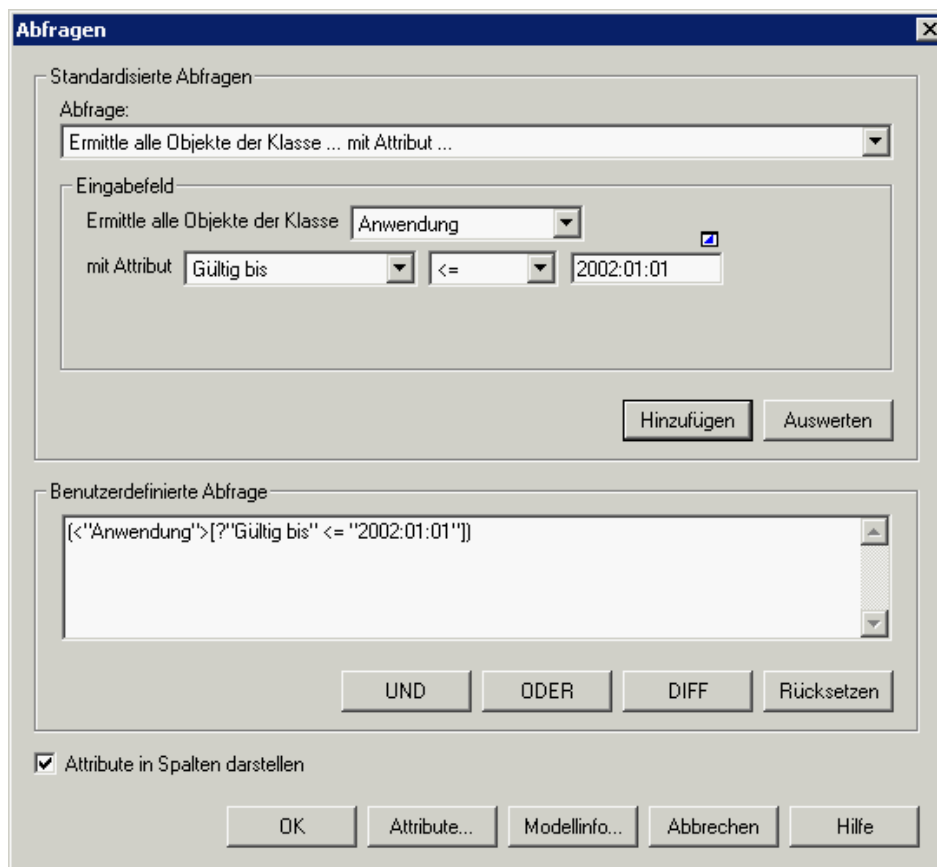


Figure 6.4: ADOit: filtering the entities displayed by a given attribute value

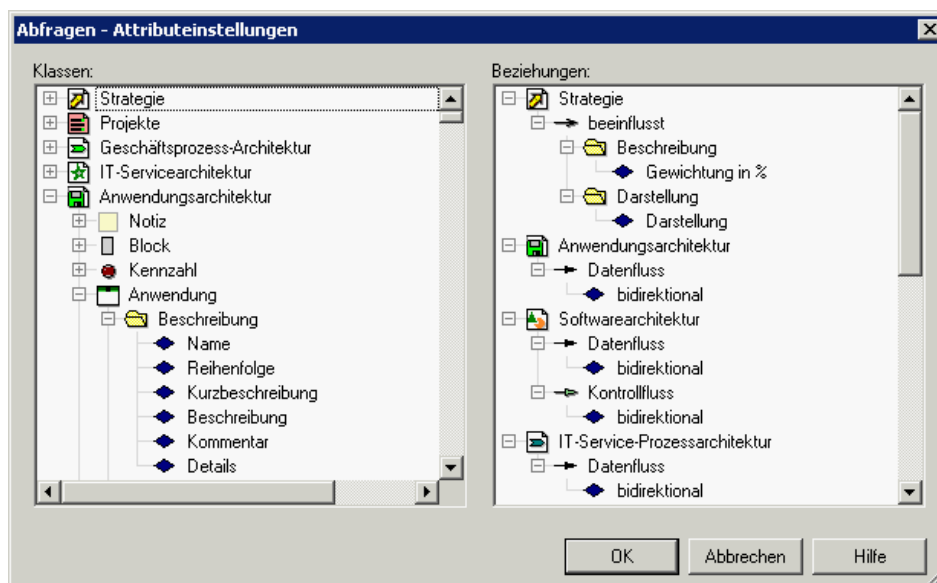


Figure 6.5: ADOit: selecting the attributes of an entity to be displayed

to be executed. These queries can also be created in the administration tool to provide *power users* the capability to predefine queries, an *everyday user* might be interested in.

The query language itself, named *AQL* (*Adonis query language*), is powerful especially regarding its filtering capabilities (see figure 6.4), while joining on a relationship is partially supported. AQL provides the capability to traverse relationship using the "union" operator on the source and target set. Therefore it is possible to identify the elements of the source set that are related to an element in the target set, but it is not possible to derive *the* element in the result set which is related.

Selecting the attributes displayed is possible, wizard guided, and in a convenient way (see figure 6.5). Aggregation functions, such as summing up or deriving averages, are not present in the query language, but can according to BOC be realized via the scripting language AdoScript. As an example a cost accounting functionality (realized in AdoScript), which allows to calculate service costs can be stated.

Rating: 2 points for impact analyses & calculation.

6.1.4 Richness of Predefined Visualization Techniques

ADOit provides one type of diagram for each model supported, spanning from e.g. *strategy* to *application architecture*. These types of diagrams are quite similar in the visualization techniques employed while they mainly differ from each other in regard to the entities, which can be displayed and modeled on them. This approach taken by *ADOit* greatly ensures diagram consistency, while it tends to limit the user in the creation of specialized diagrams which might be suitable for addressing a specific problem, but may not be covered by the methodology of *ADOit*. This is especially cumbersome concerning EA management issues spanning several layers of EA management, e.g. *applications* as well as *business services*. Visualizations containing this data may only be created using impact analyses (see figure 6.3 in section 6.1.3).

Common forms of visualization, e.g. portfolio matrices or software maps (see section A) are not directly supported by *ADOit*. Basic diagramming capabilities, like the creation of *swimlanes* are present and do even transport a semantic dimension. Concerning this, a limitation can be uncovered; an entity can always only span *one* swimlane, effectively reducing some *many-to-many* relationships that might be conform with the metamodel to *one-to-many* relationships being actually modelable.

Zooming is natively and conveniently supported in *ADOit*, while core methods for hiding complexity, e.g. layering or closeable containers are not present in *ADOit* and may only partially be substituted by functionalities enabling the user to hide a selected set of entities in the diagram. *ADOit* also offers out-of-the-box functionality to select the entities either manually or according to the criteria "valid from - to".

Rating: 3 points for richness of predefined visualization techniques.

6.1.5 Flexibility of Visualization Techniques

ADOit provides a certain flexibility in manipulating visualizations. This especially concerns positioning and sizing issues, which can be directly addressed in a *what you see is what you get* manner. Further customizations, like adaptations of color or manual insertion of a symbol for e.g. representing a SAP dependent system, cannot be performed through the graphical user interface, but may be implemented by editing the symbol description in the metamodel. This way *ADOit* is capable of ensuring a consistent representation of the entities concerned throughout all models and variants, while trading a bit of diagramming flexibility. For an example of such an adaptation of the graphical representation refer to figure 6.6, wherein traffic lights were added for visualizing the *cost* attribute exceeding certain thresholds.

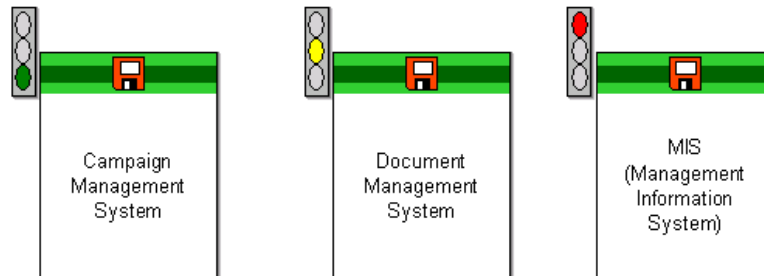


Figure 6.6: *ADOit*: applications annotated with traffic lights for displaying costs

Beside using vertical and horizontal alignment of symbols in a model, automatic layouting is not mainly present with *ADOit* and is only directly supported in the creation of impact analysis diagrams (see figure 6.3 in section 6.1.3), which are automatically laid out when being created. The underlying algorithm cannot be configured through the user interface, but further algorithms may be implemented by utilizing the *AdoScript* scripting engine.

Changes applied to a visualization by the user are persisted in the visual representation itself, as well as in the repository. Thus *ADOit* is pursuing a visualization centric approach, where the diagram is used for performing changes to the underlying data. In case of *ADOit* this approach may be considered a bit cumbersome, as the *separation of concerns* between the entity on the one hand and its graphical representation on the other hand, is not consistently given.

ADOit does not directly provide *drawing capabilities*, which would enable the user to insert graphic objects, like images into the graphical representations governed by the tool, but provides the functionality of deploying *notes* in the diagrams. These notes can contain freetext and may be linked to an external tool, like e.g. *Microsoft Paint* for displaying an image.

The philosophy of visualization in *ADOit* focuses on consistent and uniform visualizations for entities in the models. Power users or administrators are capable of changing these visualizations, which are defined in the metamodel. These changes automatically affect all corresponding visualizations. Additionally power users may enhance the flexibility of the visualizations by providing more than one depiction for an entity.

Rating: 3 points for flexibility of visualization techniques.

6.1.6 Flexibility of Reporting

ADOit provides functionalities for conveniently creating tabular reports. These reports can be based on single models, as well as on a set of models utilizing cross model references defined in between. A wizard (see figure 6.4 in section 6.1.3) guides the user through the compilation of queries, used for creating tabular reports. When concerning traversal of relationships, especially *one-to-many* relationships, the representation utilizes a *denormalized*¹ format (see figure 6.16).

Refining the reports by compiling predicates on attributes or expressions based on attributes is partially supported, while only a minor set of predicates including *equal to*, *less than*, and *greater than* are available. Joining over relationship types is according to section 6.1.3 not possible. Sorting of reports based on an attribute is supported, while the attributes reported can conveniently be selected. The

¹*Demormalized* in this context refers to the way multiple related objects are displayed.

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generated report (see figure 6.7 for an example) is generated and visualized inside *ADOit* and maybe exported to Microsoft Excel.

Additionally *ADOit* provides the functionality to generate bar charts or pie charts on numerical values contained in a report. An example visualizing costs of database systems is shown in figure 6.8.

Rating: 3 points for flexibility of reporting.

	Details	Referenzierte Komponenten
⊖ 1. Business Applications 1.0		
Accounting System	ArchSol 2b 1.0 (Softwarearchitektur)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
Business Traveling System	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Campaign Management System		Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Costing System		Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Customer Complaint System		PostgreSQL London (Komponente) - Datenbanken (Softwarearchitektur)
Customer Relationship Management System (CRM)	ArchSol 2b 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Customer Satisfaction Analysis System		PostgreSQL London (Komponente) - Datenbanken (Softwarearchitektur)
Data Warehouse	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Document Management System		Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Financial Planning System	ArchSol 2a 1.0 (Softwarearchitektur)	MySQL Munich (Komponente) - Datenbanken (Softwarearchitektur)
Fleet Management System	ArchSol 1a 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Human Resources System	ArchSol 2b 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Inventory Control System	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
MIS (Management Information System)		Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Monetary Transactions System (Germany)		Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Monetary Transactions System (Great Britain)		DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
Online Shop	ArchSol 1a 1.0 (Softwarearchitektur)	MySQL Munich (Komponente) - Datenbanken (Softwarearchitektur)
PDS System (Germany/Hamburg)	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
PDS System (Germany/Munich)	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
PDS System (Great Britain)	ArchSol 3 1.0 (Softwarearchitektur)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
Price Tag Printing System (Germany/Hamburg)	ArchSol 2a 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Price Tag Printing System (Germany/Munich)	ArchSol 2a 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Price Tag Printing System (Great Britain)	ArchSol 2b 1.0 (Softwarearchitektur)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
Product Shipment System (Germany)	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Supplier Relationship Management System	ArchSol 1b 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Worktime Management (Germany/Hamburg)	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
Worktime Management (Germany/Munich)	ArchSol 3 1.0 (Softwarearchitektur)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
Worktime Management (Great Britain)		DB2 London (Komponente) - Datenbanken (Softwarearchitektur)

Figure 6.7: *ADOit*: report over application systems showing user selected attributes

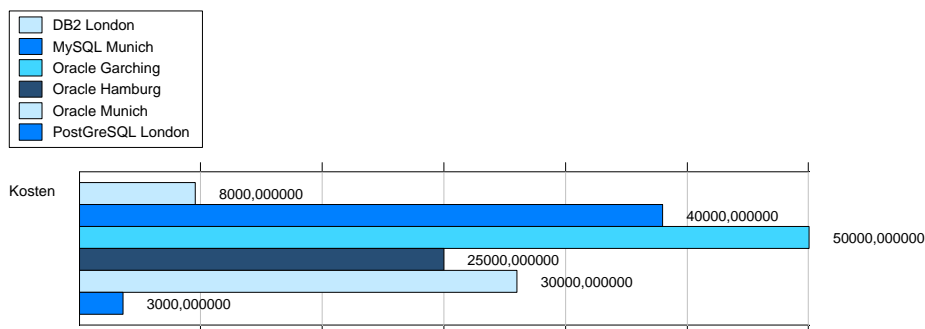


Figure 6.8: *ADOit*: report visualizing costs as a bar chart

6.1.7 Collaboration Support

ADOit supports multiple simultaneous users applying changes to data in the repository. In order to prevent concurrent changes of the same data or data inconsistency the tool imposes *pessimistic locking* on model level, meaning that all models, a user has opened in *editing mode* can only be accessed by other users in read-only mode. As models have to be open for establishing cross model references, it is an important feature, that models can be opened in *read-only mode*, to keep other users capable of referencing entities in these models.

Working on a disconnected version of the repository data is supported by the architecture of *ADOit* as the data can be exported to a local database and can be re-imported afterwards.

A java client (a java applet) with editing capabilities for the models utilizing a web browser is provided as an add-on, but is not part of *ADOit* Standard. Nevertheless exporting models to HTML and adapting the layout to a corporate design template is possible with *ADOit*. This might provide simplified reading access.

Rights management on model level is provided by *ADOit*, it is possible to create *groups* of users and assign specific rights to them. Furthermore user groups may be used to hide attributes and model types for certain user groups.

Rating: 4 points for collaboration support.

6.1.8 Import/Export & External Data Sources

For importing and exporting data into *ADOit* the component *Homer* is used, which is shipped with *ADOit*. *Homer* provides the capability to translate Microsoft Excel files into the *ADONIS Definition Language* (abbr. *ADL*²), which can be imported or exported by *ADOit*.

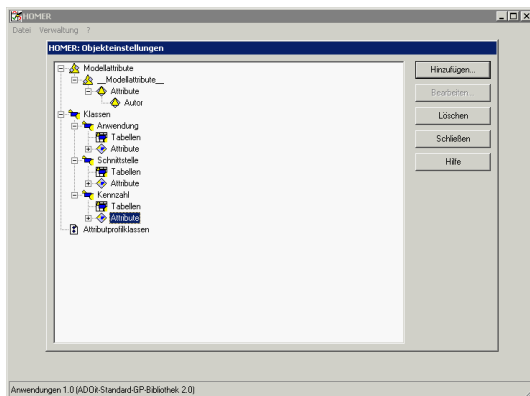


Figure 6.9: *ADOit*: screen dump of *Homer* – exporting/importing data

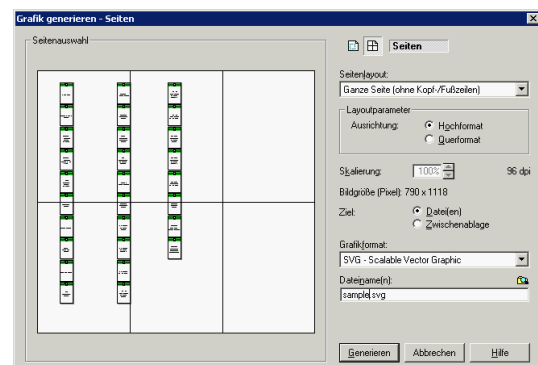


Figure 6.10: *ADOit*: Exporting a model to a graphic file

Figure 6.9 shows a screen dump from *Homer* depicting the object configuration for one import/export scenario. For each scenario, the data to be imported/exported is selected by defining the entity types, attributes, and the model attributes. Due to the fact that *ADOit* uses models for capturing data,

²ADL in this case refers to an *ADONIS/ADOit* specific data format and does not refer to a standardized architectural description language.

import/export is also done by importing/exporting data to models. Additionally *ADOit* provides capabilities for importing and exporting XML files, corresponding to an *adoxml.dtd*³.

Graphic formats supported for exporting diagrams are BMP, PCX, JPG, PNG, EMF, and SVG. Figure 6.10 shows the dialog for exporting a model to a graphic format.

AdoScript, which was not analyzed in this survey, provides the functionality to import and export data from external data sources into *ADOit*. This scripting language can be used to access different data sources programmatically, according to BOC interfaces to e.g. SAP R/3, Microsoft Project, Lotus Notes, Microsoft Excel, ODBC-compliant databases, etc. have been implemented.

Rating: 3 points for import/export & external data sources.

6.1.9 Usability

ADOit connects different models to perform EA management. These models are organized in a hierarchical structure using folders, which can freely be adapted by the user to individual needs. The information contained in the models can be accessed by opening a model, new entities can be created using the graphical view, editing existing entities can be performed using either the graphical or the tabular view. Relationships between entities can be created either graphically by linking two elements with lines, arrows or by positioning an element in a swimlane, or by creating a reference in the detail view of an entity.

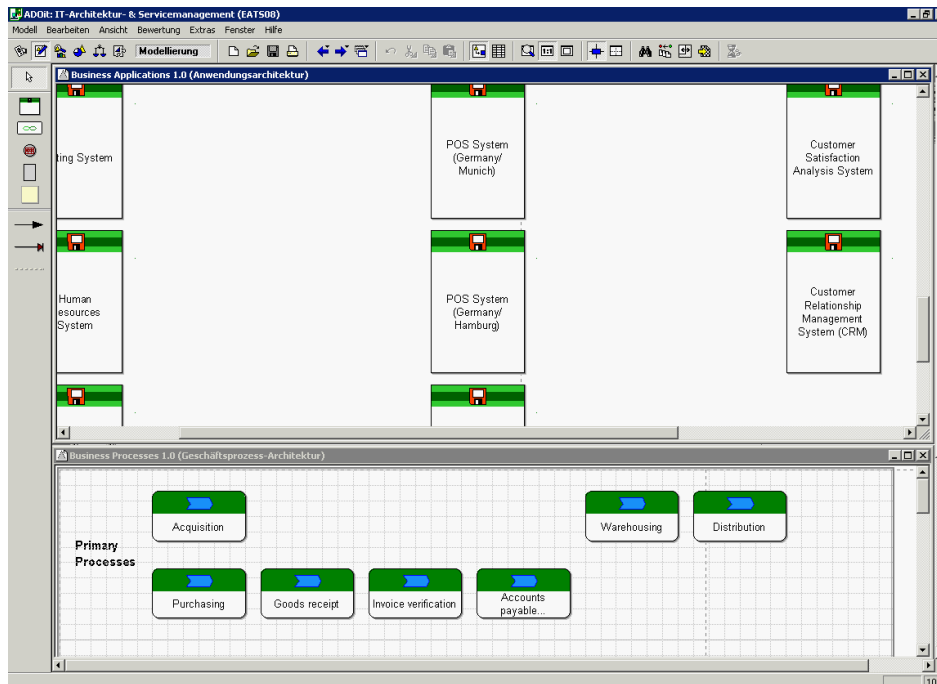


Figure 6.11: *ADOit*: screen dump of the graphical user interface

Using *ADOit* for EA management may need a training period as *ADOit* is shipped with its own metamodel and methodology. If the metamodel is not adapted by the user, the concepts have to

³ *dtd* is a document type definition (DTD), which defines the syntactical structure of a xml document. In this case xml export and import files must correspond with *adoxml.dtd*.

be internalized to be able to get along with its restrictions and facilities. In the other case, if the metamodel has been adapted in cooperation with BOC, the user might realize own ideas and needed functionality, but would need a consulting period for the adaptation. After this training or consulting period an everyday user will be able to use all the functionalities provided by *ADOit*.

For supporting users *ADOit* ships with a Microsoft Windows help file and a methodology handbook. The help file assists the user to get to know the functionality provided by *ADOit* while the methodology handbook describes the concepts used in *ADOit*. The different model types, entity types, and their attributes for the metamodel are documented.

The *ADOit* GUI is implemented for Microsoft Windows operating systems and follows the typical style and user guides for Microsoft Windows applications. Menus are positioned in a Microsoft Windows typical way and multiple windows can be opened in *ADOit* (see figure 6.11).

When modeling in *ADOit* it may be a bit irritating that models have to be *opened*, when creating references between entities of different models. Entering the information that an application A supports the IT services S, is only possible if the model, in which the application A resides is open. Also using the variant functionalities, creating more than one view on a model, may sometimes be confusing. Filters for one variant are defined on top of each other and therefore more than one filter may be activated, but the user cannot reconstruct, which filters are activated, or might not know how to disable one filter.

Rating: 3 points for usability.

6.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

6.2.1 Landscape Management

For simulating this scenario the entity types from SoKaKauf's metamodel have to be mapped to the entity types of *ADOit*. The predefined metamodel of *ADOit* connects processes to applications using the intermediary class IT service. Hence the metamodel of SoKaKauf did not define *services* neither for each process nor for all support functions of business applications, IT services with identical names as the processes in *ADOit* are created.

Furthermore *ADOit* does not distinguish between locations, organizational units, and the relationships *hosted at* and *used at*. Therefore the relationship between business applications and organizations was used to implement the information *hosted at*, because using this relationship for *used at* would require an association class or a ternary relationship also referring the business process (see SoKaKauf metamodel in figure 3.4 in section 3.3).

The graphical deliverables for this scenario (see figure 3.13, 3.14 and 3.15 in section 3.3.2) cannot be achieved using out of the box functionality. According to BOC this functionality can be added by extending the *ADOit* metamodel on customer demand.

Figure 6.12 shows a visualization utilizing swimlanes and representing the current landscape. The planned landscape (see figure 6.13) can be achieved by entering the validity date period, creating a *variant*, and filtering the variant using the planned date. The target landscape (see figure 6.14) is created in a disconnected model. The report shown in figure 6.15 depicts the comparison of the model current/planned landscape and target landscape.

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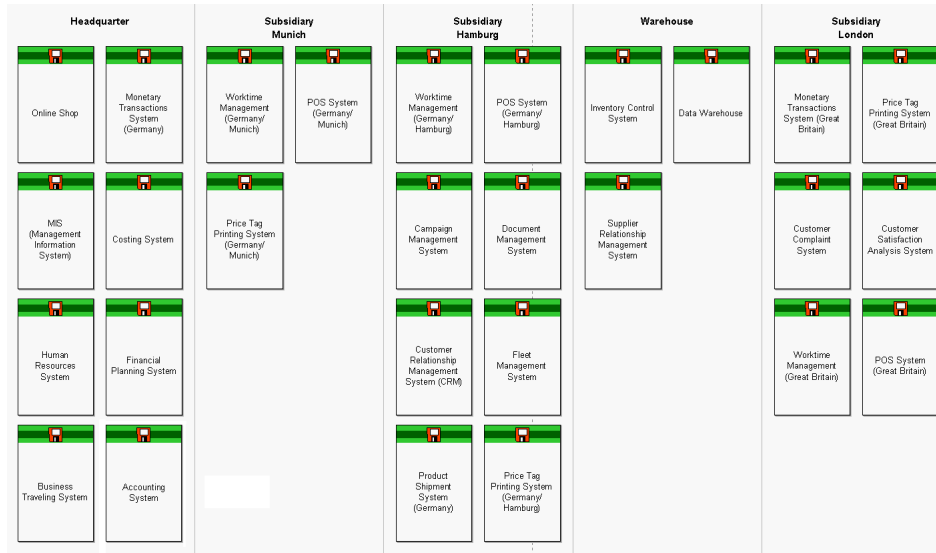


Figure 6.12: *ADOit*: current application landscape for scenario landscape management

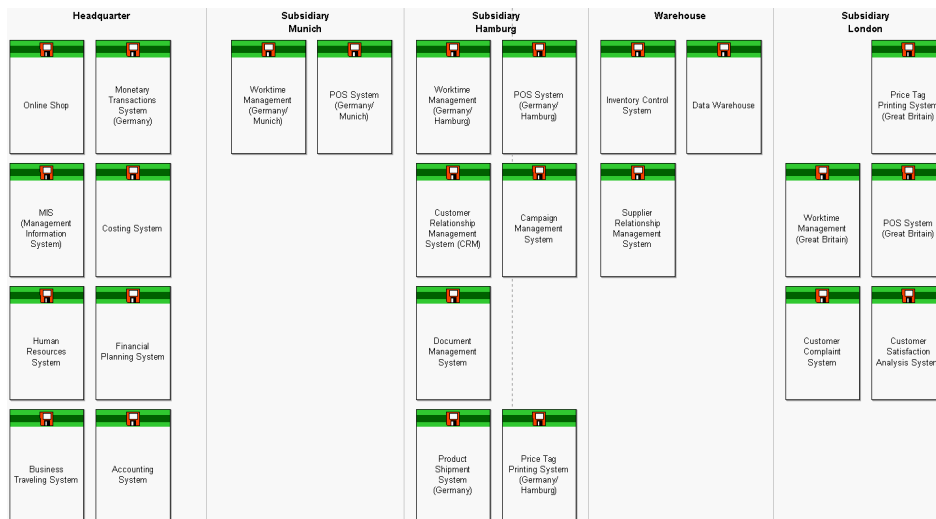


Figure 6.13: *ADOit*: planned application landscape for scenario landscape management

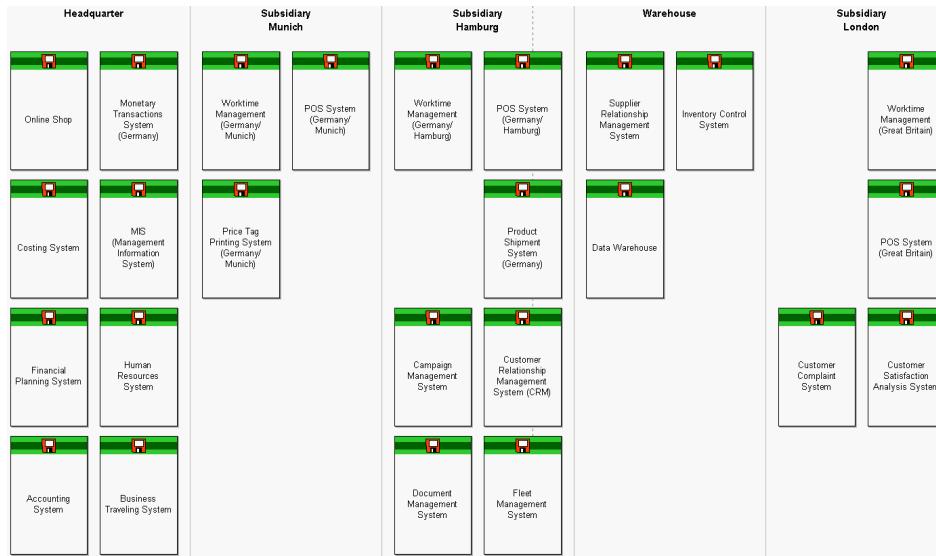


Figure 6.14: ADOit: target application landscape for scenario landscape management

Modellvergleich - Ergebnisse				
Anwendung	In beiden Modellen	Wertunterschiede	Nur im Modell Business Applications 1.0	Nur im Modell Business Application Target 1.0
Accounting System	xxx		Monetary Transactions System (Great Britain)	
Business Traveling System	xxx		Price Tag Printing System (Germany/Hamburg)	
Campaign Management System	xxx		Price Tag Printing System (Great Britain)	
Costing System	xxx			
Customer Complaint System	xxx			
Customer Relationship Management System (CRM)	xxx			
Customer Satisfaction Analysis System	xxx			
Data Warehouse	xxx			
Document Management System	xxx			
Financial Planning System	xxx			
Fleet Management System	xxx			
Human Resources System	xxx			
Inventory Control System	xxx			
MIS (Management Information System)	xxx			
Monetary Transactions System (Germany)	xxx			
Online Shop	xxx			
POS System (Germany/Hamburg)	xxx			
POS System (Germany/Munich)	xxx			
POS System (Great Britain)	xxx			
Price Tag Printing System (Germany/Munich)	xxx			
Product Shipment System (Germany)	xxx			
Supplier Relationship Management System	xxx			
Worktime Management (Germany/Hamburg)	xxx			
Worktime Management (Germany/Munich)	xxx			
Worktime Management (Great Britain)	xxx			

Figure 6.15: ADOit: report for scenario landscape management

The tool handling is intuitive, only the handling of the variants using the hide/show capabilities is a bit cumbersome.

The achievement of objectives defined for this scenario is partially given. Due to the constraint concerning the *used at* relationship (see above) the diagrams do not correspond with the deliverables described in section 3.3.2.

The procedure consistency is partially given. ADOit deals with variants and changes in the application landscape, but an application life cycle with start and end dates for each phase cannot be modeled.

The procedure integration is partially given, data already entered could be reused.

Rating: 3 points for landscape management.

6.2.2 Project Portfolio Management

The preconfigured metamodel of *ADOit* distinguishes between projects, working packages, and milestones, but only working packages and milestones can be associated with applications as an input or output. Therefore the working packages are used as projects for simulating this scenario, to be able to associate *projects* with the affected applications.

The report in figure 6.16 shows, which working packages are connected as an input to which business applications. Due to the fact that neither projects nor working packages do have an attribute status (approved, rejected, etc.), the report showing which projects are approved cannot be generated using the preconfigured metamodel. The graphical deliverable (figure 3.17 and figure 3.18 in section 3.3.2) cannot be achieved, see also section 6.2.1.

Abfrageergebnis: (<"Arbeitspaket">)	
	Input
⊖ 1. Projects	
— Consolidation of monetary transaction systems	Human Resources System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Monetary Transactions System (Germany) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Monetary Transactions System (Great Britain) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) POS System (Germany/Hamburg) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) POS System (Germany/Munich) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) POS System (Great Britain) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur)
— Database consolidation	Business Traveling System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Campaign Management System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Customer Complaint System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Customer Relationship Management System (CRM) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Customer Satisfaction Analysis System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Document Management System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Financial Planning System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Monetary Transactions System (Great Britain) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Online Shop (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) POS System (Germany/Munich) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) POS System (Great Britain) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Price Tag Printing System (Germany/Munich) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Price Tag Printing System (Great Britain) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Product Shipment System (Germany) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Supplier Relationship Management System (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Worktime Management (Germany/Munich) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur) Worktime Management (Great Britain) (Anwendung) - Business Applications 1.0 (Anwendungsarchitektur)

Figure 6.16: *ADOit*: report for scenario project portfolio management

For evaluating the portfolio the criticality of projects or maybe also the project costs can be entered using measures, which can be attached to working packages. A portfolio matrix like figure 3.23 in section 3.3.2 cannot be generated by *ADOit*, but maybe be achieved exporting the report to and editing it in Microsoft Excel.

The tool handling is intuitive.

The achievement of objectives is partially given. The tabular report can be created, the graphical visualizations cannot be achieved.

The procedure consistency is only partially given, because the preconfigured metamodel does not offer the possibility to approve or reject project proposals and do not offer the capability to evaluate the portfolio.

The procedure integration is mostly given. Business applications, business processes, and organizational units already entered into the repository could be reused.

Rating: 2 points for project portfolio management.

6.2.3 Synchronization Management

For simulating this scenario there should be a distinction between planned start and end dates on the one and actual start and end dates that may be changed due to delays in project start and execution on the other hand. *ADOit* does not distinguish these types of dates. Therefore a major functionality needed for simulating this scenario is not supported. A project delay may be entered by changing the *valid from* and/or *valid to* date, but the report requested (see section 3.3.2 figure 3.25 and figure 3.27) cannot be created, as the original dates are not retained.

According to BOC the creation of gantt like diagrams (see figures 3.24, 3.25, and 3.26 in section 3.3.2) is supported by an assessment-addon or by means of customerspecific customization. The assessment-addon was not analyzed in this survey.

The creation of reports for visualizing project dependencies, as well as the impact of a project being delayed or an application system being removed is not supported.

The tool handling is intuitive, but not all parts of the scenario could be simulated.

The achievement of objectives is minorly given. Visualizing dependencies or delays is not possible as described above.

The procedure consistency is not given, as synchronization management is not supported out-of-the-box.

The procedure integration would be given, if the procedure were implemented and repository data could be reused.

Rating: 1 points for synchronization management.

6.2.4 Traceability and Strategy Management

The predefined metamodel of *ADOit* contains the entity types *strategy*, *goal*, and *project*, which can be modeled in a so called *strategy model* (see figure 6.17). For relating projects and applications the additional creation of a specialized project model (for usage of this model refer to section 6.2.2) has to be performed. The *working packages* therein can be related to the affected business application systems. Information about the achievement of a goal, e.g. if the average delivery time was decreased, cannot be gathered using the entities of the predefined metamodel. *ADOScore* would provide such functionality, e.g. regarding *balanced scorecards*, *measures*, and *metrics*. Both tools (*ADOit* and *ADOScore*) can mutually interchange and reuse data entered in the other one and thus might cooperatively provide the functionality requested in this scenario.

An impact analysis (similar to figure 3.28 in section 3.3.2) cannot be achieved, as *ADOit* does not directly support transitive analysis, which is configurable by the user. Utilizing the integrated scripting language *AdoScript* this limitation could be removed. A report displaying the relationships between the strategies and their associated projects (compare figure 3.29 in section 3.3.2) can be derived from the *strategy model* depicted in figure 6.17. Calculations concerning the achievement of a goal as depicted in figure 3.30 in section 3.3.2 are not directly supported as explained above.

The tool handling is intuitive, but not all parts of the scenario could be simulated.

The achievement of objectives is minorly given. Performing impact analyses and creating *balanced scorecards* is only supported by means of using the strategy management tool *ADOScore* (of BOC's product family).

The procedure consistency is partially given, as the concepts needed for this scenario are mainly known by *ADOit*, but defining metrics for goal achievement is not supported out-of-the-box.

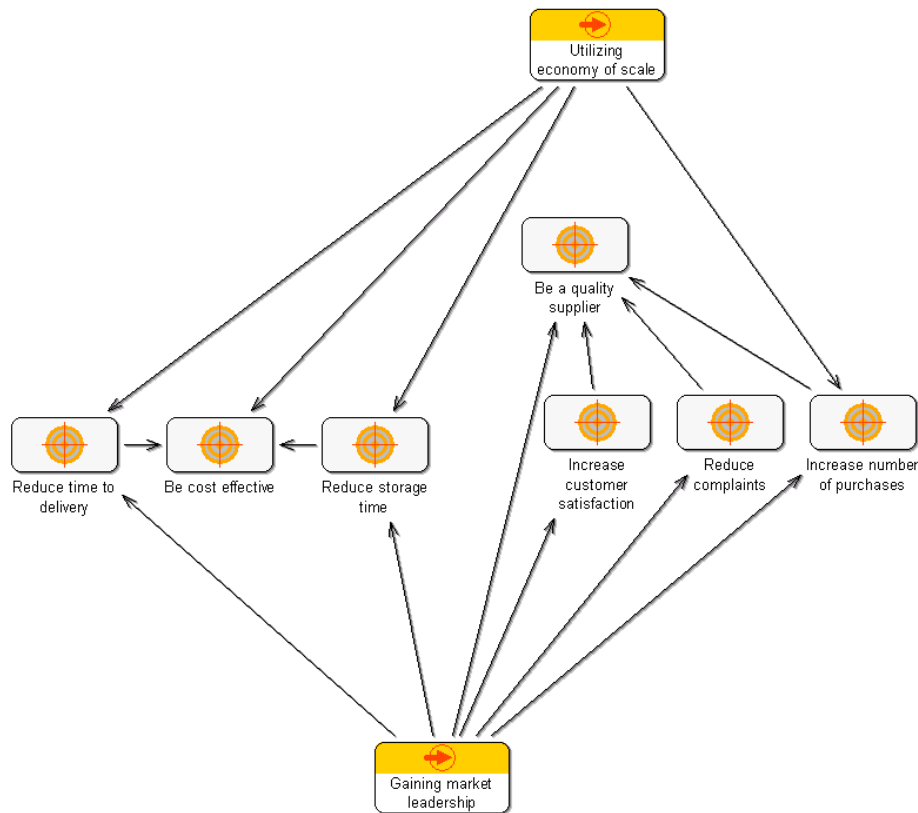


Figure 6.17: *ADOit*: manually created strategy model for scenario traceability and strategy management

The procedure integration would be given, if the procedure were fully implemented and repository data could be reused.

Rating: 2 points for traceability and strategy management.

6.2.5 Management of Business Objects and Business Services

For simulating this scenario business objects are mapped to *data objects* and interconnections are mapped to *interfaces*. Connectors are not known in the predefined metamodel, therefore information like offline/online/manual is entered directly to an interface.

The deliverable showing the flow of business objects for a specific process (see figure 3.31 in section 3.3.2) can partially be achieved. For modeling this diagram a variant of the current landscape diagram (see figure 6.12 in section 6.2.1) is build and all irrelevant business applications are hidden. Additionally the interfaces are drawn between the business applications and each data object is assigned to the corresponding interface. *ADOit* also provides the functionality to annotate an interface with the data object exchanged/modified, shown in figure 6.18. The link to a specific business process as requested by the scenario description in section 3.3.2 is not given.

The report requested (see figure 3.33 in section 3.3.2) cannot be achieved without using scripting functionality, but a report showing, which business application uses which interfaces can be generated (see figure 6.19).

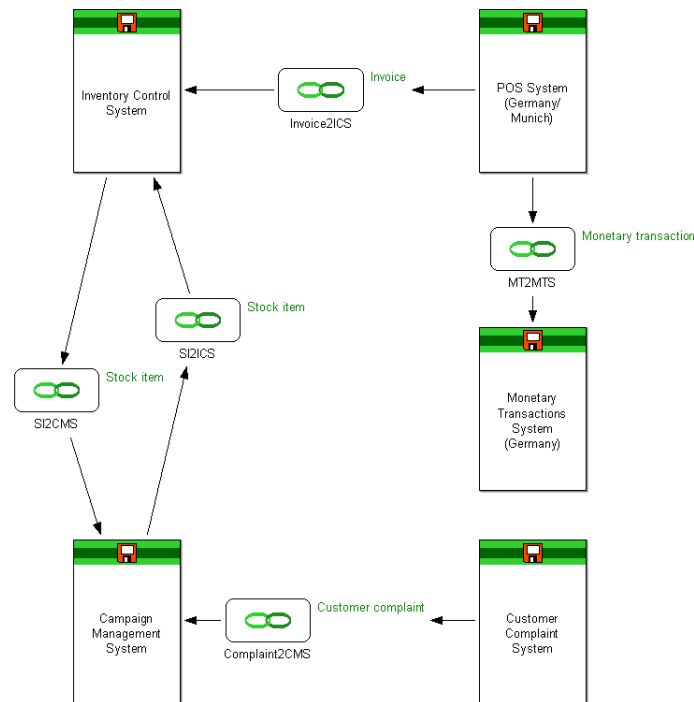


Figure 6.18: *ADOit*: diagram showing information flows between business applications for scenario management of business objects and business services

	Complaint2CMS	Invoice2ICS	MT2MTS	SI2CMS	SI2ICS
Campaign Management System	x			x	x
Customer Complaint System	x				
Inventory Control System		x		x	x
Monetary Transactions System (Germany)			x		
POS System (Germany/Munich)		x	x		

Figure 6.19: *ADOit*: report showing usage of interfaces by business applications for scenario management of business objects and business services

The tool handling is intuitive, only the usage of variants in *ADOit* may need some introductory training.

The achievement of objectives is partially given. The deliverable from figure 3.31 in section 3.3.2 can almost be achieved, the deliverables in figure 3.32 and figure 3.33 in section 3.3.2 cannot be achieved.

The procedure consistency is almost given, the concepts needed for simulating this scenario are almost known to *ADOit*.

The procedure integration is almost given, only the business process cannot be reused in this scenario.

Rating: 4 points for management of business objects and business services.

6.2.6 Application Architecture Management

Architectural blueprints and architectural solutions (see section 3.3.2) are the main concepts this scenario is dealing with. The preconfigured metamodel of *ADOit* provides a model type for software architecture, consisting of components, interfaces, databases, etc. Nevertheless concepts like architectural blueprints and architectural solutions are not known, therefore the existing concepts are used to simulate this scenario.

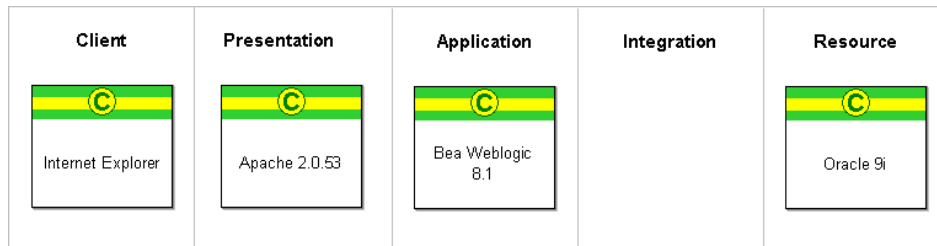


Figure 6.20: *ADOit*: modeling an architectural solution for scenario application architecture management

The concepts are used to model the technologies an architectural solution is made of. The swimlanes are used to model the different layers of an architecture (see figure 6.20). For each architectural solution a model is created, which can be referenced by a business application implementing this solution. The report in figure 6.21 shows the usage of architectural solutions of business applications.

The architectural blueprints are not modeled with *ADOit*, because software architecture models cannot reference to each other and a link between a model for an architectural solution and the corresponding architectural blueprint thus cannot be created.

Due to the fact that *ADOit* does not provide functionality to use arithmetic operations (sum, avg, etc.) in standard reports, the required report showing the number of usage cannot be generated.

The tool handling is intuitive, but not all parts of the scenario can be simulated.

The achievement of objectives is partially given. The holistic view (see figure 3.34) showing all business applications and the usage of architectural solutions cannot be generated, but a report showing the same information can be achieved. The report showing the number of usage (see figure 3.36) cannot be achieved.

The procedure consistency is minorly given. The concepts needed are only partially known to *ADOit*, especially architectural blueprints and architectural solutions are not known.

The procedure integration is partially given, business applications already modeled can be reused.

Rating: 3 points for application architecture management.

6.2.7 Infrastructure Management

Infrastructure management is partially supported by *ADOit*, concepts like *components* for representing an *infrastructure element* are present in the metamodel. Assigning *technologies* to an actual component is not directly supported similar to scenario 6.2.6.

A diagram showing, which business application is supported by which database cannot be created, while a tabular report can be easily achieved (see figure 6.22). According to BOC, such diagrams can be generated by adapting the Business Impact Analysis, performed by BOC.

	Details
⊖ 1. Business Applications 1.0	
<input checked="" type="checkbox"/> Accounting System	ArchSol 2b 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Business Traveling System	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Campaign Management System	
<input checked="" type="checkbox"/> Costing System	
<input checked="" type="checkbox"/> Customer Complaint System	
<input checked="" type="checkbox"/> Customer Relationship Management System (CRM)	ArchSol 2b 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Customer Satisfaction Analysis System	
<input checked="" type="checkbox"/> Data Warehouse	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Document Management System	
<input checked="" type="checkbox"/> Financial Planning System	ArchSol 2a 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Fleet Management System	ArchSol 1a 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Human Resources System	ArchSol 2b 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Inventory Control System	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> MIS (Management Information System)	
<input checked="" type="checkbox"/> Monetary Transactions System (Germany)	
<input checked="" type="checkbox"/> Monetary Transactions System (Great Britain)	
<input checked="" type="checkbox"/> Online Shop	ArchSol 1a 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> POS System (Germany/Hamburg)	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> POS System (Germany/Munich)	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> POS System (Great Britain)	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Price Tag Printing System (Germany/Hamburg)	ArchSol 2a 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Price Tag Printing System (Germany/Munich)	ArchSol 2a 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Price Tag Printing System (Great Britain)	ArchSol 2b 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Product Shipment System (Germany)	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Supplier Relationship Management System	ArchSol 1b 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Worktime Management (Germany/Hamburg)	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Worktime Management (Germany/Munich)	ArchSol 3 1.0 (Softwarearchitektur)
<input checked="" type="checkbox"/> Worktime Management (Great Britain)	

Figure 6.21: *ADOit*: report showing the usage of architectural solutions for scenario application architecture management

For storing the information about the date a database system is running out of support, the attribute *period of validity* was used, which can be utilized in querying. Thus a visualization of the database systems concerned can easily be generated (see figure 6.23). Transitively tracing this information to the business application systems affected is not directly possible.

Creating gantt-like visualizations displaying the different life cycle phases a database system is going to enter in the future (compare figure 3.39 in section 3.3.2) is only possible employing manual effort.

The impact, the removal of a database system has on the application landscape cannot be visualized in a graphical way but may be derived from the tabular report concerning the support relationship depicted above.

The tool handling is intuitive, but not all parts of the scenario can be simulated.

The achievement of objectives is partially given. While most of the views on the application landscape are not directly supported, often a report containing the same information can be created.

The procedure consistency is partially given. Some of the concepts needed are known to *ADOit*, but limitations apply concerning technologies that might be assigned to components.

The procedure integration is partially given, business applications already modeled can be reused.

Rating: 3 points for infrastructure management.

6. BOC GmbH (ADOit)

	Referenzierte Komponenten
⊖ 1. Business Applications 1.0	
<input type="checkbox"/> Accounting System	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Business Traveling System	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Campaign Management System	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Costing System	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Customer Complaint System	PostgreSQL London (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Customer Relationship Management System (CRM)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Customer Satisfaction Analysis System	PostgreSQL London (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Data Warehouse	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Document Management System	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Financial Planning System	MySQL Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Fleet Management System	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Human Resources System	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Inventory Control System	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> MIS (Management Information System)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Monetary Transactions System (Germany)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Monetary Transactions System (Great Britain)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Online Shop	MySQL Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> POS System (Germany/Hamburg)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> POS System (Germany/Munich)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> POS System (Great Britain)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Price Tag Printing System (Germany/Hamburg)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Price Tag Printing System (Germany/Munich)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Price Tag Printing System (Great Britain)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Product Shipment System (Germany)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Supplier Relationship Management System	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Worktime Management (Germany/Hamburg)	Oracle Hamburg (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Worktime Management (Germany/Munich)	Oracle Munich (Komponente) - Datenbanken (Softwarearchitektur)
<input type="checkbox"/> Worktime Management (Great Britain)	DB2 London (Komponente) - Datenbanken (Softwarearchitektur)

Figure 6.22: *ADOit*: report showing, which business applications are using which databases for scenario infrastructure management

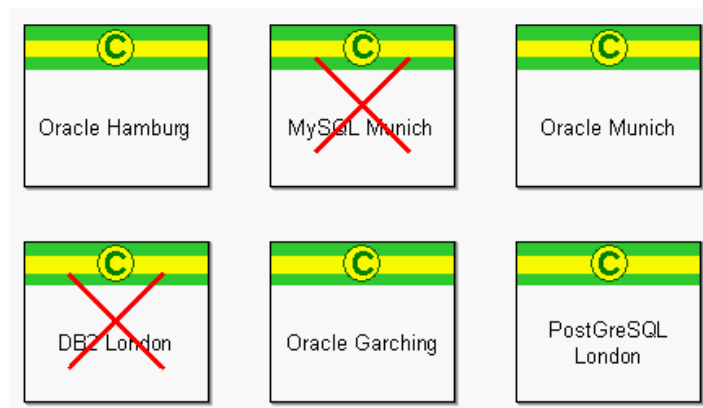


Figure 6.23: *ADOit*: diagram visualizing the databases running out of support on a given date for scenario infrastructure management

6.3 Tool Vendor's Profile

ADOit® IT Architecture and Service Management

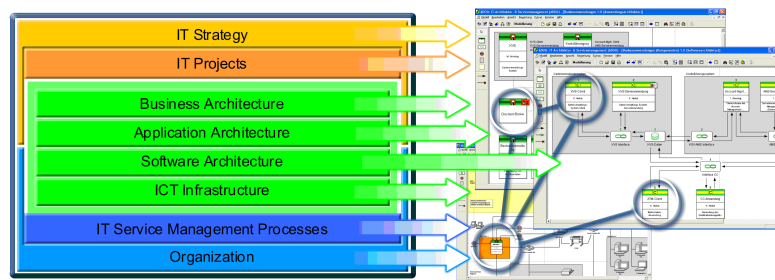
BOC GmbH

Christoph Moser (christoph.moser@boc-eu.com)

Reinhard Schlossar (reinhard.schlossar@boc-eu.com)

One of the main challenges for today's IT managers is the strict alignment of information technology (IT) with the company's business objectives. Thus, opening more opportunities for cooperation with corporate management and supporting the business processes using IT gains more and more importance. As a result, extended requirements on quality, availability and costs of IT must be met. These are accomplished by an effective IT Architecture and Service Management.

ADOit supports IT management by integrating the ITIL and CobiT Best Practices into a comprehensive IT management framework. Due to the integral view from the strategic level down to the ICT infrastructure, IT services are effectively and efficiently integrated into a scaleable and standardized IT architecture.



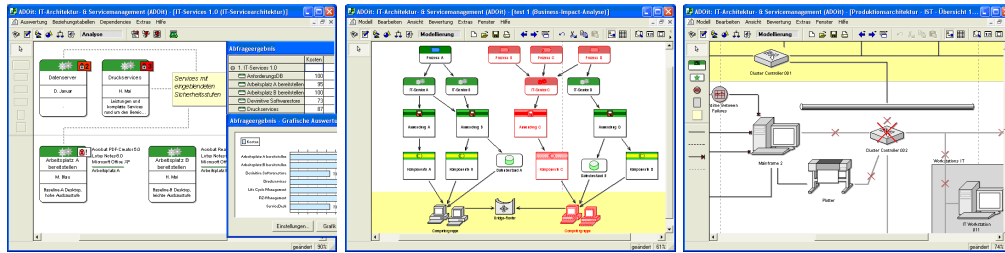
ADOit® IT Management Framework

An integral and process-based view on IT services considering the IT strategy and the requirements of the business processes represents the key to successful IT Service Management (ITSM). The IT Infrastructure Library (ITIL) offers a process-based and scaleable approach to improve planning, implementation and support of your IT services. The best practices described in ITIL are at your disposal as a hierarchical ADOit reference process library. It includes a comprehensive, model-based documentation of the ITSM processes. Other frameworks like eTOM, MOF and the German IT Grundschriftshandbuch (Notfallplanung) are also available for ADOit.

ITIL Best Practices implemented in ADOit are complemented by IT Governance support for corporate management. The main focus lies on the alignment of the IT with the corporation's business processes. The goals are efficient IT resource usage and risk management, plus the identification of IT inherent competitive advantages. ADOit is orientated towards the principles of CobiT and therefore is an ideal platform for active IT planning, managing and controlling.

ADOit is an object-oriented IT management tool available for multi-user client/ server as well as standalone usage, support Windows environments. The ADOit repository uses relational databases such as Oracle, MS SQL Server, MSDE or DB2. Data exchange and documentation generation is possible using data formats such as ADL, XML, RTF and HTML.

6. BOC GmbH (ADOit)



ADOit® sample screenshots

BOC GmbH



BOC is a consulting and software house, founded in 1995, specialised in business process management, strategy management and IT management in various fields (e.g. financial services, public administration, telecommunications, health services). We maintain close contact to our customers and offer prompt and competent support whenever needed.

Consultancy Services: Our consultants have many years of experience in business process management, managing organizational change, process based software development, Workflow management, managing IT architecture, establishing IT service based processes and management. Since 1995 we have been carrying out numerous large projects across Europe and South America based on our BPMS methodology.

Training Services: We offer an extensive training and teaching program, including training on tools and methodology, as well as specific workshops for e.g. developing the best ADOit configuration and modelling guidelines for a particular company. Of course we are ready to provide training services at customer premises.

Support Services: We will gladly provide support with the installation and individual customisation of our products ADONIS, ADOlog, ADOit, ADOscore and others. Our international Hotline can be contacted via phone, fax and email and will assist you promptly and competently with any of your questions.

Casewise Ltd. (Corporate Modeler Suite & ITAA)

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Casewise Ltd. provides the EA management tool *Corporate Modeler* and the *IT Architecture Accelerator (ITAA)*. In the following chapters the tool's evaluation referring to the axes according chapter 2.2.2 is described for *Corporate Modeler 9* with *IT Architecture Accelerator 3.6*.

The suite consisting of the tools mentioned above is composed of two main parts, the fat client *Corporate Modeler* for performing metamodeling, modeling, and exporting / importing. It is based on *Corporate Modeler DP4*, a proprietary database shipped with the tool, but may also use *Oracle* as an underlying database. The other major part of the suite is the *ITAA*, a thin client using HTML and SVG for providing the user reading access to both diagrams and data as well as editing capabilities for the repository data through HTML forms. Editing data in the *ITAA* is performed directly on the database, while the static HTML export is updated with the next run of the *web generator*. This part of the suite, responsible for creating *ITAA* presentations, can be scheduled for automatically creating *ITAA* exports in user defined intervals. A last but important part of the suite is the *Casewise Automodeler*, a tool for conveniently importing data. To make use of its capabilities best it has to be used in collaboration with Microsoft Excel, as importing data from spreadsheets can be performed easily and in a very flexible manner.

7.1 Evaluation of Specific Functionality

This section describes the results of the simulation of the scenarios for analyzing specific functionality.

7.1.1 Configurability of the Metamodel

The *Corporate Modeler* provides a standard set of entity and relationship types in the metamodel shipped with the tool. This set can be used as a starting point for adaptations of the metamodel by the user, who may not delete existing concepts, but may introduce new entity types and relationship types. Further every entity type comes with a standard set of attributes, which may be adapted by adding new attributes to it. These attributes are strongly typed, the type system provided by the *Corporate Modeler* contains many standard types (see figure 7.1), like character sequences or whole

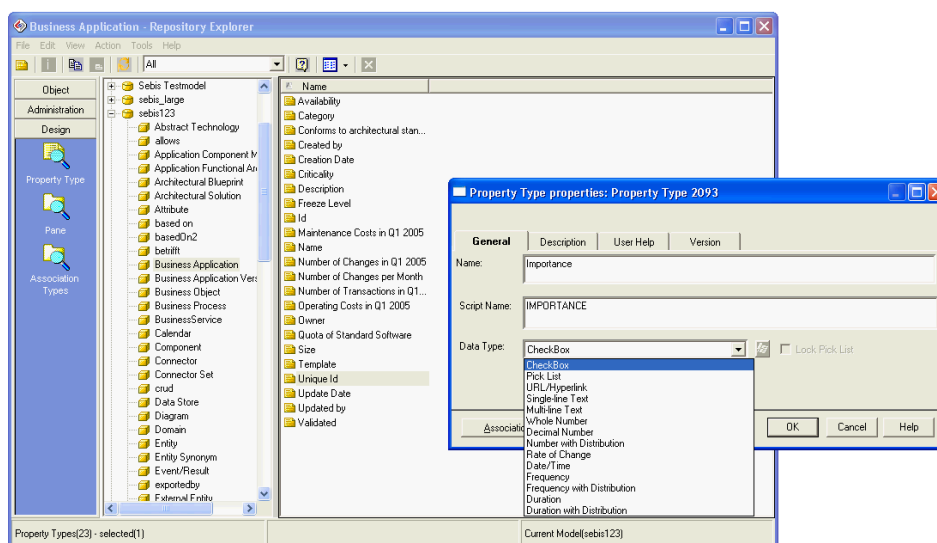


Figure 7.1: *Corporate Modeler*: creating a new attribute and selecting its data type

numbers and as well the capability to introduce user defined enumeration types¹. Defaulting the values of attributes on entity type level is not supported, but general default values, such as zero for whole numbers, are predefined in the type system. Supplying values for existing attributes, when creating new entities, by the user is not necessary, newly added attributes cannot be marked as *mandatory* either. Unlike to UML the concept of attaching attributes to a relationship using a so called *association class* is not supported by the *Corporate Modeler*.

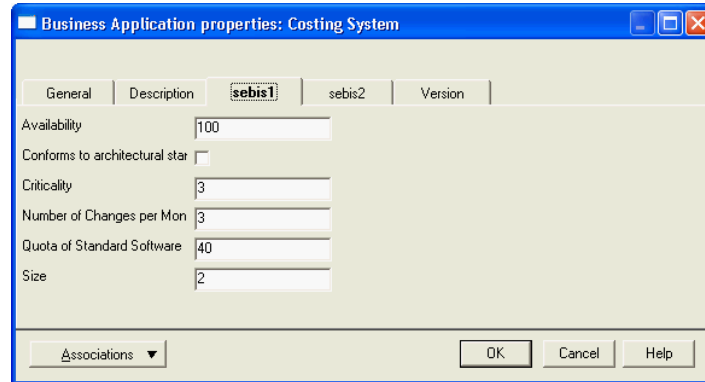


Figure 7.2: *Corporate Modeler*: a property sheet for an entity and its panes

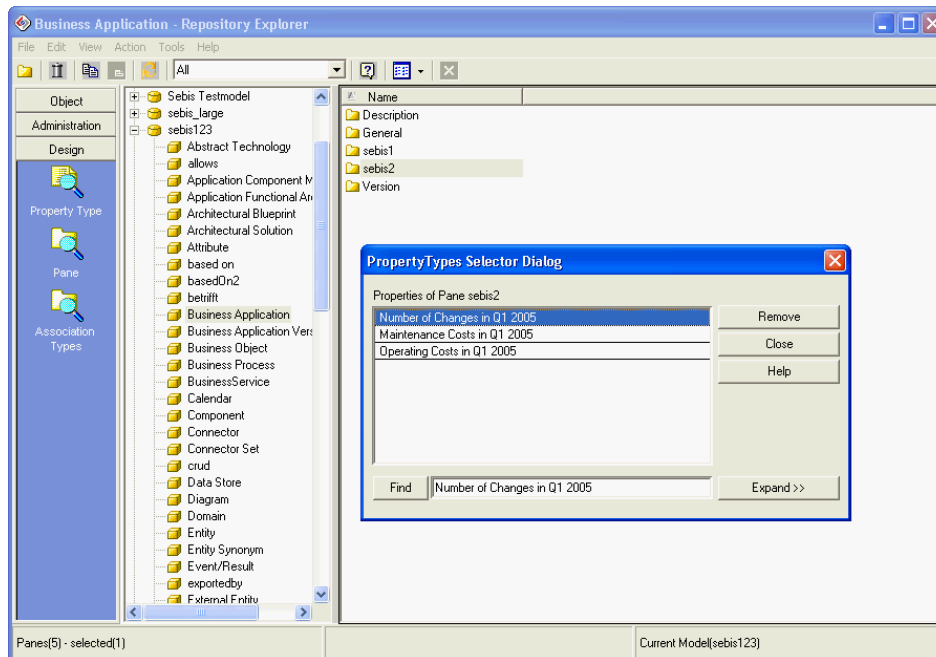


Figure 7.3: *Corporate Modeler*: assigning attributes to panes in the property sheet

By editing the metamodel the user does not automatically affect the *property sheets* (see figure 7.2). of existing model elements of that type. Instead of the modeler is provided the possibility of assigning

¹An enumeration in this context represents a type, which is limited to values from a (user) defined set of choices.

the attribute's entry to a special point of the property sheet by choosing the *pane*² the corresponding property shall be displayed on (see figure 7.3).

Rating: 4 points for configurability of the metamodel.

7.1.2 Coverage of EA Management Concepts by Predefined Metamodel

Casewise *Corporate Modeler* is shipped with a metamodel containing about 25 different entity types and about the same number of relationship types. This metamodel is strongly focused on core concepts related to EA management, like e.g. applications, processes, and projects and their core relationships to each other. Therefore the metamodel discloses itself as a starting point without lodging a claim to fully cover complex EA management scenarios. Introducing the *ITAA* a special template has to be applied, augmenting the predefined metamodel on attribute level to leverage the *ITAA* usage.

While a majority of the entity types and their attributes uses names that are easy to understand and allow easy conclusion to the concepts represented by them, a documentation containing definitions of the artifacts modeled is not available.

Core concepts of EA management are covered by the predefined metamodel, but according to our EA management information model (see section 3.1.2) some layers, e.g. the business layer, and some cross functions, e.g. strategy & goal management are only partially reflected by the entity and relationship types in the predefined metamodel. This may be convenient in cases where the modeler is just focusing on the very core of EA management as he is not weighed with an overhead of concepts, but has proven a bit unhandy when simulating the scenarios in section 7.2. Especially during the simulation of the scenarios *Traceability and Strategy Management* (see section 7.2.4), *Management of Business Objects and Business Services* (see section 7.2.5), and *Application Architecture Management* (see 7.2.6) many new entity and relationship types had to be introduced.

Rating: 2 points for coverage of EA management concepts by the predefined metamodel.

7.1.3 Support for Impact Analysis & Calculation

Corporate Modeler accommodates to the diversity of concepts modeled in EA management and the plurality of queries possible over these concepts by not supplying predefined queries. The **report** function of the *Corporate Modeler* provides the user with the functionalities necessary to perform a tabular impact analysis, the *query* can be created using a convenient graphical user interface (see figure 7.4). The analyzing capabilities are limited to the traversal of one level of relationships, thus *transitive*³ impact analysis employing more than one level of related elements cannot be performed directly. At the moment no mathematical expressions can directly be applied to the values in the report; calculations have to be performed in the Microsoft Excel export of the impact analysis result, likely to be a minor distraction when developing a query.

Rating: 2 points for impact analysis & calculation.

²A *pane* in terms of the *Corporate Modeler* refers to a tabbed pane in the property dialog.

³*Transitive* in this context refers to traversing a path of relationships from e.g. a business process via the application supporting it, to the location the application is hosted at.

Name	Availability	Conforms to architectural standard	Number of Changes per Month	Quota of Standard Software	M.
1 Accounting System	99.90	Yes	0.20	100.00	
2 Business Traveling System	99.10	Yes	0.60	0.00	
3 Campaign Management System	99.00	No	2.00	100.00	
4 Costing System	100.00	No	3.00	40.00	
5 Customer Compliant System	99.10	No	0.50	0.00	
6 Customer Database System (CRM)	99.90	Yes	2.00	4.00	
7 Customer Satisfaction Analysis System	97.10	No	1.50	30.00	
8 Data Warehouse	99.90	Yes	5.00	100.00	
9 Document Management System	99.90	No	2.00	100.00	
10 Financial Planning System	99.90	Yes	3.00	100.00	
11 Fleet Management System	99.40	Yes	1.00	3.00	
12 Human Resources System	99.40	Yes	2.00	90.00	
13 Inventory Control System	99.00	Yes	2.00	40.00	
14 MIS (Management Information System)	99.10	No	4.00	94.00	
15 Monetary Transactions System (Germany)	99.00	No	0.50	100.00	
16 Monetary Transactions System (Great Britain)	99.10	No	1.00	90.00	
17 Online Shop	99.20	Yes	3.00	20.00	
18 POS System (Germany/Hamburg)	99.40	Yes	1.00	50.00	
19 POS System (Germany/Munich)	99.40	Yes	1.00	50.00	
20 POS System (Great Britain)	97.50	Yes	0.50	60.00	
21 Price Tag Pining System (Germany/Hamburg)	99.30	Yes	2.00	90.00	
22 Price Tag Pining System (Germany/Munich)	97.30	Yes	2.00	100.00	
23 Price Tag Pining System (Great Britain)	99.10	Yes	0.50	80.00	
24 Product Shipment System (Germany)	97.70	Yes	1.00	30.00	
25 Supplier Relationship Management System	99.00	Yes	0.00	87.00	
26 Wokitime Management System (Germany/Hamburg)	99.30	Yes	0.10	100.00	
27 Wokitime Management System (Germany/Munich)	99.50	Yes	1.00	100.00	
28 Wokitime Management System (Great Britain)	99.20	No	0.10	100.00	

Figure 7.4: *Corporate Modeler*: tabular report

7.1.4 Richness of Predefined Visualization Techniques

The *Corporate Modeler* is shipped with five *modelers* for diagrams. In this respect a *modeler* is not a different type of diagram, but represents a different diagram concerning the subset of entity types available for depiction, e.g. the *process dynamics modeler* filters the repository to processes and events - the items necessary in creating an event driven process chain like visualization. The *entity modeler* focuses on entity relationship diagramming, *hierarchy modeler* and *data flow modeler* apply special selections for other EA management tasks. All the diagrams created in the *Corporate Modeler* are also available to thin client users, as they are exported to the *ITAA*.

As the requirements for a tool providing comprehensive EA management support may differ from company to company, two *freiform* diagramming *modelers* are provided, first the *generic modeler*, which does not employ a selection and thus grants access to all entities in the repository but can thus not provide mechanisms for layouting. Secondly the *matrix manager* is provided, which is capable of generically visualizing relationships between entities even in a large scale application landscape (compare section 3.3.1).

Algorithms for automatic layout of diagram objects or automatic *completion* of the visualization especially regarding the automatic creation of lines between related objects are not provided in all *modelers*, but are present in the *generic modeler*, where missing relationship representations can be created automatically. Furthermore the *Automodeler* can create e.g. *process dynamic* and *hierarchy* diagrams automatically while importing. The capabilities offered for manual layouting and *drawing* of connections are sufficient to achieve these kinds of visualizations. Nevertheless swim lane diagramming is supported and relationships can be created automatically by positioning an element in a swim lane in the *process dynamics modeler*. For the creation of *process support maps* the *topology analyzer* was used, which is capable deriving a relationship from the position in a swimlane. This link is created during the generation of the *web generator*.

Rating: 3 points for richness of predefined visualization techniques.

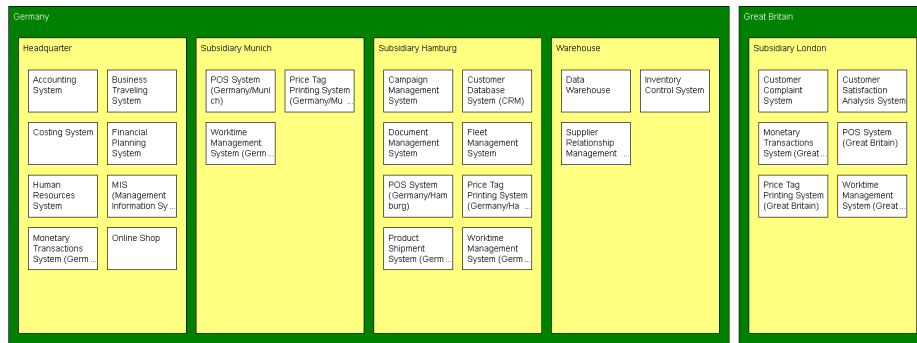


Figure 7.5: *Corporate Modeler*: manually created cluster map

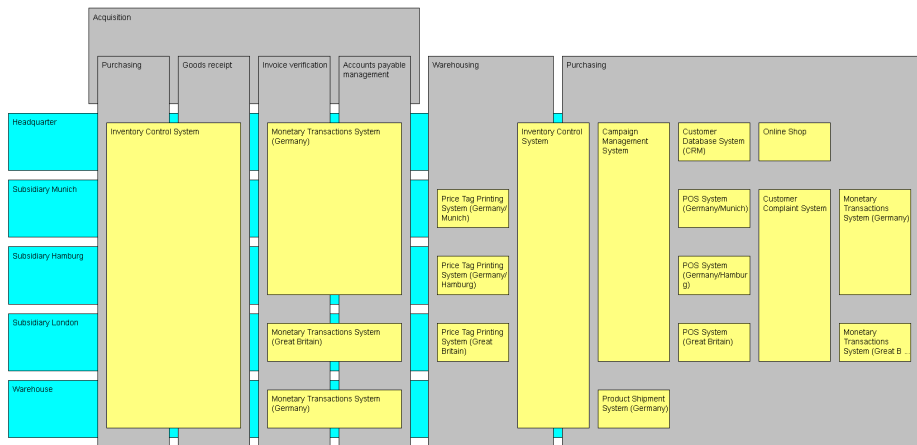


Figure 7.6: *Corporate Modeler*: manually created process support map

7.1.5 Flexibility of Visualization Techniques

The *Corporate Modeler* provides high flexibility in manipulating visualizations, emphasizing its approach of giving the user maximum control of the graphical representations created. Direct editing in "what you see is what you get" style is possible, entities can be dragged and dropped to the canvas, the look of their representations can be customized, e.g. concerning color, shape, and size through a menu. These customizations affect all representations of this entity in other diagrams, effectively ensuring a consistent view while trading a bit of diagramming flexibility. Diagramming the application landscape in a cluster map⁴ (see figure 7.5) and a process support map (see figure 7.6) can be achieved due to the flexibility with some investment in manual layouting. While the process support map utilizes the swim lane technology offered by the *Corporate Modeler* a small tradeoff has to be made in layouting as only one layer of swim lanes is supported, causing minor distractions when moving around the objects in the swim lanes.

An interval map (see figure 7.7) can also be created, but the timeline is not a supported object, thus it has to be created through using a text field, causing trade offs in zooming and printing capabilities.

⁴In this example clustering applications to organizational units is not derived from a relationship between those entities in the repository.

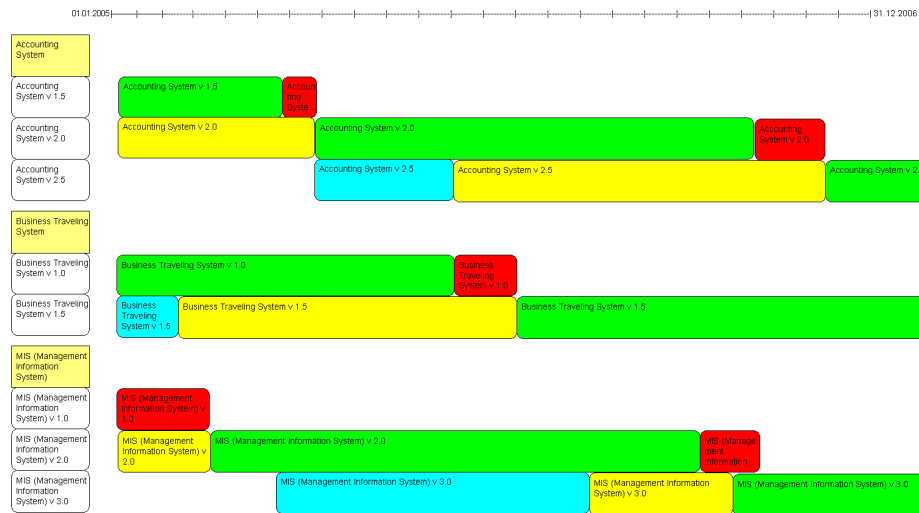


Figure 7.7: *Corporate Modeler*: manually created interval map

According to *Casewise* an object of that kind is going to be supported in the *ITAA* version 4.4.

The visualizations created in the *Corporate Modeler* are mainly repository centric, thus only entities and relationships can be visualized, but no *drawing* capabilities are provided.

Rating: 3 points for flexible visualization techniques.

7.1.6 Flexibility of Reporting

The creation of user defined reports in the *Corporate Modeler* can be performed via a graphical user interface by selecting the entity type to be shown as well as the attributes and relationships which should be shown in the report (see figure 7.8). The traversal of relationships is limited to one level and only the names of the related elements but no further attributes are available for display. An

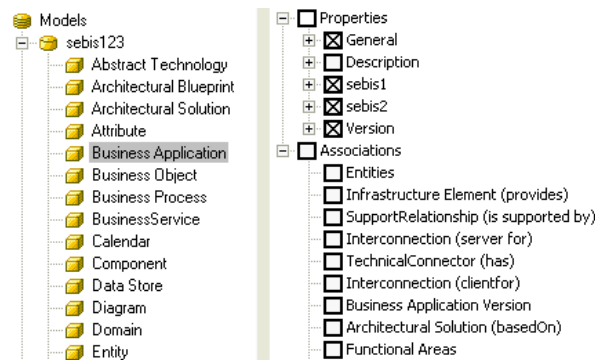


Figure 7.8: *Corporate Modeler*: choosing entity type, attributes, and relationships for a report

example of tabular report is shown in image 7.4. According to *Casewise* this limitation was removed with upcoming of version 4.1 of the *ITAA*.

Graphical reports utilizing charts (e.g. pie charts) cannot directly be created, but the information in the reports can be exported to Microsoft Excel files thus making the comprehensive diagramming features of e.g. Microsoft Excel available to the user. Further the reports can be directly exported to HTML format.

Rating: 3 points for flexibility of reporting.

7.1.7 Collaboration Support

The suite consisting of *Corporate Modeler* and *ITAA* provides support for collaborative work on the repository data, especially the web frontend (the *ITAA*) is employed in manipulating entities and attributes in a decentralized way while relationships cannot be edited through this frontend. To avoid conflicts in the *Corporate Modeler* during changing the data a role based access control concept is utilized, introducing an *ownership concept* for an artifact, like e.g. a diagram or an entity, restricting the access to such elements, so that only their owner and the administrator can change or delete them. An element currently in use is locked for every user, implementing a *pessimistic locking mechanism*.

The *ITAA* brings its own detached access control system of high granularity for introducing restrictions and granting rights. An authenticated user can be granted rights on level of the entity types and of their attributes, determining whether he is able to create, read, update, or delete such an element (see figure 7.9).

Another cornerstone contributing to the suite's multi user capabilities is the *Automodeler*, which enables users with administrator rights to import data into the repository in a flexible manner and offers a small selection of strategies, e.g. **keep newest**, of how to deal with the imported data in respect to the possibly diverging data already in the repository. After having chosen such a strategy the import runs without requiring further user interaction.

Rating: 4 points for collaboration support.

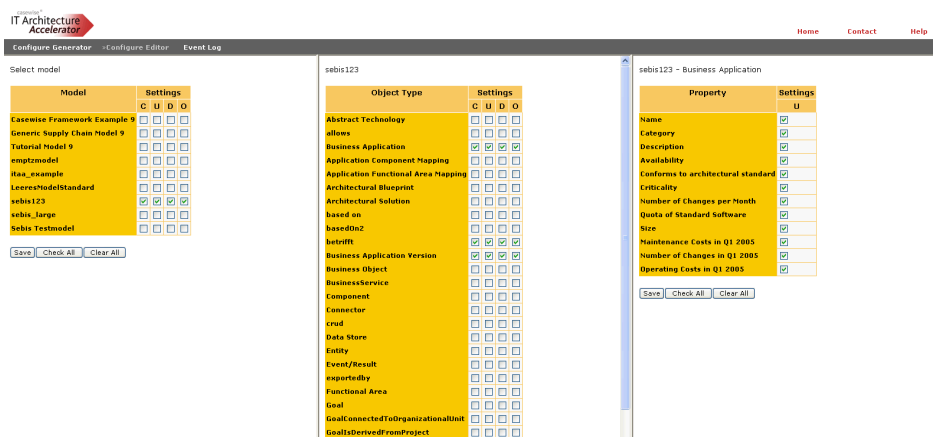
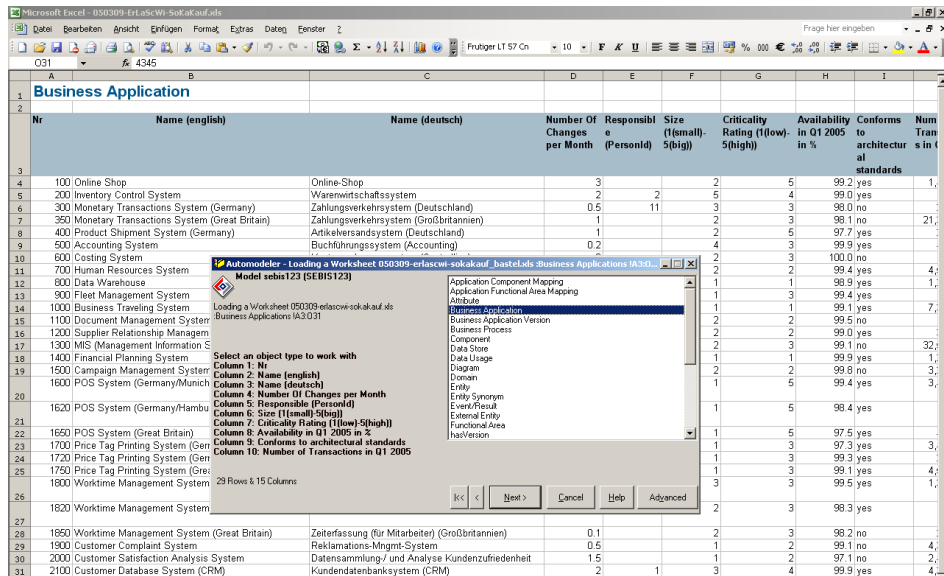


Figure 7.9: *ITAA*: the access control configuration wizard

Figure 7.10: *Corporate Modeler*: the *Automodeler* import wizard

7.1.8 Import/Export & External Data Sources

Importing data into the *Corporate Modeler* can be performed by using a tool included the suite, the *Automodeler* (see figure 7.10). This tool natively integrates with Microsoft Excel, thus allowing to import spreadsheet data of many formats, as well as Microsoft Word and comma separated value formats. After selecting an entity type to be imported the mapping between the columns of the spreadsheet and the attributes of the corresponding entity type can be chosen by selecting names from drop-down-boxes.

This way of importing is not limited to attributes, but can also cover relationships referencing the *name* attribute of the referenced entity. These references have to be provided in the spreadsheet using a special (*denormalized*⁵) format. Here we see some more potential for enhancing the tool's capabilities to provide an even more convenient importing experience through giving the user the choice to select the attribute used for determining the identity of a referenced object. According to casewise the *Automodeler* has been improved in regard to this minor drawbacks. Very impressive concerning the importing capabilities of the *Corporate Modeler* is the overall performance, visible when importing a large scale application landscape.

The xml-format is supported both for importing and for exporting hierarchical data in an easy way, although the quality of the exported xml-files regarding further processing capabilities is limited as neither a datatype definition (DTD) nor a XML schema is available. Such meta information is, according to casewise, going to be available in *Corporate Modeler* version 10, which has not been evaluated in this survey.

Spreadsheet formats, like xls or csv can also be used as export formats for the *Corporate Modeler* enabling the user of performing round trip ex- and import utilizing the *Automodeler*. This is especially convenient for performing *bulk* changes of the data in an external editor. An export to HTML is not directly provided by the *Corporate Modeler* but the suite provides the *Corporate Publisher*, capable of creating HTML exports. Furthermore it supports exporting to Microsoft Word, while the *Automodeler* provides functionalities for creating Microsoft Excel and Microsoft PowerPoint exports. The layout

⁵*Denormalized* in this context refers to the storing multiple references in one cell of the spreadsheet.

of the generated HTML cannot be directly adapted to a corporate design by applying templates, a limitation that is going to be removed in the *ITAA* version 4.5 according to Casewise.

According to Casewise external data sources can be utilized by the *Corporate Modeler* through standard interfaces as *odbc*⁶, *ADO*⁷, or direct file access, without having to copy the external data into the *Corporate Modeler* repository. According to Casewise, this way tools like Telelogic Doors can contribute to the data accessible of the *Corporate Modeler*.

Rating: 3 point for import/export & external data sources.

7.1.9 Usability

The first impression of the *Corporate Modeler* presents an intuitive and concise user interface with an easy to use repository. The functionalities of modeling, metamodeling, and diagramming are clearly separated from each other. When using the repository browser and the report functionality alternately a minor distraction is revealed, switching between those two perspectives constantly resets the selection taken, so the user repeatedly has to navigate to the entities he is interested in. As in the report perspective not only the selection taken, but also the filter set for the attributes to be displayed is revoked, the process of hiding attributes has to be executed again employing the time consuming creation of several intermediary views, as selecting or deselecting an attribute or a pane directly launches a recalculation of the view.

In the present version, the user experience regarding the diagramming features of the *Corporate Modeler* differs significantly from the diagram modeler used in some cases, a more homogenized experience is going to be implemented in *Corporate Modeler v10* according to Casewise. The next version of the tool is going to also remove a language incompatibility experienced by us during the import of floating point numbers through the *Automodeler* from a spreadsheet in a German version of Microsoft Excel, which could only be solved by switching the language settings on operating system level.

The thin client of the suite, the *ITAA*, offers very convenient configuration capabilities and provides a graphical user interface for reading or performing changes in the repository in a very easy to use way, thus contributing to a convincing overall impression of the usability provided by the tool suite.

Rating: 3 points for usability.

7.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

7.2.1 Landscape Management

Modeling an application landscape with the *Corporate Modeler* is possible, the data of the *as-is* state can almost completely be covered by the existing metamodel, minor tradeoffs have to be made regarding usage of fixed enumeration types for predefined attributes. A visualization of this current state can be created manually using the *generic modeler* (for example see figure 7.6). When regarding the creation of a planned (see figure 7.11) or a target application landscape the metamodel has to be augmented to support the evolution of application systems over time, as due to the constricted filtering capabilities offered by the tool itself the usage of date/time attributes for modeling an applications

⁶ *odbc* here means *Open DataBase Connectivity*, a standard launched by the SQL Access group in 1992.

⁷ *ADO* in this context refers to Microsoft *ActiveX Data Objects*.

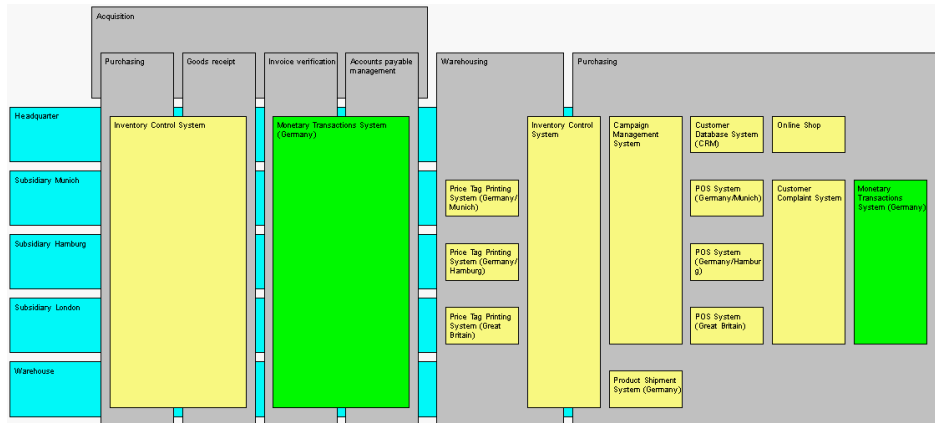


Figure 7.11: *Corporate Modeler*: manually created and colored visualization of a planned landscape for scenario landscape management

lifecycle was not directly possible. Utilizing Microsoft Excel as an additional tool could help to remove some limitations here.

Highlighting the applications affected in the visualizations (confer scenario description in section 3.3.2) for stressing differences between the current, planned, and target landscape can be performed manually using the flexible visualization techniques described in section 7.1.5. A report outlining the differences between the different landscape versions can be created manually utilizing the exporting capabilities for Microsoft Excel, but is not directly achievable in the *Corporate Modeler* itself.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of the *Corporate Modeler*.

The objectives can be achieved employing manual effort in diagram creation and in the usage of Microsoft Excel.

The procedure consistency retains potential for improvement as creation of landscaping scenarios (*current*, *planned*, and *target*) could be integrated into the tool.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for landscape management.

7.2.2 Project Portfolio Management

In performing project portfolio management with the *Corporate Modeler* the metamodel has to and can widely be adapted to suitably represent the concepts employed with this EA management task. A minor drawback in this context is that information about how a project's costs are spread over the affected application systems has to be modeled through a *weak entity*⁸ rather than through an *association class*, which would be preferred, but is as mentioned above not supported by the *Corporate Modeler* (see section 7.1.1).

⁸A *weak entity* is a concept derived from entity relationship modeling, making a relationship between two objects a new *weak* object, which can have further attributes a relation would not be capable of supporting.

ProjectPortfolio	Customer Database System (CRM)	Customer Satisfaction Analysis System	Customer Complaint System
Introduction of a knowledge management system			
Introduction of a management information system			
Optimization of accounting system			
Introduction of a bonus card system			
Replacement of the CRM system by the data warehouse			
Introduction of RFID in warehousing			
Improvement of the availability of the online shop			

Figure 7.12: *Corporate Modeler*: matrix diagram visualizing the projects affecting application systems for scenario project portfolio management

An impact analysis for deriving the application systems affected by a project proposal can be performed and a tabular visualization can be created as well as a matrix diagram (see figure 7.12). Annotating the affected application systems in a visualization previously generated e.g. by using color coding is not supported (compare e.g. figure 3.17). Transitive impact analysis concerning the business processes or organizational units indirectly affected by the projects through corresponding applications cannot be performed within the *Corporate Modeler* as it employs more than one level of relationships (see section 7.1.3). Creation of a *portfolio matrix* (see figure 3.23) is not supported by the *Corporate Modeler*. According to casewise the *ITAA* version 4.4 is going to be capable of creating *portfolio matrices*.

Calculating cumulative costs caused by the different projects for a particular calculation system (see figure 3.19) cannot be performed directly from within the *Corporate Modeler*, utilizing the export function to Microsoft Excel gives the user the possibility for achieving a report containing the calculation's result.

Performing the selection of specific project proposals being the projects to be in fact executed is supported by the *Corporate Modeler*, although some limitations apply in this field, as the project's attribute *category* is best used for storing this information, being the sole attribute allowing a convenient filtering in the created matrix visualization.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of the *Corporate Modeler*.

The objectives can partially be achieved employing some manual effort in diagramming and in the usage of Microsoft Excel.

The procedure consistency retains potential for improvement as managing a project portfolio as well as the creation of diagrams and reports is not directly supported.

The procedure integration is given, as data previously entered can be reused in the simulation of this scenario.

Rating: 2 points for project portfolio management.

7.2.3 Synchronization Management

The metamodel of *Corporate Modeler* can easily be adapted to govern the concepts of synchronization management. Directly inquiring the organizational units affected by the projects in progress is not directly possible, as it would base on a transitive impact analysis. A workaround can be found here: a report of the application systems and their related organizational units and projects can be created and sorted over the projects. The report generated in this way can be further refined using the capabilities provided by Microsoft Excel. Graphical visualizations (confer our scenario description for an example in figure 3.17) of the affected business processes or organizational units through annotating the previously generated depictions is not possible.

Visualizing the effects of a project's delay is not directly achievable in the *Corporate Modeler* as gantt-like visualizations can only be created manually adhering to some limitations regarding the time axis. An analysis of the effects of that delay can be created utilizing Microsoft Excel for performing refinement of the results of indirectly performed two level impact analysis similar to the one mentioned in section 7.2.2. A further tabular report depicting the future projects affected by the retirement of an application system can be created but is limited, as filtering over attributes (like start- or end date) is not possible within the *Corporate Modeler* but has to be assigned to Microsoft Excel.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of the *Corporate Modeler*.

The objectives cannot be achieved overall and employ intensive usage of Microsoft Excel.

The procedure consistency is not given as core synchronization management features like filtering over temporal attributes like project start and end date is not supported.

The procedure integration would be given, as data previously entered could be reused in the simulation of this scenario.

Rating: 1 points for synchronization management.

7.2.4 Traceability and Strategy Management

Dealing with strategies and goals the metamodel of the *Corporate Modeler* has to be adapted to support the concepts employed therein, while little limitations reveal when *measure assignments*⁹ shall be modeled with *association classes*. Here again the concept of the weak entity can be utilized. Balanced scorecards, a possible visualization for the concepts governed in this section, are according to casewise going to be directly supported by a new tool augmenting the *Corporate Modeler* suite version 10, the *Balanced Scorecard Accelerator*. This tool was not evaluated here as it is not available for the version of *Corporate Modeler* and *ITAA* which are objected in this survey.

When trying to perform a tracing of the projects affecting a particular application system to the strategy the specific project may have been caused by (for an example see figure 3.28 in section 3.3.2), the tool's limitations in performing transitive impact analysis (see section 7.1.3) prevent the user from gaining all information requested. Further trying to visualize the state of the goal's achievement graphical or in a tabular report (compare figure 3.30 in section 3.3.2) is not possible in the *Corporate Modeler* itself, the tabular report can be generated by manually and stepwisely exporting the data required to Microsoft Excel, utilizing its calculation capabilities.

The tool handling is intuitive, as exporting can easily be performed.

The objectives cannot be achieved directly and employ intensive usage of Microsoft Excel.

⁹ *Measure assignments* in this context refer to the possibility of assigning a target or current value to a metric operationalizing a goal defined.

The procedure consistency is not given as traceability and strategy management employs calculation of derived properties and transitive impact analysis not supported in the *Corporate Modeler*. However the *Balanced Scorecard Accelerator* is not evaluated here.

The procedure integration is given, as data previously entered can be reused in the simulation of this scenario.

Rating: 2 points for traceability and strategy management.

7.2.5 Management of Business Objects and Business Services

Managing business objects and business services is a EA management task not natively supported in the metamodel shipped with the *Corporate Modeler*. Thus adaptations have to be made and can easily be achieved.

A visualization depicting the applications, their connections, and the dataflow thereover for a particular business process can be created manually in the generic modeler. Though the *Corporate Modeler* supports matrix diagrams the creation of a diagram showing the business objects and the direction of the dataflow between client and server applications cannot be achieved (see figure 3.32 in section 3.3.2), as *autoassociations*¹⁰ cannot be used for matrix diagrams in the *Corporate Modeler*. Further the creation of such a diagram is not automatically achievable as transitive relationships are not directly depictable in the tool.

Creating a report for showing the business objects exchanged and the directions of the dataflows cannot be performed directly in the *Corporate Modeler*, as this task would employ transitively reporting relationships, which is possible utilizing Microsoft Excel.

The tool handling is partially intuitive when concerning the capabilities directly reachable through the user interface of the *Corporate Modeler*.

The objectives can partially be achieved employing some manual effort in diagramming and in the usage of Microsoft Excel.

The procedure consistency retains potential for improvement as regarding the support for depicting complex relationships in a tabular or matrix-like way.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for management of business objects and business services.

7.2.6 Application Architecture Management

Governing the application architecture task in EA management with the *Corporate Modeler* is easily possible. Using and adapting the concepts in the predefined metamodel can be performed, concepts like *blueprint architectures* can be introduced. The conformance to an architectural solution can be visualized graphically by displaying the corresponding relationship in a matrix diagram (see figure 7.13), annotating previously generated visualizations like the process support map (see figure 7.6) or the cluster map (see figure 7.5) can be performed manually in the generic modeller (compare figure 3.34 in section 3.3.2). The same information can be exported to a tabular report using the reporting functionalities described in section 7.1.3.

Visualizing the occurrence of the different blueprint applications are not directly supported in the *Corporate Modeler*, utilizing Microsoft Excel bar charts showing this information can be created.

¹⁰An *autoassociation* is a relationship type from an entity type to the same entity type

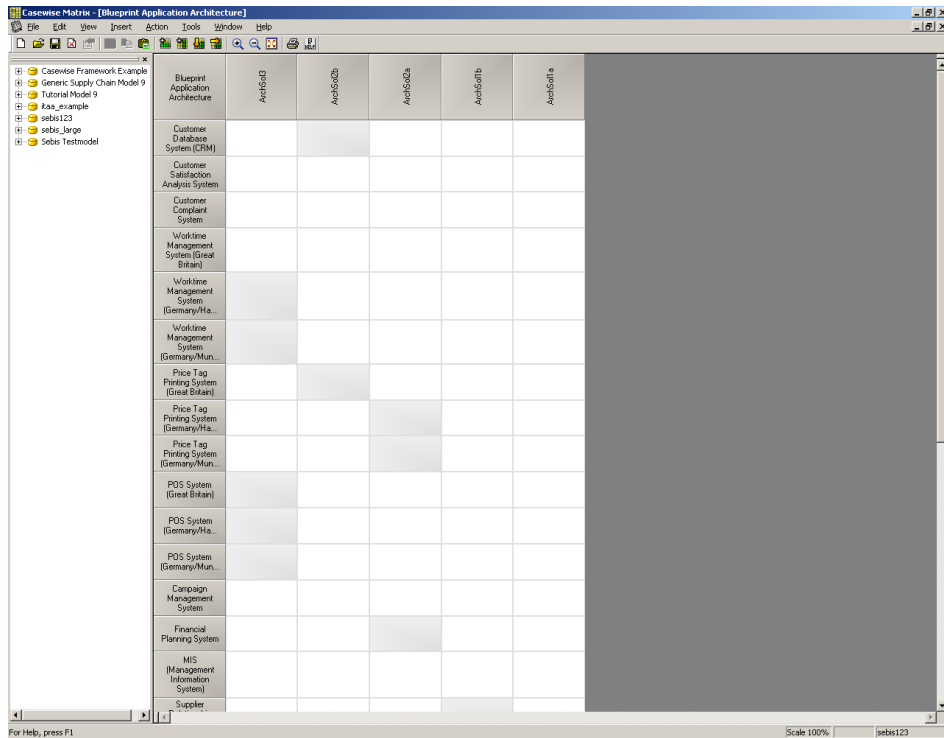


Figure 7.13: *Corporate Modeler*: matrix diagram showing which application using which architectural solution for scenario application architecture management

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of the *Corporate Modeler*.

The objectives can partially be achieved directly. When regarding bar charts they can be achieved utilizing Microsoft Excel.

The procedure consistency retains potential for improvement as direct application architecture management would need some enhancements of the tool's integrated approach.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for application architecture management.

7.2.7 Infrastructure Management

The first step of infrastructure management can be easily performed in the *Corporate Modeler* as adaptations to the metamodel are achievable in a convenient way. The connections between applications and directly related infrastructure elements can be visualized using the matrix modeler (see figure 7.14). Tabular reports can also be created using the functions described in section 7.1.3. When utilizing indirect connections (like requested in figure 3.40, see section 3.3.2) transitive analysis is not possible.

Highlighting applications that are affected by changes of the underlying infrastructure elements in the tabular report can be achieved through the usage of the sorting function, which does not allow

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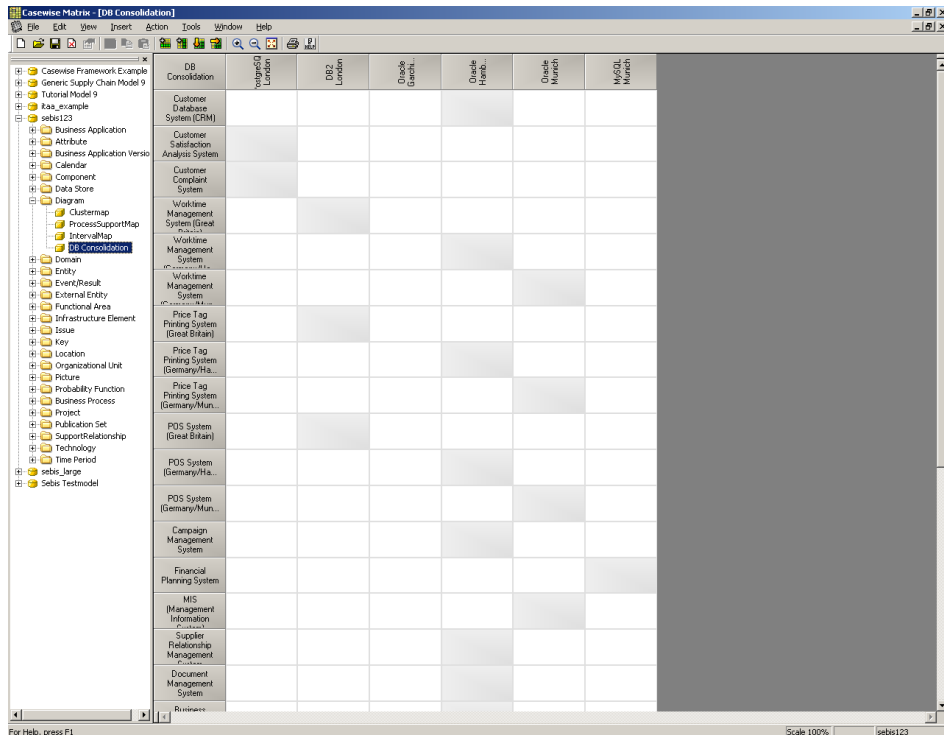


Figure 7.14: *Corporate Modeler*: matrix diagram showing the use of infrastructure for scenario infrastructure management

filtering. A graphical visualization of the affected applications in an existing depiction (see figure 3.37 in section 3.3.2) generated earlier cannot be automatically performed (see section 7.1.3).

Further, calculating cumulated costs for infrastructure elements cannot directly be performed in the *Corporate Modeler* but may be achieved utilizing Microsoft Excel, which can be used for calculations on reports.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of the *Corporate Modeler*.

The objectives can be achieved only partially even when utilizing Microsoft Excel.

The procedure consistency retains some potential for improvement as the impact analyses employed with infrastructure management are not directly supported.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for infrastructure management.

7.3 Tool Vendor's Profile

Abstract

Corporate Modeler Suite enables users to create a visual, information-rich model of how your people, processes, systems and business data are inter-linked and inter-dependent. Armed with this view you can know the impact of any proposed change ahead of time, so you can make the right business and IT planning decisions. Adding IT Architecture Accelerator - the thin-client portal for enterprise-wide architecture management - takes the value of your modeling to a whole new level within the organization. Corporate Modeler models are accessed via a robust enterprise portal that also features project planning, decision support analysis and thin-client data entry for easy updating.

The Corporate Modeler Suite

The Corporate Modeler Suite is an award winning set of integrated products that enable teams to visualize, communicate and optimize your organization's business processes, use of resources and IT. The Suite empowers business and IT professionals to model, document, analyze and improve the design of your organization's Enterprise Architecture (EA). This includes your end-to-end business processes, the resources that perform those processes and the systems and data that support them. A truly collaborative solution, the Corporate Modeler Suite links together business and IT modeling within one multi-user environment. As a result, the Suite enables multi-discipline teams to:

- Capture the "as-is" situation
- Test out "what-if"? scenarios
- Communicate and implement "to-be" enterprise improvements
- Respond to challenges faster in the future
- Continually improve processes

At the heart of the Corporate Modeler Suite is Corporate Exchange - a knowledge repository that stored and protects the information you model about your enterprise. This dynamic database makes it easy to update, extend and enhance your models to provide an ongoing knowledge base for the enterprise.

IT Architecture Accelerator



accelerator Logo

ITAA: IT architecture

Casewise IT Architecture Accelerator empowers organization across the world to align business and IT objectives, to manage portfolios and to know the impact of change for better decisions. The Accelerator also helps IS organizations increase standardization and rollout best practices for increased flexibility

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and efficiency. A web-based solution, IT Architecture Accelerator provides a central focal portal for the entire IS organization, as well as for all other areas of the business. It includes the first ever "CIO's cockpit" for effective IT project road mapping and tracking. In conjunction with Corporate Modeler, IT Architecture Accelerator provides a multi-user solution for capturing, analyzing and understanding the complex links within your enterprise architecture. Users can model the dependencies between people, processes, applications, databases, operating systems, hardware and locations and more - so you know the full "ripple" impact of any proposed change. To improve your IT operation, an interactive Roadmap facility enables enterprise-wide project planning. This unique view empowers managers to prioritize, schedule and track IT projects across the enterprise - including the consequences of any delays - and for teams to update progress information using thin-client forms.

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IDS Scheer AG is one of the major players in the business process management market. The company provides consulting and an EA management tool family called *ARIS Platform*. Its core competence is the internal, external, and overall management of processes within an enterprise. The *ARIS Platform* is based on a methodology developed by IDS Scheer called *ARIS* (Architecture of Integrated Information Systems) [Sch01].

The *ARIS Platform* ships with different full featured clients, *ARIS Toolset* the standard fat client and a Java based tool called *ARIS Web Designer*. Based on the used technology there are minor differences in the offered functionality and in the way the clients are operated. According to IDS Scheer there is a new product available with version 7.0, the *ARIS Business Architect*. *ARIS Business Architect* offers the functionality of *ARIS Toolset* in a Web-based environment.

The following section describes the evaluation of the *ARIS Platform* 6.2.3., except there are, relevant changes in version 7.0, according to IDS Scheer, which are mentioned explicitly.

8.1 Evaluation of Specific Functionality

This section describes the results of the simulation of the scenarios for evaluating specific functionality.

8.1.1 Configurability of the Metamodel

According to IDS Scheer’s methodology the configurability of the *ARIS* metamodel is limited. No new *Objects* (corresponding to entity types in our metamodel), *Attributes*, or *Relationships* can be created by the customers, nor is it possible to edit the shipped metamodel. To allow adaptation to customers’ needs, the *ARIS Platform* comes with a fixed set of predefined spare attributes with common data types like, e.g. String, Date, Time, Boolean, etc. These attributes play the role of placeholders.

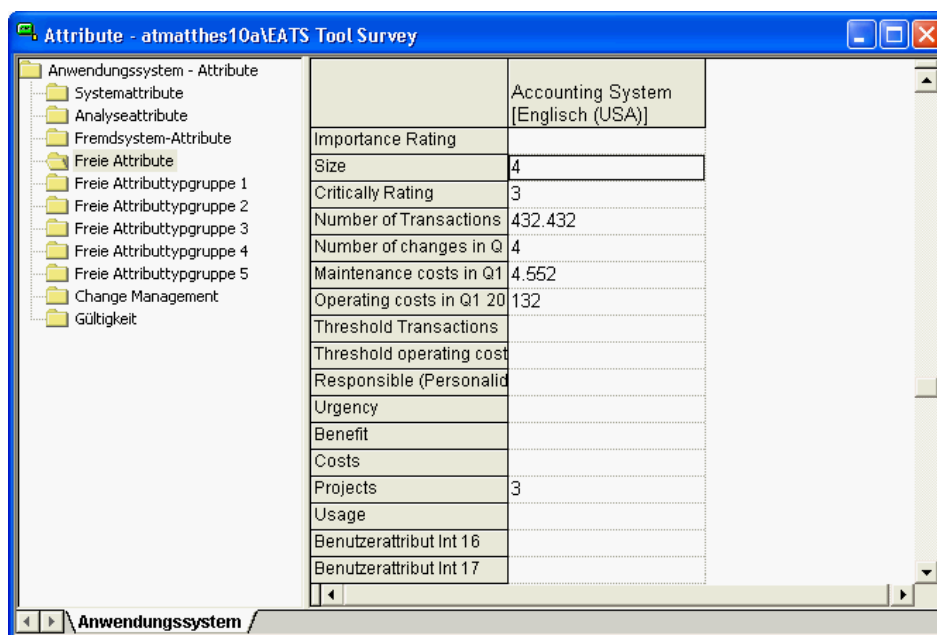


Figure 8.1: *ARIS Platform*: adapted user attributes for the entity application

Customizing the shipped metamodel is possible by renaming the objects, the models, the symbol names and the attribute types (see figure 8.1), while relationships cannot be renamed. According to IDS Scheer version 7.0 offers the possibility to rename relationships as well. Additionally symbol types representing objects in a model can be created by the user and model types can be created based on the predefined model types.

Difficulties arise as soon as the shipped objects, attributes, and relationships are not sufficient for mapping an enterprise specific information model. This restriction may be removed by the vendor, who is able to introduce new models, objects, attributes, and relationships.

A specific feature of the *ARIS Platform* metamodel is that all entities share the same set of predefined attributes. For example using one of these attributes for storing location information of an organizational unit all processes also feature an attribute for location information. If the name of one of these attributes is changed the name of the attribute of all other entities will be changed as well. To prevent this situation a feature called *method filter* can be used. The *ARIS Platform* ships with a predefined set of filters which can be extended with new filters by the customer by means of using a wizard. Those filters define which attributes, objects, relationships, and models¹ will be visible to the user. Additionally it can be specified which entities and relationship of a predefined set, according to the *ARIS* methodology, may be used within a model. According to IDS Scheer version 7.0 of the *ARIS Platform* offers the possibility to filter user created model types in the same way as predefined model types.

The advantage of the predefined methodology is that you can start right away after internalizing the IDS Scheer methodology without having to deal with metamodeling.

Rating: 2 points for configurability of the metamodel.

8.1.2 Coverage of EA Management Concepts by Predefined Metamodel

The *ARIS Platform* comes with a large predefined metamodel consisting of about 120 model types² and about 320 object types, depending on specific product licensing. The metamodel is primarily based on the *ARIS* framework consisting of five different views (see figure 8.2), which allow a holistic view on business processes, but also supports other standard frameworks like Zachmann [ZIF05], TOGAF [TOG05], ITIL [OGCO00], DoDAF [DoD4], FEAF, or C4ISR. Documentation explaining the *ARIS* methodology is available in a *method manual*, which describes the methodology on a general level. In addition the online help describes the model types, object types, and attribute types.

Most aspects of EA management are covered by the shipped metamodel. The scenarios *Landscape Management*, *Traceability and Strategy Management* could be simulated with minor adaptations to the metamodel, like adding new attributes. Problems may arise in the areas of *Blueprint Architectures*, simulated in scenario *Application Architecture Management* (see section 8.2.6) and concerning the scenario *Synchronization Management* (see section 8.2.3) as these concepts are not direct parts of the *ARIS* methodology.

Rating: 3 points for coverage of EA management concepts by the metamodel.

¹Models correspond to diagrams in other tools

²Model types correspond to diagrams types in other tools.

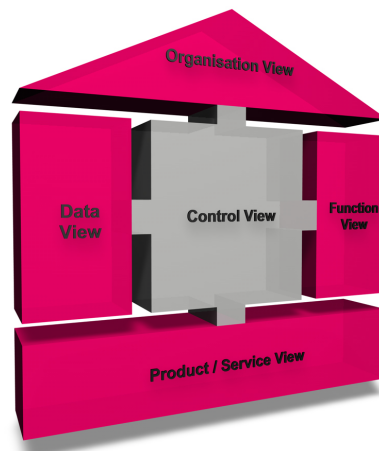


Figure 8.2: *ARIS Platform*: *ARIS* house of business engineering

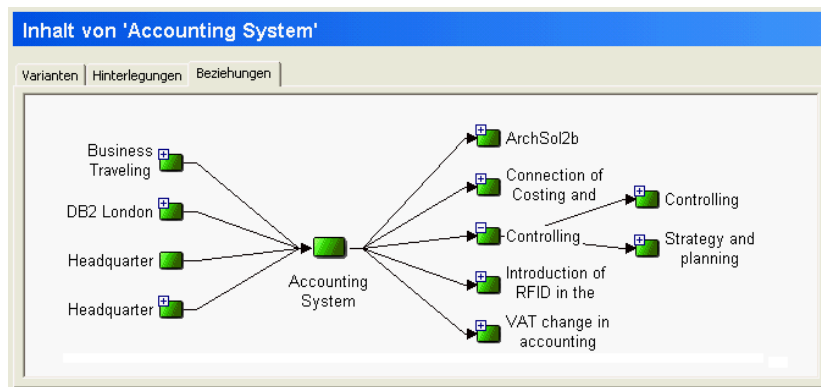


Figure 8.3: *ARIS Platform*: relationship tab, which is available for every object within the *ARIS Platform* repository

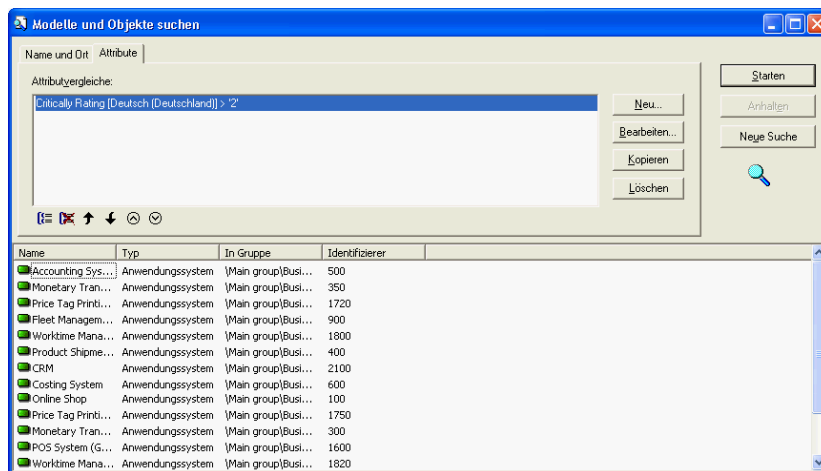


Figure 8.4: *ARIS Platform*: search dialog

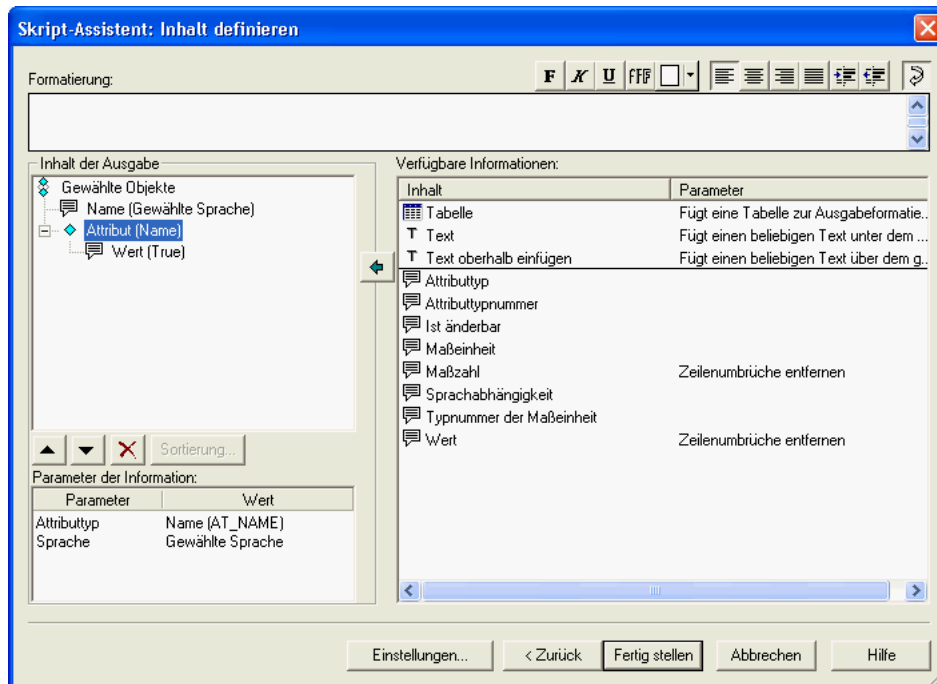


Figure 8.5: *ARIS Platform*: script wizard for creating user defined reports

8.1.3 Support for Impact Analysis & Calculation

The *ARIS Platform* supports different ways to perform impact analysis and calculations. First of all it is possible to use the *relationship tab* which is available for all objects within the *ARIS Platform* repository (see figure 8.3).

This dialog shows all connections of a selected object to other objects featuring the possibility to navigate using the shown relationships. To perform calculations, user defined reports and analysis scripts³ can be used. These may be created by utilizing a wizard or the integrated Microsoft Visual Basic editor. For selecting the objects used in the analysis the customer may use the integrated search functionality provided as a dialog oriented query builder (see figure 8.4). The second option is to select the appropriate objects within the repository explorer. After the report creation, e.g. which may result in a RTF document, the reports may easily be extended with expressions using the functionality of an external tool to perform the calculations.

According to IDS Scheer version 7 introduces a new query wizard, which is able to define queries allowing to navigate across relationships in the database, e.g. give me all processes supported by a specific business application system.

The last and most powerful way to perform impact analysis, as well as calculations is to use the integrated scripting abilities (see figure 8.5) of the *ARIS Platform*, as the whole repository, including all models, objects, and attributes can be accessed. Thus it is possible to manipulate and create models, diagrams, and reports. Certainly this approach comprises a certain complexity.

Rating: 3 points for support of impact analysis & calculation.

³Microsoft Visual Basic can be used to create scripts with full repository access which are also able to create and manipulate models and reports.

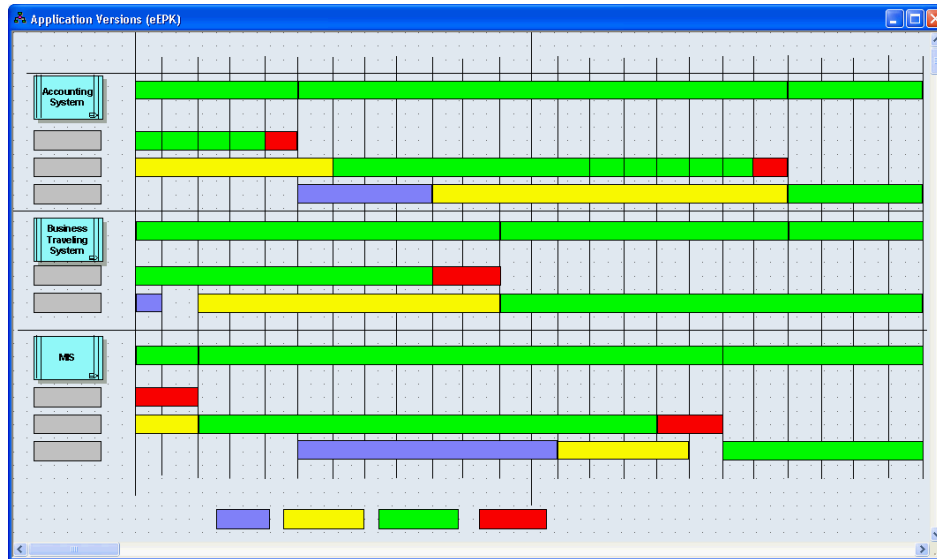


Figure 8.6: *ARIS Platform*: manually created interval map showing lifecycles of application versions

8.1.4 Richness of Predefined Visualization Techniques

As already mentioned in section 8.1.2, the *ARIS Platform* includes about 120 model types which can be used to create visualizations. The shipped method manual contains a comprehensive list of model types bundled with a documentation of objects types and relationship types, that may be used within a model, according to the *ARIS* framework. Most of the models refer to what we call a software map without a base map (see section A.2), but also balanced score cards (see section 8.2.4), and models using swim lanes are supported. Additionally there is one model, called *casual model*, which can be used to freely create visualizations. This model is intended to create a visualization without having to care about a methodology. According to IDS Scheer, the *Semantic Generator Wizard* may be used to define mappings between the elements of a casual model and the objects of the *ARIS* methodology in order to automatically convert them.

As casual models are not based on the *ARIS* methodology, none of the objects defined earlier can be used within the model, but it is possible to deposit⁴ other models, and thus create hierarchical relationships between models. This kind of relationships can also be created in all other visualizations and may be used to navigate between models.

Cluster maps (see figure 8.29 in section 8.2.6), process support (see figure 8.15 in section 8.2.1) maps, and interval maps (see figure 8.6) may be created manually or by using scripting to generate the model. Creating these visualizations is as easy as creating a Microsoft Visio drawing incorporating information stored within the *ARIS Platform* repository.

Visualizations showing the relationships of selected objects can be automatically generated (see figure 8.7). The layout of these visualizations cannot be configured and is completely automated by *ARIS Platform*. The creation can be influenced by several options and used filters.

For visualizing objects *ARIS Platform* ships with a large set of predefined symbols. Additionally this set can be extended by symbols in WMF or EMF format. Which symbols may be used for which

⁴The technique of *depositing* objects within a model with other models creates a hierarchical relationship between them.

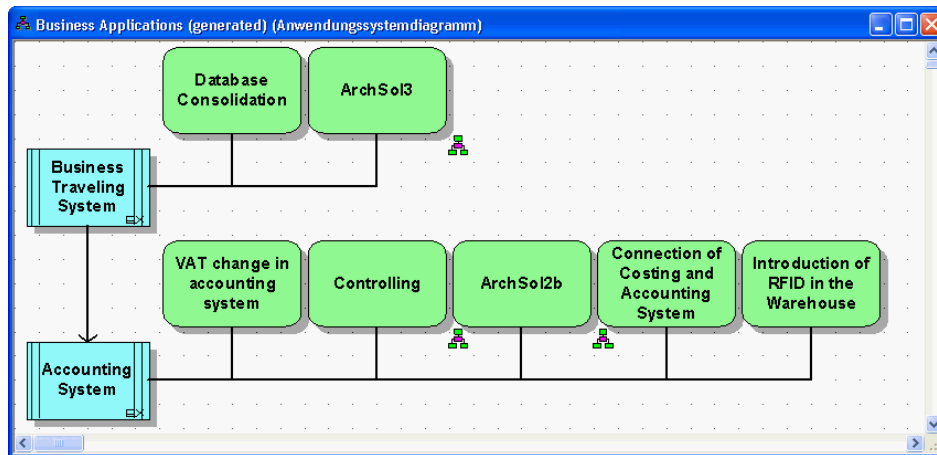


Figure 8.7: *ARIS Platform*: automatically generated model showing available relationships for *Business Traveling System* and *Accounting System*

object can be defined within the method configuration. Both clients offer zooming of the created visualizations according to the users' needs. According to IDS Scheer with version 7.0 there is a SVG based file format with an on board symbol editor allowing extended features.

To reduce complexity *ARIS Web Designer* allows to hide elements, while layering, another way to reduce complexity within visualizations, is not supported by any of the clients.

Rating: 3 points for richness of predefined visualization techniques.

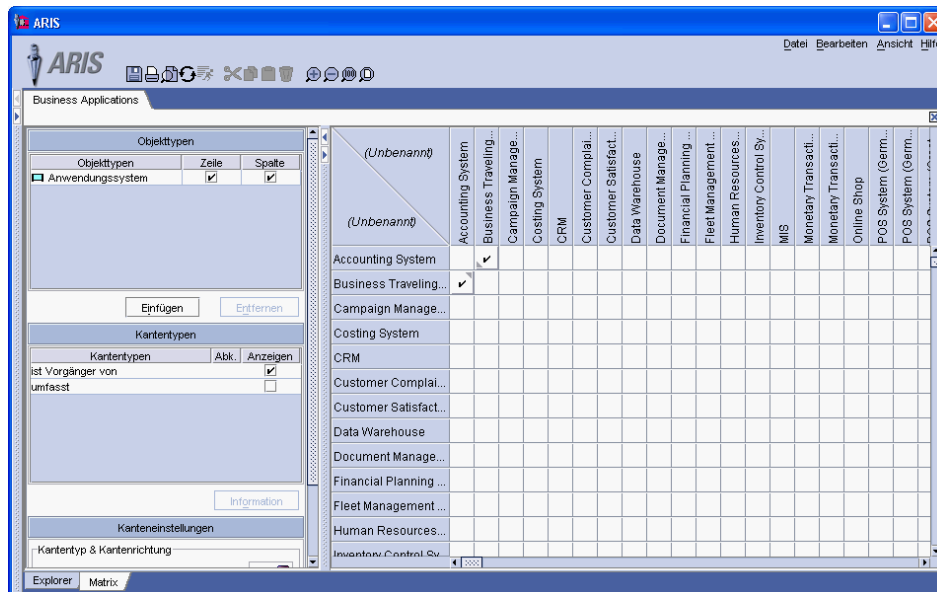
8.1.5 Flexibility of Visualization Techniques

ARIS Toolset and *ARIS Web Designer* offer the possibility to use templates to manipulate visualizations. Templates may change the colors, the attributes shown on the symbols, the style of interconnections, and some other visualization options. They can be configured in the *convention* configuration and can easily be selected within the models or automatically be applied while the creation of models.

New models may be generated automatically by the *ARIS Toolset* after selecting objects within the the *ARIS Toolset Explorer* (see figure 8.7 in section 8.1.4). Those models may be used as a starting point for customized visualizations, as the generation concerning the layouting cannot be configured. To generate customized visualizations according to enterprise styleguides it is possible to use the shipped scripting language, which offers full customizability like e.g. positioning and sizing.

Visualizations may also be altered by the user by dragging elements of the visualization. This functionality is supported by basic layout algorithms like alignment of objects. The changes within a visualization can be maintained by saving the model. When referring to the capabilities to manipulate the visualization and the underlying data, it has to be distinguished between the functionality of the fat client and the web client. It is for example possible in the *ARIS Web Designer* to use a *Relationship Matrix* to edit the interconnections between objects (see figure 8.8). These interconnections are hidden in a model, unless the function `show relationships`, available in *ARIS Toolset* is used. Additionally *ARIS Web Designer* offers the possibility to hide objects within models, which can be used to reduce complexity.

The behavior of relationships not automatically appearing in visualizations is intended by IDS Scheer, as they differ between relationship within the repository and within models. One advantage of this

Figure 8.8: *ARIS Platform*: relationship matrix

technique is, that if a relationship is deleted within a model, but is still present in another, this relationship will not be deleted in the repository. Relationships within the repository, which do not have a graphical representation in a model, may be removed by reorganizing the repository, using administrative tools.

Rating: 4 points for flexibility of visualization techniques.

8.1.6 Flexibility of Reporting

The *ARIS* products offer possibilities for creating various tabular reports. According to the selected elements within the *explorer* different categories of reports with a predefined selection of data is available. Another way to select elements is to use the integrated search functionality which is able to search for objects and models based on selected criteria (see section 8.1.3).

During the creation of the report the desired language⁵ together with the reporting format can be selected. The following formats are supported:

- Microsoft Excel (XLS)
- HTML
- Rich Text Format (RTF)
- Text File (TXT)
- Microsoft Word (DOC)
- *ARIS* tabular format (ATF)

⁵*ARIS Platform* allows to store language specific values for each attribute, e.g. name of a business application. During the creation of a report the customer has to select which language specific values should be used.

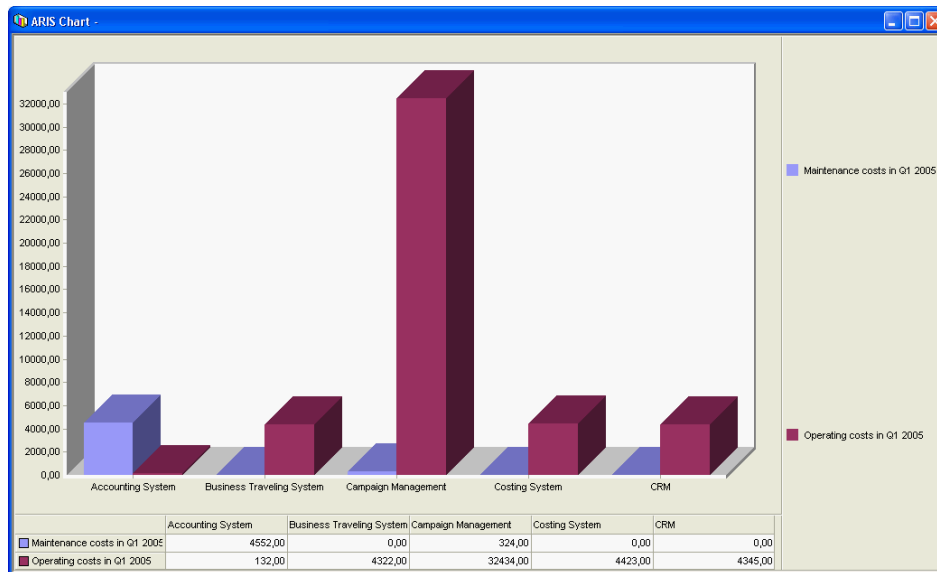


Figure 8.9: *ARIS Platform*: Chart created with *ARIS Toolset*

According to IDS Scheer PDF is also available for the Web-based products with version 7.0.

The layout and appearance, like logos, header, and footer can be adapted to corporate design within the repository configuration. For an example of a report see figure 8.21 in section 8.2.2.

In addition to the reporting capabilities described above *ARIS Toolset* supports user defined reports. These are created utilizing a wizard (see figure 8.5) and can be saved as a script file. This allows complete customization as it is even possible to select and sort attributes. Using the created scripts without any adaption it is not possible to perform calculations. These can be performed by extending the script or by using the calculation functionality of e.g. Microsoft Excel.

ARIS Toolset offers a second reporting option. It is able to create Microsoft Excel-like diagrams, e.g. bar charts, pie charts, etc., which can be configured in the *convention* configuration. The user may select the object type, the attributes which should be visualized, one of the 20 available chart types together with its specific options and one sorting criteria (see figure 8.9). The created charts may be printed or saved in an *ARIS Platform* specific format called *ach*.

Rating: 4 points for flexibility of reporting.

8.1.7 Collaboration Support

Concurrent working of multiple users is supported by *ARIS Platform*. Depending on the kind of object different locking strategies will be used: models will be locked pessimistically, objects will be locked optimistically using the *last save wins strategy* i.e. the last saved attribute values will be stored in the database.

To control user access to data within the repository the rights **read**, **write** and **delete** may be granted for every role⁶ to every folder where objects and models may be arranged (see figure 8.10).

ARIS Platform does not ship with a light weight reader, but it is possible to use the *ARIS Web*

⁶Role in this context refers to role based access control (RBAC) and are attached to users.

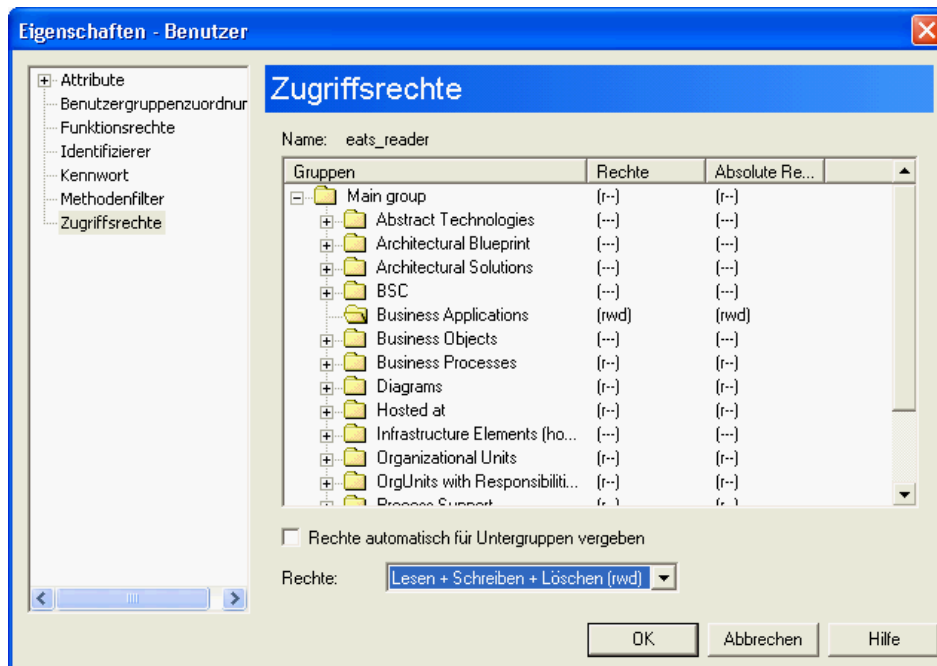


Figure 8.10: ARIS Platform: rights configuration



Figure 8.11: ARIS Platform: Web Publisher wizard

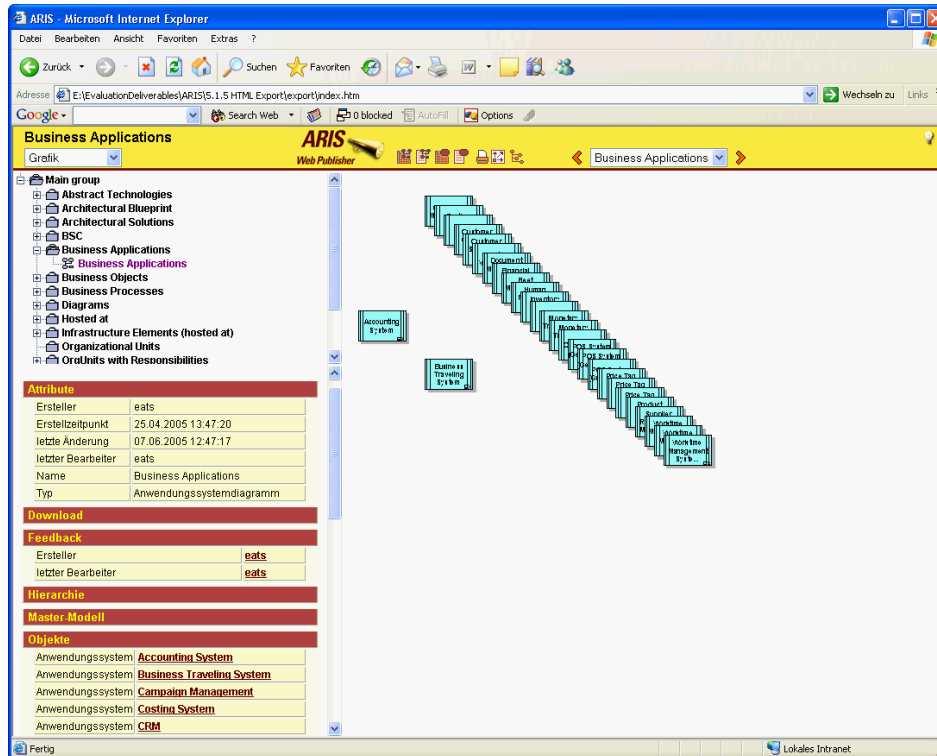


Figure 8.12: ARIS Platform: web export

Publisher (see figure 8.11) to create a HTML export with all repository data, including all visualizations (see figure 8.12). Within the export it is possible to navigate through the data by using Java applets, JavaScript, and hyperlinks.

Based on selections within in the shipped wizard, it is possible to narrow down the exported data to specific needs. Finishing the wizard a script file can be created which may be used to run the generation in a batch mode, to keep the web pages up to date on a regular basis.

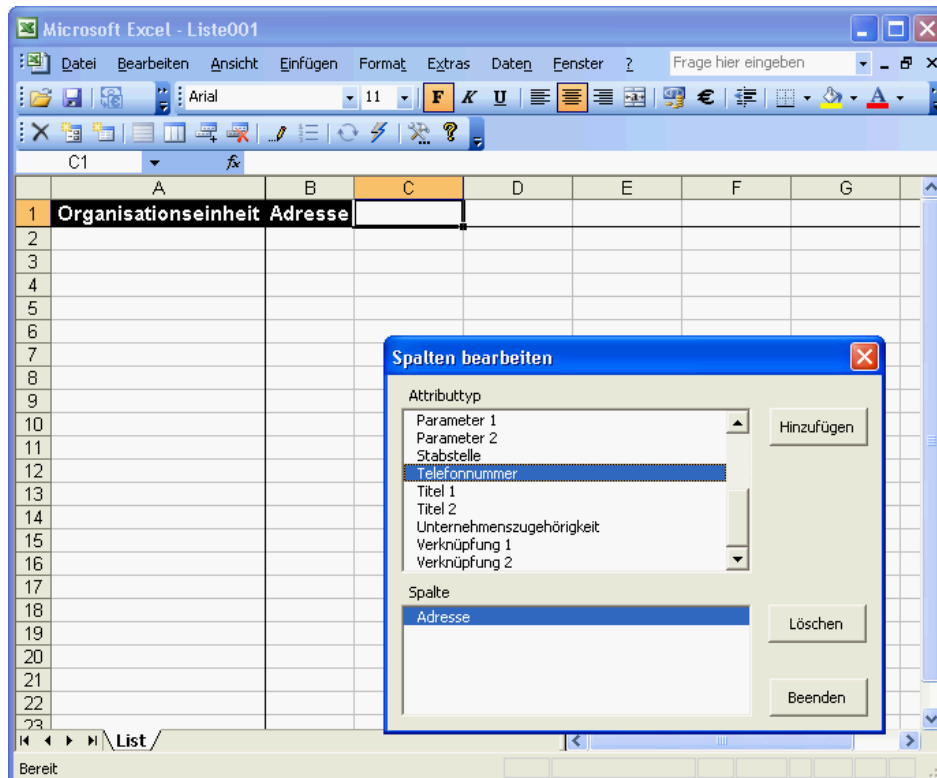
In order to support offline working, parts of the repository may be exported to a local repository. Changes that have been carried out on a local repository may later be merged to a central server with conflict resolution.

Rating: 4 points for collaboration support.

8.1.8 Import/Export & External Data Sources

ARIS Platform ships with an Microsoft Excel-Macro called *Process Generator* (see figure 8.13), which may be used to import data from Microsoft Excel files. The main focus of this solution is to import process steps and their relationships. Import of other objects, attributes and their relationships is restricted.

There are two other major ways available for importing/exporting data. The first way is to use the well documented *ARIS Markup Language* a xml dialect used to import/export data from/to *ARIS Platform*. The second way is to import data via scripting, for example Microsoft Excel can be extended with a Microsoft Visual Basic script directly accessing the *ARIS Platform* Repository.

Figure 8.13: *ARIS Platform*: process generator

According to IDS Scheer the *ARIS Platform* supports multiple standard data formats, like BPML and XMI. With version 7.0 it also offers the possibility to export BPEL, XPDL and to import WSDL files.

Integration of external repositories is not the main focus of *ARIS Platform*, nevertheless it is possible to use LDAP to access externally managed user information or the integrated scripting functionality to access other repositories.

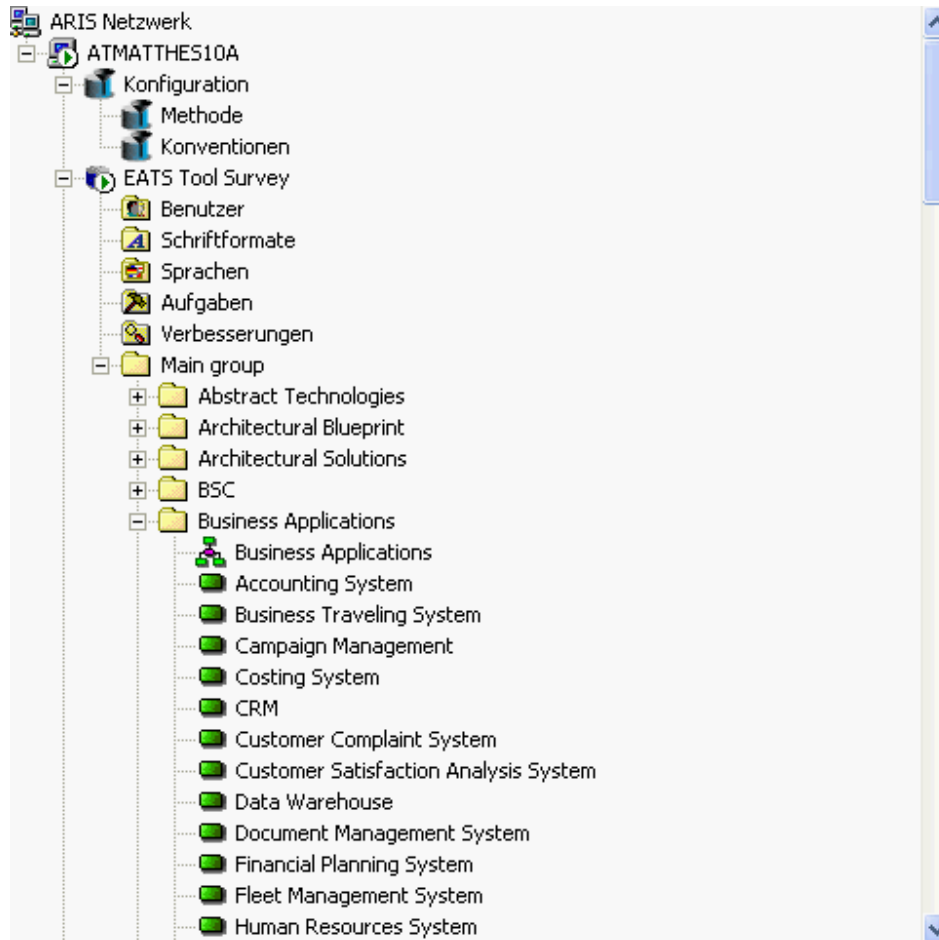
Rating: 3 points for import/export & external data sources.

8.1.9 Usability

ARIS Platform uses different objects and models to perform EA management. The information therein together with additional settings are organized in a tree structure, which allows direct access to all data saved within the repository (see figure 8.14). Additionally the integrated search functionality can be used to find information within the repository. The repositories are themselves divided in two parts, database wide settings and the different repositories to save the data needed for EA management. Repositories further contain specific settings, e.g. user management as well as folders for objects and models. This folder hierarchy may completely be adapted to customers needs.

Data entry is also divided into two parts. Information like name, identifier, etc. is entered using dialogs. Relationships are created graphically using models or using the matrix editor.

ARIS Platform is a sophisticated tool, using its own methodology to guide users through the process of EA management. This methodology has to be internalized by the user to be able to get along with

Figure 8.14: *ARIS Platform: ARIS Toolset explorer*

its restrictions and facilities. The complexity is also reflected by the user interface utilizing a high number of tool bars for offering context sensitive functionality. In addition the right mouse button offers a context sensitive menu providing possible functions. To ease the handling of the tool the *method filter* may be used which is able to hide functionality not needed. It may also be used to adapt the metamodel to customer needs (see section 8.1.1).

After a period of vocational adjustment all basic and most of the advanced functionalities can be used by an ordinary user. Especially as there is no need for such users to extend the *ARIS Platform* with additional scripts and reports because they can be provided by trained administrators. Nevertheless these functionalities provide the possibility to almost completely customize reporting and creation/manipulation of visualizations.

Rating: 3 points for usability.

8.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

8.2.1 Landscape Management

The *ARIS Platform* offers integrated support for landscape management using the functionality for building variants of models and objects. This functionality can be used to start with a current landscape (see figure 8.15), e.g. visualized as a process support map, and create different version that represent planned (see figure 8.16) and target landscapes (see figure 8.17). Different colors within the visualizations show different statuses (changed/unchanged) of the application systems. The colors have been manually selected, but this could also be done programmatically utilizing the shipped scripting engine.

This scripting engine together with an attribute containing a validity period for business applications has to be used if a visualization of the application landscape at a special point of time should be shown.

The variants created may later be compared to each other utilizing a wizard, shown in figure 8.18. It is also possible to create tabular reports (see section 8.1.6 for additional information about reporting) of the different versions or based on their comparison.

A problem with this technique is that there is no integrated way to establish relationships to projects and programs. This may be done by creating another model showing the influences of projects to applications of the application landscape. Afterwards this model has to be *deposit* to the changed applications. Another way to solve this problem is to use the c^3 -method which is part of the *ARIS* methodology. This model mainly focuses on change management and provides the possibility to visualize relationships between business processes, organizational units, projects, goals and other objects, like e.g. tools needed to improve a process. Relationships to business applications can be found in the property dialog of the objects representing projects.

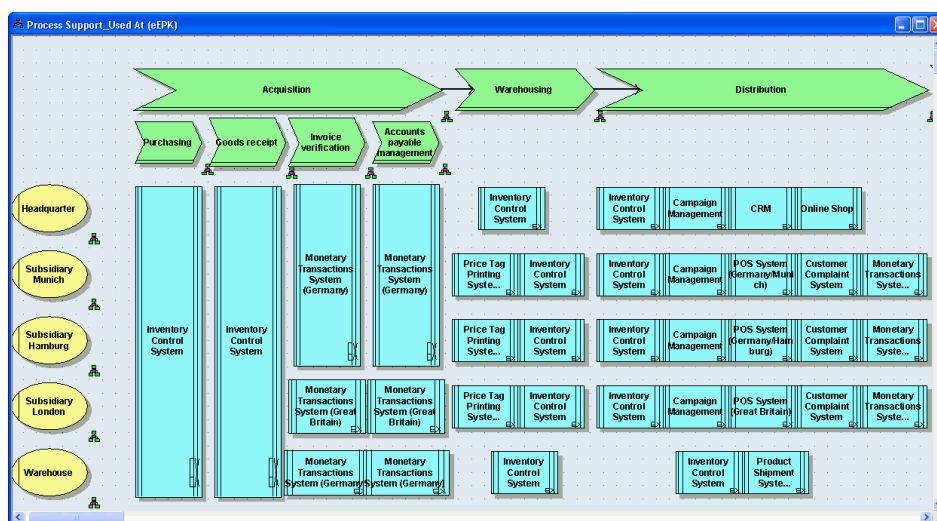


Figure 8.15: *ARIS Platform*: the current application landscape visualized as a process support map for scenario landscape management

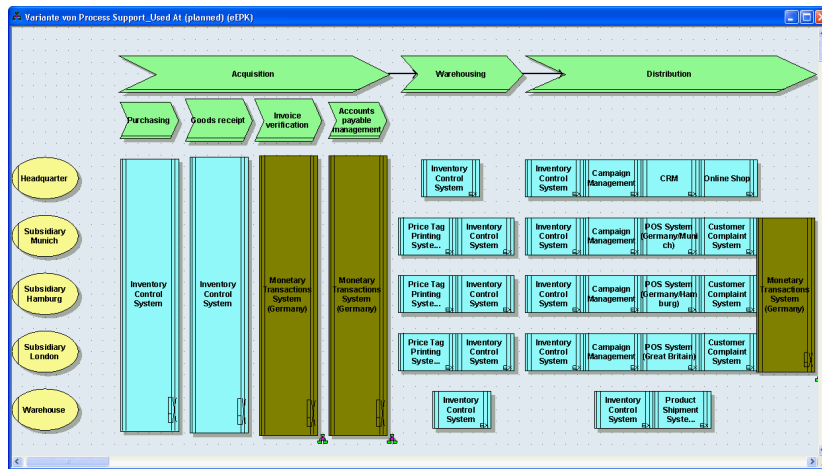


Figure 8.16: ARIS Platform: the planned application landscape visualized as a process support map for scenario landscape management

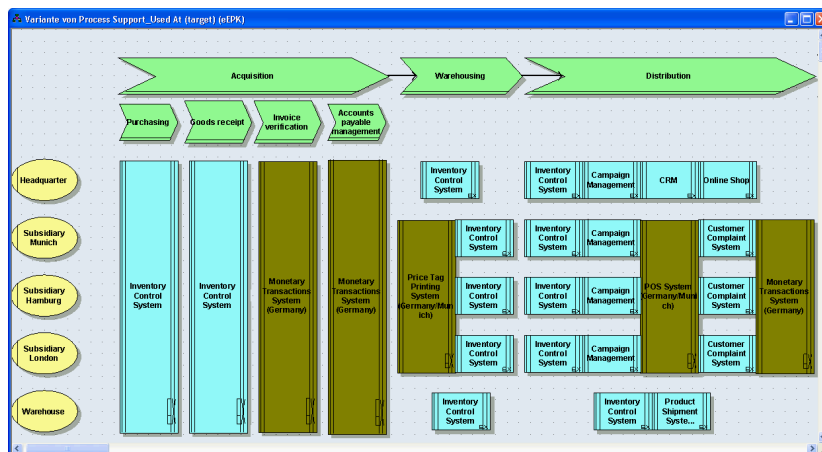


Figure 8.17: ARIS Platform: the target application landscape visualized as a process support map for scenario landscape management

Modellvergleich

Master-Modell mit Modellvariante | Modellvariante mit Modellvariante

Master-Modell: Process Support_Used At

Modellvariante: Variante von Process Support_Used At (planned)

Anzeigeoptionen

- Objekt in Master und Variante
- Objekt nur im Master
- Objekt nur in der Variante

Master-Objekt	Typ	Anzahl in M...	Objektvariante	Anzahl in de...	Identifizierung
Monetary Transactions System (Great Brit...	Anwendung...	3	[Nicht identifiziert]	0	nur im Master

Figure 8.18: ARIS Platform: wizard for performing model comparisons showing the differences between the current and the planned landscape for scenario landscape management

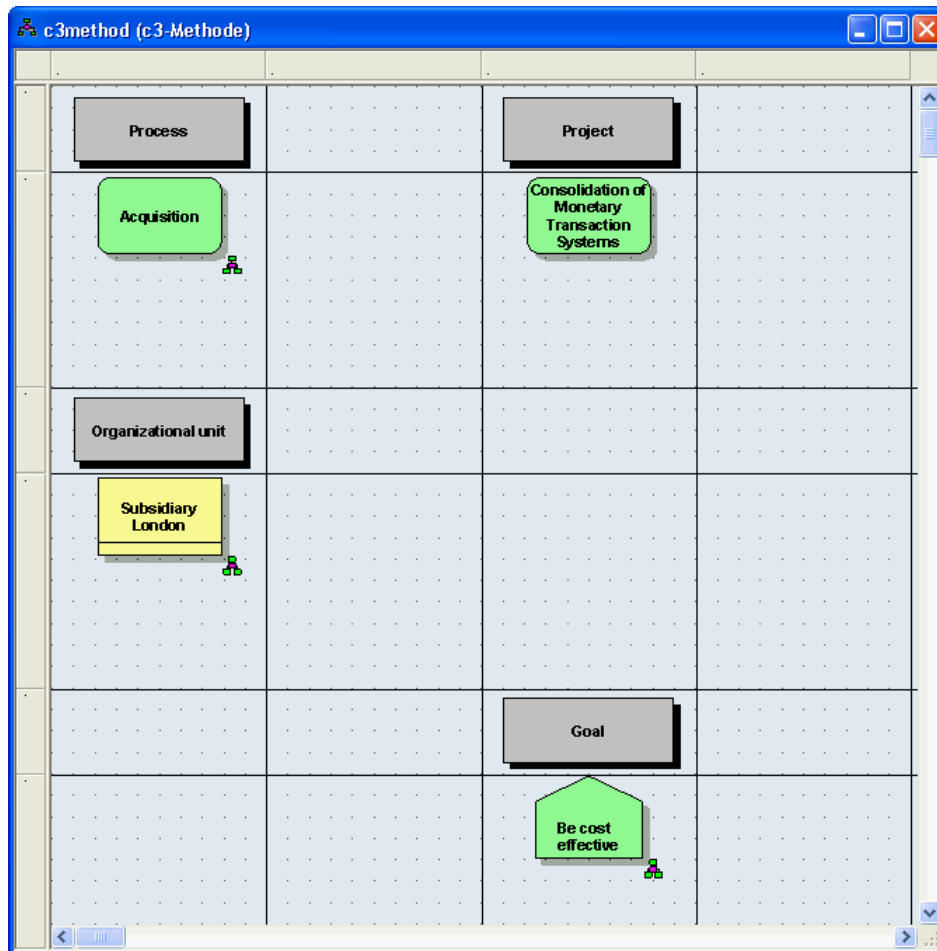


Figure 8.19: *ARIS Platform*: diagram showing the relationship between business processes, organizational units, projects, and goals for scenario landscape management

The tool handling for this scenario is good. Creating variants of models is an integrated feature of the *ARIS Platform*. The linkage between project and programs and the landscape management can be visualized using the c^3 -method.

The achievement of objectives is given. All visualizations can be achieved by drawing or by using scripting. Tabular reports can be achieved utilizing a wizard.

The procedure consistency is mostly given. Projects need to be connected to applications, used in current, planned and target landscapes, via additional models.

The procedure integration is mostly given, e.g. application systems already entered may be reused for planing a target application landscape, but relationships between projects and applications need to be entered.

Rating: 4 points for landscape management.

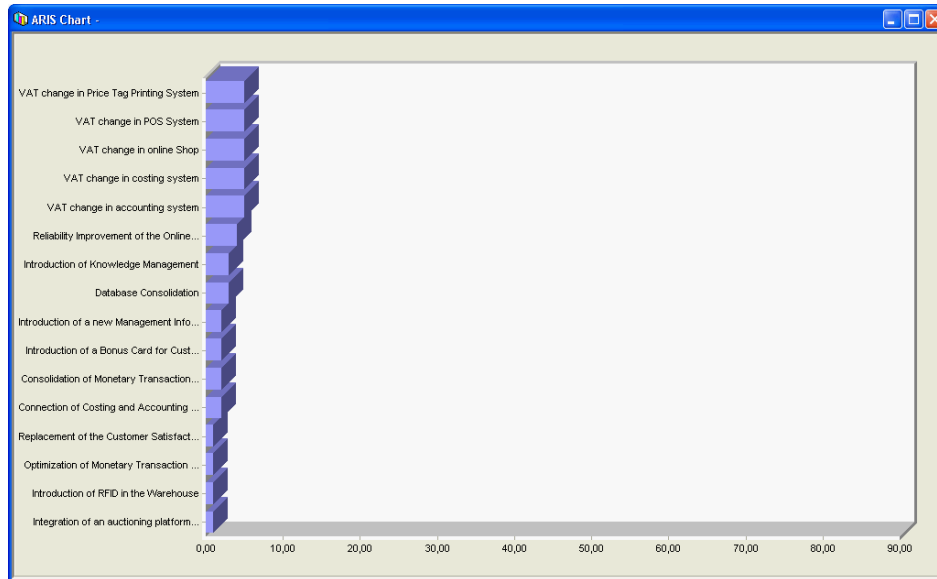


Figure 8.20: *ARIS Platform*: chart visualizing the urgency of project proposals for scenario project portfolio management

8.2.2 Project Portfolio Management

In order to be able to simulate this scenario, projects have to be entered into the *ARIS Platform*. The concept of project management is not part of the *ARIS* methodology. Hence an existing object type, in this case a *function* has to be used to represent a project. This decision has some influence on the scenario simulation as not all objects can be connected to each other according to the *ARIS* methodology. Additional relationships have to be used to represent different semantics compared to the methodology as the entity type function has been selected to represent projects. Other entity types of the *SoKaKauf information model* (see figure 3.4) have been mapped to functions as well, which leads to the situation that a relationship is used with multiple semantics. This results in problems when creating reports, because it is not possible to filter relationships according to their semantics utilizing reports created by the reporting wizard.

After entering the data a list of project proposals together with their costs (see figure 8.21) can be created utilizing a wizard (see section 8.5). The costs arising for every business application cannot be entered into the repository and therefore are not reflected in the report. A solution for this problem may be, that the costs are saved for each project. Assigning cost to a specific business application can, according to IDS Scheer, be performed using the *Process Cost Analyzer*⁷.

As already mentioned in section 8.1.6 calculations have to be performed with another tool e.g. Microsoft Excel. To create a ranking which projects have to be accomplished by all means a tabular list sorted by criticality may be created. Another possibility is to create a chart visualizing the urgency.

A portfolio matrix visualizing business applications as bubbles, their size as the bubble radius, their criticality rating on the y-axis, and number of projects affecting the business applications on the x-axis cannot be created directly. This may be compensated by using a few other diagrams and charts

⁷The tool *Process Cost Analyzer* has not been evaluated in this survey and is called *Business Optimizer* in the *ARIS Platform* version 7.0. According to IDS Scheer the tool is based on a standard method, which may be customized according to customers needs.



ARIS Report

```

Server: atmatthes10a
Datenbank: EATS Tool Survey
Benutzer: eats

--- Project ---
Connection of Costing and Accounting System
--- Business Applications ---
Costing System

Database Consolidation

Accounting System
--- Attributes ---
Costs
1.000.000
Benefits
2
Urgency
2
    
```

Figure 8.21: *ARIS Platform*: tabular report about the project portfolio together with the costs, benefits and urgencies for scenario project portfolio management

like the one shown in figure 8.20 for gathering the appropriate information or by using scripting for creating a user defined diagram or report.

The impacts of projects to organizational units and business processes have to be modeled in additional models to be able to use the *relationship tab* (see section 8.3). Otherwise the transitive relationship from a project to an organizational unit or a business process is only supported by using the integrated scripting functionality or by using the report wizard.

According to IDS Scheer version 7.0 introduces a new concept, which offers the possibility to define search queries using a wizard. The queries are available on the server for all modelers.

To be able to mark a project as selected a new attribute has to be introduced. This attribute may afterwards be used to filter the list of projects for selected/not selected projects.

The tool handling for this scenario is adequate. The object type *function* has to be used to manage projects. Reports or charts for selecting projects from the portfolio can be created utilizing wizards or the integrated scripting functionality

The achievement of objectives is partially given, as it is possible to enter and manage project portfolios (see figure 8.21 and figure 8.3), but not all reports, e.g. the portfolio matrix can be created. Additional problems arise as relationships have to be used with different semantics compared to the *ARIS* methodology, because functions are used to represent projects. There are two ways to solve this problem. The first one is to introduce additional attributes specifying the type of object used. The second one is to use different symbols for distinguishing between different object types. Information needed for the selection of projects may also be gathered by using other reports or charts.

The **procedure consistency** is adequate. The object type *function* has to be used in a different way than demanded by the *ARIS* methodology, as well as the relationship of projects has to be mapped to an existing relationship between a function and an application system.

The **procedure integration** is mostly given. Business applications, business processes, and organizational units already entered into the repository could be reused.

Rating: 2 points for project portfolio management.

8.2.3 Synchronization Management

The information already entered for the selected projects may be reused for this scenario. Dependencies between projects concerning impacts on the same organizational units can be visualized using the relationship tab already mentioned in section 8.2.2. The disadvantage of this diagram is that it may not be filtered for a special object type, e.g. organizational units. This may be accomplished by using the report wizard or by using the integrated scripting functionality for creating completely customized visualizations and tabular reports. Another way to solve this problem is to use the property dialog, which is available for each object within the repository. This offers the possibility for visualizing all available relationships for an object and may additionally be sorted by name, type, etc. (see figure 8.22).

The limitations mentioned above is applying to dependencies between projects. If a program is delayed the end date of the project (represented by a function object, see section 8.2.2) has to be adapted. The start and end dates may than be used to determine intersections in execution periods. Direct dependencies can be discovered by using the integrated search function (see figure 8.23), transitive dependencies can be discovered by using the scripting engine.

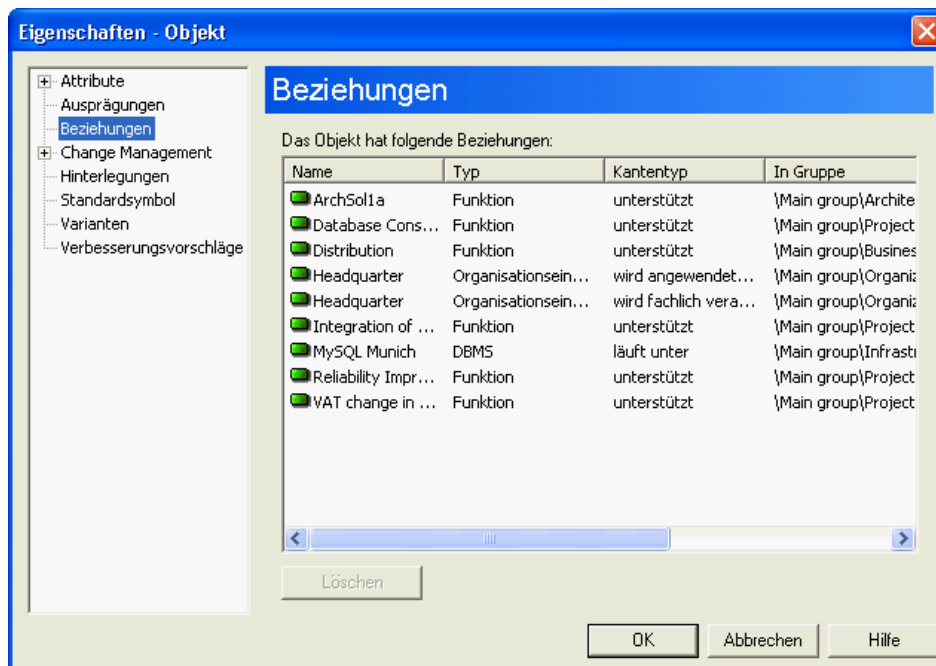


Figure 8.22: *ARIS Platform*: relationships of the business application *Online Shop* for scenario project synchronization management

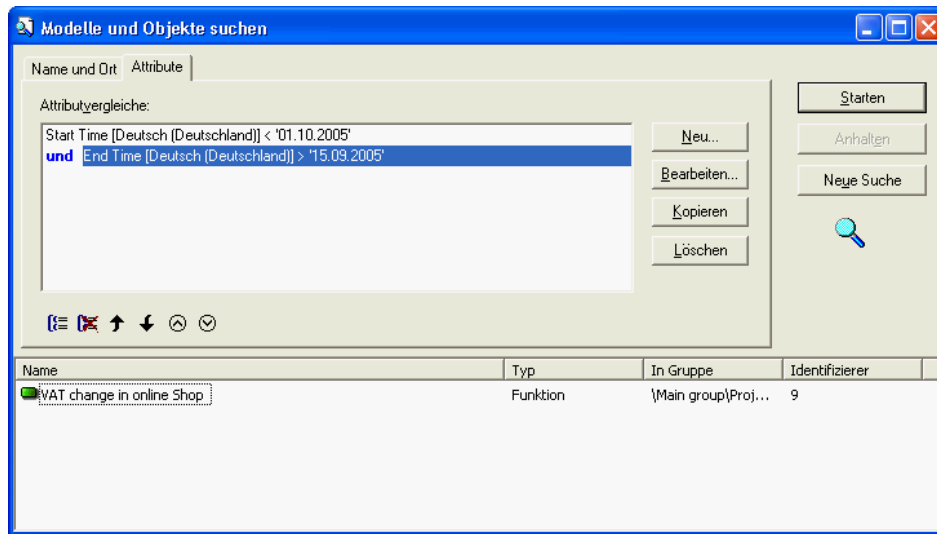


Figure 8.23: *ARIS Platform*: search for direct dependencies to the delay of project *database consolidation* for scenario project synchronization management

The tool handling for this scenario is adequate. Standard functionality may be used to detect direct dependencies or impacts. To be able to detect transitive relationships the integrated scripting engine has to be used⁸.

The achievement of objectives is partially given. It is possible to create reports of direct dependencies. Resolution of transitive dependencies is possible by programming.

The procedure consistency is adequate. The impact analysis needed for detecting dependencies or impacts has to be performed by using functionality developed for other parts of the methodology.

The procedure integration is given. The information about projects, their interdependencies, and their impacts can be reused from the previous scenario.

Rating: 2 points for synchronization management.

8.2.4 Traceability and Strategy Management

Strategy management is an integrated feature of the *ARIS* methodology. Strategies, goals, metrics, and perspectives, as well as a model for visualizing balanced score cards (BSC) are part of the metamodel, so entering the needed data and creating the visualizations (see figure 8.24 and 8.25) was an easy task.

In figure 8.24, a visualization of a BSC showing which strategies leads to which goals in which perspective can be seen. The model shown can be extended with trend indicators, using integrated functionality to perform calculations for BSCs showing how powerful automation using scripting can be. Other functionality like performing is-plan comparisons, creating management views, exporting to Microsoft Excel, and analyzing processes and measurements are also available.

According to IDS Scheer version 7.0 of the *ARIS Platform* includes the *ARIS Business Optimizer*, which offers extended calculation capabilities for BSCs.

⁸According to IDS Scheer detecting transitive relationships will also be possible using search queries in version 7.0.

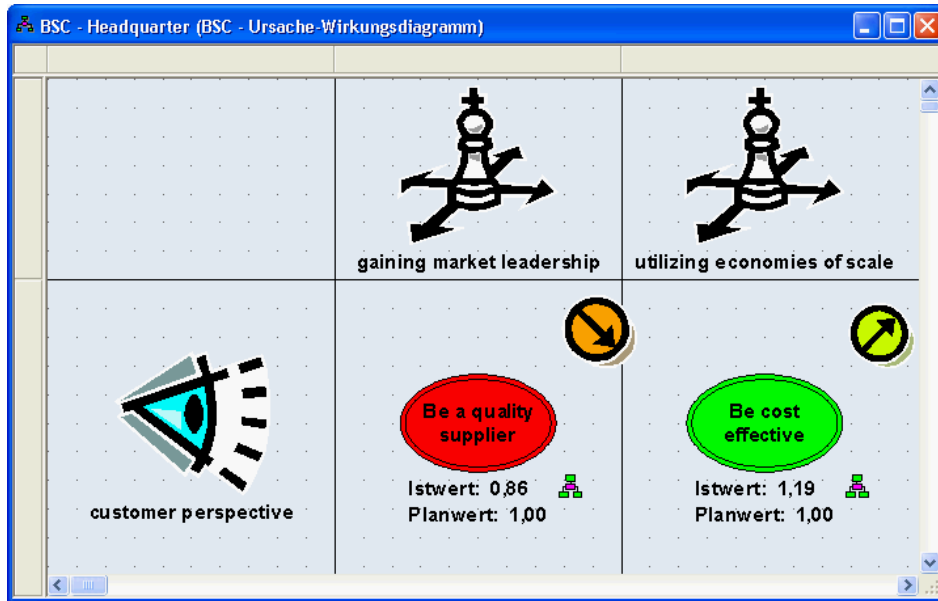


Figure 8.24: ARIS Platform: balanced score card for the organizational unit *headquarter* and the customer perspective for scenario traceability and strategy management

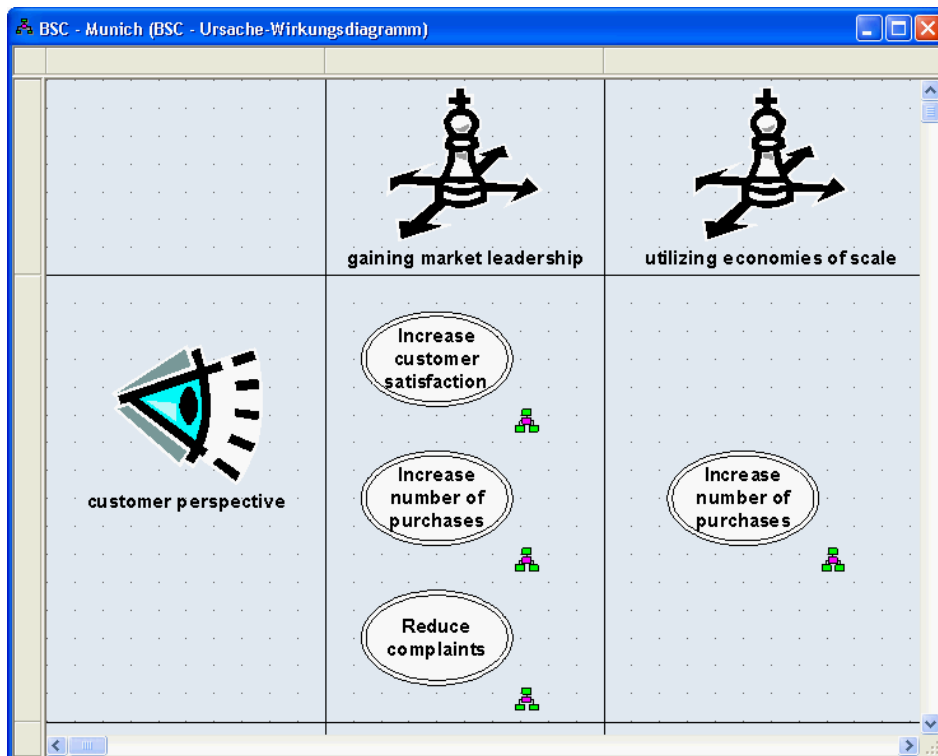


Figure 8.25: ARIS Platform: balanced score card for the organizational unit *munich* showing sub goals of the organizational unit *headquarter* and the customer perspective for scenario traceability and strategy management

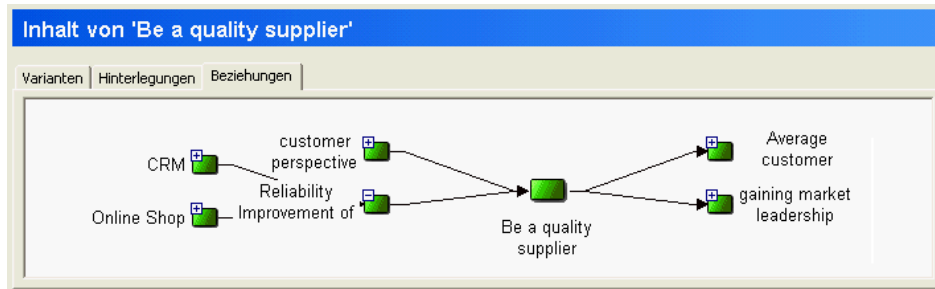


Figure 8.26: *ARIS Platform*: traceability utilizing the relationship tab for scenario traceability and strategy management

Tracing projects to strategies and goals is also possible utilizing integrated functionality. Figure 8.26 shows the *relationship tab* visualizing the relations between business applications, projects, goals, and strategies⁹. One drawback might be that this dialog cannot be filtered. A workaround for this problem may be to use the property dialog (see figure 8.22 in section 8.2.3), which is available for all objects within the repository, as already described in section 8.2.3. Those kind of impact analysis may also be performed using the integrated scripting functionality.

The tool handling for this scenario is intuitive. All objects (strategies, goals, metrics, and perspectives) and models needed to manage strategy are available and easy to use in the *ARIS Platform*. Traceability is also given using the relationship tab.

The achievement of objectives is given.

The procedure consistency is given. The concepts of the *ARIS Platform* correspond with the concepts of the scenario.

The procedure integration is given, as it was possible to reuse all data previously entered into the *ARIS Platform*.

Rating: 5 points for traceability and strategy management.

8.2.5 Management of Business Objects and Business Services

Management of business objects and business services is supported by the *ARIS Platform*. The following mappings have been used to simulate the scenario: business services are represented by *application system type* and connectors by *class*. Those objects may be used and interconnected within an *access diagram*. Business objects can be modeled by depositing the connector with a *UML class diagram*. This approach offers the possibility to store and visualize the data needed for simulating the scenario.

Figure 8.27 shows a visualization of the interconnections between business applications at the organizational unit *subsidiary munich*. Another visualization of the same information can be seen in figure 8.28. Both are based on repository data and have been created by manually positioning the objects used. Similar results can be achieved using the integrated scripting engine.

The tool handling for this scenario is adequate. The visualizations can be drawn manually, based on the data previously entered into the repository.

⁹According to IDS Scheer ARIS 7.0 provides the possibility to create queries which may be used to perform such kind of impact analysis.

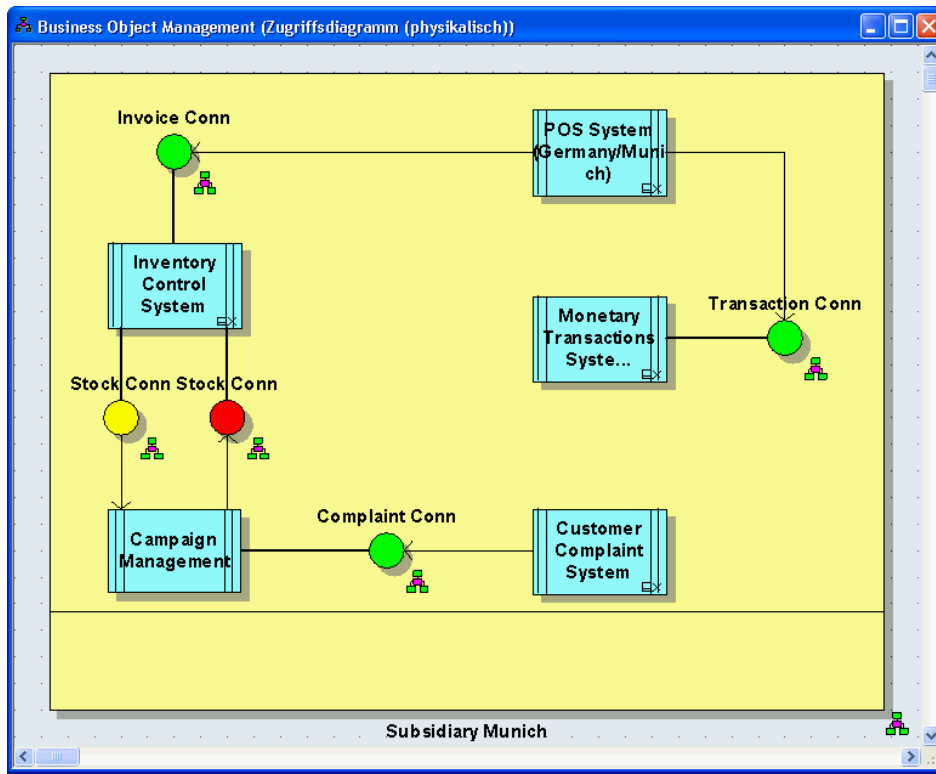


Figure 8.27: ARIS Platform: cluster map showing the relationships between business applications, connectors, interconnections, and business objects for scenario management of business objects and business services

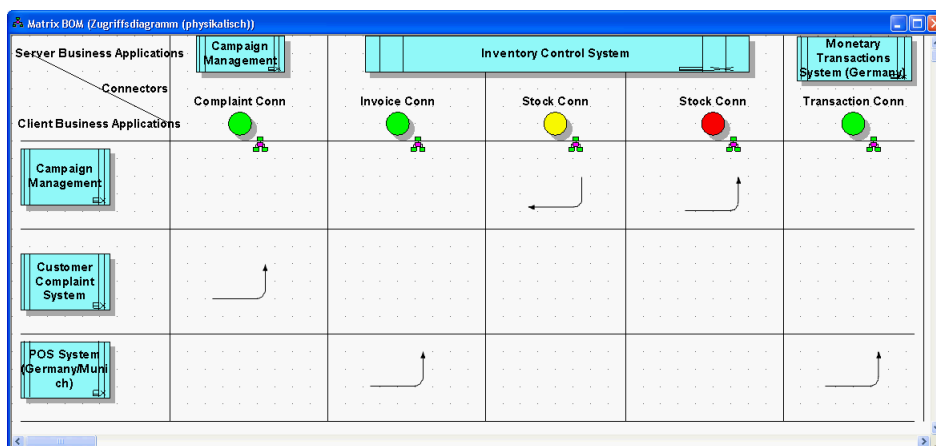


Figure 8.28: ARIS Platform: matrix map showing the relationships between business applications, connectors, interconnections, business services, and business objects for scenario management of business objects and business services

The achievement of objectives is given by manually drawing the visualizations. Automated generation is possible by using the integrated scripting functionality.

The procedure consistency is given. All information needed can be stored using objects of the *ARIS* methodology.

The procedure integration is given as it is possible to use all data previously entered into the *ARIS Platform*, like e.g. business applications.

Rating: 3 points for management of business objects and business services.

8.2.6 Application Architecture Management

The scenario application architecture management can be simulated using the object type *application system class* for abstract technologies and architectural solutions. Blueprint architectures and technologies are mapped to object type *application system type*. Differentiating between the different object types in visualizations and reports is possible by choosing different symbols to represent different object types.

To prevent the creation of relationships not corresponding to the concepts of application architecture management, e.g. relations between an architectural blueprint and a technology, a *method filter* can be used to restrict the usage of relationships.

The visualizations demanded, see figure 8.29 and figure 8.30, together with the report can be achieved using integrated functionality. Elements within the diagram have to be manually positioned and highlighted. The same result could be achieved by using the integrated scripting engine.

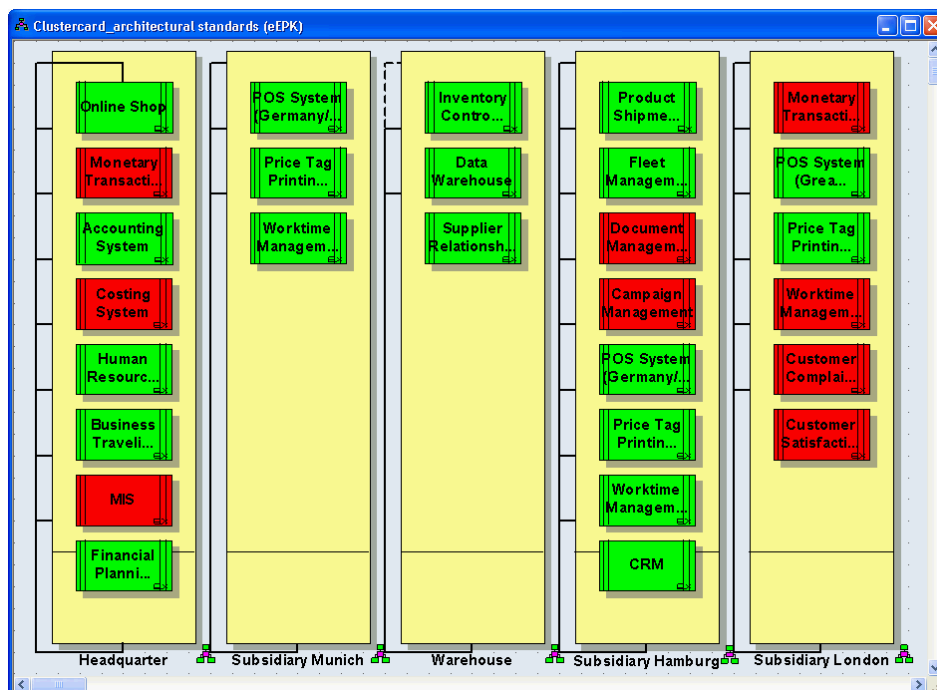


Figure 8.29: *ARIS Platform*: cluster map visualizing the conformity of business applications to architectural standards at each organizational unit for scenario application architecture management

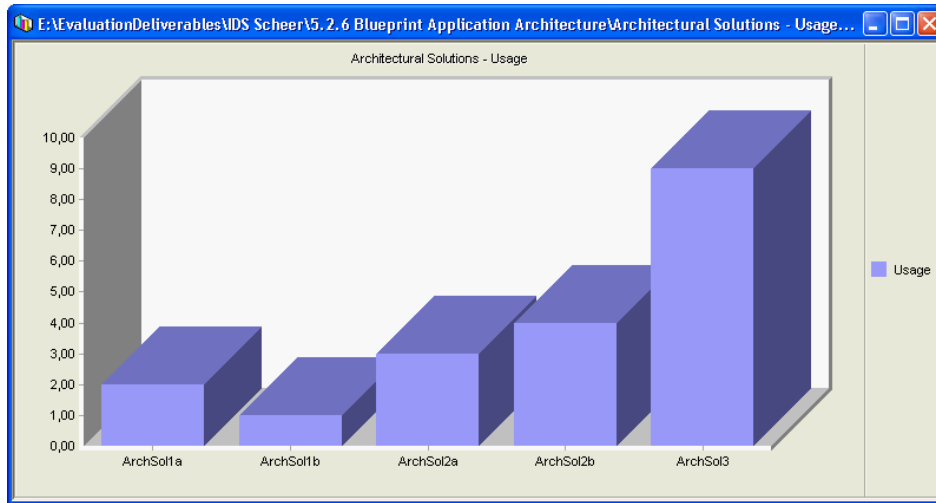


Figure 8.30: *ARIS Platform*: bar chart showing number of usage of architectural solutions for scenario application architecture management

The tool handling for this scenario is adequate. The information required can be entered and visualizations can be created..

The achievement of objectives is given. The demanded cluster map visualizing the standard conformity of business applications (see figure 8.29), the bar chart showing the number of usages of architectural solutions (see figure 8.30) and the report can be created.

The procedure consistency is given, blueprint architectures, architectural solutions, abstract technologies and technologies can be mapped to objects of the *ARIS* methodology.

The procedure integration is given. Data already entered can be reused for this scenario, e.g. business applications.

Rating: 3 points for application architecture management.

8.2.7 Infrastructure Management

Visualizing which business applications are hosted at which location and uses which database (infrastructure element) is possible but needs user interaction or a programmatic extension for positioning of elements or for adding of symbols depicting the end of the support period (see figure 8.31). The efforts could be minimized by using Microsoft Visual Basic for automatic layouting and manipulating the diagrams. Creating visualizations according to our definition of an interval map (see section A.1.3) is possible but implies the same drawbacks. An example of an interval map created in the *ARIS Platform* can be seen in figure 8.6.

Creating the requested reports can be achieved by utilizing the report wizard. Using only the wizard results in a drawback. It is not possible to directly include any calculations. These can be inserted into an already created report, e.g. by using features of Microsoft Excel, or the Microsoft Visual Basic script created by the wizard has to be extended manually.

The tool handling for this scenario is intuitive, except the needed workaround to use the object type *dbms-type* as infrastructure elements.

The achievement of objectives is given with a certain amount of manual operation. Calculations cannot be used in standard reports created by the wizard.

The procedure consistency is mostly given, as all information concerning infrastructure management can be entered and visualized. The object type *dbms-type* has been used to represent infrastructure elements.

The procedure integration is given. Information about business applications, organizational units and infrastructure elements already entered for other scenarios can be reused.

Rating: 3 points for infrastructure management.

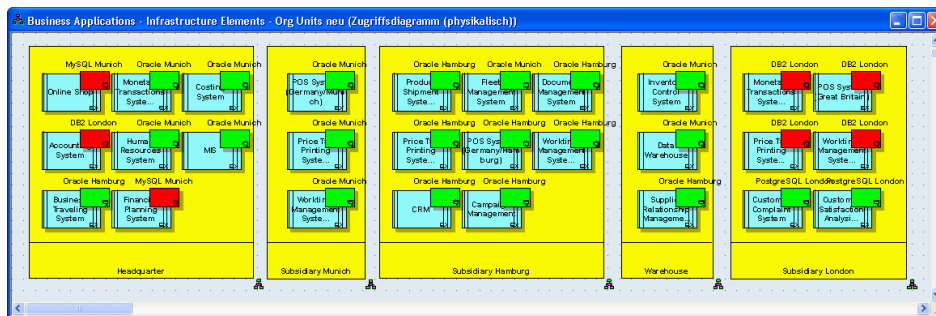


Figure 8.31: ARIS Platform: cluster map visualizing, which business elements are hosted at which location and use which database for scenario infrastructure management

	eatsDatabaseInformation	
--	-------------------------	--

ARIS Report

Server: atmatthes10a
 Datenbank: EATS Tool Survey
 Benutzer: eats

Identifizierer	Name	License Cost	Operating Cost	Sum
200	Oracle Munich	10000	20000	30000
600	PostgreSQL London	0	3000	3000
300	Oracle Hamburg	5000	20000	25000
400	Oracle Garching	10000	40000	50000
100	MySQL Munich	0	40000	40000
500	DB2 London	5000	3000	8000
				156000

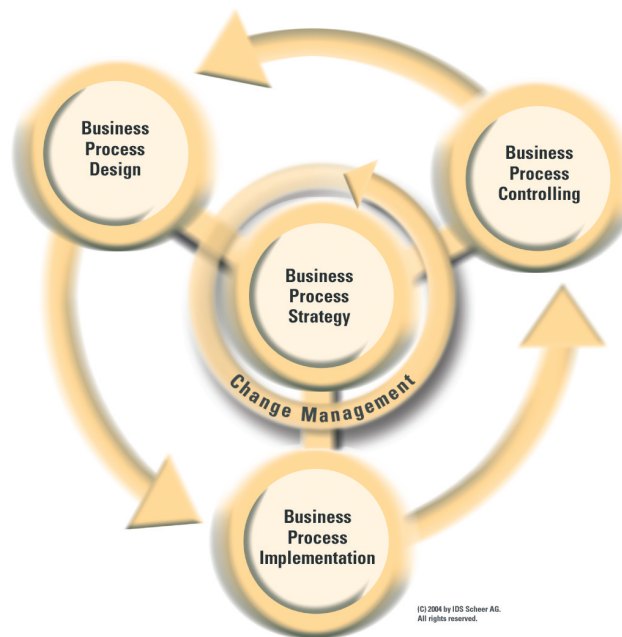
Figure 8.32: ARIS Platform: tabular report showing costs of the databases which are in use for scenario infrastructure management

8.3 Tool Vendor's Profile

Business Process Excellence

IDS Scheer AG

IDS Scheer stands for Business Process Excellence. This is our promise of service, and it relates to our dealings with every customer, from the moment we become involved.



The Process Life Cycle - continuous optimization

It's the result that counts

Business - We make our customers more successful in their lines of business. We view the success of a project in terms of a measurable increase in productivity and profitability. This is how we provide our customers with that critical edge on their competitors.

Process - The analysis of your business processes provides information about your current needs and our core competence: efficient and effective process management. For continuous optimization, IDS Scheer provides world leading tools and proven methods.

Excellence - Our aim, our minimum requirement, and our promise to you - is excellence. From its beginning, IDS Scheer has achieved a significant lead in expertise by combining technical research and practical experience, and an unfailing commitment to business management and IT-supported methods. Many years of experience have enabled us to develop specialized methodologies and skills, which are reflected in every aspect of our services and products.

Around the world, 4,000 large and leading companies rely on IDS Scheer. Over 90% of the DAX-30 companies are IDS Scheer customers. In over 50 countries employees are working together towards a single, shared objective: **Business Process Excellence**.

Quality and substance make all the difference

World market leader for Business Process Management

We have implemented the results of our research and development in software solutions that enable our customers to independently design and improve their own processes. The ARIS Platform offers those tools for the entire business process management life cycle that companies need for their continuous improvement strategy: in 2003 analysts at Gartner Group once again described IDS Scheer as worldwide market leader and visionary in the field of software for business process management.

ARIS Design Platform

ARIS Design Platform includes products that support the alignment of corporate processes with the requirements and needs of the market. It enables design, analysis and optimization of business processes to be incorporated in the continuous improvement loop. ARIS Web Designer and ARIS Toolset ensure successful implementation.

ARIS Implementation Platform

With the ARIS P2A initiative the ARIS Platform enables the seamless implementation of business logic in executable applications. ARIS for mySAP NetWeaver supports the introduction of SAP NetWeaver and mySAP solutions. For software engineering projects, ARIS UML Designer combines technological and technical content in a single tool. This saves time and reflects more closely the requirements of the technical departments.

ARIS Controlling Platform

The performance capabilities and actual costs of the processes implemented in IT systems are made measurable by the ARIS Controlling Platform. The ARIS Process Performance Manager makes running business processes transparent by analyzing events running in IT systems. ARIS Process Cost Analyzer creates transparency of costs for process planning and controlling. In order to comply with requirements arising from legislation such as the Sarbanes-Oxley Act, companies must implement internal control systems. The ARIS SOx Audit Manager is an operative workflow system that supports the required test, control and documentation process.

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www.ids-scheer.com

MEGA International SA (MEGA)

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MEGA International SA provides the EA management tool *MEGA*. In the following sections the evaluation sketched in section 2.2.6 is described in detail. *MEGA* provides modeling solutions (methodology, techniques, consulting and tools) for business process analysis and enterprise architecture. The evaluated version of *MEGA* is version 6.1 service pack 3.

9.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

9.1.1 Configurability of the Metamodel

Configurability of the metamodel is one of *MEGA*'s biggest strengths. According to MEGA International, *MEGA* is based on a MOF compliant repository and provides the possibility to completely adapted the metamodel. Everything within the metamodel is an object, even attributes, relationships and diagrams.¹ So a once created meta attribute can be used by multiple meta entities. The relationship between the attribute and the entity has to be created by *connecting* the attribute to the entity. For this reason it is possible to add, delete and edit meta entities, meta attributes and meta association according to own needs. Even the multiplicities *, 0..*, 1 and 1..* are supported.

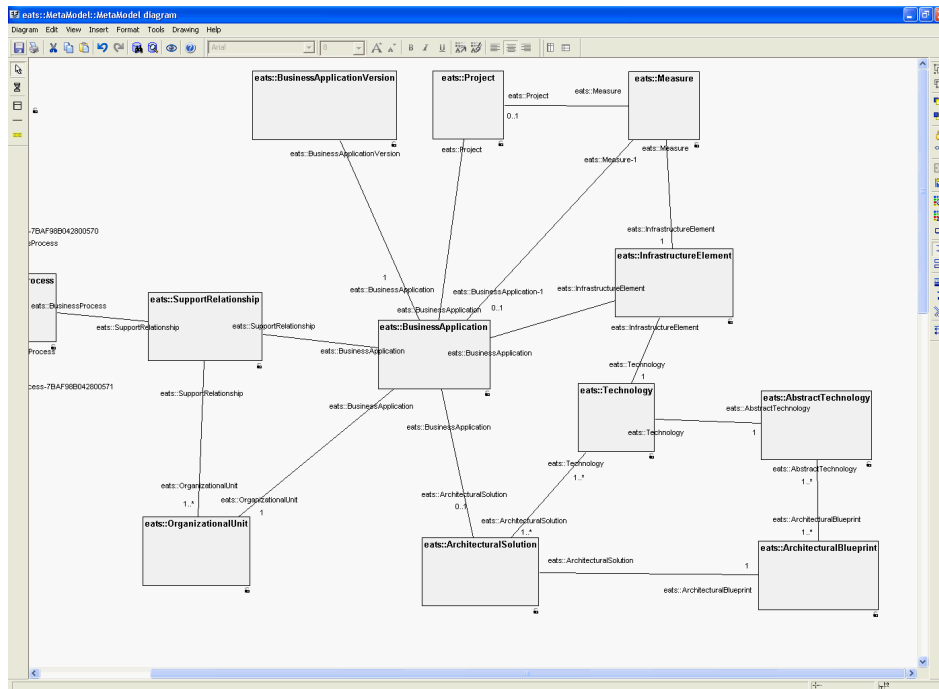


Figure 9.1: *MEGA*: Metamodel adaptations can be done via a graphical user interface

Creating new entities and establishing relationships can be done via a graphical user interface shown in figure 9.1 which is intuitive and easy to use. Other changes, like connecting an attribute can be done using the *MEGA Explorer* (see figure 9.2). Additionally it is possible to use the meta-class editor,

¹Meta objects correspond to entity types, meta attributes to attribute types and meta associations to association types.

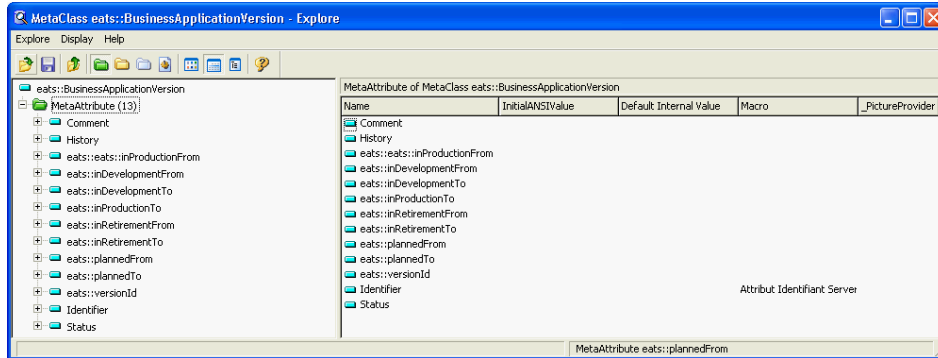


Figure 9.2: MEGA: Explorer showing the newly created meta entity *eats::BusinessApplicationVersion*

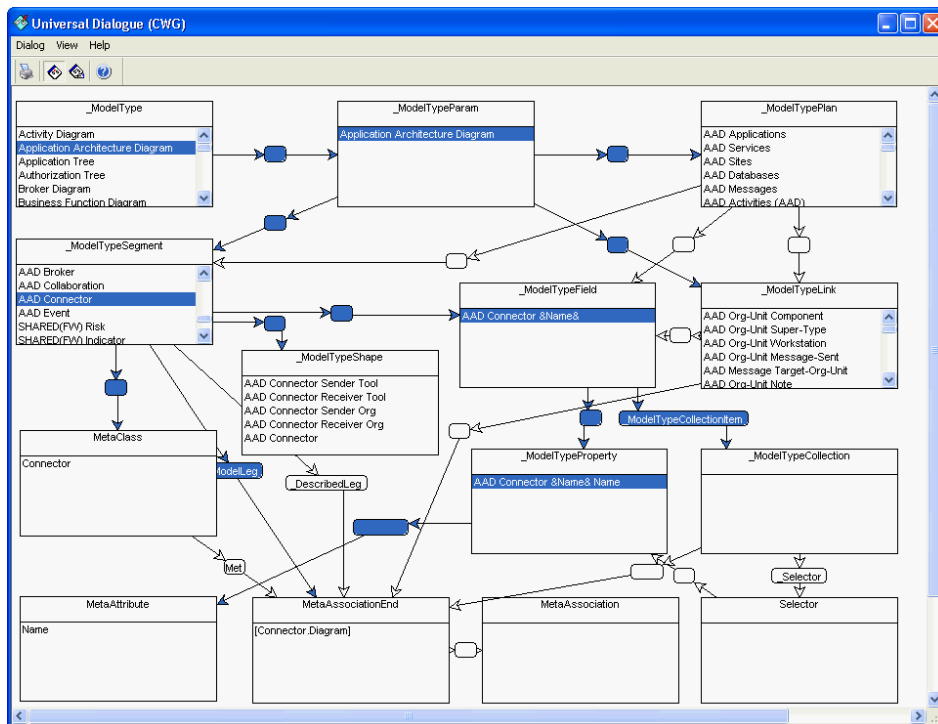


Figure 9.3: MEGA: dialog utilized for editing the diagram type *Application Architecture Diagram*

which is available via a right click on a newly created meta-class allowing to create new meta-attributes for that specific meta-class, in the corresponding meta-attribute tab.

Associations between entities consist of three objects, two meta association ends and one meta association. As already mentioned, diagrams are as well modeled as objects within the *MEGA* repository. To be able to use objects which have been created during the metamodel extension within a diagram, they have to be connected to each other. There are two ways for accomplishing this task, the so called *Dialog* (see figure 9.3) and the *Explorer* (see figure 9.2). Both are very powerful, but even with help of the available documentation this kind of metamodel adaption is a quite challenging task, which is usually done by MEGAs consultants.

Some example Dialogs are shipped with *MEGA*. New ones can be completely customized, e.g. integrating some documentation realized as additional labels to reduce the complexity. According to MEGA International dialogs represent the *old* way to work with *MEGA*.

All modifications that can be done with the Dialogs can also be done utilizing the Explorer, for example it is possible to connect different entities within the metamodel. According to MEGA International this way of working with *MEGA* will become the preferred way for the next versions of *MEGA*.

Rating: 5 points for configurability of the metamodel.

9.1.2 Coverage of EA Management Concepts by Predefined Metamodel

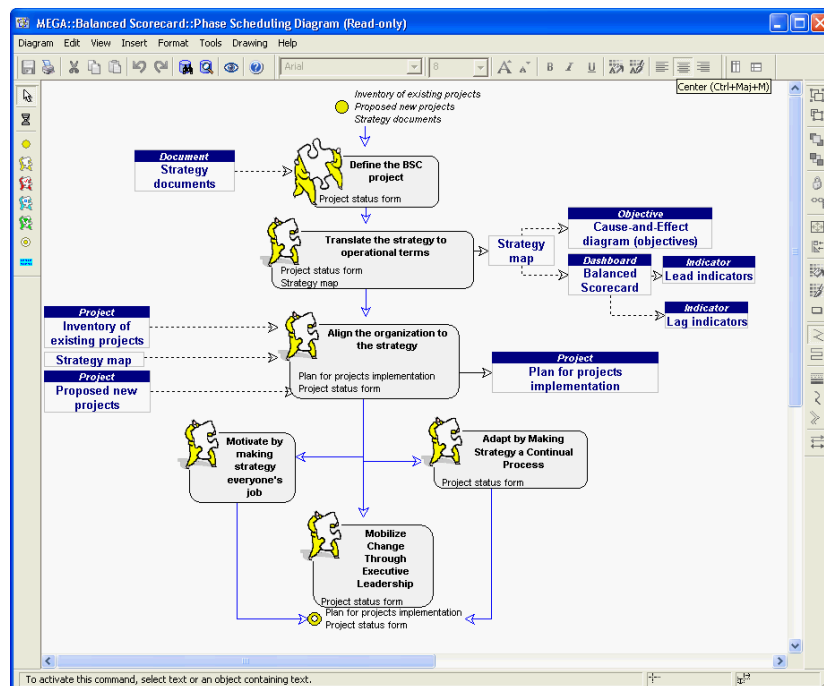


Figure 9.4: *MEGA*: diagram visualizing the procedure for a methodology

MEGA ships with a very large metamodel of 212 entity types, which is sufficient to accomplish most EA management tasks. According to MEGA International standard frameworks like Zachmann [ZIF05], TOGAF [TOG05] or ITIL [OGCO00] are directly supported by their metamodel which is based on a MOF compliant repository. *MEGA* relies on a metamodel and on modeling guidelines (see figure 9.4)

that optimize the use of this metamodel during EA management. However, *MEGA* customers can also develop their own methodology, by adapting the metamodel to customers' needs (see section 9.1.1) as well as the related guidelines².

The shipped metamodel is sufficient to completely simulate the scenarios *landscape management* (see section 9.2.1), *project portfolio management* (see section 9.2.2) and *traceability and strategy management* (see section 9.2.4). Other scenarios, e.g. *synchronization management* (see section 9.2.3), *management of business objects and business services* (see section 9.2.5), etc. can be simulated with minor deduction, as some concepts like execution time of a project or business objects are not part of the standard metamodel. This drawback may be removed by adapting the metamodel to completely fit to customers needs.

Rating: 4 points for coverage of EA management concepts of the metamodel.

9.1.3 Support for Impact Analyses & Calculation

MEGA supports different ways to perform impact analysis. First of all it is possible to use the properties dialog which is available for every object within the repository. This dialog offers the possibility to visualize the interconnections of the object to other objects (see figure 9.5). An equivalent dialog may also be opened utilizing an element within the shown tree. Using this approach it is possible to navigate all available relationships by hand but without the ability to perform calculations.

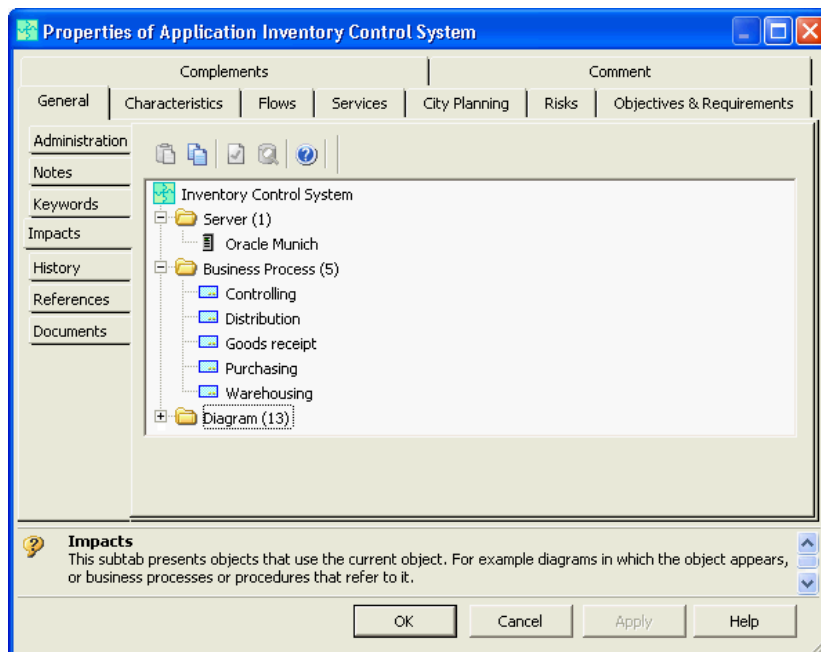


Figure 9.5: *MEGA*: properties of application *Inventory Control System*

The second way is to use the integrated query engine which comes in two different representations, a graphical user interface (see figure 9.6) and a text based query builder (see figure 9.7). Both provide the possibility to select objects by attribute values and to join objects considering the available

²According to *MEGA*, *MEGA 2005* includes an extended method guideline, supporting the customer to perform EA management.

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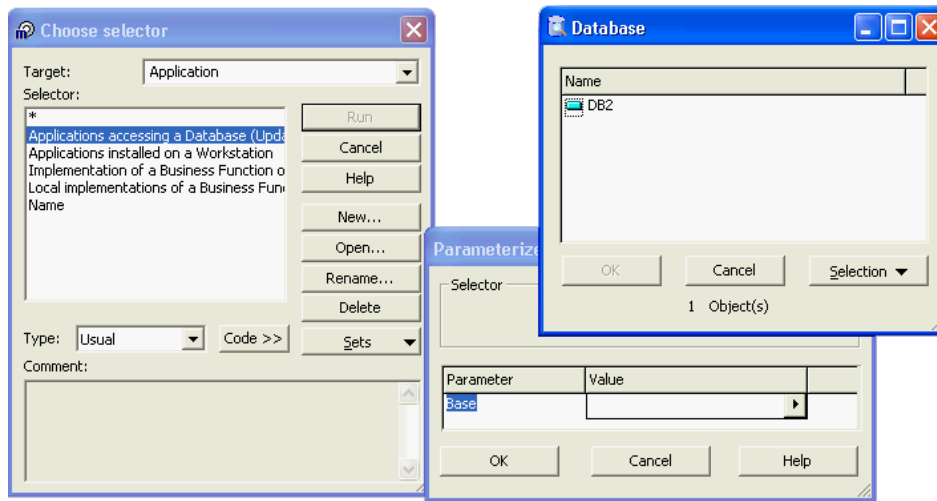


Figure 9.6: *MEGA*: query builder based on a graphical user interface

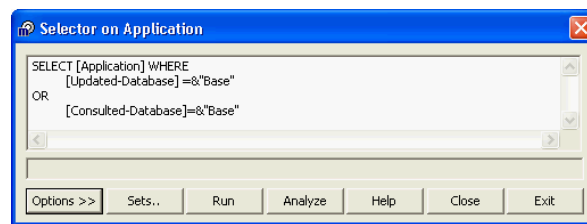


Figure 9.7: *MEGA*: text based query builder

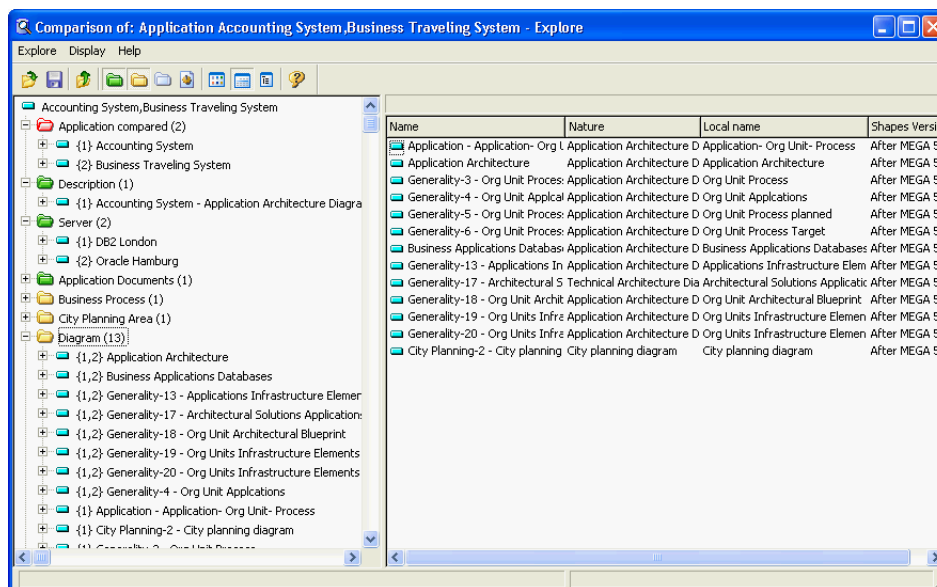


Figure 9.8: *MEGA*: result of comparing the business application systems *accounting system* and *business traveling system*

(Application / Diagram)	Org Unit Process	Org Unit Process planned	Org Unit Process Target
Application Input-Output			
Application-1			
Business Traveling System			
Campaign Management System	X	X	X
Costing System	X	X	X
Customer Complaint System	X	X	X
Customer Relationship Management System (CRM)	X	X	X
Customer Satisfaction Analysis System			
Data Warehouse	X	X	X

Figure 9.9: *MEGA*: *matrix dialog* for visualizing and editing relationships between objects

relationships according to the underlying metamodel. Additionally it is possible to switch between the two different query interfaces and save the created query for later use. Sorting or calculations, like *count*, *sum*, etc. are not supported by the query language. The restriction of not being able to sort query results is of minor importance, as those results are displayed in an own dialog which offers the possibility to sort elements by clicking the column headers.

MEGA offers the functionality of comparing multiple objects (see figure 9.8), e.g. based on query results. This can be used to determine differences in relationships to other objects like business applications or occurrences in diagrams.

Relationships between objects can be managed with a special matrix dialog (see figure 9.9). Using different wizards, it is possible to completely customize which objects are shown on the axes and which relationships are shown between the objects. These relationships can even be created and deleted using the matrix within the dialog. Additionally it is possible to export the matrix to Microsoft Excel.

According to *MEGA* it is possible to utilize *MEGA Exchange* for extended reporting and calculation capabilities. These capabilities are based on Microsoft Excel.

The most powerful way to perform impact analysis and calculations is to use the integrated Microsoft Visual Basic for Applications engine or the *MEGA* API for Microsoft Visual Basic. This offers the possibility to access all objects within the *MEGA* repository. Thus it is possible to search for objects, perform calculations and create, edit, and delete them. Additionally it is possible to create or manipulate diagrams³ or other external documents like Microsoft PowerPoint files, assumed that the application creating these files offers an API which can be accessed by Microsoft Visual Basic for Applications or Microsoft Visual Basic.

Rating: 3 points for support of impact analyses & calculation.

³As already mentioned in section 9.1.1 all other elements within the *MEGA* repository are represented by objects.

9.1.4 Richness of Predefined Visualization Techniques

Predefined visualization techniques are as flexible as the underlying repository, because the presentation, e.g. which objects and relationships may be used within a diagram can be changed by adapting the metamodel. Those elements are assigned to layers which may be shown/hidden separately to reduce complexity in visualizations (see figure 9.10).

MEGA ships with its own shape editor for customizing symbols representing objects of the metamodel (see figure 9.11). This editor also may be used to define which attributes will be shown in a visualization by defining *placeholders*. One object within the metamodel may be represented by multiple shapes, selectable by the user. This detachment offers the possibility to use special symbols for different applications. It is even possible to automatically change the visualization according to attribute values of the object. Those features require changes to the metamodel which should be performed by specially trained administrators or by *MEGA* International consultants.

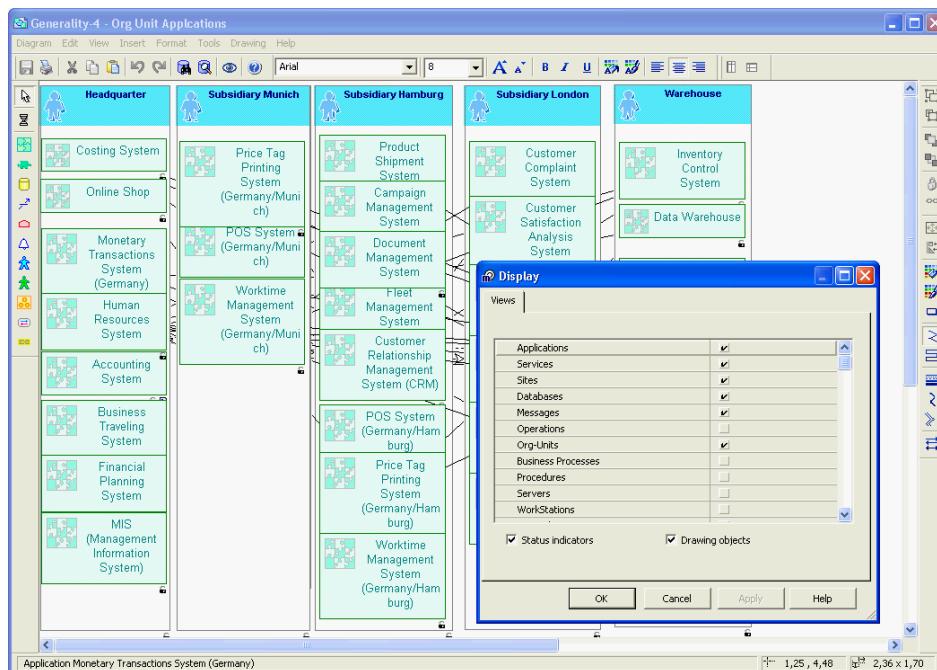


Figure 9.10: *MEGA*: objects can be organized in views, which correspond to layers and may be shown/hidden separately

As all diagrams are page based (see figure 9.12 and figure 9.13) the visualizations may be printed easily. This approach also influences the way zooming is integrated into *MEGA*. It is possible to zoom according to page borders or to use a special zoom dialog shown in figure 9.13.

The *MEGA* standard installation ships with different diagram types which differ by the objects that may be used on them. Those elements may then be freely placed within the diagrams, offering the possibility to create visualizations corresponding to a *Cluster Map* (see figure 9.14), a *Process Support Map* (see figure 9.25 in section 9.2.1) or an *Interval Map* by manually positioning the elements of the visualization. Additionally *MEGA* offers integrated support for *aligning*, *spacing* and *sizing* of elements within a diagram. Some diagram types, e.g. flowcharts, business process diagrams, etc. do also support *swimlanes* for aligning and positioning elements. Creation of visualization like the ones mentioned earlier could also be automated by using the integrated scripting engine.

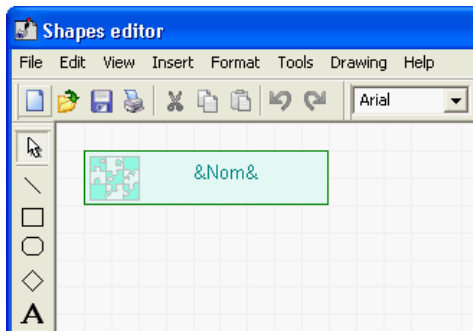


Figure 9.11: *MEGA*: shapes editor for creating and editing shapes

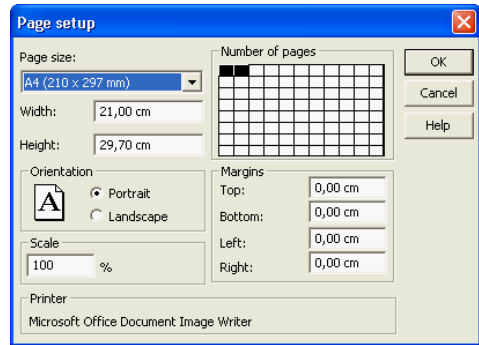


Figure 9.12: *MEGA*: page setup dialog for a diagram

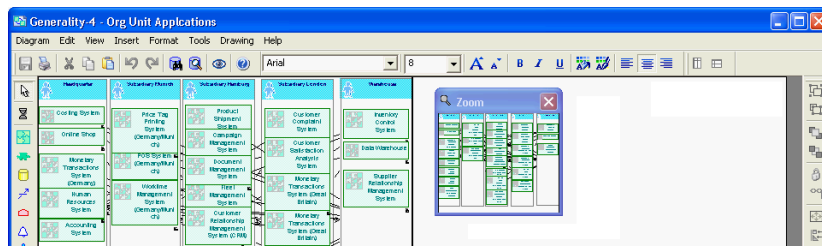


Figure 9.13: *MEGA*: zooming diagrams is page based or done by using a special zoom dialog

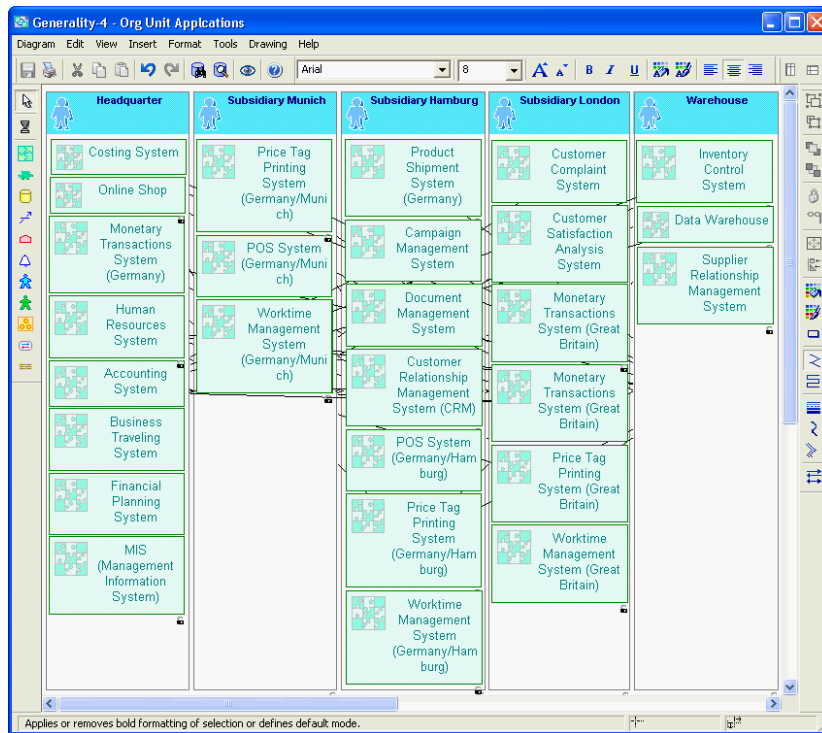


Figure 9.14: *MEGA*: Cluster Map created with *MEGA*

MEGA visualizations offer a special functionality. If a shape is placed within the boundaries of another shape a relationship is created. Both symbols act like they have been grouped together⁴. This kind of grouping may create a semantic relationship in some diagrams, for example in IT city planning diagrams: *IT city planning area contains an application*.

Rating: 3 points for richness of predefined visualization techniques.

9.1.5 Flexibility of Visualization Techniques

In addition to the predefined visualization techniques *MEGA* offers flexibility regarding its visualizations. For example basic layouting is a directly integrated feature (see figure 9.15). The following four layouts are available:

- barycentric
- orthogonal
- hierarchical vertical
- hierarchical horizontal

It is also possible to manually change and save a visualization. Additionally shapes can automatically be changed according to attribute values. This is possible as this functionality is an integrated part of the metamodel and objects are separated from their graphical representation. Objects can be mapped to different views which may be hidden or shown to reduce complexity in visualizations (see section 9.1.4).

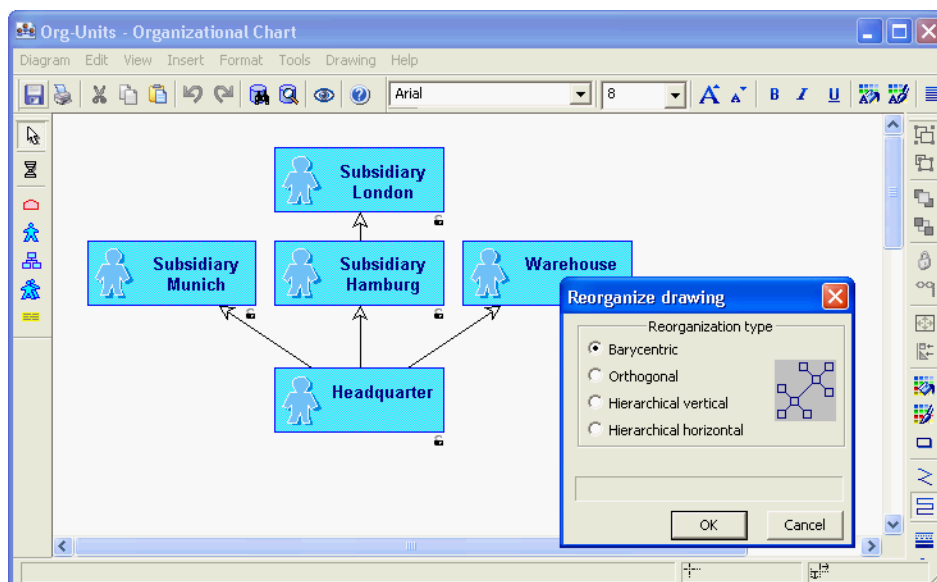


Figure 9.15: *MEGA*: diagrams support basic automatic layouting

The most advanced feature concerning the flexibility of visualizations is the integrated Microsoft Visual Basic for Applications scripting engine and the possibility to access all objects within the repository

⁴The grouping of symbols may be used to create *Cluster Maps* (see appendix A.1.1).

through the Microsoft Visual Basic API (see section 9.1.3). This offers the possibility to completely automatic generation and manipulation of visualizations.

Rating: 4 points for flexibility of visualization techniques.

9.1.6 Flexibility of Reporting

MEGA ships with 31 predefined report templates, which are based on the shipped metamodel. Additionally there is the possibility to create customer defined reports via a tree view (see figure 9.16), utilizing the *report template editor*. This can be used to define which objects the report can be used for, together with the attributes and diagrams that should be shown. All instances of *meta objects* (see section 9.1.1), e.g. accounting system, an organizational chart, etc. can be used as base objects for the report. All reports are in Microsoft Word format and are based on Microsoft Word templates which offers the possibility to customize the appearance of the reports according to customer needs.

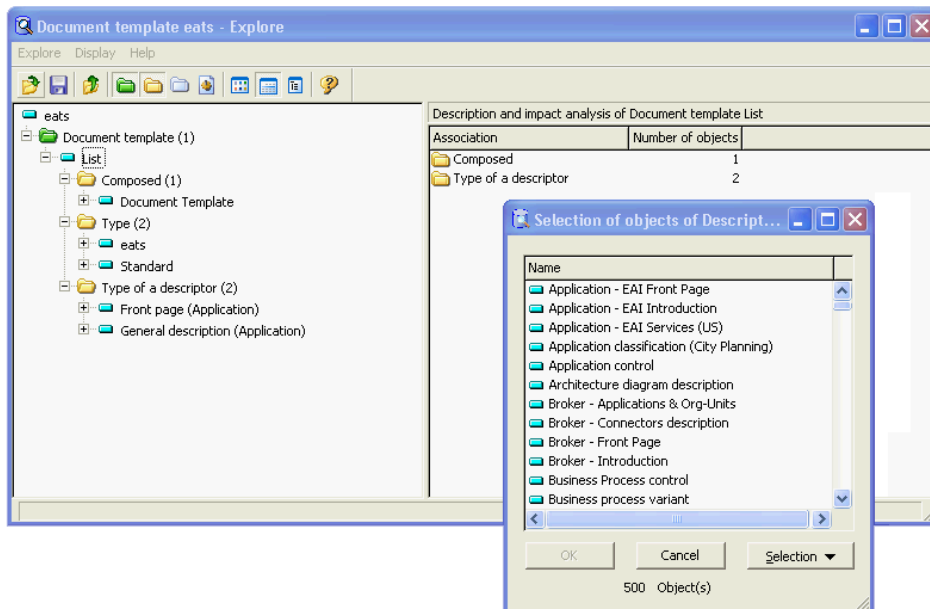


Figure 9.16: *MEGA*: reports can be customized by the user utilizing a tree structure

There are two ways for creating a report. The first one is to use the standard graphical user interface (see figure 9.17) by right clicking on an object within the tree view. The second one is to use the properties dialog (see figure 9.18), which is available for all objects within the *MEGA* repository. A list of already created reports can be found here. There is also the possibility to open and create new reports according to the object type of the selected object.

Reports may be saved within the repository or a folder which may be selected during the report creation. Already created reports are not decoupled from the repository and may be updated using a macro which is integrated into the Microsoft Word report.

MEGA also offers export capabilities for Microsoft Excel documents. They can be achieved by using the matrix dialog (see figure 9.9 in section 9.1.3), which offers the possibility to export the matrix to Microsoft Excel.

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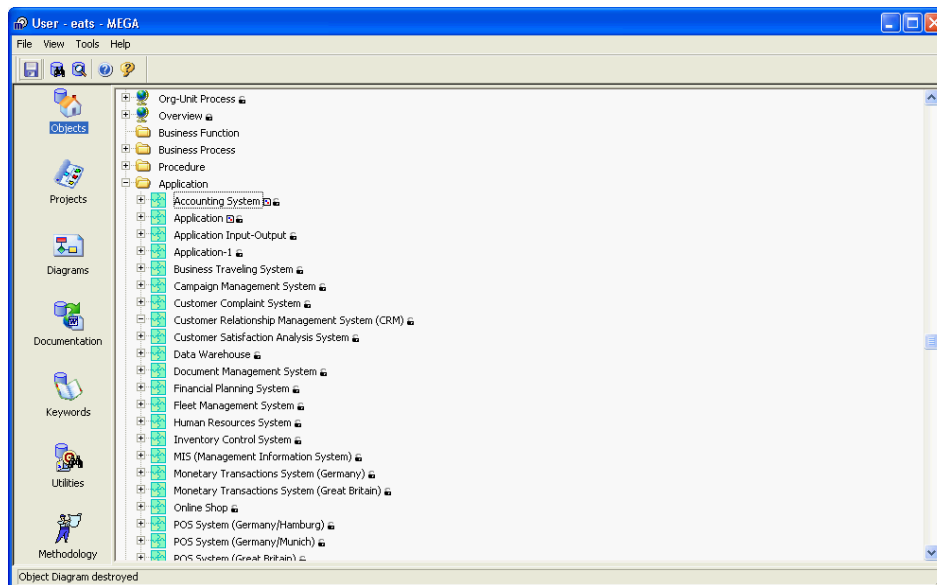


Figure 9.17: *MEGA*: graphical user interface of *MEGA*

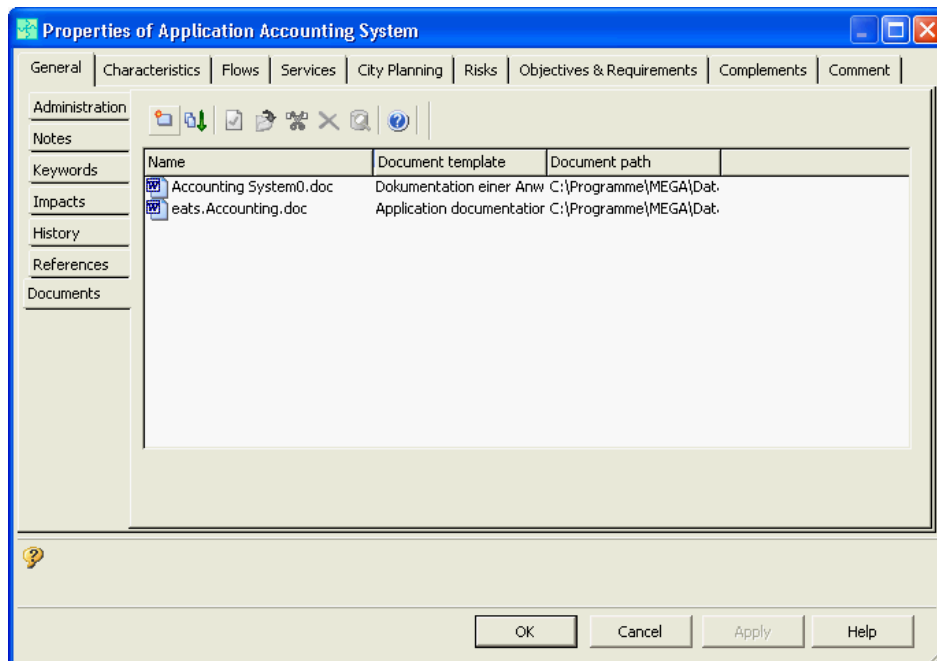


Figure 9.18: *MEGA*: already created reports of an object are listed within the properties dialog

Additionally all reports can also be created programatically utilizing the integrated scripting engine or the Microsoft Visual Basic API offering complete access to the *MEGA* repository and customization of the report.

Rating: 3 points for flexibility of reporting.

9.1.7 Collaboration Support

MEGA consists of a fat client (see figure 9.17) which ships as a Microsoft Windows application and may also be used via a terminal server like Microsoft Terminal Server or Citrix Access Plattform. Additionally it is possible to create web sites based on templates using a wizard (see figure 9.19).

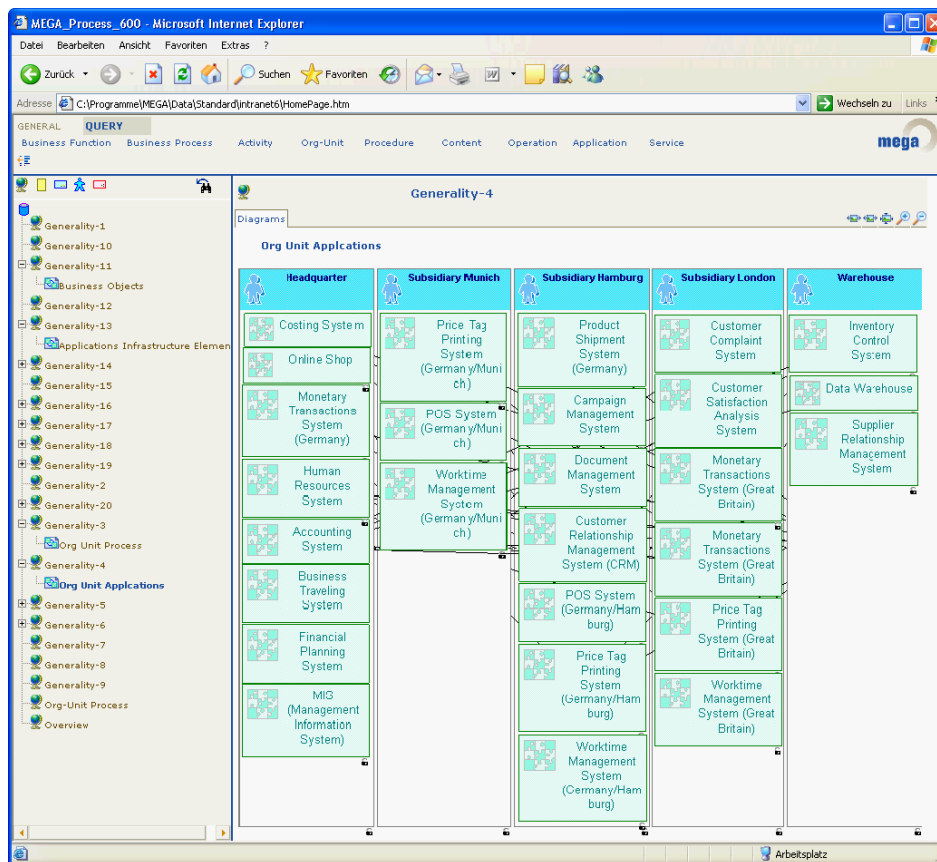


Figure 9.19: *MEGA*: web site created created utilizing the shipped wizard

Such web sites consist of static HTML pages created by batch processing and may be used as a HTML based viewer client. Navigation between pages is realized using hyperlinks and JavaScript. Diagrams may be exported as bitmap, JPG, PNG or SVG file.

In order to support offline working *MEGA* offers the possibility to use a local copy of the repository with full editing capabilities. All performed changes may afterwards be synchronized with the main repository. Concurrent use of one repository is possible as *MEGA* supports three different locking mechanisms based on objects of the repository⁵. *Lock mode*: Only one user may edit an object, others

⁵As all elements within the *MEGA* repository are represented by an object, locks may be placed on entities,

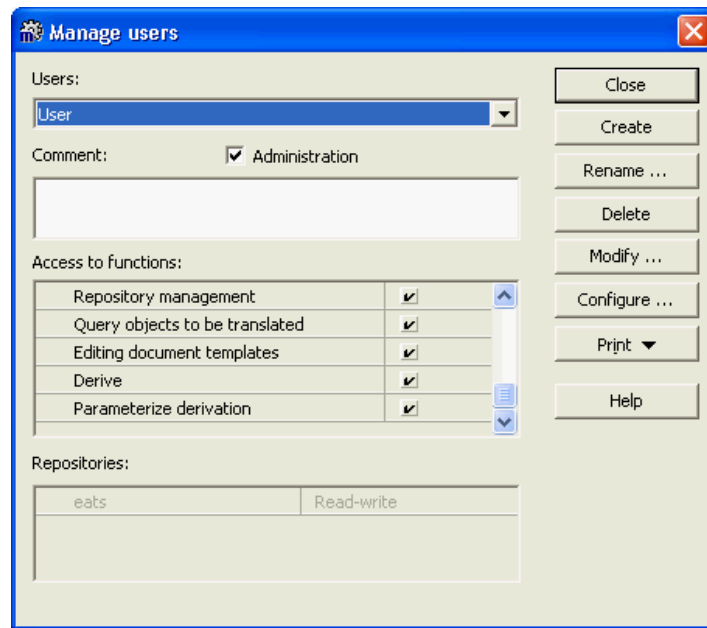


Figure 9.20: MEGA: configuring rights for a user

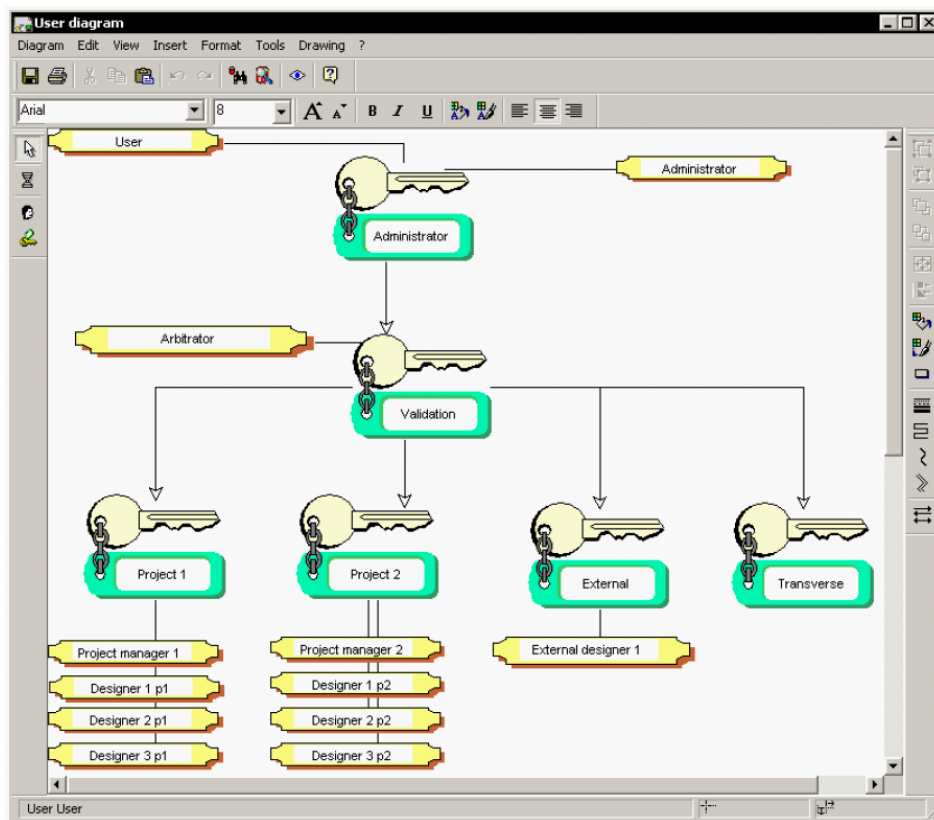


Figure 9.21: MEGA: user diagram for configuring user rights

may only view it. *Preventive mode*: Multiple users may edit an object concurrently, a message will be shown to additional users trying to access the object. *Disabled mode*: concurrent access is not controlled, all modifications are processed sequentially as they are dispatched.

Rights can be granted to groups and roles. Running *MEGA* using the *Supervisor option*⁶ enables working with an advanced user and rights configuration based on diagrams (see figure 9.21). Rights may be granted on different functionalities (see figure 9.20), e.g. user management, repository management, etc. and on the repository⁷.

Rating: 4 points for collaboration support.

9.1.8 Import/Export & External Data Sources

Concerning importing and exporting of data using *MEGA* two strategies have to be distinguished. One way is utilizing the *MEGA* API by programming, for example utilizing a Microsoft Excel macro (see figure 9.22), which offers the possibility for creating completely customized extensions to *MEGA* and complete access to the repository but requires a certain amount of programming as standard installations do not ship with such a macro⁸. Such a Microsoft Excel integration additionally offers the possibility to edit data with an external application, as all objects are identified by a unified identifier which may also be exported, for example to edit a big amount of data. The same approach could also be used for integrating external data sources like other repositories.

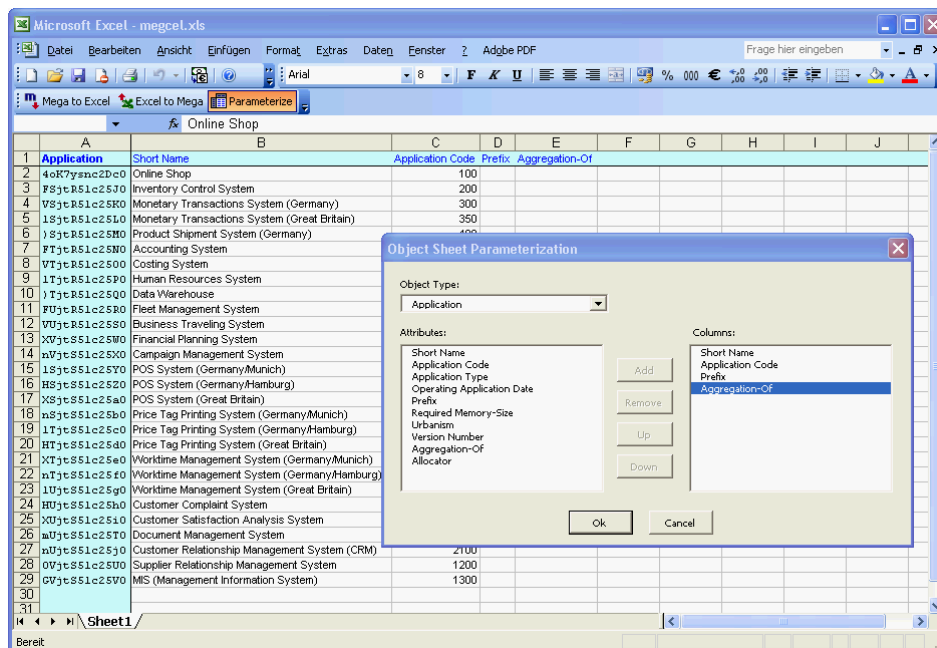


Figure 9.22: *MEGA*: importing and exporting of objects using a Microsoft Excel macro

as well as on diagrams.

⁶The *MEGA* Supervisor option offers advanced functions such as authorizations management, query for isolated objects and the comparison of objects in two repositories.

⁷The rights read/write, read only and access denied can be granted on every repository.

⁸According to *MEGA*, *MEGA 2005* includes Microsoft Excel import/export functionality as a standard feature.

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The second way is to use a proprietary *MEGA* file format called MGR. This format may also be used for exchanging data between repositories or for backing up a repository. Additionally it is possible to import and export UML models as IBM Rational Rose or XMI files. The matrix dialog (see figure 9.9 in section 9.1.3) also offers exporting capabilities, as the customer may export the visualized matrix to Microsoft Excel.

Rating: 3 points for import/export & external data sources.

9.1.9 Usability

MEGA offers a graphical user interface which is easy to use and based on Microsoft Windows standards (see figure 9.17 in section 9.1.6). Menues and dialogs are intuitive and well structured. Property dialogs may even be adapted by performing changes to the metamodel. Additionally, the graphical user interface and the repository are able to cope with multiple languages. Changing the language is possible at runtime using a simple menu. Navigation is usually performed utilizing an explorer like dialog (see figure 9.23) or by the integrated search engine (see figure 9.6 in section 9.1.3). Using the standard interface (see figure 9.17 in section 9.1.6) restricts the access to root objects⁹.

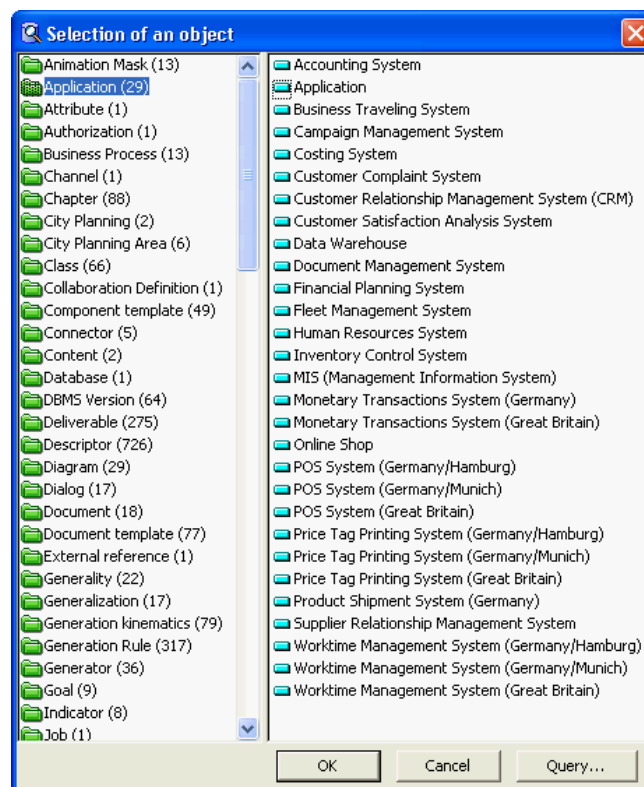


Figure 9.23: *MEGA*: *MEGA* Explorer for managing objects within the repository

Parts of the metamodel adaption are an easy task using *MEGA* as a customer specific metamodel can be created by using a diagram like in a UML modeling tool. Difficulties arise if the new objects of the metamodel should be connected to diagrams in order to be able to use them for modeling (see

⁹Root objects within *MEGA* are basic entities of the metamodel, e.g. application, business process, organizational unit, etc.

figure 9.1 in section 9.1.1). As this task is usually performed by trained administrators or *MEGA* consultants this drawback is of minor importance.

For supporting customers *MEGA* ships with a comprehensive Microsoft Windows help file. Additionally there are also technical articles and product manuals available which focus on special interests like *shapes programming*, *MEGA administration*, diagram configuration, etc.

MEGA features some additional concepts and functionalities. For example it is possible to query for untranslated objects within the repository and the concept of layers is available for reducing complexity of visualizations (see section 9.1.4).

Rating: 3 points for usability.

9.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

9.2.1 Landscape Management

MEGA supports the basic concept of landscape management. Diagrams representing different versions¹⁰ of the application landscape can be created, but there is no direct relationship between them, which could be used for comparison. This may be compensated by using a functionality which offers the possibility to compare diagrams (see figure 9.24). One result of this comparison is a visualization showing which application systems are part of which version of the application landscape.

Association	Number of objects
Diagram compared	2
Business Process	10
Org-Unit	5
Application	23

Figure 9.24: *MEGA*: comparison of two diagrams for scenario landscape management

¹⁰Versions in this context means current, planned, and target landscapes.

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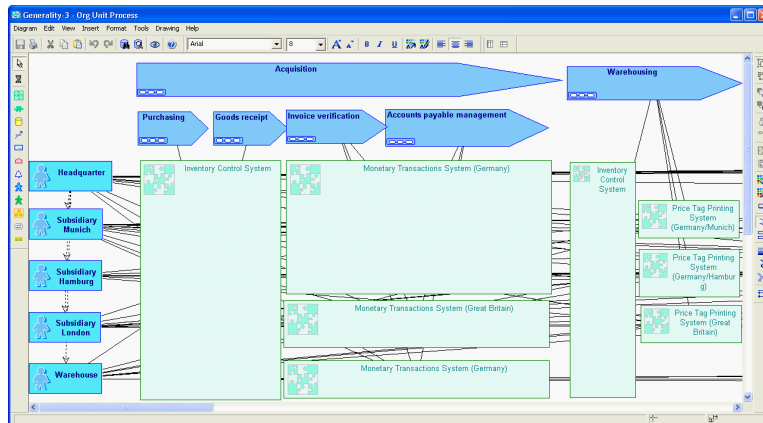


Figure 9.25: *MEGA*: the current application landscape visualized as a process support map for scenario landscape management

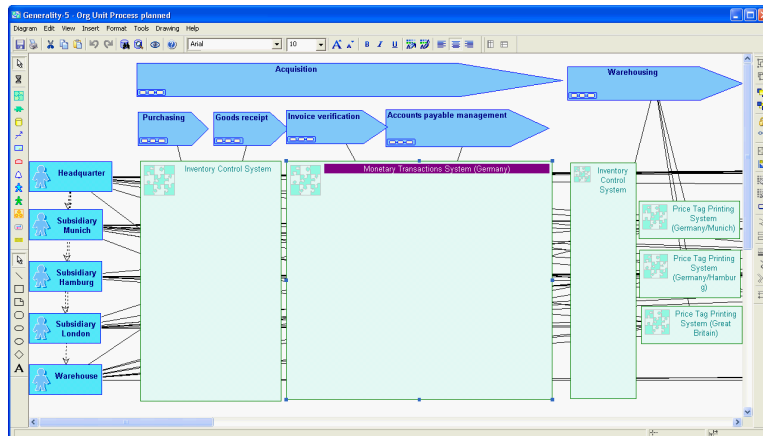


Figure 9.26: *MEGA*: the planned application landscape visualized as a process support map for scenario landscape management

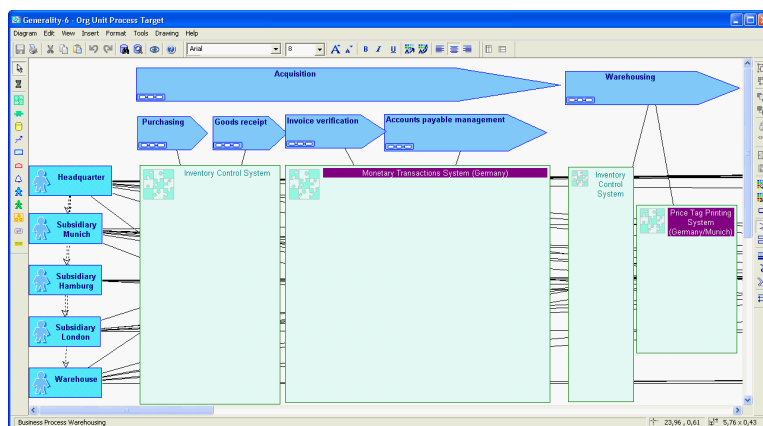


Figure 9.27: *MEGA*: the target application landscape visualized as a process support map for scenario landscape management

The elements of the visualization can be manually positioned and colored¹¹ to create process support maps representing a current (see figure 9.25), a planned (see figure 9.26), and a target landscape (see figure 9.27).

A tabular report visualizing, which applications are part of which version of the landscape, can be created using the matrix dialog (see figure 9.9 in section 9.1.3). The matrix can afterwards be exported to Microsoft Excel.

Adapting the metamodel results in a more advanced implementation of the concept of landscape management, as a time of validity of applications may be introduced. This extension combined with automatic diagram generation using the integrated scripting engine enables the user to create snapshots of the application landscape for a point in time.

The tool handling for this scenario is adequate. Different versions of the application landscape can be created and compared to each other using a special dialog.

The achievement of objectives is given. All visualizations can be created by drawing or by using scripting. The tabular report can be created using the matrix dialog.

The procedure consistency is partially given. All information concerning current, planned and target landscapes, together with the projects influencing them can be entered, but there is no direct relationship between the different versions of the application landscape.

The procedure integration is given. Information about business applications, organizational units, business processes, and projects can be reused.

Rating: 3 points for landscape management.

9.2.2 Project Portfolio Management

Projects are an integrated part of *MEGA*. Performing minor metamodel adaptations, e.g. adding attributes for execution period, criticality, costs, etc. would result in the ability to almost completely simulate this scenario with automated functions. Only the creation of a portfolio matrix would require programming or manual positioning of elements within a diagram.

Figure 9.28 shows an extract of a *process support map* showing which projects have an impact on which business application systems at which organizational units supporting which business processes. Elements like business applications already entered in the repository can be reused but have to be manually positioned, as well as the numbers indicating the *identifier* of projects. Using the integrated scripting engine the visualization could also be generated automatically.

Impacts of the projects can also be visualized tabularly utilizing the matrix dialog and may be exported to Microsoft Excel. After performing the metamodel adaptation described it is also possible to create reports displaying costs or execution periods.

Objects representing projects in the shipped metamodel do not include an attribute for managing the status, like approved, rejected, etc. Extending the metamodel can resolve this drawback.

The tool handling for this scenario is intuitive as projects are an integrated concept of *MEGA*. This could be extended by adding additional attributes to projects which would offer the possibility to simulate the whole scenario.

The achievement of objectives is given. The process support maps demanded (see figure 9.28) are created by manual positioning objects and indicators. A matrix visualizing the impact of projects to organizational units may be created using the matrix dialog (see figure 9.29). The portfolio

¹¹Colors depict changes in the application landscape.

9. MEGA International SA (MEGA)

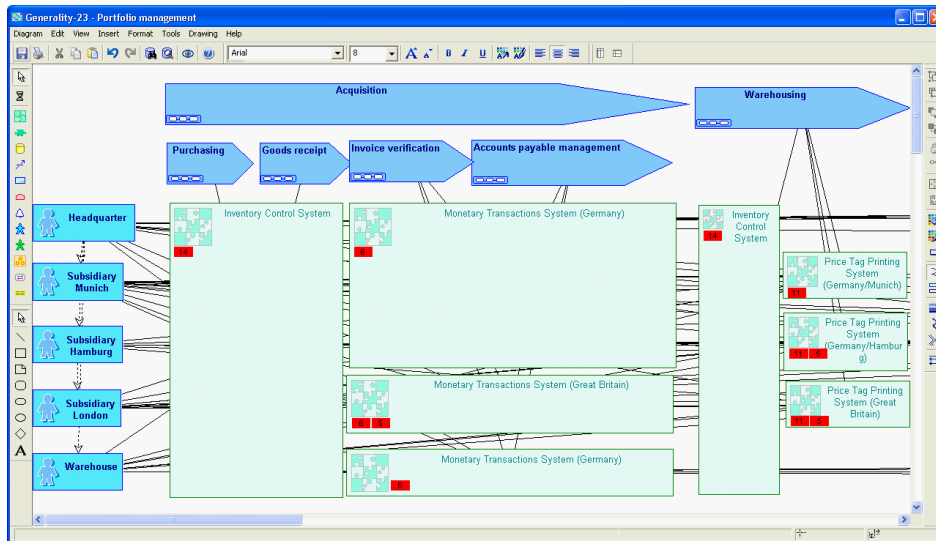


Figure 9.28: *MEGA*: process support map showing which projects have an impact on which business applications for scenario project portfolio management

(Project / Org-Unit)	Headquarter	Subsidiary Hamburg	Subsidiary London	Subsidiary Munich	Warehouse
Connection of Costing and Accounting System	X	X	X	X	X
Consolidation of Monetary Transaction Systems	X	X	X	X	X
Database Consolidation	X	X	X	X	X
Integration of an auctioning platform into the online shop	X				
Introduction of a Bonus Card for Customers	X	X	X	X	
Introduction of a new Management Information System	X				
Introduction of Knowledge Management	X				
Introduction of RFID in the Warehouse	X	X	X	X	X
Optimization of Monetary Transaction System	X	X	X	X	X
Reliability Improvement of the Online Shop	X				
Replacement of the Customer Satisfaction Analysis System by the Data Warehouse	X	X	X	X	
VAT change in accounting system	X				
VAT change in costing system	X	X	X	X	X
VAT change in online Shop	X				
VAT change in POS System		X	X	X	
VAT change in Price Tag Printing System		X	X	X	

L Project : testproject::Translate the strategy to operational terms

Figure 9.29: *MEGA*: matrix dialog showing which projects have an impact on which organizational unit for scenario project portfolio management

matrix cannot be created as needed attributes would have required a metamodel adaptation, automatic generation would require programmatical adaptation using the scripting engine.

The procedure consistency is basically given. Projects are part of the shipped metamodel. A minor drawback are missing attributes like execution time of projects which may be added by performing metamodel adaptations. Impacts of projects can be visualized using the matrix dialog (see figure 9.29).

The procedure integration is given. Objects which have already been entered, e.g. business applications can be reused for this scenario.

Rating: 3 points for project portfolio management.

9.2.3 Synchronization Management

Synchronization management is a task which has to be performed after the selection of projects has been executed, to be able to detect conflicts between projects. For simulating this scenario it is necessary to capture the start and end date of a project (see section 9.2.2). For that reason tasks like examining conflicts between projects may be performed after the metamodel has been adapted to support such a concept. Transitive impact analysis may be performed utilizing these extensions by using the integrated query engine or the integrated scripting engine.

According to MEGA, Microsoft Project is recommended to be used to manage temporal inter-project dependencies.

For visualizing dependencies of projects and organizational units the matrix dialog may be used (see figure 9.29 in section 9.2.2).

The tool handling for this scenario is adequate. Already when using the shipped metamodel *MEGA* supports managing of projects. Management of temporal dependencies between projects require an extension of the shipped metamodel.

The achievement of objectives is partially given. Impacts of projects to organizational units can be visualized using the matrix dialog (see figure 9.29 in section 9.2.2). Interval maps (e.g. see figure 3.25 in section 3.3.2) cannot be achieved.

The procedure consistency is basically given as management of projects is part of the shipped metamodel. Temporal dependencies require an extension of the metamodel.

The procedure integration is given. Information about projects already entered can be reused in the scenario. Managing projects is supported by a special methodology.

Rating: 2 points for synchronization management.

9.2.4 Traceability and Strategy Management

One way to manage strategies is the usage of balanced scorecards, which are supported by *MEGA* utilizing *objective and requirement diagrams* (see figure 9.30). Relationships between perspectives, objectives¹², indicators¹³, projects, and organizational units can be visualized utilizing these diagrams. Creating such diagrams and managing strategies is quite intuitive as a wizard is available offering a step by step instruction (see figure 9.31). Using *MEGA* it is possible to simulate different strategic hypothesis by providing calculation instructions to every indicator.

¹²Objectives have been used to map strategies and goals using *MEGA*.

¹³Indicators have been used to map metrics.

9. MEGA International SA (MEGA)

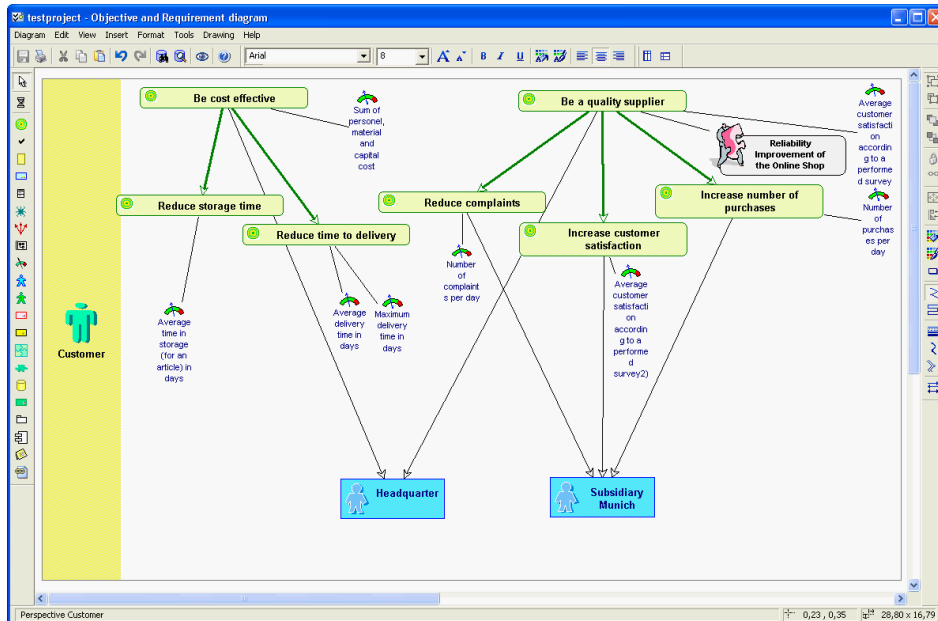


Figure 9.30: *MEGA*: balanced score card for the customer perspective using an objective and requirement diagram for scenario traceability and strategy management

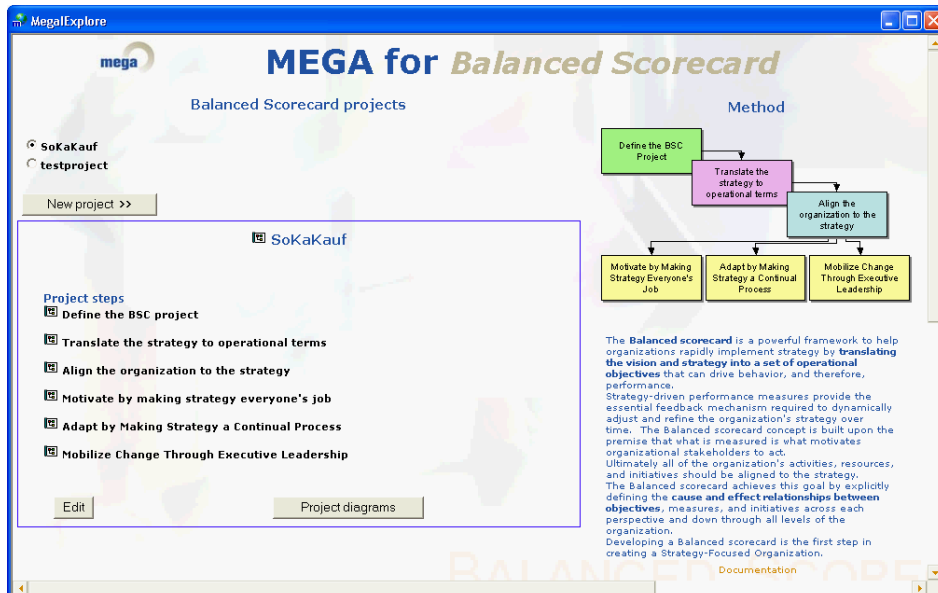


Figure 9.31: *MEGA*: wizard for defining a balanced score card project for scenario traceability and strategy management

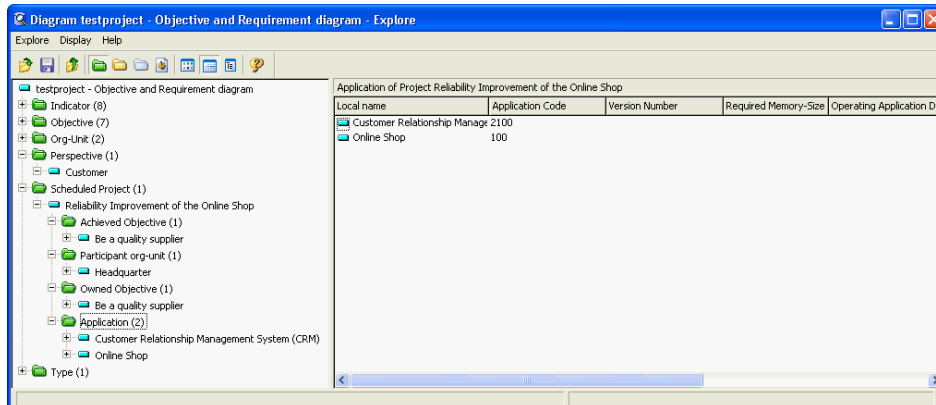


Figure 9.32: *MEGA*: traceability utilizing the *MEGA* explorer for scenario traceability and strategy management

Traceability is another important fact in EA management which may be reflected in *MEGA* utilizing different functionalities. One way is to use objective and requirement diagrams which already visualize the required information, except the relationship between a project and applications which may be found in the properties dialog of the project¹⁴. As adapting diagrams is also possible by extending the metamodel this minor drawback may be removed easily. Another way to warrant traceability is to use the *MEGA* explorer (see figure 9.32), offering the possibility to show all available relationships of an object, like e.g. a relationship to a strategy.

The tool handling for this scenario is intuitive. A wizard for guiding users creating balanced score cards is available. Needed relationships between objectives, indicators, projects, and organizational units are available in the shipped metamodel and may be used within objective and requirement diagrams.

The achievement of objectives is mostly given. A balanced scorecard can be created visualizing the coherences (see figure 9.30).

The procedure consistency is given as the concept of balanced scorecards is part of the standard *MEGA* methodology and metamodel.

The procedure integration is given. Objects already entered, like projects or organizational units can be reused. Additional information like metrics have to be entered. A wizard offering step by step instructions is available.

Rating: 4 points for traceability and strategy management.

9.2.5 Management of Business Objects and Business Services

The scenario management of business objects and business services can be simulated mapping business objects and interconnections to existing objects within the *MEGA* metamodel. The following mapping has been used. *Business services* are mapped to *services*, *business objects* to *messages*¹⁵, and *interconnections* to *links between business applications and messages*. The business object with its attributes may additionally be specified using a *class*.

¹⁴For more information about impact analysis see section 9.1.3.

¹⁵Instead of *messages* it would also be possible to use *events* or *collaborations* depending on the context of the visualization.

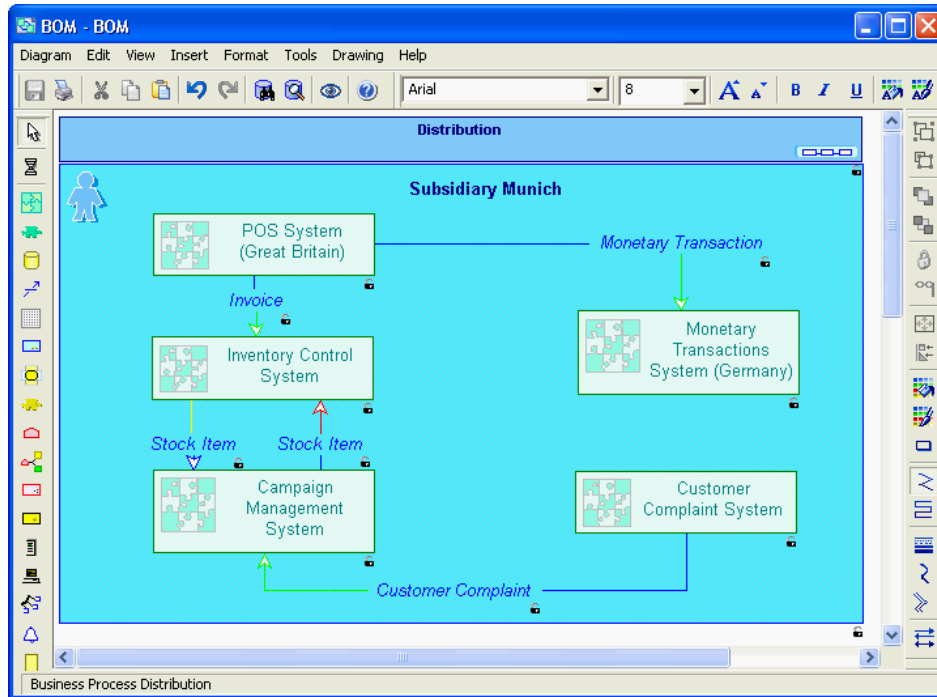


Figure 9.33: *MEGA*: visualization showing the relationships between organizational unit, business service, business object, connector and interconnection for scenario management of business objects and business services

This mapping offers the possibility to create the diagram shown in figure 9.33. The line showing the relationships between the business applications and the business process, which have been created during the previous scenarios were hidden to reduce complexity of the visualization.

A report showing the incoming and outgoing messages of a business application can be created. Other deliverables like a report (see figure 3.32 and figure 3.33 in section 3.3.2) cannot automatically be achieved. This may be done by programming.

The tool handling for this scenario is adequate as it is possible to manage business objects and business services using integrated functionality.

The achievement of objectives is partially given (see figure 9.33). The deliverables shown in figure 3.32 and figure 3.33 in section 3.3.2 can be achieved using programming.

The procedure consistency is given as all entities needed for the simulation of the scenario can be mapped to entities within the shipped metamodel.

The procedure integration is given. Business applications and business processes already entered can be reused to simulate the scenario.

Rating: 4 points for management of business objects and business services.

9.2.6 Application Architecture Management

Using the standard metamodel *MEGA* does not support the concepts needed for application architecture management. *Abstract technologies*, *technologies*, *architectural blueprints*, and *architectural*

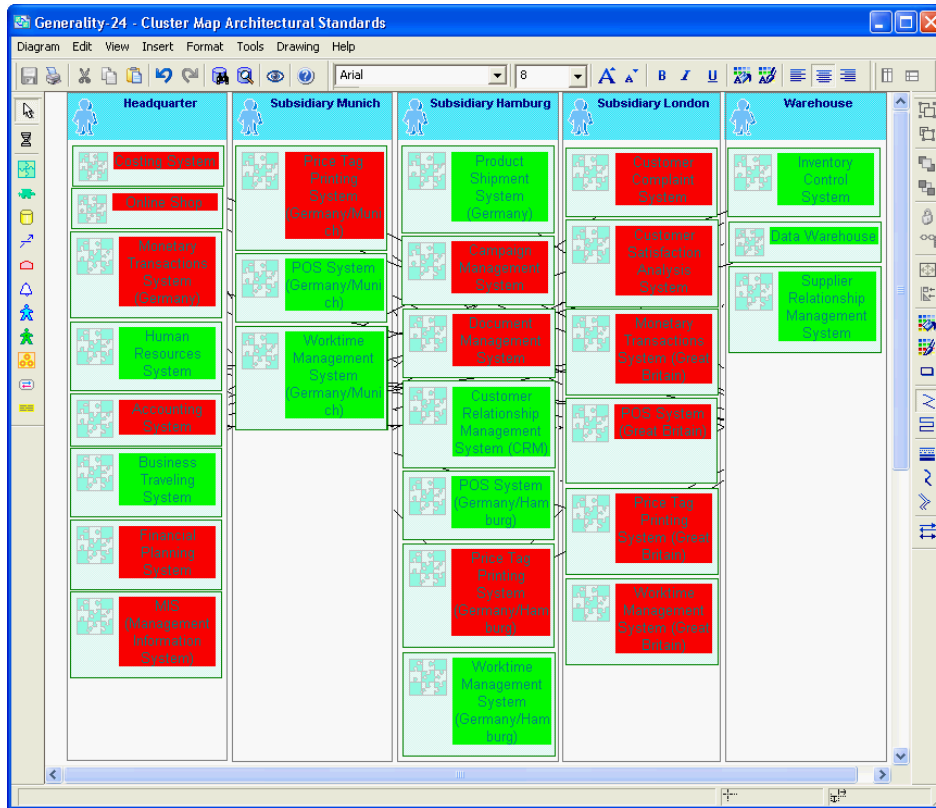


Figure 9.34: *MEGA*: cluster map visualizing conformity of applications to architectural solutions for scenario application architecture management

solutions have to be mapped to elements of the shipped metamodel. Adapting the metamodel according to own needs could solve this problem.

Figure 9.34 shows a cluster map visualizing the conformity of business applications to architectural solutions. This diagram has been created using manual positioning and highlighting of elements, but could also be created by adding an attribute indicating the standard conformity and using programming to automatically generate the visualization.

This also applies to figure 9.35 which shows, which infrastructure element is based on which technology. By using metamodel adaptation and programming *MEGA* may be extended to completely match this scenario. This would also offer the possibility to create a report like figure 3.35 in section 3.3.2.

The tool handling for this scenario is adequate. After selecting appropriate elements of the metamodel or adapting the metamodel for supporting application architecture management the tool is easy to use.

The achievement of objectives is partially given (see figure 9.34). Other deliverables (see figure 3.35 and figure 3.36 in section 3.3.2) required adapting the metamodel.

The procedure consistency is basically given. The metamodel has to be extended to completely simulate the scenario as e.g. abstract technologies are not part of the shipped metamodel.

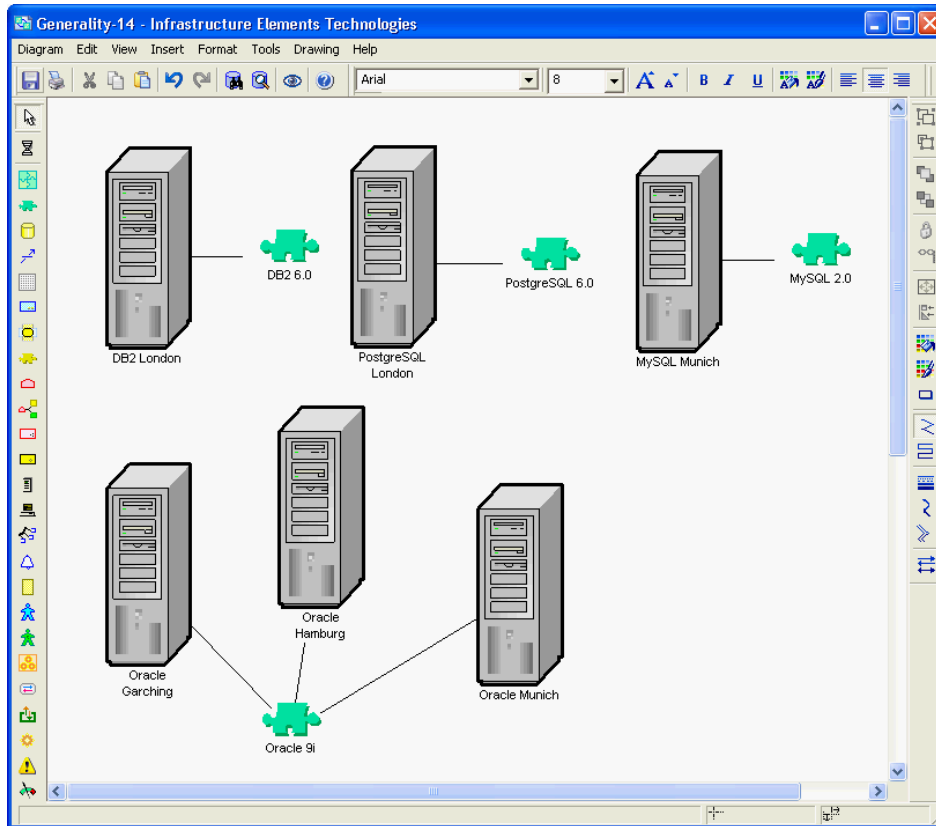


Figure 9.35: *MEGA*: diagram visualizing which infrastructure element is based on which technology for scenario application architecture management

The procedure integration is basically given. Business applications and organizational units already entered can be reused to simulate the scenario.

Rating: 3 points for application architecture management.

9.2.7 Infrastructure Management

Managing infrastructure elements like databases can be performed using the standard *MEGA* metamodel. *MEGA* focuses on hardware or operating systems, but does not consider concepts like lifecycles¹⁶ or costs. This may be changed by adapting the metamodel, which would offer the possibility to manage all the required information. Additionally this would enable the customer to create diagrams like an interval map (see figure 3.39 in section 3.3.2).

Figure 9.36 shows a diagram created using manual positioning and highlighting of elements. Using the integrated scripting engine the diagram could be automatically created. This also applies to the demanded spreadsheet-like report, listing information like costs about the databases.

Utilizing the matrix dialog (see figure 9.37) it may be determined which databases are used by which business applications within the enterprise.

¹⁶Extending the metamodel with the concept of time has already been discussed in section 9.2.3.

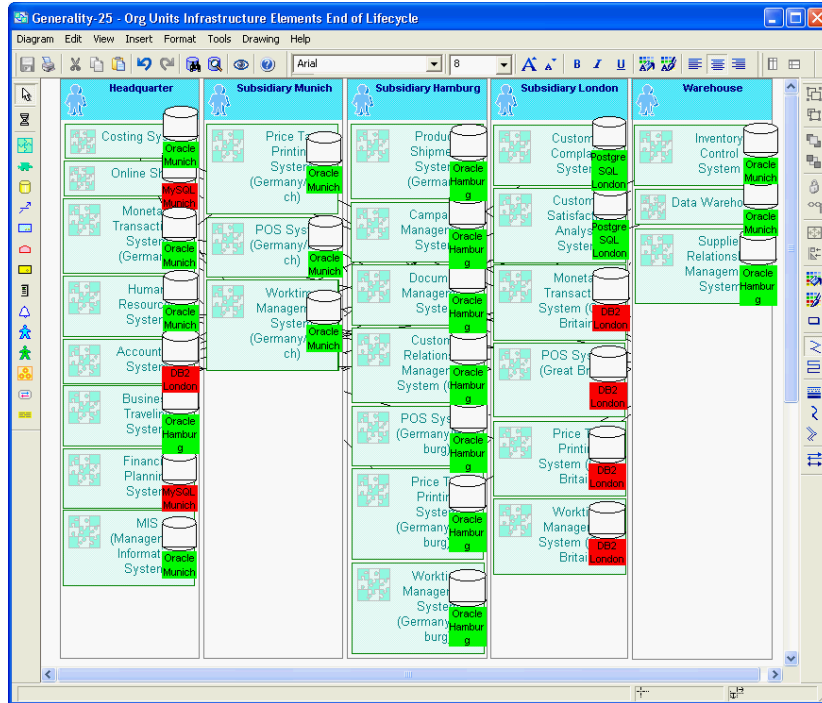


Figure 9.36: *MEGA*: diagram visualizing which business applications use which database for scenario infrastructure management

(Server / Application)	Accounting System	Business Traveling System	Campaign Management System	Costing System	Customer Complaint System	Customer Relationship Management System (CRM)	Customer Satisfaction Analysis System	Data Warehouse	Document Management System	Financial Planning System	Fleet Management System	Human Resources System	Inventory Control System
DB2 London	X												
MySQL Munich										X			
Oracle Garching													
Oracle Hamburg		X	X			X		X					
Oracle Munich				X			X				X	X	X
PostgreSQL London					X		X						

Figure 9.37: *MEGA*: matrix dialog visualizing which business application uses which database for scenario infrastructure management

The tool handling for this scenario is adequate. Management of infrastructure elements can easily be performed using *MEGA*.

The achievement of objectives is partially given (see figure 9.36). Other deliverables (see figure 3.38, figure 3.39, figure 3.40 and figure 3.41 in section 3.3.2) require a high manual effort without using the integrated scripting engine or adapting the metamodel to include all required information.

The procedure consistency is mostly given. The metamodel has to be adapted to completely simulate the scenario as e.g. servers or databases do not have attributes for simulating the lifecycle.

The procedure integration is mostly given. Business applications and organizational units already entered can be reused to simulate the scenario.

Rating: 3 points for infrastructure management.

9.3 Tool Vendor's Profile

The independent leader in Business Process Analysis and Enterprise Architecture

Jean-Marie Zirano, Vice President, Marketing - jmzirano@mega.com, MEGA International, Inc.

Highlights

MEGA, The Company

- 200 employees
- Over 100 Consultants, more than 15 nationalities
- www.mega.com

Paris Londres Munich Milan Boston Tokyo

o Clients

- More than 500 projects per year
- More than 30,000 licenses in more than 30 countries

o Partners

- Canada, Mexico & US
- Morocco
- New Zealand
- United Arab Emirates...

o A Complete Solution for Modeling-based projects

- Skills & Best Practices
- Methodology
- Modeling Tools

o 4 Business Units

- Banking
- Insurance
- Administration, Services & Retail
- Manufacturing & Utilities

Revenue (M€)

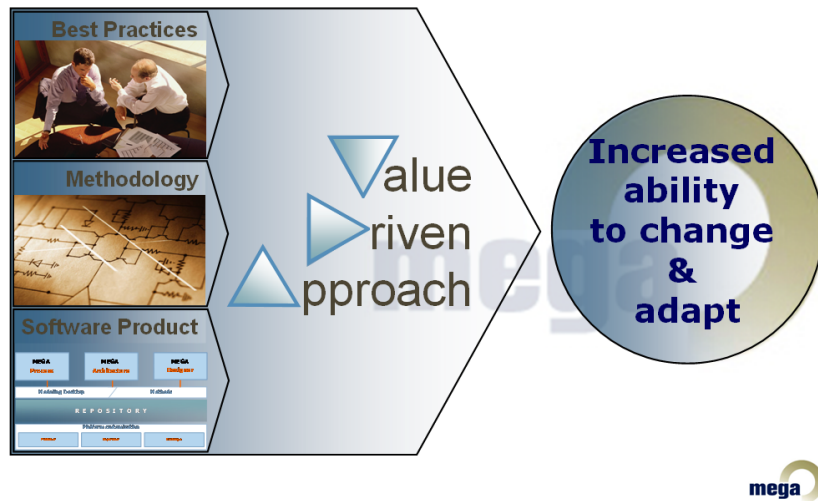
Year	Revenue (M€)
2000	11.5
2001	14.5
2002	17.0
2003	19.0
2004	22.0

MODELING SOLUTIONS FOR PROCESS EXCELLENCE AND ENTERPRISE ARCHITECTURE

MEGA company Profile

Value Proposition

MEGA consultants utilize the MEGA value driven approach and our capable business modeling tools to deliver a powerful, robust and scalable Enterprise Business Repository. It collaboratively drives and leverages local initiatives to aggregate to enterprise optimization for our clients.



MEGA value driven approach

The *MEGA* Approach enables our client executives and management to successfully transform their business, guarantee and maintain regulatory compliance and integrate best practices to Enterprise and IT Governance. *MEGA*'s secret is our deep knowledge and know how concerning the use of modeling for Enterprise description regardless of the business issue. Unlocking and delivering this value, "the ability to empower enterprise change", is our mission and our competence. *MEGA* assists leading corporations to discover, understand, align and control their business processes and enterprise architecture in order to create and sustain competitive advantage.

About *MEGA*

MEGA International is the global leader in Process Excellence and Enterprise Architecture modeling solutions. The *MEGA* value driven approach combines proven methods, modeling software and consulting to deliver the client enterprise repository. This enterprise repository provides to executives and operational managers the ability to understand, discover, align and control as governed from the enterprise level. *MEGA* International, headquartered in Paris, France and founded in 1991, focuses in Europe and North America through operations and affiliates in the United States, United Kingdom, Germany, France, Italy, Canada, Mexico, and more recently in Central and Eastern Europe and Japan. *MEGA* clients include Alitalia, Allianz, British American Tobacco, Crédit Lyonnais, Novartis, Renault, Société Générale, Target, Vitro and Wyeth.

Mercury Interactive Corp. (IT Governance Center)

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Mercury Interactive Corporation provides the tools *Mercury IT Governance Center*, which mainly focuses on the IT project and portfolio management process and *Mercury Application Mapping*, which mainly focuses on automatic discovery of elements of the IT landscape. The *Mercury IT Governance Center* shall provide visibility and control over the demands, the portfolio of IT projects, and the roll-out of strategic changes. These changes can be controlled using the results of *Mercury Application Mapping*.

Section 10.1 contains a statement why we did not analyze the *Mercury IT Governance Center* and *Mercury Application Mapping* followed by a tool vendor's profile in section 10.2.

10.1 Statement to Analysis of IT Governance Center

During the preparation phase of this EA management survey we identified different tools in the area of EA management, using the input of partners and internet research activities. In this phase we also identified the tools *Mercury IT Governance Center* and *Mercury Application Mapping* as interesting tools, which should be included in the analysis of this survey.

After preparing the list of criteria (see section 3.2) and the scenarios (see section 3.3) we invited Mercury to an initial tool presentation. During the presentation and the following first analyzing steps we agreed with Mercury that a detailed analysis and evaluation would not lead to meaningful results. The scenarios we built in cooperation with our project partners mostly cannot be simulated due to the following reasons:

Mercury IT Governance Center concentrates on management of projects, portfolios, strategies, etc., but in the underlying information model an association between the business layer¹, consisting of business processes, organizational units, etc. and the application layer, consisting of business applications, components, etc. does not exist: e.g. a business processes cannot be connected to business applications using a *support-relationship*. The second tool *Mercury Application Mapping* focuses on automatic discovery of elements of the IT landscape, together with their relationships using discovery patterns to identify them. The information gathered is stored in a CMDB² and can be used to perform impact analysis in order to control resulting changes of e.g. an application change, but cannot be used to plan the development of the IT landscape.

According to Mercury Interactive Corp. both products will be connected to each other by an standard interface in the 3rd quarter of 2005. This interconnection offers the possibility to control, if a change management project, which has been planned using *Mercury IT Governance Center*, achieved the demanded changes to the IT landscape, by automatic discovery of the changes using *Mercury Application Mapping*. The focus of the combination of both products is planning and controlling the realization of projects and the operation of business applications, focusing on *real* business applications which have been automatically discovered and stored in a CMDB.

Therefore Mercury Interactive Corp. does not focus on continually planning and developing the EA like demanded in the scenarios *landscape management* (see section 3.3.2), *synchronization management* (see section 3.3.2), *traceability and strategy management* (see section 3.3.2), *management of business objects and business services* (see section 3.3.2), and *application architecture management* (see section 3.3.2), which all cope with conceptional elements of the EA, like e.g. planned or target landscapes, which cannot be discovered using the *Mercury Application Mapping* technology.

Hence we agreed with Mercury Interactive Corp, that most of the scenarios concerning EA management support, see above, cannot be simulated using their products and so we decided to neither analyze *Mercury IT Governance Center* nor *Mercury Application Mapping* within the scope of our survey.

The statements above do not refer to the capabilities of *Mercury IT Governance Center* as a project portfolio management tool or the capabilities of *Mercury Application Mapping* as a tool for automatic discovery of elements of the EA. These statements only reflect the capabilities of both tools as EA management tools, like introduced in section 3.

¹For a deeper introduction to these layers of an information model see section 3.1.2.

²CMDB in this context means an ITIL compliant *configuration management database*, which stores information about the elements of the IT landscape, like e.g. routers, middleware, business applications, etc.

10.2 Tool Vendor's Profile

Corporate Information

Mercury Interactive Corp.

Mercury is the global leader in business technology optimization (BTO). We have a simple and powerful commitment: to help our customers optimize the business value of IT.

Mercury is one of the largest and fastest growing enterprise software companies in the world. Nearly 90-percent of Fortune 100 companies, and dozens of government agencies globally rely on Mercury to fulfill their BTO strategies. We have over one billion U.S. dollars in cash, are a NASDAQ 100 company, and are part of the Standard & Poors 500. Founded in 1989, Mercury conducts business in more than 35 countries and has been a public traded company for over 10 years.

Mercury began shipping software quality testing products in 1991. Since then, we have introduced a variety of software and services for BTO, including offerings in application delivery (pre-production quality and performance testing), application management (in-production application performance monitoring and management) and, following the acquisition of Kintana, Inc. in August 2003, a family of IT governance offerings.

Our BTO offerings for application delivery, application management, and IT governance help customers maximize the business value of IT by optimizing application quality, performance, and availability as well as managing IT costs, risks, and compliance.

In recognition of the company's outstanding track record, Forbes Magazine named Mercury CEO, Amnon Landan Entrepreneur of the Year for 2003.

BTO Leadership

Mercury is the first enterprise software company to offer a BTO technology blueprint for optimizing IT.

Flexible Software Delivery Model

Mercury offers a unique, customer-centric model for delivering BTO software and services.

Delivering Business Value

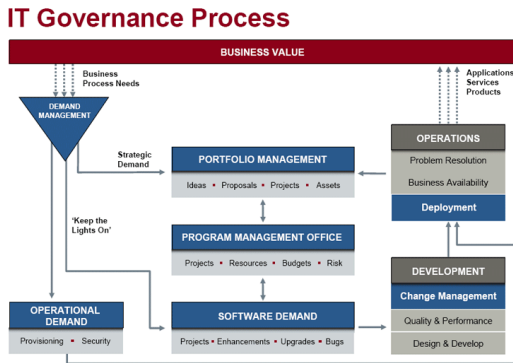
Mercury has the vision, ability to execute, and financial resources to be a great business partner for your enterprise.

Mercury IT Governance Center

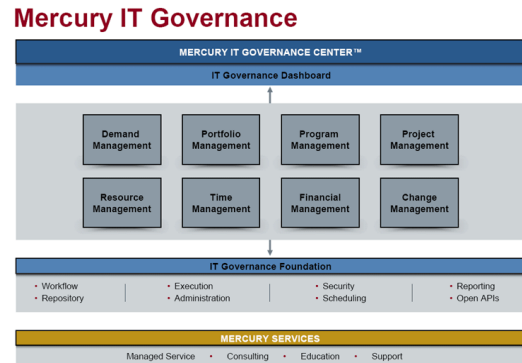
Mercury IT Governance Center™, our integrated suite of software, services, and best practices, provides visibility and control over the demands being made of IT, your portfolio of IT projects, and the roll-out of strategic changes. With Mercury IT Governance Center, you get total transparency regarding IT priorities, projects, and investments. You can effectively decide what to do, or not; when to end projects or eliminate or automate low-value activities; and how to manage time more effectively to free up resources for more strategic projects.

Mercury IT Governance Center also helps you lower the cost of compliance with regulations such as Sarbanes-Oxley by automating processes, required controls, and reporting. And it supports quality programs and process control frameworks such as Six-Sigma, CMMI (Capability Maturity Model Integration), ITIL (IT Infrastructure Library), ISO-9000, and CobiT (Control objectives for information and related Technologies).

Mercury IT Governance Process



Mercury's approach to IT governance



Mercury IT governance

Mercury's approach to IT Governance optimizes IT business processes from demand through production - ensuring that both strategic projects and "keep-the-lights-on" IT activities are aligned with business goals.

You can implement Mercury IT Governance Center applications individually, starting with the area of greatest need, then expand across IT, adding value all the way. Here are four popular starting points:

- *Portfolio Management* Manage your portfolio of current applications, in-flight projects, and proposed investments to align IT with business priorities.
- *Project Visibility and Control* Provide complete visibility into project and program status, using a real-time dashboard to manage assignments, exceptions, and drill into details.
- *IT Services Automation* Manage the demand on IT by providing visibility and control over processes and resources - including outsourced processes and resources.
- *Application Change Management* Digitize the change process to support compliance initiatives, reduce application downtime, lower total costs, and minimize risk.

Run IT Like a Business

IT professionals use Mercury to automate and enforce their IT governance decision-making frameworks and align the priorities, processes, and people required to run IT like a business.

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The tool *process4.biz* supports documenting business processes and enterprise architectures. It is based on Microsoft Visio, which it leverages by building a database based repository around it.

Using this lightweight approach, *process4.biz* manages to provide core functionalities necessary for EA management in a way that makes the tool both easy to use and flexible.

One of the key characteristics of *process4.biz* is its strong integration into the Microsoft product portfolio: besides using Microsoft Visio and the Microsoft SQL Server, *process4.biz* also implements Axapta, although this is not part of the functionality evaluated in this survey. Consequently, the tool vendor, process4.biz GmbH, is a Microsoft Certified Partner.

11.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

11.1.1 Configurability of the Metamodel

Basically all details of the metamodel of *process4.biz* can be adapted by the user: it is possible to add, modify, and delete entity types. The same is true for the attributes, they can also be added, modified, and deleted by the user. As data types for attributes, *process4.biz* offers a reasonable selection of data types including filesystem paths and hyperlinks, which was completely sufficient during the simulation of the scenarios detailed in section 3.3. All these adaptations can be done in a very easy to use and straightforward way. In this context, the tool also provides some capabilities to prevent accidental loss of data or other harmful effects connected to metamodel adaptations: there are warnings when the modification leads to loss of data in the repository and the deletion of some of the attributes that are vital to the operation of the tool (e.g. the *name*-attribute for entities) is forbidden. Referring to the scenarios, it was possible to capture all entities and their attributes in *process4.biz*.

A more limited part of the metamodeling mechanisms in *process4.biz* is the support of relationship types, which in some respect departs from the philosophy behind UML. At the repository level, *process4.biz* allows the creation of an *object link* between every two different entities. This approach differs from the one taken by UML or by ER-modeling in several significant aspects:

- In UML or in ER-modeling, a relationship type governs objects of which type can be linked to an object of a certain type. In *process4.biz* every pair of different objects can be linked by an *object link*.
- In UML or in ER-modeling the construct of relationship types with relationship ends provides the capability to specify the cardinalities of a relationship type. Thereby, it can for example be specified that a process has exactly one superprocess. In a repository governed by a metamodel specifying this, it is impossible to attach more than one superprocess to a process. Such restrictions are not supported by *process4.biz*.
- In UML or in ER-modeling, two or more links between two different objects can exist, if the metamodel provides two or more relationships types between the entity types of the two objects. In *process4.biz* an *object link* between two entities exists or it does not exist. In this context there is another construct that the *process4.biz* repository is unable to capture directly: a relationship from an object to itself. This limitation became obvious in importing the data relevant for the scenario in section 3.3.1 into the tool: the two relationships *predecessor* and *superprocess* connecting *business processes* to *business processes* could not be captured directly via *object links*. The workaround employed consists of introducing two integer attributes to the entity type *business process*:
 - an attribute named *previous* that stores the id of the previous process

- an attribute named *super* that stores the id of the superprocess.

Obviously, this workaround offers no way to ensure referential integrity.

- In UML or in ER-modeling, some of the semantics of a relationship can be captured in the metamodel by providing a descriptive name for a relationship type. An example for this is the relationship between *business application* and *organizational unit* relevant to the scenario describe in section 3.3.1: the metamodel contains the information that this relationship has the meaning *hosted at*, as opposed to *used at* or *developed at*, which are also possible relationships involving a business application and an organizational unit. This kind of information can not be stored in the *process4.biz* repository at the metamodel level. We see two ways to deal with this:
 - In the visualization, a text which describes the meaning of a specific relationship is attached to the graphical element representing this relationship. This relies on the condition that the relationships are visualized in at least one diagram.
 - Another approach was used in the execution of the scenarios: the meaning of an *object link* between two types of objects is written down in an external document. In the following, an *object link* between such entities is always assumed to represent this kind of relationship. It is upon the modelers to ensure that the *object links* are used in this way and also properly understood by the other users. In the repository itself, a description of the meaning can not be found. For example, in scenario described in section 3.3.1 it was stated in a document describing the execution of the scenario that a link between a business application and an organizational unit is viewed as a *hosted at* relationship.

As it becomes obvious from the examples of the scenario simulation employed above, the realization of the relationships in *process4.biz* did not pose any unsurmountable difficulties in capturing the data of the scenarios in the repository. By using workarounds where necessary, it was possible to capture the desired information in the repository. However, this does not eliminate the risk that these workarounds later impede certain types of data visualization, analysis, or export.

A more marginal limitation of the metamodeling capabilities in *process4.biz* is the lacking of a mechanism to specify that attributes (besides the name, which is mandatory by default) are mandatory.

Summing up, a key strength of *process4.biz* regarding the configurability of the metamodel lies in the ease of use and the simplicity of the handling. Nevertheless it has to be noted that in some respects capabilities of the repository are not powerful enough to reach the expressiveness known from ER-modeling or UML.

Rating: 3 points for configurability of the metamodel.

11.1.2 Coverage of EA Management Concepts by Predefined Metamodel

Also the predefined metamodel of *process4.biz* reflects the lightweight approach this tool takes to support EA management.

process4.biz offers several different metamodels (EPC modeling, Catalyst, EAM, UML, Data Modeling), with each of them containing relatively straightforward ten to twenty entity types and, as described in section 11.1.1, no relationship types.

For the EA management tool survey, the EA management metamodel, which *process4.biz* offers for EA management, was used as the predefined metamodel. This metamodel contains entity types like *Process*, *Application*, or *Hardware*. It fits the lightweight approach of *process4.biz* that it is by far not necessary to provide data for all entity types provided in the predefined metamodel.

process4.biz stresses the ability of the tool to adapt the metamodel to the needs arising from a certain task over offering a metamodel that is sufficient for every use case relevant to EA management. Metamodels are offered as starting points for customer projects. For example several adaptations have been necessary during the execution of the scenario described in section 3.3.1.

In order to capture the versioning and life cycle information available for some of the business applications, a new entity type called *Application Version* is created. The entity type *Application* is extended with some attributes to enable its objects to store all information available for the business applications. The adaptation of the name of the entity type from *Application* to *Business Application* is not vital to the scenario execution and was only done due to the simplicity of such changes in *process4.biz*. Similar modifications are performed for the entity types *Process* and *Organization*. A entity type for *Technology* has to be introduced.

A more drastic modification of the predefined metamodel is necessary in the course of the simulation of the scenario in section 3.3.1 due to the three valued relationship containing the information which Business Application supports which Business Process in which Organizational Unit. This relationship, modeled in figure 3.4 as the association *supports* with the association class *SupportsRelationship* is implemented in *process4.biz* by introducing the entity type *SupportsRelationship*. Several reasons contributed to the choice of this approach:

- *process4.biz* does not support three-valued relationships. The object link can only connect two entities, not three. Therefore, a standard approach for resolving three-valued relationships is chosen: a weak entity (the *SupportsRelationship*) is introduced and all entities (Organizational Unit, Business Process and Business Application) that are connected by one instance of the three-valued relationship share a connection to a unique instance of *SupportsRelationship*.
- Another benefit derived from the approach chosen lies in the ability to capture the information that a *Business Application* supports a *Business Process* in an *Organizational Unit* via the *Swimlane Technology* of *process4.biz*. More about this functionality is described in section 11.1.4.

For the development of the different predefined metamodels of *process4.biz* as named above, the following standards and standardized frameworks have been considered: *ITIL*, *EPC*, *ARIS*, *Catalyst*, *CobiT*, *MOF (Microsoft Operations Framework)*, and *AXAPTA*. Hereby, the metamodels are not offered as a complete implementation of the respective standard but as an entry point for customer projects.

Regarding documentation, *process4.biz* contains a basic description of the ideas behind the predefined metamodel in its user manual, although this does not reach the detail level of the specific entity types.

Altogether, the most notable fact about the predefined metamodel in *process4.biz* is that it is provided as a starting point for a project. It is not meant to provide an out of the box-solution for every possible use case in EA management and therefore not meant to relieve the user of making adaptations to the metamodel.

Rating: 1 point for coverage of EA Management concepts by predefined metamodel.

11.1.3 Support for Impact Analysis & Calculation

As a drawing tool, Microsoft Visio, which constitutes a core component of *process4.biz*, does not contain functionality supporting audit and control, as for example capabilities for metrics calculation or impact analysis which are subject to the EA management tool survey. Features in this area are mainly going to be present in the next version of *process4.biz*, *process4.biz 2005*.

At the moment, there is no direct way to calculate metrics within *process4.biz*. An export of data to Microsoft Excel would make it at least possible to perform calculations on data of the instances of a

	A	B	X	Y	Z
1	Business Application	Object Name	UUID	Object Links	
2		1037 Accounting System	8d3c3791-e571-4b77-a43a-e0291f72b62	Campaign Management (Marketing Automation System) : Business Application DB2 London : Infrastructure Element Headquarter : Organizational Unit	
3		1038 Business Traveling System	8da69a0c-3416-48f2-aa06-97c5ab04d2da	Oracle Hamburg : Infrastructure Element Accounting System : Business Application Database Consolidation : Project Distribution : Business Process Headquarter-Distribution : Supports Relationship Oracle Hamburg : Infrastructure Element Subsidiary Hamburg : Organizational Unit SubsidiaryHamburg-Distribution : Supports Relationship	
4		1039 Campaign Management (Marketing Automation System)	cdcfa7e7-6d87-4987-966d-f92b5c9d174	SubsidiaryLondon-Distribution : Supports Relationship SubsidiaryMunich-Distribution : Supports Relationship	
5		1040 Costing System	8cdad47-fc63-4b1d-af4d-e14350efb17e	Headquarter : Organizational Unit Oracle Munich : Infrastructure Element Database Consolidation : Project Distribution : Business Process	

Figure 11.1: *process4.biz*: denormalized format of the object links in the Microsoft Excel export

single entity type, but the denormalized format the object links are exported to Microsoft Excel (see figure 11.1) make them a bit difficult to use in Microsoft Excel expressions.

This for example turned out to be impedimental in the simulation of scenario *project portfolio management*. In this scenario, one of the requested deliverables consists of a tabular report showing which projects will cause which cumulated costs at which business applications. In order to create such a report it is necessary to access the relationships from *Projects* to *Business Applications* in an expression calculating these amounts, this would be facilitated if the relationships could be exported in a normalized form.

Process4.biz 2005 will introduce the capability of metrics calculation via the new features called *Excel Pivot Reports* and *Business Intelligence SharePoint Services*.

Impact Analysis occurs in several scenarios in section 3.3.2, e.g. in scenario *Infrastructure Management* or in scenario *Project Portfolio Management*.

In scenario *Infrastructure Management*, it is, among other things, to be determined which databases are used by which business applications. A way to do this in a diagram consists of an impact analysis that traverses the relationships between given databases and business applications. In scenario *Project Portfolio Management*, impact analysis can be helpful to show which business applications, processes, and organizational units are affected by the various projects.

Although diagrams visualizing relationships are necessarily helpful for an user in traversing the relationship him- or herself, there is no automated support for impact analysis in *process4.biz*. It can be noted that the next version (*process4.biz 2005*) promises an automatic support for impact analysis: it is going to be possible to generate a new diagram from an existing diagram, which contains the selected object and the objects it has relationships or transitive relationships to.

Rating: 1 point for impact analysis and metrics calculation.

11.1.4 Richness of Predefined Visualization Techniques

The predefined visualization techniques in *process4.biz* are realized as a special Microsoft Visio stencil¹ called *eam* that provides mastershapes² for the entity types contained in the predefined metamodel of the tool. Together with the diagram navigation capabilities and the automated linking strategies these make up the predefined visualization techniques evaluated in this section.

¹A *stencil* is a collection of *mastershapes*.

²A *mastershape* is the generic shape that is instantiated if it is dragged on the canvas.

Basically, the eam stencil with the functionality, which will be outlined in section 11.1.5, does not determine the way its shapes are used to create a visualization. The shapes can be used to implement the visualization approaches considered in the EA management tool survey, although not without some manual effort.

A set of features that contributes to the suitability of *process4.biz* to support some of these visualization approaches is made up by the automated linking strategies (*Verknüpfungsstrategien*). These enable the tool to automatically create *object links* if certain graphical relationships between certain entities exist. Examples are:

- Direct connections (*Direktverknüpfungstechnologie*): connecting graphical elements via a Microsoft Visio connector results in the entities they represent being connected by an *object link*. This feature is meant to support modeling of flows, e.g. process flows.
- Indirect connections (*Indirekte Verknüpfungsstrategie*): this is similar to the direct connections except for the possibility to have several Microsoft Visio connectors with objects representing decisions (xor, or, and) between them. Also this feature is meant to support process flows.
- Swimlane (*Schwimmbahmentechnologie*): graphical elements that at least partially overlap have the entities they represent connected by an *object link*. This feature is helpful in the creation of *cluster maps* as it can capture the information entered into the tool during the process of the manually performed map creation.
- Alignment (*XY-Technologie*): if two graphical elements align horizontally or vertically, an object link is created between the two entities they represent. This feature is helpful in the creation of *process support maps*.

Although it is basically possible to create a portfolio matrix, this diagram type is not explicitly considered as among the ones supported by *process4.biz*. This may be due to some difficulties regarding some aspects of the portfolio matrix. For example, the eam stencil in *process4.biz* does not visualize any entity with circles, which on the other hand is quite common for boston square diagrams. Therefore, the creation of such diagrams might call for the introduction of a new stencil (which can be done by the user), as one might not want to change the shape representing application systems to a circle in all other diagrams, which would happen if one would change the mastershape for business application in the eam stencil.

An example cluster map created (manually) in the simulation of the scenario described in section 3.3.1 is shown in figure 11.2. The map was drawn manually by dragging the imported entities from a repository tree on the diagram. By placing them according to the conventions of a cluster map, the relationships are automatically captured in the repository.

Figure 11.3 shows an exemplary process support map created (manually) in the simulation of the scenario in section 3.3.1. Similar to the creation of the cluster map, the tool is able to capture the relationships between the depicted objects in the manual creation of the map.

Creation of an interval map is also possible as shown in figure 11.4, when investing manual work, although *process4.biz* does not state to support this kind of diagram. This might be due to the tedious process involved in creating the time axis: each month has been created and positioned as an entity manually.

Unfortunately some of the zooming and navigation features of Microsoft Visio are not available in *process4.biz* in the current version, but are according to *process4.biz* going to be available in *process4.biz 2005*. Especially the fact that this also concerns the layer mechanism, which, as it is argued by [LMW05a], would be very suitable to provide capabilities of information filtering, is regrettable.

11. process4.biz GmbH (process4.biz)

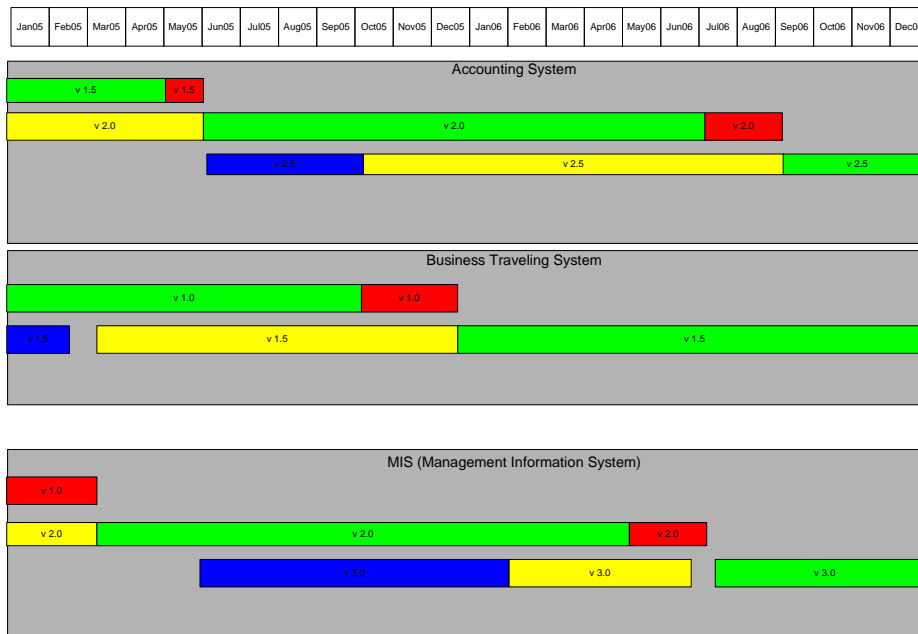


Figure 11.4: *process4.biz*: interval map

Basically, visualizations following the visualization techniques considered in the survey can be created in *process4.biz* but several aspects of these visualization techniques are not part of the predefined visualization techniques, but have to be realized with the capabilities described in section 11.1.5.

Rating: 3 points for richness of predefined visualization techniques.

11.1.5 Flexibility of Visualization Techniques

The concept of a visualization technique or a visualization template that provides for certain graphical elements and allows or disallows certain usage of them is realized in *process4.biz* as a Microsoft Visio stencil. Thereby, *process4.biz* is able to use the extensive visualization capabilities of Microsoft Visio.

For every stencil, one type of graphical element (a so-called mastershape in the nomenclature of Microsoft Visio), can be assigned to each entity type. In another stencil, another type of graphical element can be used for a specific entity type. A specific diagram has to exactly use one stencil.

When designing the graphical element type (the mastershape) for a certain entity type, the considerable capabilities of Microsoft Visio can be leveraged to construct the symbol: from composing vector-based symbols, to using a bitmap-based icon a plethora of approaches from the Microsoft Visio standard software to construct diagram symbols is available.

In order to visualize attributes, the tool offers a mechanism that is based on the shapesheets in Microsoft Visio. A shapesheet (as for example shown in figure 11.5) is a spreadsheet-based representation of the shapes in Microsoft Visio. It shows the different attributes that control the appearance of the shape and their respective values. This technique makes it possible to control almost all features of the shape reaching from different colors (fill color, border color, etc.) to size and even the shape itself, which can also be modified using the shapesheet. If a shape consists of several sub-shapes, it is also possible to control their visibility separately. Thereby, it is possible to employ user-defined variables

Shape Transform		PinX	PinY	FlipX	FlipY
Width	22.5000 mm	86.0000 mm	170.0000 mm	FALSE	FALSE
Height	13.5000 mm				
Angle	0.0000 deg	11.2500 mm		0	
		LocPinY	6.7500 mm		

User-defined Cells		Value	Prompt
User.PhoenixObjectGUID		7c-4d47-91d3-72e4fac8053b	

Connection Points	X	Y	DirX / A	DirY / B	Type / C	D
1	0.0000 mm	6.7500 mm	No Formula	No Formula	No Formula	
2	22.5000 mm	6.7500 mm	No Formula	No Formula	No Formula	
3	11.2500 mm	0.0000 mm	No Formula	No Formula	No Formula	
4	11.2500 mm	13.5000 mm	No Formula	No Formula	No Formula	
5	19.5223 mm	12.3475 mm	-14.1949 mm	-21.0634 mm	0	
6	19.8000 mm	1.3500 mm	-15.2400 mm	20.3200 mm	0	
7	2.2213 mm	1.7446 mm	17.0412 mm	18.8350 mm	0	
8	2.1616 mm	11.7007 mm	17.2660 mm	-18.6291 mm	0	

Geometry 1		FALSE	No Formula	No Formula	No Formula		
Name		X	Y	A	B	C	D
1	MoveTo	0.0000 mm	0.0000 mm				
2	LineTo	22.5000 mm	0.0000 mm				

Figure 11.5: *process4.biz*: shapessheet in Microsoft Visio

and an Microsoft Excel-like expression language to control the values of attributes in the shapessheets. *process4.biz* synchronizes user-defined variables with attributes of the represented entity that have the same name.

A source of distraction in this context is the apparent lack of documentation regarding the Microsoft Visio Shapessheets. *process4.biz* offers some documentation on the creation of new mastershapes, but for example the details of the expression language supported by the shapessheets are not documented. A feature regarding the definition of visualization techniques that is missing is the possibility to define and enforce restrictions regarding the placement of graphical elements on the diagrams and their connections.

Nevertheless, by building on Microsoft Visio, *process4.biz* has managed to incorporate a technique for building graphical elements to represent entities, that is both powerful and easy to use.

The initial creation of a diagram in *process4.biz* has to be performed manually. The tool does not support importing a set of entities into a diagram. They have to be placed on the diagram by hand, one by one. This, for example, makes it difficult to create diagrams containing thousands of graphical elements, as demanded in the scenario described in section 3.3.1. Once graphical elements are on the diagram, the layout features of Microsoft Visio can be used on them, although these mechanisms are unaware of the different entity types the graphical elements represent.

The functionality *process4.biz* offers in respect to adaptations of the graphical elements themselves according to changes in the repository data is much more powerful, as the functionalities to manipulate the shape appearance via the shapessheet can be employed here.

Since essential parts of the creation of a diagram in *process4.biz* are performed manually, manual editing of the visualization is an important feature of the tool. Basically, *process4.biz* employs the capabilities of Microsoft Visio to provide functionality in this area, although it has to be noted in this respect, that some of the regular features of Microsoft Visio are not part of *process4.biz*. In this respect, the general drawing tool capabilities of Microsoft Visio (lines, simple boxes, text etc.) have been deactivated. Also the standard Microsoft Visio stencils are not present in *process4.biz* by default and opening and using them is not deemed advisable: the use of especially the more complex mastershapes e.g. the UML lollipop symbol or the configurable axis might corrupt the diagrams.

According to *process4.biz* the upcoming version *2005* is equipped with general drawing capabilities provided by Microsoft Visio.

In the context of manual visualization adaption, the feature of *updating* diagrams or representations has to be mentioned: this feature allows to synchronize the representation of entities of a certain type or of all entities in a diagram to the appearance they should have according to the employed stencil and the data its master shapes use from the repository, in case aspects influenced hereby have been manually changed. A feature that can dispel reluctance to use this functionality is the possibility to automatically backup diagrams before they are thus automatically modified.

Regarding the flexibility of repository content visualization, it argues for *process4.biz* as a visualization centric tool that all graphical deliverables of the scenarios described in section 3.3 could be created, although in some cases a considerable manual effort is necessary.

Rating: 4 points for flexibility of visualization techniques.

11.1.6 Flexibility of Reporting

In addition to the Microsoft Visio based visualizations, *process4.biz* offers a tree-like *repository view* on the data it governs. This view provides a way of navigating the repository including the possibility for performing searches and using subcategories. Details about entities in the metamodel can be accessed in this view via an object inspector (see figure 11.6), which also allows changes to the repository data. It is possible to create, change, and delete entities. Figure 11.7 shows the *repository view*.

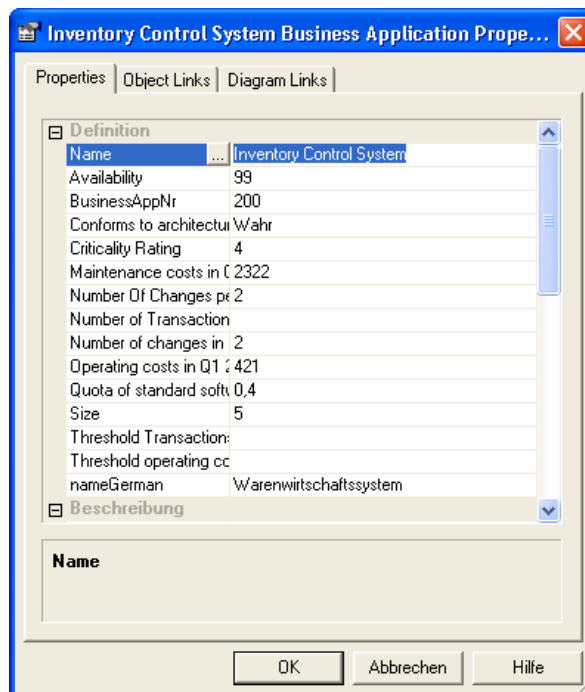


Figure 11.6: *process4.biz*: object inspector like view

Regarding the reporting functionalities, two exporters of *process4.biz* are of importance: the Microsoft Excel exporter and the Microsoft Word reporter. The Microsoft Excel exporter is able to export a

Name	Availability	BusinessAppNr	Conforms to architectural standards	Criticality
Accounting System	99,9	500	Wahr	3
Business Traveling System	99,1	1000	Wahr	1
Campaign Management (Marketing Automation System)	99,8	1500	Falsch	2
Costing System	100	600	Falsch	3
Customer Complaint System	99,1	1900	Falsch	2
Customer Database System (CRM)	99,9	2100	Wahr	4
Customer Satisfaction Analysis System	97,1	2000	Falsch	2
Data Warehouse	98,9	800	Wahr	1
Document Management System	99,5	1100	Falsch	2
Financial Planning System	99,9	1400	Wahr	1
Fleet Management System	99,4	900	Wahr	3
Human Resources System	99,4	700	Wahr	2
Inventory Control System	99	200	Wahr	4
Inventory Management System			Falsch	
MIS (Management Information System)	99,1	1300	Falsch	3
Monetary Transactions System (Germany)	98	300	Falsch	3
Monetary Transactions System (Great Britain)	98,1	350	Falsch	3
Online Shop	99,2	100	Wahr	5
POS System (Germany/Hamburg)	98,4	1620	Wahr	5
POS System (Germany/Munich)	98,4	1600	Wahr	5
POS System (Great Britain)	97,5	1650	Wahr	5
Price Tag Printing System (Germany/Hamburg)	99,3	1720	Wahr	3
Price Tag Printing System (Germany/Munich)	97,3	1700	Wahr	3
Price Tag Printing System (Great Britain)	99,1	1750	Wahr	3

Figure 11.7: *process4.biz*: repository view

1.1.1.7 Business Application: Online Shop

Name: Online Shop
 Availability: 99,2
 BusinessAppNr: 100
 Conforms to architectural standards: Wahr
 Criticality Rating: 5
 Maintenance costs in Q1 2005: 4000
 Number Of Changes per Month: 3
 Number of Transactions in Q1 2005: 10
 Number of changes in Q1 2005: 10
 Operating costs in Q1 2005:
 Quota of standard software in%: 0,2
 Size: 2
 Threshold Transactions:
 Threshold operating costs:
 nameGerman: Online-Shop
 test:
 Hilfe:
 Eigentümer: Claudius Hauptmann
 Erstellt am: 22.04.2005 11:24:00
 Erstellt von: Claudius Hauptmann
 Geändert am: 23.05.2005 14:45:00
 Geändert von: Claudius Hauptmann
 ID: 1053
 UUID: e71f6413-dc9e-441e-8a53-292b91e02c38

Figure 11.8: *process4.biz*: excerpt of an export to Microsoft Word

user defined subset of all attributes of an entity type for all entities of this type. The export format is the same as the one used by the excel import of *process4.biz*, therefore if it is chosen to export also the object links, this is done in the denormalized format shown in figure 11.1. In order to create reports that contain diagrams like bar charts, line charts, pie charts, etc. based on repository data, *process4.biz* suggests exporting the respective data to Microsoft Excel and creating these diagrams there. The word reporter offers similar functionality for exporting data to Microsoft Word, as shown in figure 11.8 including the ability to also export visualizations into the word documents created by the reporter.

Generally, the reporting capabilities of *process4.biz* fulfill the usual requirements for this kind of functionality, although an advanced user might also desire the features to create reports that directly combine data from entities of different types by the execution of more complex queries than the ones supported by *process4.biz*. Similarly, the possibility that object links (relationships) can only be exported in a denormalized format might be regarded as an issue by some users.

Rating: 3 points for flexibility of reporting.

11.1.7 Collaboration Support

process4.biz supports collaboration of multiple users filling different roles with different usage types by supporting multiple users with particular access rights working together on one repository via different clients of various types. Also functionality addressing the issues of locking and versioning is present in *process4.biz*.

process4.biz uses locking as a means to prevent modification of repository data during ongoing changes of the metamodel. Hereby, every container in the tool's *container hierarchy*, which is shown in figure 11.9, can be locked separately. Locking is also used in order to prevent duplicate modifications of diagrams or entities. A pessimistic locking strategy forbids write access to diagrams opened by another user or to entities which another user has opened in an object inspector.

process4.biz builds its rights management functionality on the role-based access control approach. Arbitrary roles, which can be created by the user, can be assigned to the users. The specific rights *administration*, *design*, *update*, *create*, *delete*, and *read* are granted not on the level of individual entities or entity types but on the level of containers, as for example *SoKaKauf2* in figure 11.9.

process4.biz addresses the vast range of usage types that are relevant to the different users in the course of the different EA management tasks by providing three different clients. The *fat client*, the client that is described in chapter 11 except where noted otherwise, offers, according to the rights attached to the account used to log into the tool, full data entry, data viewing and modeling capabilities. When local installation on the workstation of the architect designated to use the tool is not an option, application of a terminal server is possible. *process4.biz* states that an installation on a Citrix terminal server is currently working at the University of Vienna. An installation utilizing a Windows Terminal Server is according to *process4.biz* in use at the company SWS in Vienna.

Web-based read-only access to both repository data and diagrams can be provided via the *process4.biz Publisher*, a *php*³-based web application. This client works on data especially exported from the repository for this purpose and therefore does not reflect live data but a snapshot of the situation at the time of the export. Navigating through the data exported to the *Publisher* is possible by a navigation tree as shown in figure 11.10, which reflects the entity types in the respective container. Search functionality allows the retrieval of specific entities via a search string.

³*php* is a scripting language intended for usage in web development.

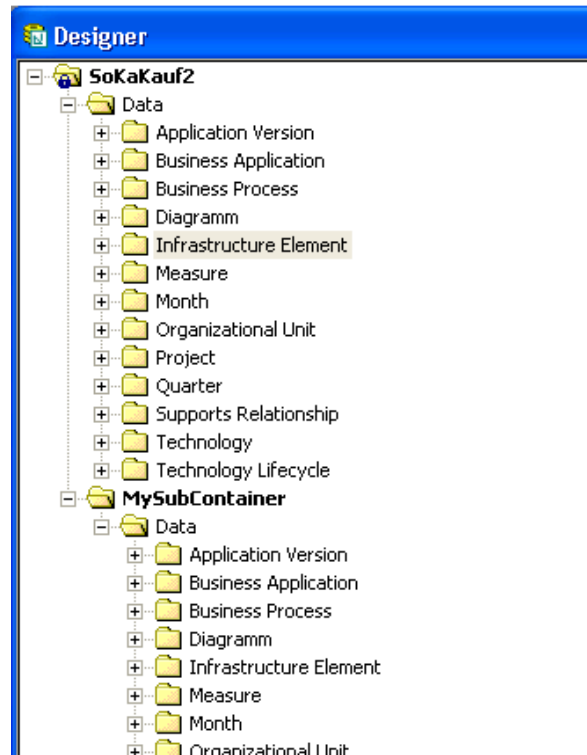


Figure 11.9: *process4.biz*: container hierarchy with container inheritance

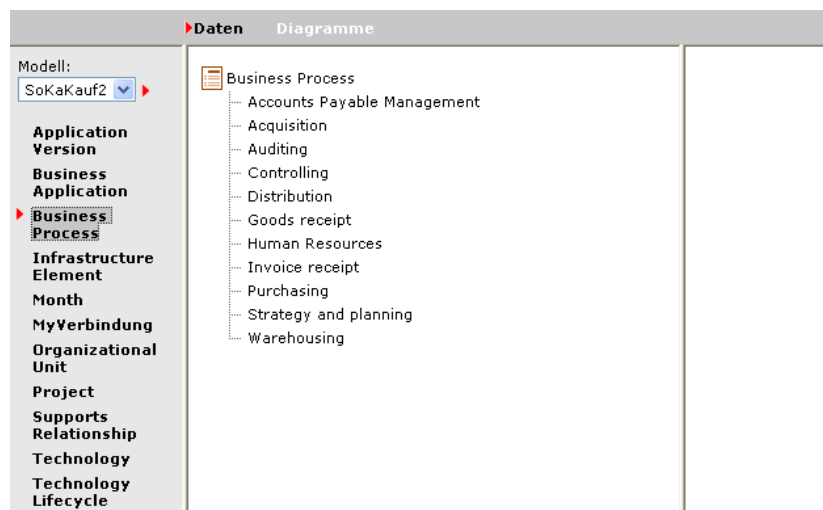


Figure 11.10: *process4.biz*: exported entities with navigation in the *Publisher*

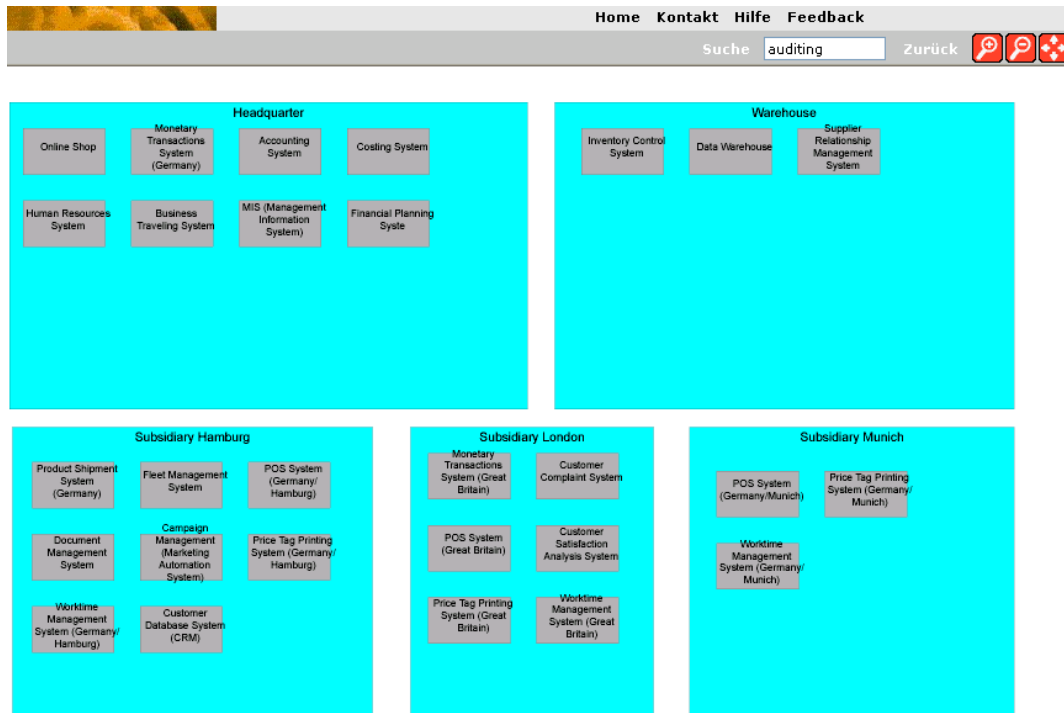


Figure 11.11: *process4.biz*: exported cluster map in the *Publisher*

Diagrams are exported as *SVG*⁴ graphics, this approach allows *process4.biz* to deliver diagrams of high graphical quality. Visualizations of the types cluster map, process support map, and interval map have been exported to the *process4.biz Publisher* in the context of the simulation of the scenario in section 3.3.1, filling the respective websites with good readonly diagrams: the exported cluster map, shown in figure 11.11, offers full zooming capabilities.

The exported process support map and interval maps support the user in navigating the respective diagrams with the same zooming capabilities. All exported diagrams allow viewing information which describes in detail the entities depicted in the diagrams. Embedded links to other diagrams are also preserved.

The *Enterprise Portal*, the third client available for *process4.biz* and also a web client, offers live access to the repository data, which also includes the capability of data entry and manipulation, according to the rights of the used account. Such a client might for example be useful in a case where data entry into the tool is to be performed in a decentralized fashion.

Especially when working on shared data and/or opting for decentralized data entry, the versioning capabilities of the employed tool contribute to a tool's usefulness. *process4.biz* suggests realizing aspects of versioning via the *container hierarchy*. This *container hierarchy* allows inheritance of containers, as shown in figure 11.9, in which the container *MySubContainer* inherits from the container *SoKaKauf2*.

In this context, inheritance means that the sub-container contains all entity types of the super-container. To entity types thus inherited, new attributes can be added in the subcontainer while it is also possible to add new entity types to the container. The behavior regarding objects is similar: entities of a certain entity type in the super-container also show up in the sub-container. They cannot be modified. New entities of course, can be created and modified.

⁴*SVG* - Scalable Vector Graphics [W3C03]

In order to create a new version of an entity, *process4.biz* suggests using the container hierarchy and declare the contents of the inheriting container as information regarding a subsequent version. Problems might arise if the desire to have different values of any attributes of the new versions surfaces, due to the behavior of the *container hierarchy* described above. To address this case *process4.biz* suggests creating a new object that is meant to represent the new version. This fact can then be expressed through an *object link* between subsequent versions. The same mechanisms are suggested to help describing different branches in the version history of an entity.

Another approach to capturing version information in the *process4.biz* repository is employed in the execution of the scenario described in section 3.3.1: in order to capture the versioning information given for the business application, an entity type called *business application version* is created. This entity type is meant to represent a phase in the life cycle of a specific version of a business application. The fact that an application version is a version of a certain business application is captured by an *object link*. Compared to versioning in temporal databases, versioning control systems, etc., it may be stated that *process4.biz* supports a subset of the functionality applicable to versioning, which might turn the user to workarounds in some use cases.

Altogether, it may be expected that the different clients for *process4.biz* provide the capabilities to adapt to vast range of use cases surfacing in EA management quite well, especially when seen complementary to the rights management of the *process4.biz* repository.

Rating: 4 points for collaboration support.

11.1.8 Import/Export & External Data Sources

process4.biz supports importing data present in a Microsoft Excel file that adheres to a certain format. This format represents entities as lines in a spreadsheet with the columns representing attributes. Every worksheet in the Excel file can be used for an entity type. Object links must be specified using the denormalized schema shown in figure 11.1. The import process itself is carried out using a wizard guiding the user through two major steps shown in the figures 11.12 (specifying the file containing the data and some general parameters) and 11.13 (assigning worksheets to entity types and columns to attributes).

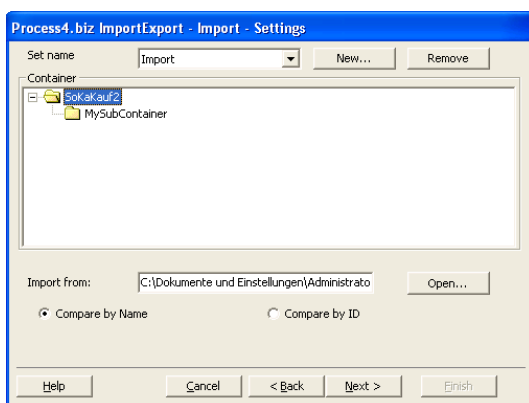


Figure 11.12: *process4.biz*: first step of the import wizard

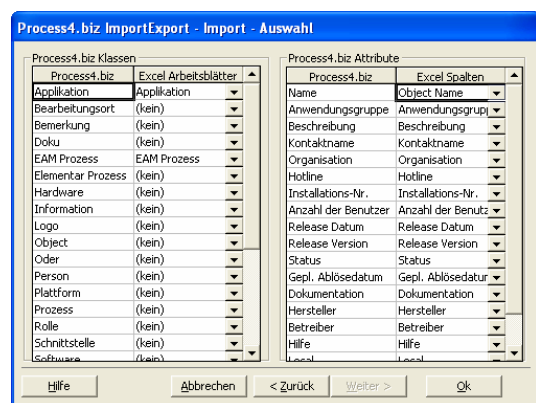


Figure 11.13: *process4.biz*: import mapping

Several ways of exporting data are supported in *process4.biz*. In addition to the Microsoft Excel and the Microsoft Word exporter that have been described in section 11.1.6, *process4.biz* also supports

exporting the diagrams as HTML pages. This is done via the functionality Microsoft Visio provides to save diagrams as a HTML page. While *process4.biz* thus generates a rather nice, SVG-based document (see figure 11.14), specific functionalities (possibility to view details of the entities represented on the diagram, links to other documents, etc.) of *process4.biz* are not contained in the exported document.

When viewed in the Internet Explorer, the exported document contains the zooming features visible in the upper left corner of figure 11.14.

Another export format supported by *process4.biz* is Microsoft PowerPoint. This feature exports the diagrams modeled in *process4.biz* to Microsoft PowerPoint, creating slides like the one shown in figure 11.15. The wizard allows to specify whether the diagrams to be embedded in the Microsoft PowerPoint slides as bitmap-based images or as a Microsoft Visio object, which has been the case for the exemplary slide shown in figure 11.15.

To sum up, the export formats supported by *process4.biz* as described above should be able to meet the requirements for external usage of the data and visualizations in most case, although it has to be noted that there is no direct support for exporting in a format adhering to the popular XML standard. Users that are in the situation of having to cope with more complex tool landscapes in their EA management effort might miss the ability to integrate existing repositories into *process4.biz* without having to move the data into the repository and thereby direct control of *process4.biz*.

Rating: 3 points for import/export & external data sources.

11.1.9 Usability

Basically, *process4.biz* provides a rather good usability due to the straightforward and lightweight approach it takes to support EA management. Concepts introduced in the tool are fairly comprehensible and intuitive. All functionality of the tool is accessible via the graphical user interface, eliminating the need of learning text-based commands or language constructs. Further aspects that contribute to the usability of the tool is the leveraging of Microsoft Visio, which might be a well-known piece of standard software for a large number of users.

Together with the lack of some functionality elaborated in sections 11.1.1 to 11.1.8 which in some cases requires workarounds characterized by tedious manual procedures, they are minor distractions that prevent us from giving a top score in the category *Usability*. Issues that can be named in this context are:

- One example for an inconsistency in the user experience is in the behavior of the Import-/Export-Wizard, more precisely in the dialog shown in figure 11.13. The content of the right hand side of the dialog changes appropriately of the focused dropdown box in the column *process4.biz Classes* changes. If a dropdown box in the column *Excel Worksheets* changes, nothing happens on the right hand side of the dialog.
- After an import the views present in the main window of *process4.biz* fail to reflect the newly imported data. Only after triggering a refresh of the window it is possible to view the new current state of the repository.
- It is somehow disturbing that some of the options Microsoft Visio offers regarding zooming in the diagram are disabled in current version of *process4.biz*. This restraint is according to *process4.biz* going to be removed in the upcoming version 2005.
- It is rather difficult to show another attribute of an entity textually on the graphical element depicting this entity than its name. This might lead to intricate situations in combination with the fact that *process4.biz* uses the name as the foreign key to create object links. An user who wants to use the id as the foreign key instead of an descriptive name that might change in the

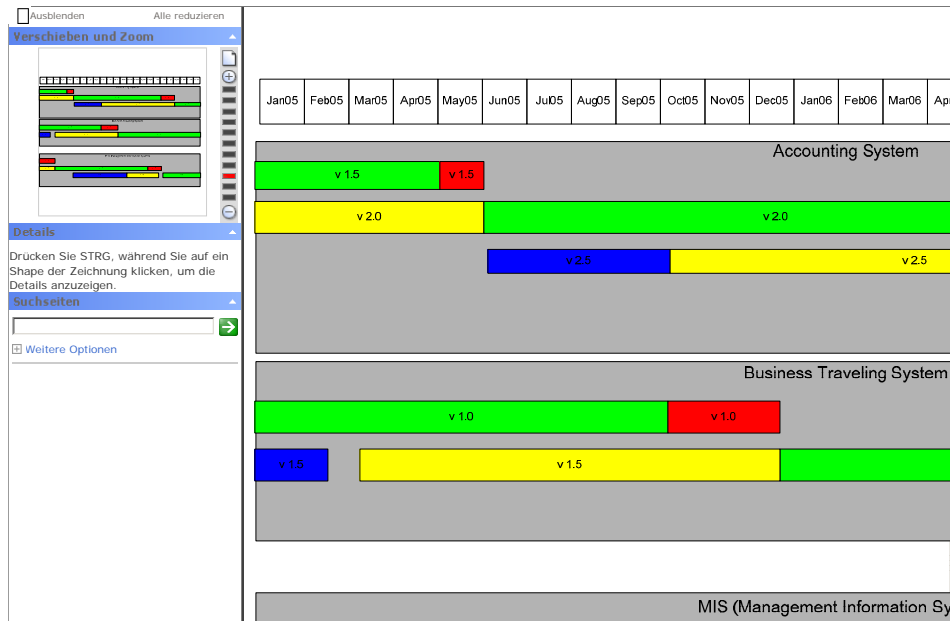


Figure 11.14: *process4.biz*: HTML export of a diagram

IntervalMap

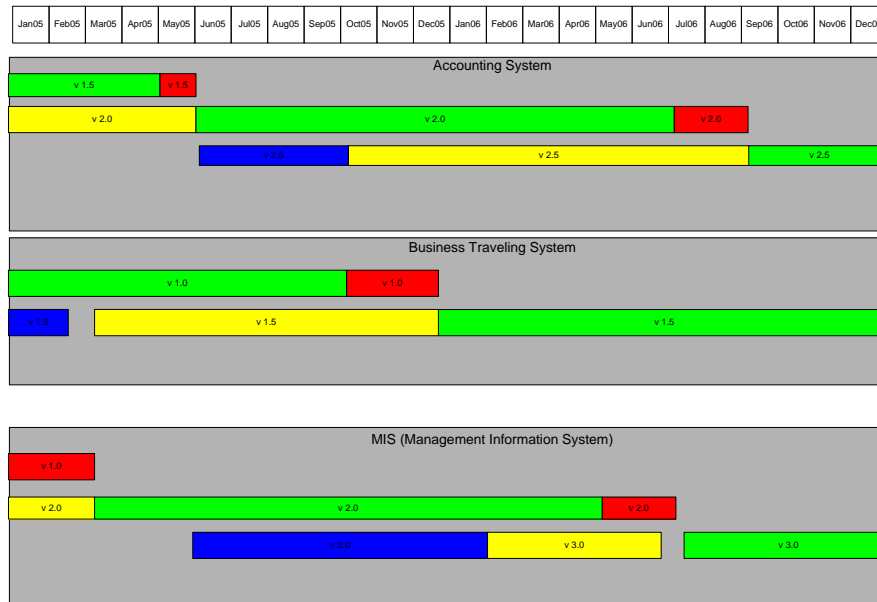


Figure 11.15: *process4.biz*: Slide containing an interval map as created by the Powerpoint Exporter

future is left unable to display this name on the visualizations. Instead of this, only the id is shown.

- Another caveat is that the copy operation in the diagrams behaves differently than some users might expect: when performing a copy and paste operation in the diagrams of *process4.biz*, neither a deep copy nor a new reference to the same entity is created. Instead of this, a dialog box for creating a new entity of the type of the copied entity is opened. According to *process4.biz* improvements regarding this area are going to be shipped with the upcoming version *2005*.
- An obvious approach to show a time axis is to use the time axis supplied with Microsoft Visio. It might be a surprise to a user new to *process4.biz* that using standard Microsoft Visio mastershapes can destroy *process4.biz* diagrams. The probability for this to happen is expected to grow with the complexity of the employed Microsoft Visio mastershapes.

These are, as said above, on the whole minor distractions in a tool that is easy to use and easy to learn.

Rating: 3 points for usability.

11.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

11.2.1 Landscape Management

In order to simulate the scenario *landscape management*, the versioning approach based on the container hierarchy, as described in section 11.1.7, is used. Therefore, as shown in figure 11.16, two additional containers, *Planned* and *Target*, were created, employing the container inheritance in order to reflect that the planned landscape is based on the current landscape and the target landscape on the planned landscape.

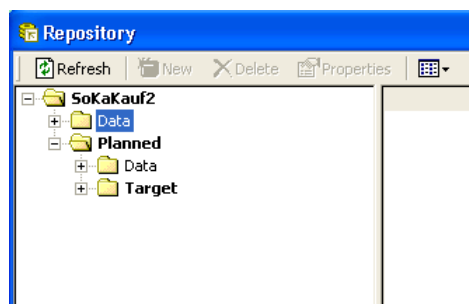


Figure 11.16: *process4.biz*: container hierarchy created for scenario landscape management

Thus, it is achieved that the sub-containers initially reflect the state of their respective super-containers, as they inherit their data. In order to model the differences between the current and the planned landscape or rather between the planned and the target landscape, new entities have to be introduced, as it is not possible to change inherited entities in an inheriting container. In order to indicate that a new business application entity replaces an old one, an object link to this old entity is created. Thus, for example, to reflect the changes between the current and the planned landscape, a new business application called *Monetary Transactions System (Germany)* is created in the container *Planned*,

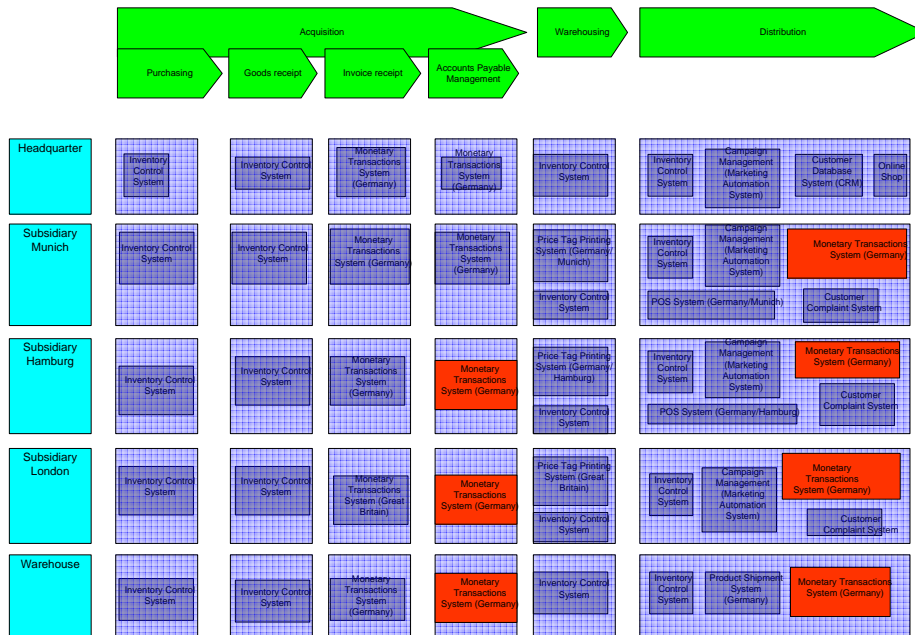


Figure 11.17: *process4.biz*: visualization of the planned landscape for scenario landscape management

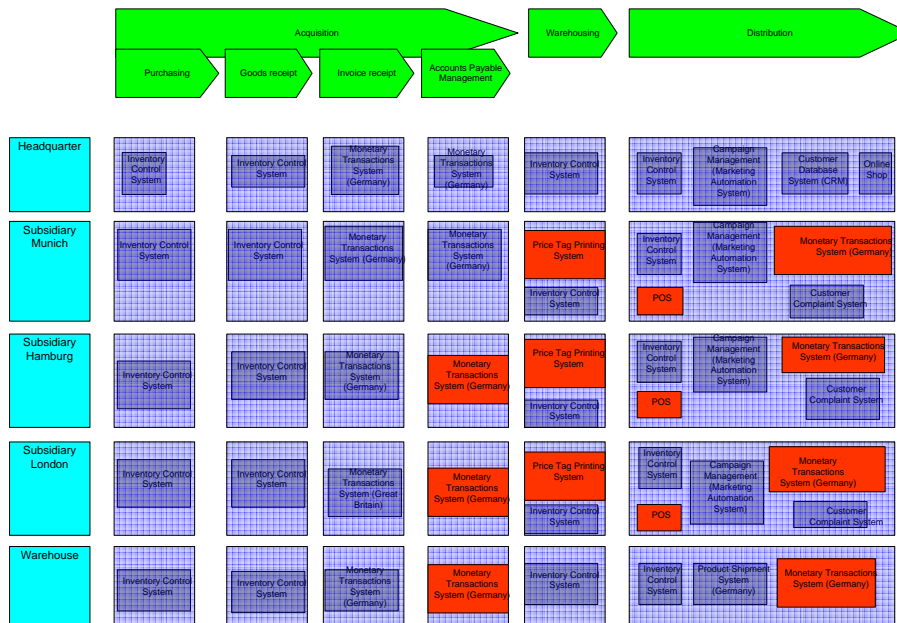


Figure 11.18: *process4.biz*: visualization of the target landscape for scenario landscape management

which has an object link to the business application *Monetary Transaction System Germany* (the old one) and the business application *Monetary Transaction System (Great Britain)*.

For the visualization of the planned landscape, the process support map shown in figure 11.3 is reused. Using the newly created entities, the copied process support map can be manually changed to reflect the planned landscape, as it is shown in figure 11.17.

A part of the generation of this diagram could be automated. A flag that has been introduced to the entity type *business application* to indicate business applications that have been changed in a planned or target landscape would allow to set the different color chosen for changed applications automatically via the shap sheets. Similar to the procedure described above, the planned landscape, shown in figure 11.18, can be modeled and visualized.

The flag indicating that an entity has been introduced in a planned or target landscape container in order to reflect changes in the respective variants of the landscape is also helpful in the creation of a report that enumerates the changes from the current to the planned or target landscape: By exporting the business applications in the planned or target container to Microsoft Excel and filtering by this flag, the changes can be shown. Of course, it is absolutely mandatory that this flag is always set correctly when the planned or target landscape is modeled: Whenever a system is changed, a respective entity has to be created in the respective container, with the flag set to indicate that this entity is added in a planned or target container and that the object links are correctly pointing to the predecessors.

The tool handling is intuitive. The functionality necessary for this scenario was easily accessible, although it was not sufficient to spare the user of manual diagram adaptations.

The achievement of objectives is given. The requested software maps and the report was created in the course of the scenario simulation.

The procedure consistency is a bit hard to determine, as finally, it is a user defined one devised during the simulation of the scenario. Nevertheless, the way the tool lends itself to the simulation of the respective scenario may lead to the conclusion that the tool was designed with such use cases in mind. The statement that the procedure consistency is partially given has to be seen under this assumption.

The procedure integration is basically given. The models and data entered before were able to be reused in the simulation of the scenario *landscape management*.

Rating: 3 points for landscape management.

11.2.2 Project Portfolio Management

The starting point for the simulation of the scenario *project portfolio management* are some changes to the metamodel of *process4.biz* that are necessary to enter the information needed for this scenario. The entity type *Projekt* has been renamed to *Project* and the following attributes have been added: *ProjectNr*, *Benefit*, *Costs*, *End Time*, *Selected*, *Start Time*, and *Urgency*. This allows the tool to import the data available about projects in the documentation of the application landscape.

As imported information about which project affects which business application would be of little use in creating a visualization of these relationships but can, on the other side, be captured automatically during this activity, this relationship data is not imported. Instead of this, a diagram similar to the exemplary deliverable shown in figure 3.17 is created manually. Therefore, the mastershape attached to the entity type *process* is changed to a screwdriver, as can be seen in figure 11.19.

By switching on the swimlane technology, object links between the respective business applications and projects are automatically created when the symbols representing them are placed on the diagram according to the rule: *A screwdriver representing a certain project is placed on each rectangle representing a business application it affects.*

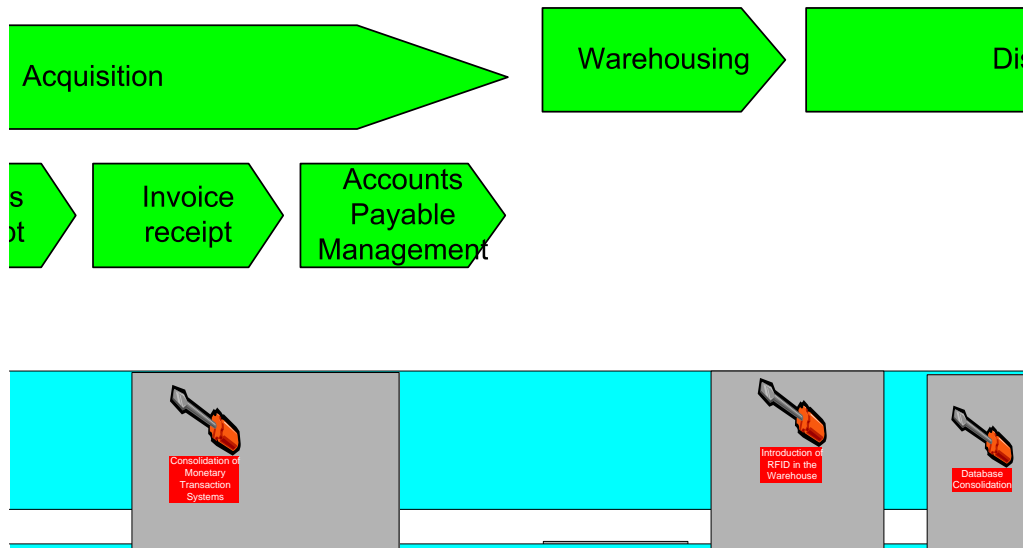


Figure 11.19: *process4.biz*: cut-out of a process support map with projects affecting the different business applications for scenario project portfolio management

The data captured hereby can be used to generate the textual report demanded for this scenario that also shows which projects affect which business applications. This can be done via the Microsoft Excel export, creating a report like the excerpt shown in figure 11.20. This report shows the projects affecting the business applications as project entities referenced via object links. Unfortunately, it is not possible to configure, which kind of object links are exported. Thus, also entities which are of other types and are referenced by the business applications are shown.

Also creating a tabular report containing organizational units and/or processes which are indirectly affected as projects change business applications that are used by certain organizational units to support certain processes is connected to some manual effort. Basically, *process4.biz* only exports direct relationships without traversing transitive relationships. *process4.biz 2005* might contain functionality useful in this respect.

Allocation of project costs to business application according to factors attached to each relationship of type *modifies* between a business application and a project is difficult to perform in a diagram: access to the data of objects referenced via an object link is not possible in the shap sheets used by *process4.biz*/Microsoft Visio. Therefore, such data can not be used in calculations controlling visualizations. Of course, the functionality of Microsoft Excel can be leveraged on data exported from *process4.biz* to perform such calculations in a tabular report, although this would call for some prior manual adaption of the exported data.

The situation regarding the creation of a report that identifies projects which can not be in progress at the same time if simultaneous modification of a business application by two projects should be prevented is similar. The report can be constructed based on data exported to Microsoft Excel, while there is no support for fully automatic generation of such a report, the diagram shown in figure 11.19 in excerpt can be helpful in the manual construction.

The creation of a diagram similar to the one in figure 11.19 but limited to projects that have been selected to be carried out can be accomplished with the shap sheet functionality of *process4.biz* described in section 11.1.5. The mastershape used for projects can be adapted to hide the screwdriver symbol in case the represented project has its *selected*-attribute set to false. This should be done in a

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Business Application	Object Name	Object Links
1037	Accounting System	Campaign Management (Marketing Automation System) : Business Application Connection of Costing and Accounting System : Project DB2 London : Infrastructure Element Headquarter : Organizational Unit Introduction of RFID in the Warehouse : Project VAT change in accounting system : Project
1038	Business Traveling System	Database Consolidation : Project Headquarter : Organizational Unit Oracle Hamburg : Infrastructure Element
1039	Campaign Management (Marketing Automation System)	Accounting System : Business Application Accounts Payable Management : Business Process Database Consolidation : Project Distribution : Business Process Goods receipt : Business Process Headquarter-Distribution : Supports Relationship Invoice receipt : Business Process Oracle Hamburg : Infrastructure Element Purchasing : Business Process Subsidiary Hamburg : Organizational Unit SubsidiaryHamburg-Distribution : Supports Relationship SubsidiaryLondon-Distribution : Supports Relationship SubsidiaryMunich-Distribution : Supports Relationship planned sales : Interconnection stock information : Interconnection
1040	Costing System	Connection of Costing and Accounting System : Project Headquarter : Organizational Unit Oracle Munich : Infrastructure Element VAT change in costing system : Project

Figure 11.20: *process4.biz*: cut-out of a report created showing the projects modifying each business application for scenario project portfolio management

separate stencil in order to prevent all screwdrivers that represent projects that have not been chosen from disappearing, which would flaw e.g. the diagram created at the beginning of the simulation of scenario *project portfolio management*.

Even more simple is the creation of the respective tabular report. Microsoft Excel is able to filter the project data exported from *process4.biz* by the attribute *selected*, hiding all projects that have not been selected.

The capability of *process4.biz* to leverage shapeseets in order to manipulate symbols on the diagrams according to attributes of represented entities is also helpful in the creation of a portfolio matrix as the exemplary deliverable showed in figure 3.23. So, for example, the size of the bubbles can be automatically set according to the *size*-attribute of the represented application system. Contrariwise, the position of the bubbles has to be determined by hand: the number of projects linked to a specific application system is not accessible in the shapeseets. Another problem in creating the portfolio matrix arises from the deactivated standard Microsoft Visio drawing tools, which makes it difficult to bring the background and the axes into the diagram. Importing a graphic into the diagram might be a viable solution here.

The tool handling is basically intuitive, except the adaptations in the shapeseets, which call for a user more advanced in Microsoft Visio. Even so, the functionality is not always sufficient to eliminate repetitive manual tasks.

The achievement of objectives is partially given. The requested software maps and the report was created in the course of the scenario simulation. The report calculating the project cost for each business application as shown in figure 3.20, the reports showing the business processes and organizational units indirectly affected by projects (compare figure 3.21 and figure 3.22) and also the report detailing the projects unable to proceed simultaneously (see figure 3.19) have not been created as this would have involved mainly Microsoft Excel instead of *process4.biz* functionality.

The procedure consistency is a bit hard to determine, as finally, it is an option thought up during the simulation of the scenario.

The **procedure integration** is basically given. The models and data entered before were able to be reused in the simulation of the scenario *project portfolio management*.

Rating: 2 points for project portfolio management.

11.2.3 Synchronization Management

The data relevant to the scenario *synchronization management* has largely been imported during previous scenario simulations, as for example the simulation of scenario *visualization of the application landscape* or *project portfolio management* described in section 11.2.2 and can be reused without further effort. The only data that still needs to be entered into the tool is part of the relationships of type *modifies* between business applications and projects.

A graphical deliverable to be created during the simulation of scenario *landscape management* is a diagram that shows which projects affect which organizational units during which time spans. *Affects* means in this context that the project affects a business application that is used in the respective organizational unit (see figure 3.24). As *process4.biz* does not recommend a standard procedure for this kind of use case, the approach taken in the creation of the exemplary deliverable is chosen. The deliverable has to be created by hand, *process4.biz* provides the following support but also demands attention regarding some caveats. Figure 11.21 shows the respective diagram created in *process4.biz*.

- The fact that *process4.biz* does not support automatically traversing relationships, the information which project affects which organizational unit according to the definition provided above has to be gathered manually. Exporting the data to Microsoft Excel might be helpful in matching the respective data items in order to find out which project indirectly affects which organizational unit.
- When this information has been extracted, it can lead the manual construction of the diagram, but not after a time axis has been created for this diagram. Here, the same difficulties as experienced during the creation of the interval map (figure 11.4) elaborated on in section 11.1.4 emerge. In addition, the axis can not simply be copied from a diagram where its already present, as for example the one shown in figure 11.4: As described in section 11.1.9, copying an entity leads to a dialog prompting for input of data leading to the creation of a new entity, which pops up for every copied entity.
- When trying to visualize each project as a rectangle which graphical appearance is then manually adjusted to reflect the timespan of the respective projects, a interference with a visualization chosen for scenario *project portfolio management* surfaces. In this scenario, projects have been visualized using screwdrivers, not rectangles. While using a new stencil for scenario *synchronization management* would be a solution here, a more simple approach is chosen: Plain rectangles are placed on the diagram to reflect the different time spans, a screwdriver placed on the rectangles indicates graphically, which project they represent.

In order to examine the effects of a delayed project graphically, a visualization similar to the exemplary deliverable shown in figure 3.25 can be created employing a procedure resembling the one described above. Nevertheless, the functionality of *process4.biz* can more easily be leveraged in the creation of a tabular report showing the projects that need to be rescheduled as a consequence of the delayed project. When exporting the project data to Microsoft Excel, the filtering capabilities of Microsoft Excel can be applied in the following way: A filter is set to show only projects that start between the original and the actual end time of the delayed project. Doing so, one project to be delayed can be found in the test data, as shown in figure 11.22.

Of course, this report does not contain the projects that have to be rescheduled due to the necessary delay of the project shown in figure 11.22. After rescheduling a project, the procedure outlined above has to be applied recursively.

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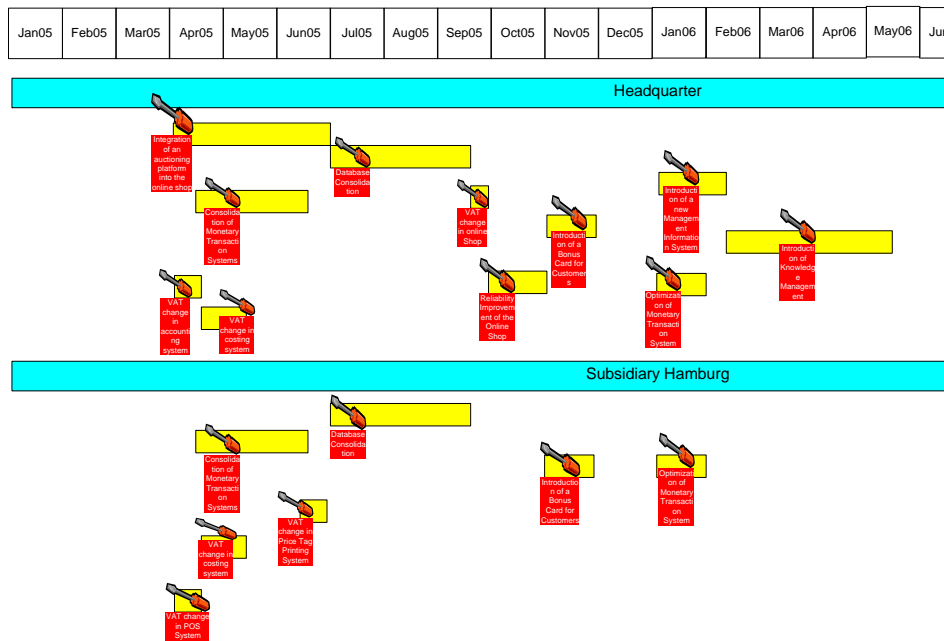


Figure 11.21: *process4.biz*: diagram created detailing which projects affect which organizational units (excerpt) for scenario synchronization management

Project	Object Name	End Time	Selected	Start Time
1309	VAT change in online Shop	01.10.2005	WAHR	15.09.2005

Figure 11.22: *process4.biz*: diagram showing projects directly affected by the delay of project *database consolidation* considered for scenario synchronization management

Also regarding the examination of the effects of the the deletion of the business application *Customer Satisfaction Analysis System* on projects, the situation in respect to the graphical deliverable is similar as described above. Mainly, the capabilities of the Microsoft Visio part of *process4.biz* would be used in a similar fashion as described above. More interesting is the leveraging of *process4.biz*'s Microsoft Excel export in creating the respective tabular report. By applying three filters to the exported project data (end date after 4/1/2005, start date before 5/30/2005 and the field showing the object links containing *Customer Satisfaction Analysis System*), the affected project can be found.

The tool handling is basically intuitive, except the behavior regarding the copy operations on the graphical symbols in diagrams, which increases the already perceivable manual effort necessary for the simulation of the scenario.

The achievement of objectives is partially given. One diagram and all requested reports were created in the course of the scenario simulation. Diagrams like the ones shown in the exemplary deliverables figure 3.25 and figure 3.26 have not been created as this would result in a high manual effort involving mainly standard Microsoft Visio drawing functionality.

The procedure consistency is a bit hard to determine when taking into consideration that the used procedure has been devised during the scenario simulation. Even though, it has to be

noted that the tool provides no strong diagramming support regarding issues involving time. This might limit the tool's suitability for synchronization management.

The procedure integration is basically given. The models and data entered before were able to be reused in the simulation of the scenario.

Rating: 1 point for synchronization management.

11.2.4 Traceability and Strategy Management

In order to capture the data necessary for the simulation of the scenario *traceability and strategy management* in *process4.biz*, some metamodel changes are necessary. While the *Strategy* and *Goal* entity types can be created in direct accordance to the UML diagram in figure 3.4, some adaptations have been performed regarding the *Metric*, *Measure* and *MeasureAssignment* classes. In order to be able to create comparisons of target and actual values in a straightforward manner, instead of three entity types one entity type called *Measure* is created in *process4.biz*.

This entity type has the information about the metric⁵ used for the determination of the measures⁶ in the attribute *Name*, the respective values in the subsequent attributes of type *Double*. The names of these attributes determines the validity period and role of the respective measures, which is the information contained in the association class *MeasureAssignment* in the UML diagram in figure 3.4.

This approach is chosen as it supports exporting both target and actual measures into a Microsoft Excel document, where it can be easily determined whether there are deviations from the target values.

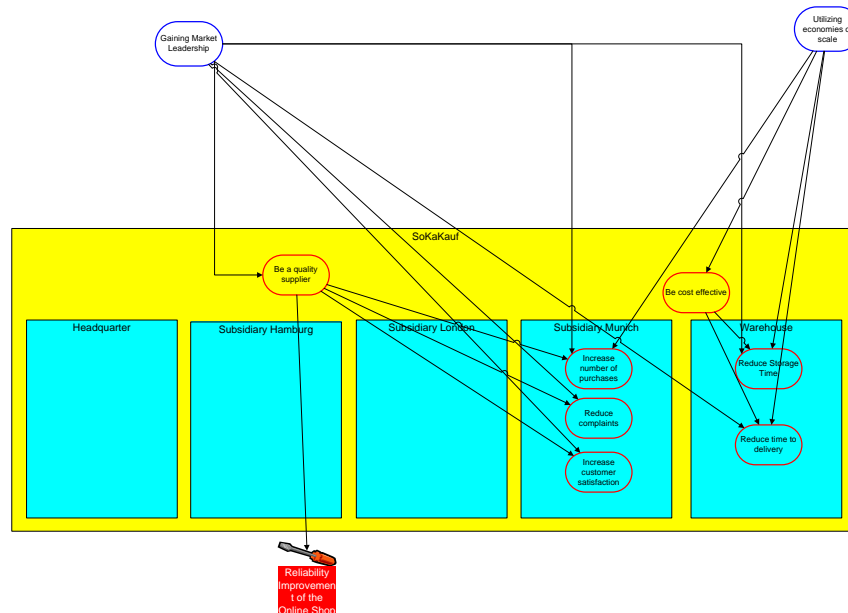


Figure 11.23: *process4.biz*: diagram showing relationships between strategies, goals organizational units and projects for scenario traceability and strategy management

⁵*Metric* describes the measurement process employed for determining metric values for a certain object under evaluation here.

⁶*Measures* are specific metric values.

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Measure	Object Name	id	is050501	is050801	targetValue	Object Links
1383	Average customer satisfaction according to a performed survey (may range	2	6	7	7	Be a quality supplier : Goal
1389	Average customer satisfaction according to a performed survey (may range	8	6	7	7	Increase customer satisfaction : Goal
1386	Average delivery time in days	5	5	5	4.2	Reduce time to delivery : Goal
1384	Average time in storage (for an article) in	3	10	8	9	Reduce Storage Time : Goal
1385	Maximum delivery time in days	4	30	25	21	Reduce time to delivery : Goal
1388	Number of complaints per day	7	10	9	8	Reduce complaints : Goal
1387	Number of purchases per day	6	14000	15000	15400	Increase number of purchases : Goal
1382	Sum of personel, material and capital cost	1	50000000	442001471	45000000	Be cost effective : Goal

Figure 11.24: *process4.biz*: report showing goal achievement according to measures attached to goals for scenario traceability and strategy management

Capturing the information regarding strategies and goals as well as their dependencies and relationships to organizational units and projects is done via graphically modeling the respective diagram, shown in figure 11.23. In order to capture the information expressed in the diagram into the repository without further manual steps, automated linking strategies of *process4.biz* are used.

This approach, possible as there are no relationship types involved in this scenario that have identical relationships ends, allows easy and intuitive capturing of the data regarding the scenario *traceability and strategy management*. Filtering the diagram in order to derive a visualization that limits its content to the one shown in figure 3.28 is not automatically supported.

The information regarding metrics used to operationalize the different goals is entered into entities of the type *Measure* created above. The information which *Measure*-entity contains information about which goal is represented by *process4.biz object links*.

In order to annotate the visualization shown in figure 11.23 with symbols reflecting the metric values, the shapeshheet technology of *process4.biz*, detailed in section 11.1.5 can be used, although changing the metrics visualized (e.g. switching to another year) would then involve changing shapeshheet code. Creating a tabular report containing information whether certain goals have been achieved according to the measure information available can be done more easy by exporting the measure data to Microsoft Excel. By leveraging the capabilities of Microsoft Excel a report as shown in figure 11.24 can be created. The goals operationalized by the different measures are visible in the *object links* column.

The formatting conditions responsible for coloring metrics indicating a goal that has not been achieved has to be entered into Microsoft Excel by hand.

The tool handling is basically intuitive, except for adapting stylesheets, which calls for more advanced Microsoft Visio skills.

The achievement of objectives is mostly given, except for the filtered diagram as described above, which, after all, could also be filtered by hand.

The procedure consistency is a bit hard to determine, as finally the employed procedure was planned by the user during the execution of the scenario.

The procedure integration is basically given. It is possible to reuse data entered during the simulation of other scenarios.

Rating: 2 points for traceability and strategy management.

11.2.5 Management of Business Objects and Business Services

Central to scenario *management of business objects and business services* are the business objects, which are in this scenario detailed by their attributes. Therefore, two new entity types with their

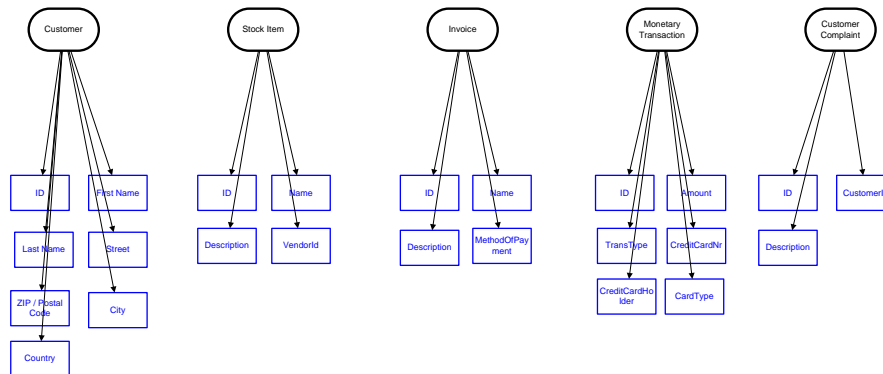


Figure 11.25: *process4.biz*: diagram showing the business objects with their attributes for scenario management of business objects and business services

respective symbols are created. The entity type *Business Object* and the entity type *Business Object Attribute*, with object links indicating the business object attributes belonging to the respective business objects. The information about the business objects and their attributes is then entered into the tool by creating the diagram shown in figure 11.25.

Information about *business applications* relevant to this scenario has been captured in scenarios previously simulated, the information about *Business Services*, *Connectors* and *Interconnections* is captured during the construction of the respective diagrams, as this appeared to be the easiest way in *process4.biz*. This led to the construction of the diagram shown in figure 11.26, thereby it has to be noted that, as the entity types *Connector* (the lollipop symbol), *Interconnection* (the red oval) and *Business Object* (the transparent oval) have been created by the user, the same is true for their symbols.

The diagram, while resembling the exemplary delivery shown in figure 3.31 has some features incorporated to adapt to the functionality of *process4.biz*:

- Instead of being attached to the rectangles representing the organizational units, the lollipops overlap with them. This is done in order to leverage the swimlane technology (see section 11.1.4).
- Using *direct connections* in order to capture the information that a business application is connected to a *connector* of another business application is not advisable, if the information which business application has which connectors is to be preserved in the repository. As using the *direct connection* as described above creates an *object link* in the repository similar to the ones indicating that a business application has a connector, another approach has to be devised here. Hence, it is chosen to add an element of indirection between the connectors and the business applications that connect to them: the *interconnection*-entities, symbolized as red ovals.
- Due to the rather indirect support of the relationship type concept elaborated on in section 11.1.1, being able to capture the direction of relationships would call for even more elements of indirection to the representation of the interconnections as described above. Therefore, it is abstracted away from this information here.

The matrix map showing the information flows between the business applications, as shown as an example in figure 3.32, can be drawn using Microsoft Visio based visualization capabilities of *process4.biz*,

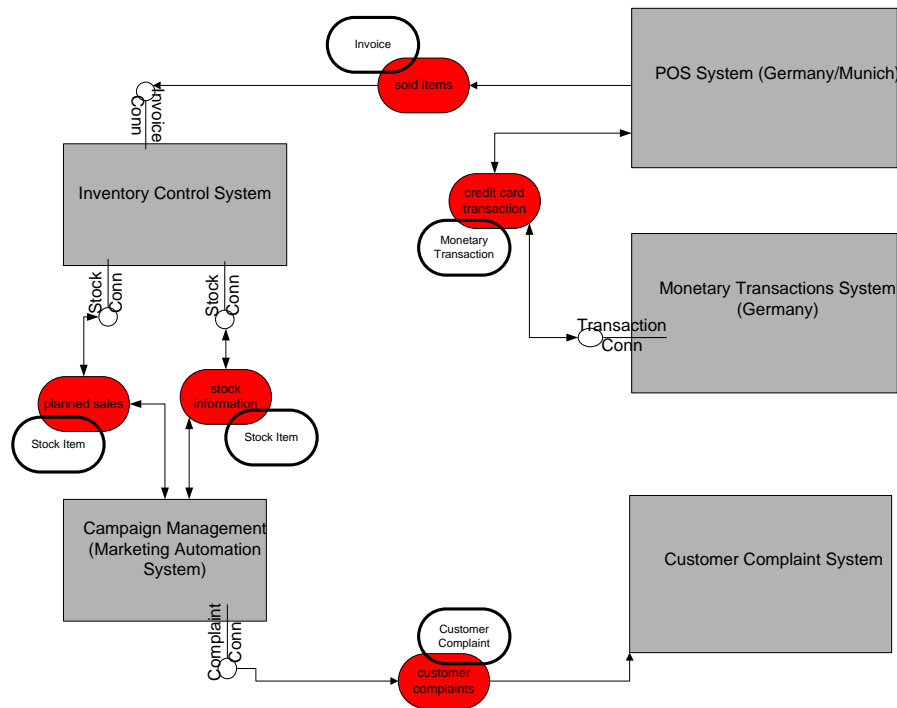


Figure 11.26: *process4.biz*: cluster map visualizing the connectors, interconnections and transferred business objects relevant to process *Distribution* for scenario management of business objects and business services

hereby it is helpful that the necessary entities have already been captured in the repository of *process4.biz*. As creating the deliverable would involve mainly manual positioning of the graphical elements, it has not been performed in the simulation of the scenario.

Figure 11.27 shows an automatically generated report containing some of the information covered by the exemplary deliverable in figure 3.33.

Every cell in the column *Object Links* contains part the information contained in one cell of the exemplary report in figure 3.33. As it can be seen, the deliverable in figure 11.27 does not employ the position in a matrix to express the respective information. The information to which business applications the connectors referenced in the report belong, would have to added manually, the information about the direction of the information flow is not contained in the repository, due to reasons detailed above.

The tool handling is basically intuitive, only the creation of the lollipop symbol has to be done manually.

The achievement of objectives is mostly given, some information (e.g. the directions of the data flows) can not be included in the demanded report (see figure 11.27) automatically.

The procedure consistency is a bit hard to determine, as it was necessary to devise a procedure sufficient for the scenario. Basically, the functionality of *process4.biz* lends itself to the execution of this scenario quite well, although the way relationships between entities are handled in *process4.biz* leads to some workarounds here.

Interconnection	Object Name	Object Links
1430	credit card transaction	Monetary Transaction : Business Object POS System (Germany/Munich) : Business Application Transaction Conn : Connector
1431	customer complaints	Complaint Conn : Connector Customer Complaint : Business Object Customer Complaint System : Business Application
1429	planned sales	Campaign Management (Marketing Automation System) : Business Application Stock Conn : Connector Stock Item : Business Object
1427	sold items	Invoice : Business Object Invoice Conn : Connector POS System (Germany/Munich) : Business Application
1428	stock information	Campaign Management (Marketing Automation System) : Business Application Stock Conn : Connector Stock Item : Business Object

Figure 11.27: *process4.biz*: cluster map visualizing information flows between business applications for scenario management of business objects and business services

The procedure integration is basically given. Data entered before can be reused in the simulation of the scenario.

Rating: 2 points for management of business objects and business services.

11.2.6 Application Architecture Management

In order to capture the information about architectural blueprints and their implementations relevant to this scenario in *process4.biz*, four new entity types, in direct correspondence with the UML in figure 3.4, have to be created: *Abstract Technology*, *Technology*, *Architectural Blueprint* and *Architectural Solution*. It is helpful that none of the entity types is connected to another entity type by more than one relationship type, as this spares the user from workarounds necessary to keep the ability of distinguishing these different types of relationships.

After creating the entity types, the respective information is, as in several scenarios described above, captured by graphically modeling the entities and their interconnections, as shown in figure 11.28.

The visualization depicts technologies as rectangles, contained within a black rounded rectangle representing the abstract technology they belong to. The red rounded rectangles visualize the architectural blueprints, also with the architectural solutions that implement them, symbolized as blue circles, contained. Arrows indicate the technologies the specific architectural blueprints use. The visualization does not show the connections between architectural blueprints and abstract technologies in order to limit the number of elements and keep the diagram readable.

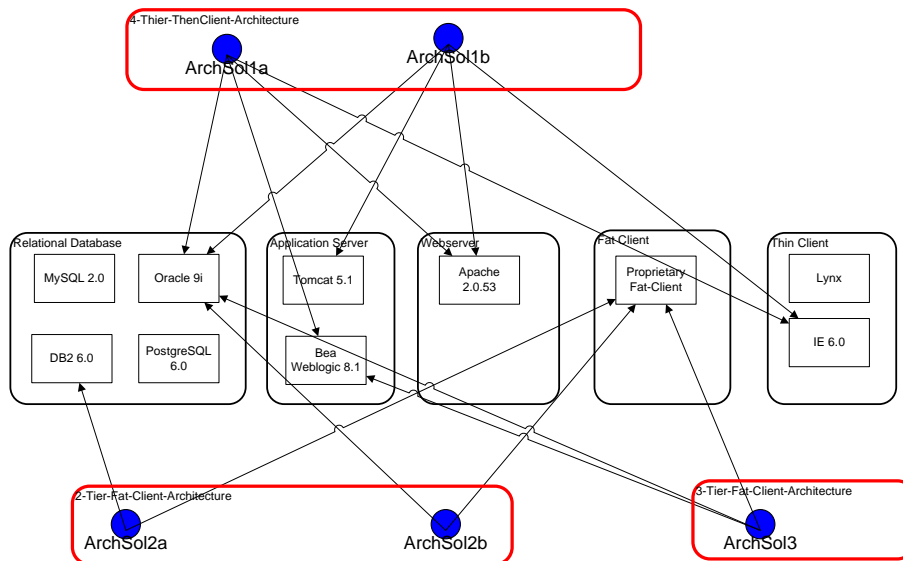


Figure 11.28: *process4.biz*: instantiations of blueprint architectures and their implementation based on technologies for scenario application architecture management

When constructing this visualization, it is especially taken into account that the symbol used for the *Architectural Solution* can later be placed on the business applications of a cluster map, capturing the relationship (*based on*) between business applications and architectural solutions via the swimlane technology. The respective diagram is shown in figure 11.29.

Business applications not conforming to one of the architectural solutions, which are therefore considered as being not standard-compliant, are (manually) colored red.

A report showing business applications with their *architectural solutions* and employed *technologies*, similar to the exemplary deliverable in figure 3.35 can be created, although the information about *used technologies* would have to be added in a procedure involving some manual effort. When only relying on direct automated functionality of the *process4.biz* exporter, a report like the one shown in excerpt in figure 11.30 can be created. It has to be noted that the column *Object Links* also contains links that point to entities not of type *ArchitecturalSolution*.

A bar chart showing the number of usages of the architectural solutions as the exemplary deliverable in figure 3.36 would be created in Microsoft Excel, based on exports from *process4.biz*. Therefore, the chart could be customized to look exactly like the exemplary deliverable. Admittedly, the data necessary to construct the diagram has to be post-worked manually in order to serve as an adequate base for constructing the bar chart. As it has been noted in section 11.1.3, the format *process4.biz* uses in exporting relationships is not always perfectly accessible for Microsoft Excel.

The tool handling is intuitive, all functionality used in the simulation of the scenario is easily accessible.

The achievement of objectives is basically given, the construction of some deliverables, as for example visualizations similar to figure 3.35 or 3.36, is tied to steps involving manual effort.

The procedure consistency is a bit hard to determine, as finally, the procedure had to be thought up by the user during the scenario simulation.

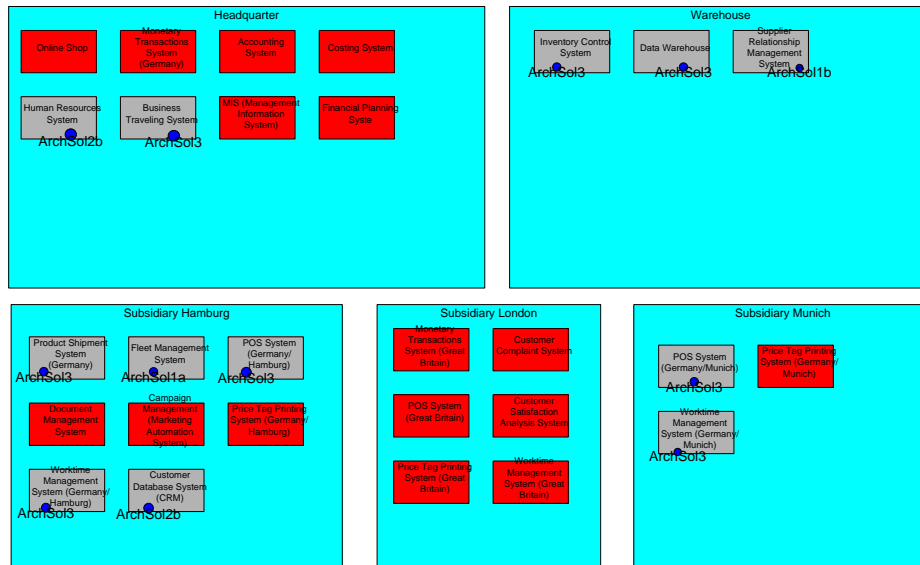


Figure 11.29: *process4.biz*: architectural solutions used by the business applications for scenario application architecture management

Business Application	Object Name	Object Links
1037	Accounting System	Campaign Management (Marketing Automation System) : Business Application Connection of Costing and Accounting System : Project DB2 London : Infrastructure Element Headquarter : Organizational Unit Introduction of RFID in the Warehouse : Project VAT change in accounting system : Project
1038	Business Traveling System	ArchSol3 : ArchitecturalSolution Database Consolidation : Project Headquarter : Organizational Unit Oracle Hamburg : Infrastructure Element
1044	Data Warehouse	ArchSol3 : ArchitecturalSolution Introduction of Knowledge Management : Project Introduction of a Bonus Card for Customers : Project Oracle Munich : Infrastructure Element Replacement of the Customer Satisfaction Analysis System by the Data Warehouse : Project Warehouse : Organizational Unit
1045	Document Management System	Database Consolidation : Project Introduction of Knowledge Management : Project Oracle Hamburg : Infrastructure Element Subsidiary Hamburg : Organizational Unit

Figure 11.30: *process4.biz*: excerpt from a report showing the architectural solutions the business applications are based on for scenario application architecture management

The **procedure integration** is basically given. Data entered before were able to be reused in the simulation of the scenario.

Rating: 3 points for application architecture management.

11.2.7 Infrastructure Management

Most of the information and the respective entity types relevant to scenario *infrastructure management* have already been introduced in scenarios previously simulated and can thus be reused here. This is true for the *organizational units*, the *business applications* and the *technologies*. Only for the *infrastructure elements* are entity type creation and data entry necessary.

Further, the choice to reuse the cluster map created during simulation of scenario *visualization of the application landscape* is made. As Microsoft Visio's layering principle has been deactivated in *process4.biz*, the reuse of the cluster map is done by creating a copy of it, aware that this model has to be changed separately if adaptations to the cluster map become necessary.

After importing the *infrastructure element*-entities, the respective technology is attached to them by hand via creating *object links*. Of course, the technologies used here are database technologies, as the infrastructure elements under consideration in this scenario are databases.

The information which business applications use which databases (i.e. *infrastructure elements*) is captured in the repository during the manual augmentation of the copied cluster map with the database information, of which the result is shown in figure 11.31.

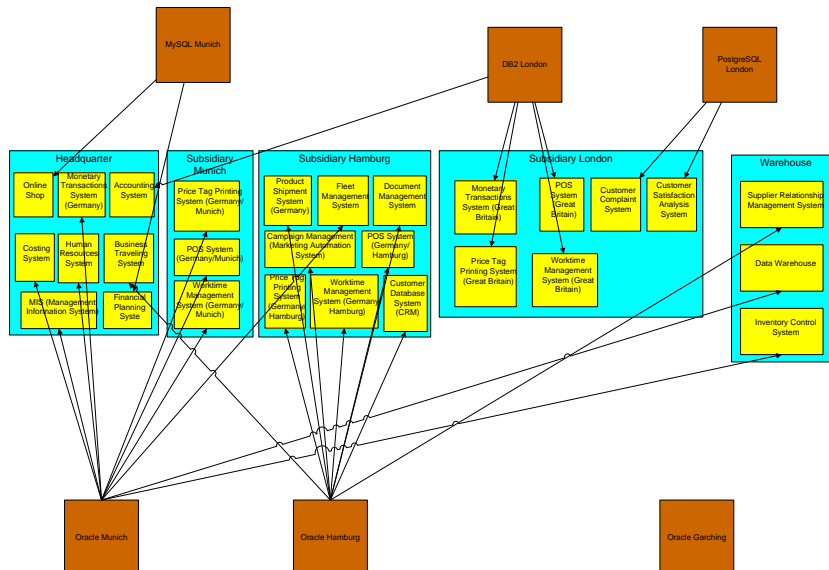


Figure 11.31: *process4.biz*: cluster map visualizing database usage of the business applications for scenario infrastructure management

A tabular report containing the same information as the diagram in figure 11.31 can be created by exporting the entities of type *infrastructure element*.

Infrastructure Element	Object Name	License Cost	Operating Cost	Sum	Object Links
1247	DB2 London	5000	3000	8000	500 : Technology Accounting System : Business Application Monetary Transactions System (Great Britain) : Business Application POS System (Great Britain) : Business Application Price Tag Printing System (Great Britain) : Business Application Worktime Management System (Great Britain) : Business Application
1243	MySQL Munich	0		0	100 : Technology Financial Planning System : Business Application Online Shop : Business Application
1246	Oracle Garching	10000		10000	200 : Technology
1245	Oracle Hamburg	5000	20000	25000	200 : Technology Business Traveling System : Business Application Campaign Management (Marketing Automation System) : Business Application Document Management System : Business Application POS System (Germany/Hamburg) : Business Application Price Tag Printing System (Germany/Hamburg) : Business Application Product Shipment System (Germany) : Business Application Supplier Relationship Management System : Business Application Worktime Management System (Germany/Hamburg) : Business Application
1244	Oracle Munich	10000	20000	30000	200 : Technology Costing System : Business Application Data Warehouse : Business Application Fleet Management System : Business Application Human Resources System : Business Application Inventory Control System : Business Application Inventory Management System : Business Application MIS (Management Information System) : Business Application Monetary Transactions System (Germany) : Business Application POS System (Germany/Munich) : Business Application Price Tag Printing System (Germany/Munich) : Business Application Worktime Management System (Germany/Munich) : Business Application
1248	PostgreSQL	0	3000	3000	600 : Technology Customer Complaint System : Business Application Customer Database System (CRM) : Business Application Customer Satisfaction Analysis System : Business Application

Figure 11.32: *process4.biz*: report listing the database usage of the business applications for scenario infrastructure management

Figure 11.32 shows the result, which contains the business applications used by the respective database in the column *object link*. Due to the limited filtering capabilities regarding the export of object links, this report also shows other entities besides the ones of type *business application* the infrastructure elements have object links to.

A report detailing the costs of operating and licensing for the specific databases is best created via the calculation capabilities of Microsoft Excel based on the report shown in figure 11.32. Creating a visualization that expresses the same information would reach the limits of *process4.biz*'s functionality, as using attributes of linked entities in shapsheet calculations is not supported.

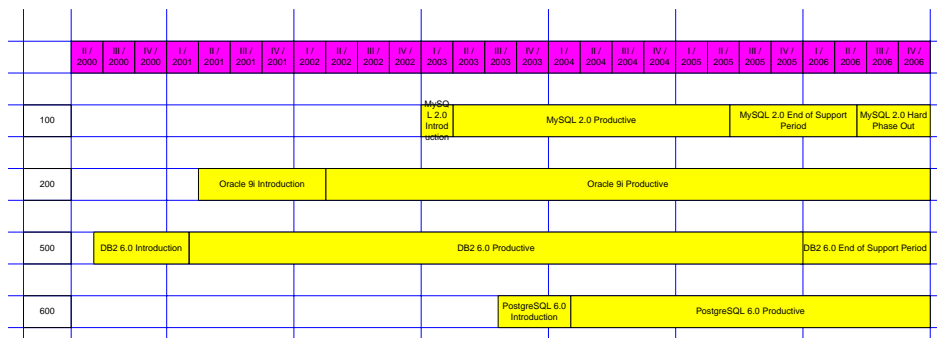


Figure 11.33: *process4.biz*: interval map visualizing the life cycle phases of the different (database) technologies for scenario infrastructure management

In order to be able to use as much as possible of the functionality of *process4.biz* in the construction of a *process support map* showing the life cycle phases of the database technologies similar to exemplary deliverable in figure 3.39, a deviation from the UML shown in figure 3.4 is made when introducing the respective concepts into *process4.biz*. Instead of having attributes indicating the begin of each life cycle stage in the technology entity type, another approach is chosen. The respective attributes are

factored out into entities of type *Technology Lifecycle* that separately model each life cycle phase of a technology which is then attached to the respective technology via an object link. These object links were able to be captured automatically during the construction of the diagram depicted in figure 11.33, by leveraging the *swimlane technology*.

Admittedly, following this approach is not without a downturn, which in this case would be manual effort in creating a report showing the information contained in figure 11.33, as the exemplary report shown in figure 3.41. In order to create such a report automatically, it would be necessary to be able to perform a join between the entities of type *Technology* and the ones of type *Technology Lifecycle*.

A tabular report listing business applications affected by the database consolidation subject to scenario *infrastructure management* can be created in Microsoft Excel based on the report shown in figure 11.32, if a flag indicating the replacement of a database is included in the export. When having this flag available, databases untouched by the consolidation project can be filtered out. Thus, the column titled *Object Links* contains now only entities of type *business object* affected by the database consolidation.

Visualization of the respective information, exemplarily shown in figure 3.38, can be achieved in *process4.biz* by switching the color of the symbols depicting the *technology*-entities according to the value of the flag that indicates infrastructure elements (databases) that are affected by the consolidation. Therefore, working with shap sheets is necessary.

The tool handling is basically intuitive, difficulties may be expected when working with shap sheets, as this might call for advanced Microsoft Visio skills.

The achievement of objectives is mostly given, some information can not be included in the demanded report (figure 11.27) automatically. It has to be noted that when following a way more similar to the UML in figure 3.4 regarding the implementation of the life cycle phases in *process4.biz*, creation of the respective report would be more easily, but creation of the graphical deliverable would be less supported by the features of *process4.biz*.

The procedure consistency is a bit hard to determine, as finally, the employed procedure was a user-devised one. Regarding the entity types necessary, the predefined metamodel of *process4.biz* knows the entity type *Hardware*, which it might understand similar to the *Infrastructure Element* introduced for the scenario simulation.

The procedure integration is basically given. Data entered before were able to be reused in the simulation of the scenario.

Rating: 2 points for infrastructure management.

11.3 Tool Vendor's Profile

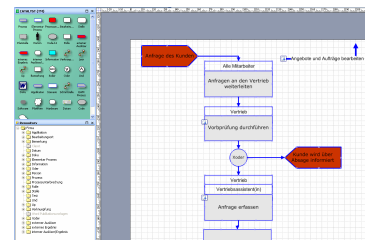
Using process4biz (p4b) – to plan, analyze and document complex, corporate business processes, corporate architectures and systems

Mag. Thomas Handlir, CEO of process4.biz GmbH

Process4.biz® (so called: p4b) approach is geared towards more than solely business process modeling, it also covers requirements such as strategic IT planning, CobiT, ITIL, Enterprise Architecture Management (EAM) and BPM. Additionally p4b also comes with an interface to the ERP system AXAPTA® and enables its implementation along the process4.AXAPTA reference models, as well as its automatic (Re)-documentation. Central requirements for revision & audit, certification, Sarbanes Oxley Act and Basel 2 can be solved using p4b, which is offering latest Cobit templates delivered directly from ISACA Group.

p4b – Process and IT architecture modeling solution

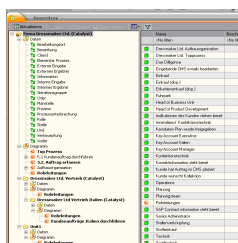
Based on Microsoft Visio 2003, process4.biz supports you in the visualization, analysis, documentation and evaluation of business processes and architectures. The p4b solution, next to the pure modelling of process organization and organizational structures, also enables you to structure and display the application / technology / information / interface architectures. In addition to this, implementation roadmaps can render future oriented scenarios more transparent as part of a comprehensive Enterprise Architecture. This transparency is similarly ideal for the CIO, and the CEO with regard to the strategic alignment of the company, as it is for consultants, who are charged with the task of implementing the above-mentioned topics.



Templates and reference models

Process4.biz encompasses templates for: EPC (Event-driven Process Chains), CatalystSM from CSC, EAM (Enterprise Architecture Management) and AXAPTA. It is also possible to create separate templates and to use p4b without methods and notation. This renders p4b an ideal tool in IT governance projects based on reference models from CobiT (Control Objectives for Information and related Technologies) and ITIL (IT Infrastructure Library).

Flexible Repository



The p4b database is designed such that working in genuine multi-user mode is possible. Objects and data used throughout the company are created 1 x only and they can be used again in all projects with p4b. This enables you to maintain a central "redundancy free" knowledge database across the entire corporate architecture. You can adapt data structures within the p4b database freely and without restrictions. Repository flexibility enables objects to be inherited "top-down" along the hierarchical structure and thus not only ensures continuity in the model and extreme acceleration in modelling, but also supports the establishment and implementation of the models in general practice.

P4b – Grapical Visio Modeler

The p4b – Graphical Visio Modeller is the client-solution on the base of Microsoft SQL Server database for one or many work places based on Microsoft Visio 2003 technology. P4b's multi-user access capability with record and diagram locking guarantees consistent results.

Reports, Integration with Microsoft Office and Web-Portal

User's own reports can be created quickly by using either SQL (Structured Query Language) or Excel Pivot Table Reports. Data import and export with wizards for Microsoft Office (Excel) help users if it is necessary to use p4b data in other applications or to import data. Publication of data and graphical models to MS PowerPoint, Word are supported as well. The p4b-Web-Publisher Server has been developed for teamwork intranet purposes and the p4b-Enterprise Portal Server expands the teamwork activity with a powerful intranet portal. Here selected contents can be automatically published to different Webservers, in different languages, for and by different users and editing of data is possible with a simple WebBrowser to the last field.

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Telelogic AB provides the EA management tool *System Architect*. In the following sections the evaluation sketched in section 2.2.8 is described in detail. *System Architect* had formerly been developed by Popkin Software, Inc., which was acquired by Telelogic AB in 2005. The evaluated version of *System Architect* is version 10.1.11.

12.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

12.1.1 Configurability of the Metamodel

System Architect enables the user to create a new metamodel or to adapt and extend the metamodel shipped. This adaptation is performed utilizing a SQL-like data definition language employing a comprehensive list of data types, especially when regarding reference types, while lacking the support for floating point numbers, which may be substituted by text values. *System Architect* does not provide a graphical user interface for performing adaptations and extensions of the metamodel, while a documentation of the concepts employed in metamodeling is available.

The definition of the metamodel is splitted into two files. One file contains the basic metamodel shipped with *System Architect*. The second file may be used by the customer to adapt the metamodel according to own needs. Adaptations include adding new entities, attributes, relationships, symbols, and diagrams, elements of the predefined metamodel may be adapted or hidden. Relationships support the following cardinalities, 0..1, 1, 0..* and 1..*, but mandatory attributes are not supported. Metamodel adaptation also includes the possibility to define, which entities and relationships, represented by which symbols, may be used within which diagrams, together with the layout of property dialogs.

The split-up into two files allows to upgrade a customized metamodel to future releases of *System Architect*. For performance reasons the metamodel is automatically compiled after changes have been performed.

Rating: 5 points for configurability of the metamodel.

12.1.2 Coverage of EA Management Concepts by Predefined Metamodel

System Architect ships with a comprehensive metamodel offering the possibility to choose the publicly available framework the metamodel should attain to, by simply hiding parts of the metamodel. Some of the frameworks supported according to *Telelogic* are, Zachman [ZIF05], TOGAF [TOG05], DODAF, and FEAF. *Opting in* and *opting out* reduces the number of concepts covered by the predefined metamodel, which overall sum up to a number of 350 entity types. A minor drawback regarding the set of predefined concepts arises from the lack of a comprehensive documentation explaining the available entity and relationship types.

The shipped metamodel of *System Architect* is already sufficient to basically simulate the scenarios landscape management (see section 12.2.1), traceability and strategy management (see section 12.2.4) and management of business objects and business services (see section 12.2.5). Problems arising during the simulation of these scenarios using the predefined metamodel basically result from missing relationships and attributes. For simulating the other scenarios, concepts like e.g. architectural blueprints (see section 3.3.2) are missing within the standard metamodel. Nevertheless all missing concepts can be introduced by adapting the metamodel.

Rating: 4 points for coverage of EA management concepts of the metamodel.

12.1.3 Support for Impact Analyses & Calculation

System Architect offers multiple ways to perform impact analysis. The first way is to use the *explorer diagram* (see figure 12.1). The special feature of this diagram is the possibility to *show all immediate relatives of an entity*, a very intuitive way to perform transitive, graphical impact analysis. For filtering elements within an explorer dialog two different techniques can be applied. *Explorer relationship reports* can be used to highlight entities and relationships within the diagram. Selecting the appropriate elements, a SQL-like query language can be used. The same language can be used for selecting elements in an *explorer object report*. This report can be used to populate an explorer diagram.

Both kind of reports have to be dropped on an explorer diagram to be executed. Depending on the location where they are dropped the results differ, as the location is used as the starting point of the query.

An equal functionality may be achieved using the integrated Microsoft Visual Basic for Applications scripting engine. Using this approach the complete repository and all *objects* within a diagram can be accessed, offering the possibility to hide, show, or highlight elements of the visualization (see figure 12.2). The scripting engine can also be used to perform calculations, transitively traverse relationships, or create reports, as external APIs, e.g. of Microsoft Word can be accessed.

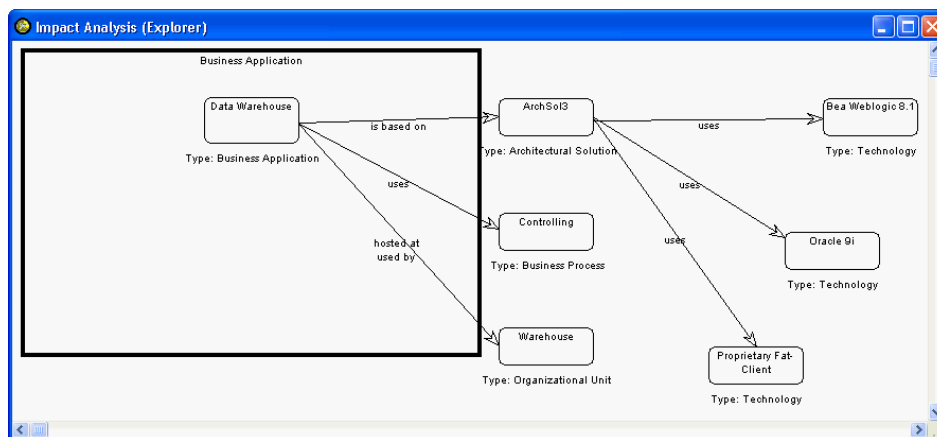


Figure 12.1: *System Architect*: *explorer diagram* to perform impact analysis

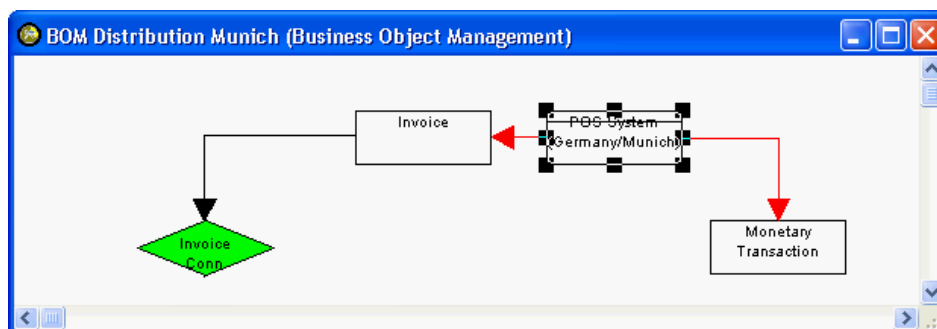


Figure 12.2: *System Architect*: Microsoft Visual Basic for Applications macro has been used to highlight selected symbol's relations

12. Telelogic AB (System Architect)

A third way to perform impact analysis is to use the report generator (see section 12.1.6), which allows to use SQL-like queries to create dbase files, text files or HTML reports.

Rating: 4 points for support of impact analyses & calculation.

12.1.4 Richness of Predefined Visualization Techniques

System Architect offers three different diagram types. The first type corresponds to our *map without a base map* (see appendix A.2). This diagram type can be specified by adapting the metamodel to define, which entities, symbols, and relationships may be used. It can also be utilized to create cluster maps (see figure 12.3), process support maps (see figure 12.15), and interval maps by manually positioning and highlighting elements of the visualization.

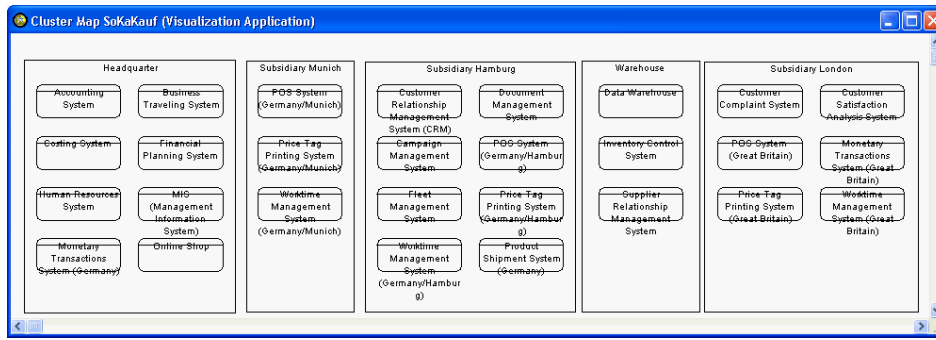


Figure 12.3: *System Architect*: cluster map created with *System Architect*

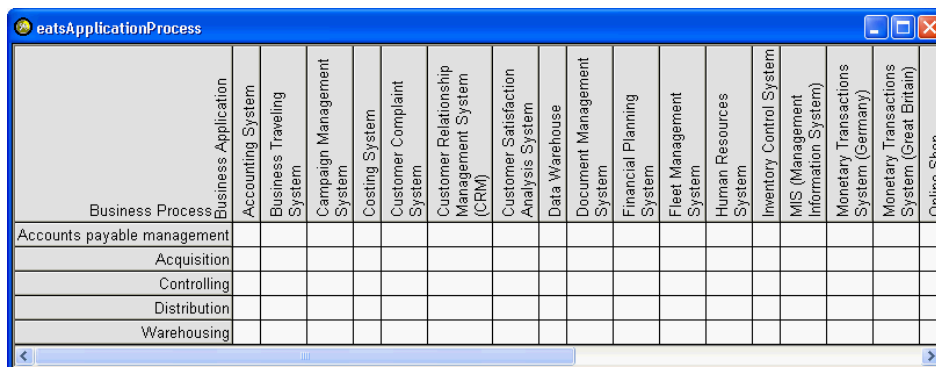


Figure 12.4: *System Architect*: matrix diagram showing relationships between business applications and processes

Another diagram type is the explorer diagram¹ (see figure 12.1), which can be used to perform graphical impact analysis, as it is possible to automatically *show immediate relatives of an entity*. The third type is a matrix diagram (see figure 12.4), which may be used to show and edit relationships between entities of the metamodel. This diagram type is as well as the first diagram type specified through metamodel

¹For additional information about filtering of explorer diagrams see section 12.1.3.

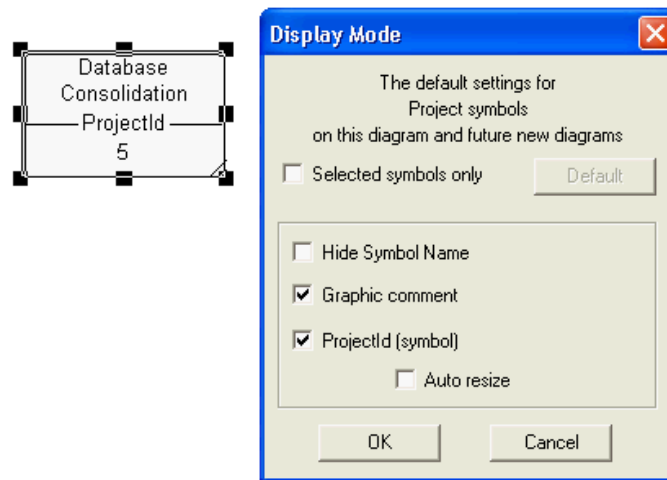


Figure 12.5: *System Architect*: selection of attributes to be shown can be performed using a dialog

adaptation, whereby the extensions required can be created using a wizard. The information visualized in this kind of diagrams may also be exported to Microsoft Excel, Microsoft Word, CSV, and HTML.

The first two diagram types offer the possibility to perform additional layout operations, e.g. aligning, snap to grid, highlighting through colors, arranging symbols as a circle, etc. Additionally clustering (see figure 12.3) functionality may be used in maps without a base map, but without a semantic meaning. Swimlanes and pools may also be used in this kind of diagram for some entity types, like e.g. business processes.

Zooming is supported in all diagram types, but concepts like filtering or layering, in order to reduce complexity of the visualizations, are not provided.

Maps without a base map and *explorer diagrams* offer the possibility to show up to 37 attributes for each symbol within a diagram. The attributes available for selection (see figure 12.5) can be defined for every symbol by adapting the metamodel. Diagrams of these two diagram types may also be interconnected to each other in a parent-child relationship. This functionality may be used to navigate between diagrams but cannot be applied for performing impact analysis or reporting.

A drawback of *maps without a base map* and *explorer diagrams* is that only some attributes, like name, etc. may be shown within a diagram. Diagrams of these two diagram types may also be interconnected to each other in a parent-child relationship. This functionality may be used to navigate between diagrams but cannot be used in performing impact analysis or reporting.

Rating: 3 points for richness of predefined visualization techniques.

12.1.5 Flexibility of Visualization Techniques

As already mentioned in the section richness of predefined visualization techniques (see section 12.1.4) it is possible to manually adapt visualizations according to specific demands. These adaptations may be saved in every diagram type. Utilizing automatic positioning of symbols does not consider

manual changes performed earlier. Four different layout algorithms are available, *arrange all symbols as a network*, *arrange all symbols hierarchically*, *isolate*² and *arrange selected symbols as a circle*, and *isolate selected symbol and attachment*.

Another way to perform automatic layouting is to use the Microsoft Visual Basic for Applications scripting engine, offering the possibility to reposition and format elements of the visualization according to specific needs. The disadvantage is that this approach demands for implementing layout rules.

The format of symbols in a visualization can be adapted by changing the color, the font, the line width, etc. This may be done manually or by using a format file offering the possibility to save formatting for later use.

Using metamodel adaptation (see section 12.1.1) it can be defined which entity is represented by which symbol. This even offers the possibility to change the representation of an image according to attribute values, as a separation between the entity and its graphical representation is supported by *System Architect*. Additionally *analytic depictions*, e.g. traffic lights are available, which can also be configured by metamodel adaptation and may be shown or hidden within a diagram. These depictions are placed around the symbol they have been added to. They cannot be based on *ordinary* attributes, therefore additional attributes are introduced. Values may be copied between these two attribute types using the integrated scripting engine.

Rating: 4 points for flexibility of visualization techniques.

12.1.6 Flexibility of Reporting

System Architect supports different ways for reporting. One way is to create static HTML files (see figure 12.10) including information about entities and diagrams. These can be selected using an integrated wizard (see figure 12.6)³.

Another way is to use predefined Microsoft Word reports offering the possibility to create e.g. lists of diagrams, etc. The reports mostly are matched to the predefined metamodel, e.g. it is possible to create *Business Enterprise Reports*, which do not include entities added to the predefined metamodel.

More flexibility in creating reports, also including extensions to the metamodel, like additional attributes, etc., is offered by the *Report Generator* (see figure 12.7), which is based on SQL-like queries. These are created using the graphical user interface of the report generator. The queries provide the functionality to join entities and thus allow transitive impact analysis. Selection and ordering of entities reported is possible utilizing their entity type and by attribute values, also including attributes added to the predefined metamodel. Aggregation functions, like count, sum, etc. are not supported. Reports can be created in text (see figure 12.18), HTML (see figure 12.8) or dbase format.

The last and most flexible way is to use the integrated Microsoft Visual Basic for Applications scripting engine, which may be used to access the complete repository but demands for a certain programming effort. This way also offers the possibility to perform calculations based on entities or attributes. Reports can be created in, e.g. Microsoft Word or Microsoft Excel format as the APIs of the appropriate application can be accessed by Microsoft Visual Basic for Applications.

Rating: 3 points for flexibility of reporting.

²Isolation in this context means that the selected symbol is separated from the rest of the symbols.

³For more information about exporting HTML files see section 12.1.8.

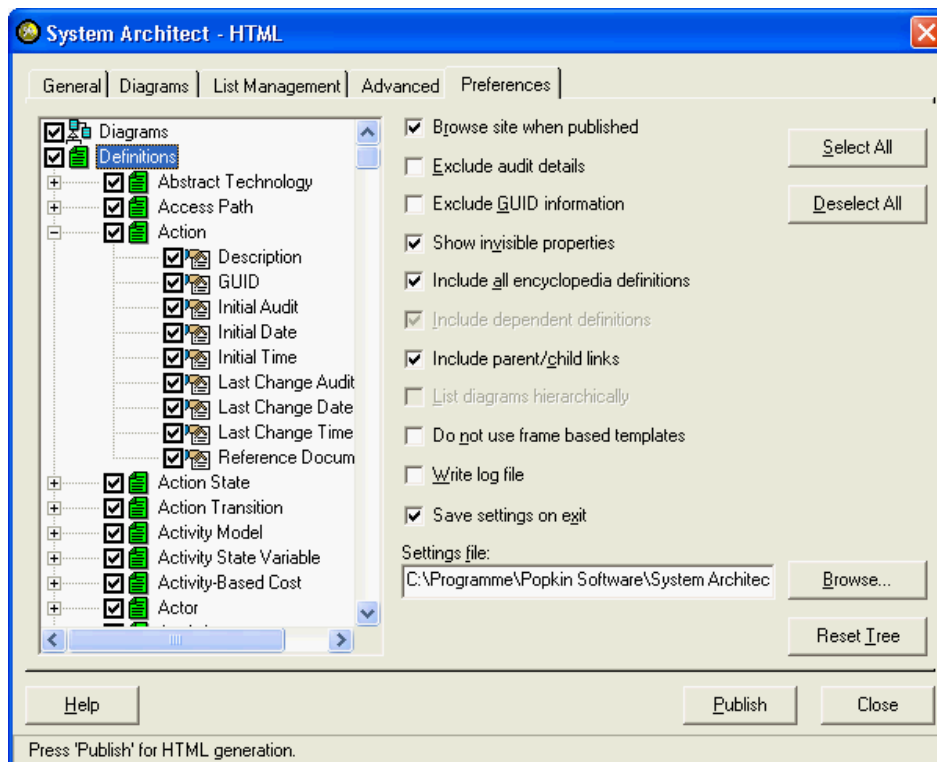


Figure 12.6: *System Architect*: HTML report generator

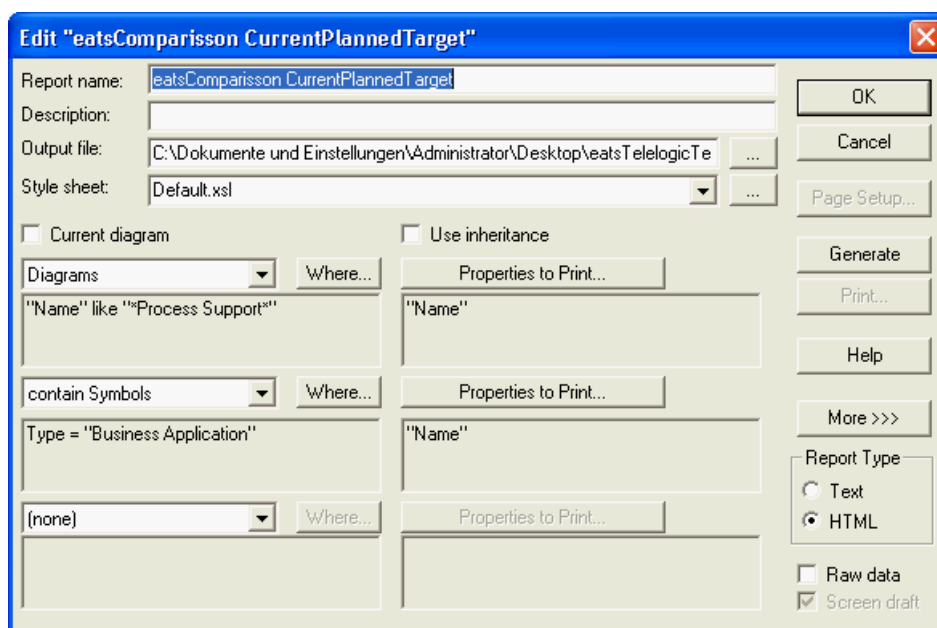


Figure 12.7: *System Architect*: creating a text based report using the *Report Generator*

12. Telelogic AB (System Architect)

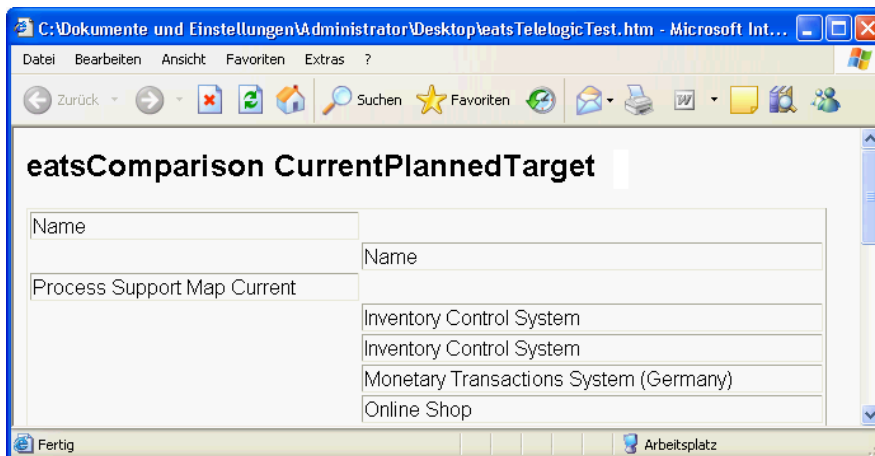


Figure 12.8: *System Architect*: list of business applications appearing in diagrams as HTML file

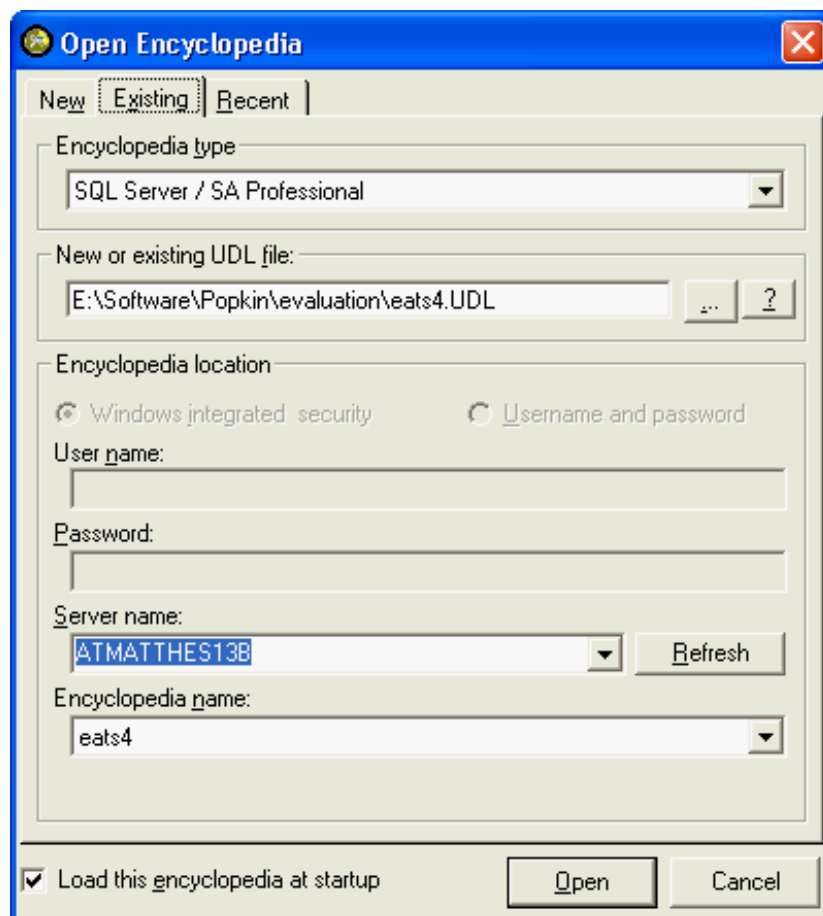


Figure 12.9: *System Architect*: open dialog for an *Encyclopedia*

12.1.7 Collaboration Support

System Architect supports multi user access to the repository. Elements within the repository are locked pessimistically. Only one user at a time is allowed to edit data. Data elements that are to be changed will be locked.

A web client is not shipped with the tool, only static HTML files may be exported, containing selected entities, attributes, and diagrams (see section 12.1.8). Working offline is supported, as it is possible to *check out* parts of the repository to a local database. To be able to use this functionality the customer needs a local copy of *System Architect*. Changes to the data may later be merged with the existing database. The user may select between the options *Use the more recent*, *Always replace target*, and *Never replace target* in order to resolve conflicts.

System Architect supports role based access control, which can control access to functionality, menus, encyclopedias, and object types. Locking can be performed at individual item level for access control purposes.

For authenticating users two different ways can be utilized. The first way is to use *windows integrated security*, the second way is to use *a user name and password for a Microsoft SQL Server*. Both alternatives can be selected when opening an *encyclopedia*⁴ (see figure 12.9).

Rating: 4 points for collaboration support.

12.1.8 Import/Export & External Data Sources

Depending on the kind of data that should be exported, the available export formats vary. As already mentioned in section 12.1.6 Microsoft Word reports can be created for elements of the shipped metamodel. These reports cannot be adapted by the customer.

HTML Reports realized as static HTML files (see figure 12.10) can also be created using a special wizard. This wizard offers the possibility to manually select the entities, attributes, and diagrams that will be included in the export (see figure 12.6 in section 12.1.6). Diagrams are included as JPG, PNG, or SVG files. Layout and style of the HTML files may be adapted according to corporate design using templates.

Using a *matrix diagram* (see section 12.1.4) offers the possibility to export the data shown to Microsoft Excel and the report generator (see section 12.1.6) is able to create lists of entities based on SQL-like queries. These lists can be exported to text, HTML, or dbase files.

System Architect offers a XMI Interface for exporting and importing of XMI from UML information contained within Class and Use Case diagrams in System Architect. Importing and exporting of *definitions*⁵ is performed by using CSV or XML⁶ files.

Using the integrated Microsoft Visual Basic for Applications scripting engine is the most flexible way to import and export data to *System Architect*, as it is possible to access the whole repository and every other application, which offers an API accessible through Microsoft Visual Basic for Applications. This can also be utilized to use external data sources without copying the data.

Rating: 3 points for import/export & external data sources.

⁴Encyclopedia corresponds to repository in other tools.

⁵*Definitions* correspond to entities in other tools.

⁶A XML schema describing the XML structure is available.

12. Telelogic AB (System Architect)

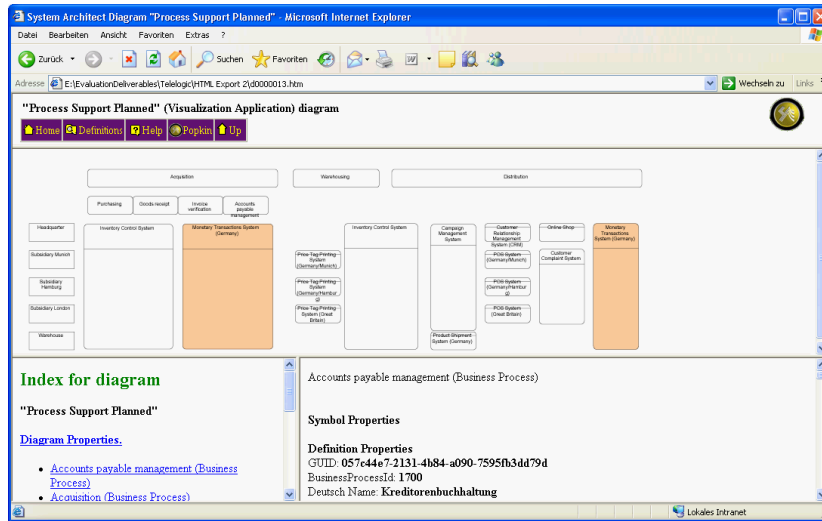


Figure 12.10: *System Architect*: HTML export showing the planned application landscape

12.1.9 Usability

System Architect has a quite intuitive and easy to use user interface (see figure 12.11). All entities, diagrams and matrices are organized within the tree views, depending on their type. The tree views can be customized by selecting, which entities and diagrams will be shown in the different tabs containing the tree views. Entities can be used within a visualization, by simply dragging them onto a diagram.

As manipulating visualizations by drawing associations or repository elements does not influence data within the repository, the entities are edited using property dialogs, which can be accessed either through the repository tree or by double clicking on the entity within a diagram. These dialogs may be configured using metamodel adaptation (see section 12.1.1). Creating relationships according to the metamodel can be performed by drag and drop (see figure 12.12).

To perform graphical impact analysis the *explorer diagram* may be used (see section 12.1.3), which offers the possibility to *show immediate relatives*, together with their relationships.

System Architect comes with a so called *Guidebook* (see figure 12.13) as an integrated help system, which is HTML based and may be customized and extended according to specific needs. Additionally there is a Microsoft Windows help file, which contains answer to most of the occurring questions. It also includes some tutorials for helping customers doing their first step in using *System Architect*.

The integrated report generator, which is based on a SQL-like query engine is a quite powerful tool to create listings of entities or diagrams and to perform impact analysis. The results may be exported to text, HTML, or dbase files, offering the possibility to use the reports as a basis for extended reports utilizing, e.g. Microsoft Excel.

For increasing usability *System Architect* ships with visualizations and guidelines how to use the supported EA frameworks, like DODAF, TOGAF [TOG05], and Zachmann [ZIF05]. This support is implemented by a visualization, which offers the possibility to specify which entities or diagrams may be edited according to the selected part of the methodology (see figure 12.14). This technique can also be customized, as it is possible to use own visualizations and an integrated wizard offering the possibility to specify the mapping described above.

Rating: 4 points for usability.

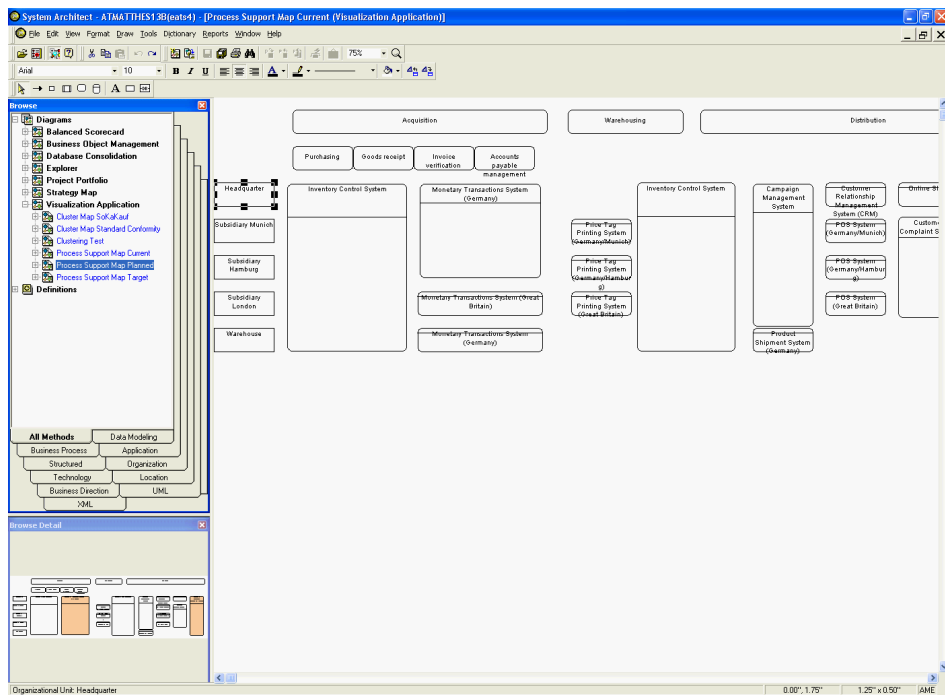


Figure 12.11: *System Architect*: graphical user interface of *System Architect*

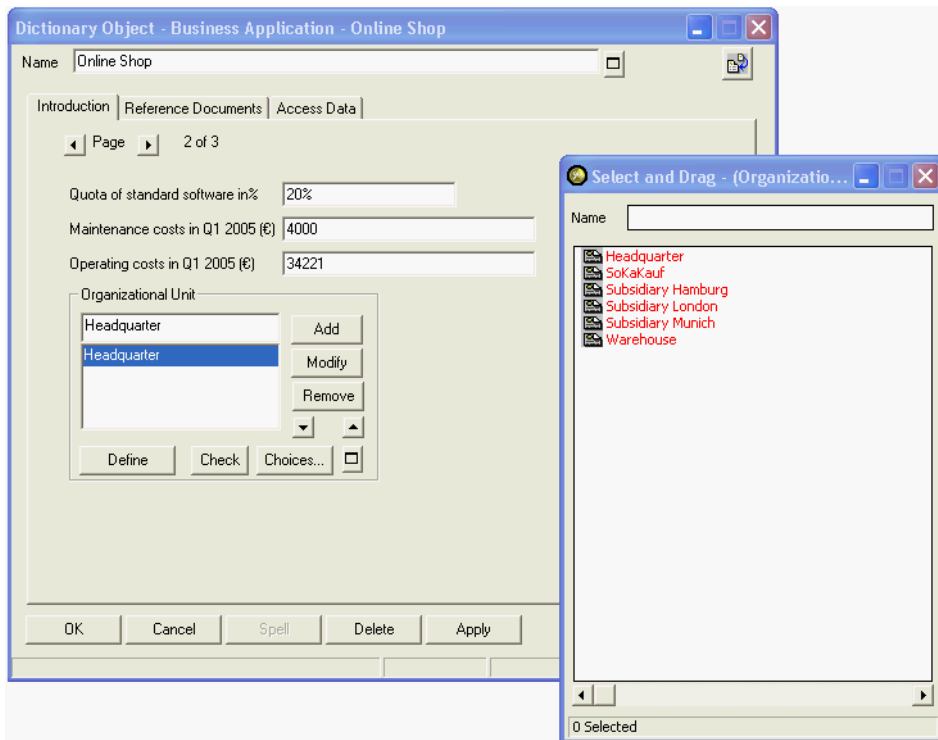


Figure 12.12: *System Architect*: property dialog of an entity

12. Telelogic AB (System Architect)



Figure 12.13: *System Architect: Guidebook*, a customizable integrated help system

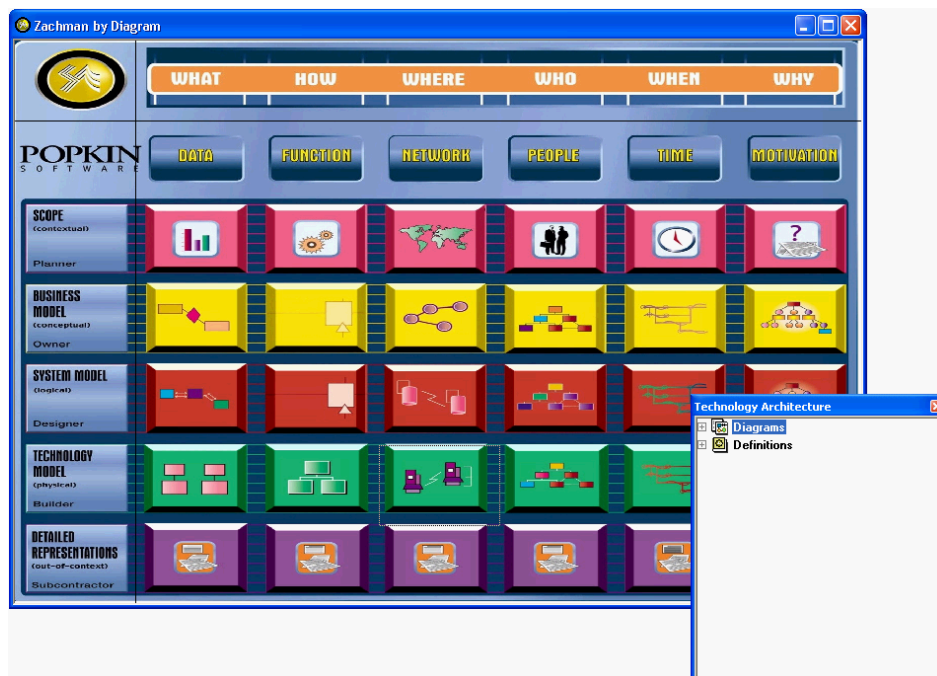


Figure 12.14: *System Architect*: graphics representing methodologies may be used as a guideline for EA management

12.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

12.2.1 Landscape Management

Using *System Architect* it is possible to simulate the scenario landscape management. All required data can be entered into the tool, after the metamodel has been adapted.

The data entered can be used to create process support maps visualizing current, planned, and target landscapes (see figure 12.15, figure 12.16 and figure 12.17). These diagrams have all been created manually by positioning and highlighting elements of the visualization. Using the integrated scripting engine the creation could also be completely automated, e.g. regarding highlighting of elements according to attribute values.

Relationships between the different entities used in this scenario have been created using dialogs which are available for every entity (see figure 12.12 in section 12.1.9).

According to Telelogic AB, the different versions of the application landscape can be connected via relationships, i.e. there is a semantic meaning like the planned landscape is a variant of the current landscape.

The integrated *Report Generator* (see section 12.1.6) offers the possibility to create text (see figure 12.18), HTML (see figure 12.8 in section 12.1.6), or dbase files. The reports are based on SQL-like queries, which can be created using the graphical user interface (see figure 12.7 in section 12.1.6). This functionality may be used to create a list of business applications, which are part of the diagrams representing current, planned, and target landscapes. The list can be used to compare the different landscapes. Using the integrated scripting engine it is possible to create completely customized reports as it is possible to access the complete repository and to utilize APIs of other applications, e.g. Microsoft Word.

The tool handling for this scenario is intuitive. Different versions of the application landscape can be created using integrated functionality. A comparison can be performed by creating lists of business applications, which are visualized in the diagrams.

The achievement of objectives is mostly given. All visualizations can be created by drawing or by using scripting (see figure 12.15, figure 12.16 and figure 12.17). A listing of the business applications appearing on the diagrams can be created using the report generator (see figure 12.18).

The procedure consistency is given. All information concerning current, planned, and target landscapes, together with the projects influencing them can be entered, there is a direct relationship between the different versions of the application landscape, which can be used, e.g. for reporting, etc.

The procedure integration is given. Information about business applications, organizational units, business processes, and projects already entered into the repository can be reused.

Rating: 4 points for landscape management.

12. Telelogic AB (System Architect)

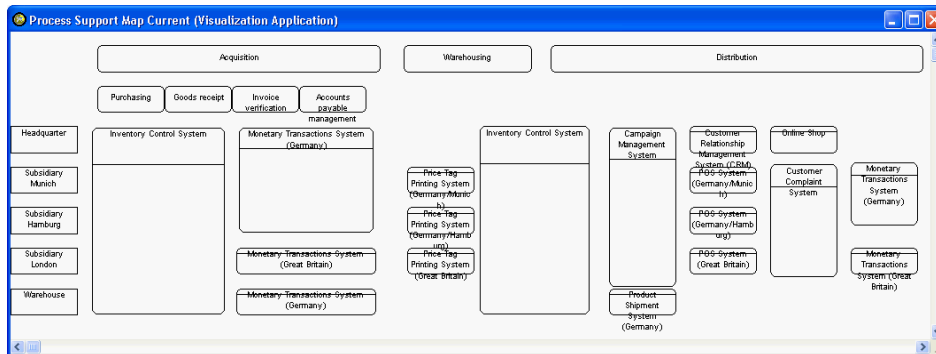


Figure 12.15: *System Architect*: the current application landscape visualized as a process support map for scenario landscape management

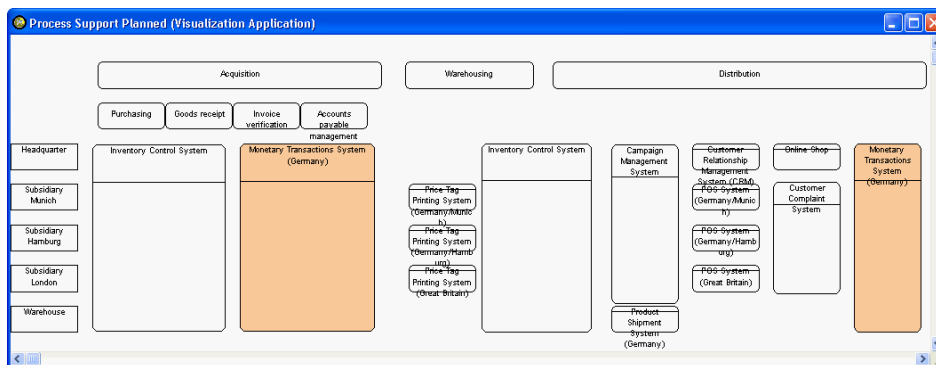


Figure 12.16: *System Architect*: the planned application landscape visualized as a process support map for scenario landscape management

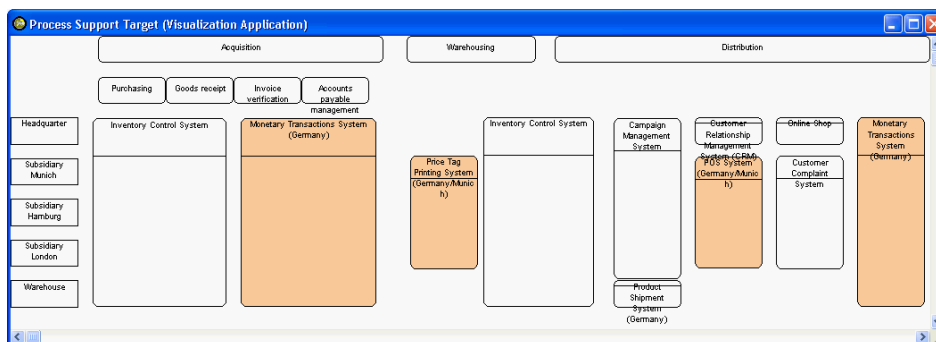


Figure 12.17: *System Architect*: the target application landscape visualized as a process support map for scenario landscape management

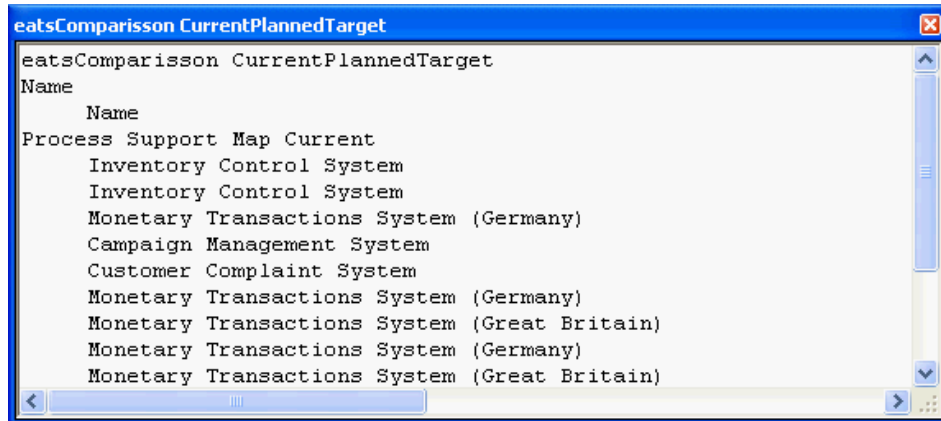


Figure 12.18: *System Architect*: list of business applications appearing in diagrams for scenario landscape management

12.2.2 Project Portfolio Management

System Architect offers the possibility to adapt the metamodel, thus all data needed for the simulation of the scenario can be entered into the tool. Therefore *System Architect* may be used to perform project portfolio management tasks, for example, it is possible to *select* projects from proposals received, based on e.g. costs, criticality, etc. Creating lists of the selected projects, together with their attributes and relationships can be performed using the report generator or by programming (see figure 12.19 and figure 12.20). Completely customized reports can be created by using the Microsoft Visual Basic for Applications scripting engine.

Dependencies of projects to organizational units, business processes, and business applications can be detected utilizing the *explorer diagram* to perform impact analysis. Additionally it is possible to manually create visualizations like a process support map (see figure 12.21). Creating a portfolio matrix (see figure 3.23 in section 3.3.2) demands usage of the integrated scripting engine.

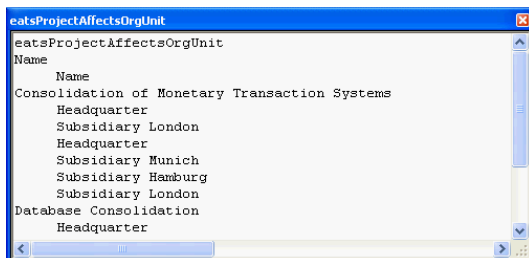


Figure 12.19: *System Architect*: report showing which projects affect which organizational units for scenario project portfolio management

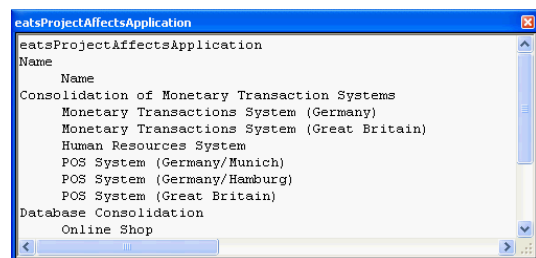


Figure 12.20: *System Architect*: report visualizing, which projects affect which business application for scenario project portfolio management

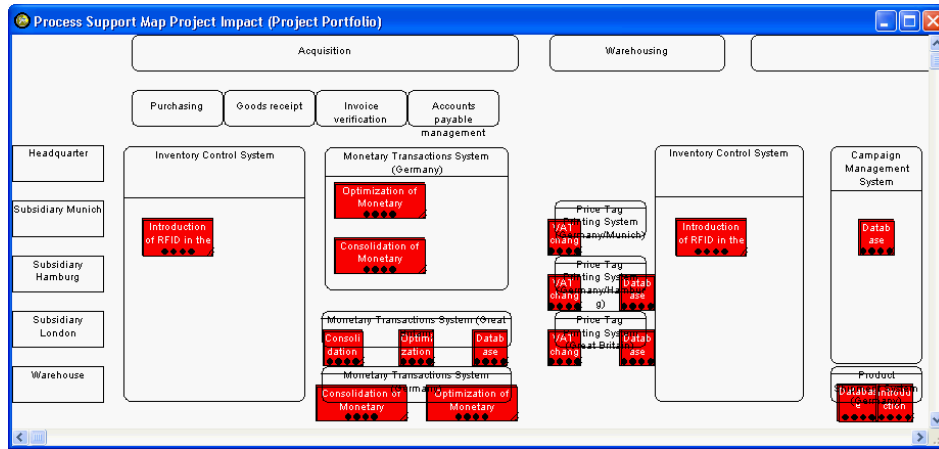


Figure 12.21: *System Architect*: process support map visualizing, which organizational units and which processes are affected by which projects for scenario project portfolio management

The tool handling for this scenario is intuitive. All data can be entered and the needed tasks can be executed.

The achievement of objectives is partially given. The process support maps demanded (see figure 12.21) can be created by manually positioning and highlighting elements of the visualization or by using scripting. Reports containing the basic information of the demanded reports can be created (see figure 12.19 and figure 12.20) using the report generator.

The procedure consistency is partially given. Project management tasks can be performed with integrated functionality after the metamodel has been adapted, to contain the appropriate entities, attributes, relationships, and diagrams.

The procedure integration is given, as data already saved can be reused for this scenario.

Rating: 3 points for project portfolio management.

12.2.3 Synchronization Management

After projects have been selected interdependencies between them have to be considered, e.g. the delay of a project may influence the begin of other projects. Therefore impact analysis has to be performed to detect these. This can be accomplished utilizing the *explorer diagram*. Figure 12.22, which can be generated automatically, shows that multiple projects affect the same business application. The explorer diagram offers the possibility to *show immediate relatives* of an entity. This functionality can be extended by using *explorer object reports* and *explorer relationship reports* to highlight or filter entities and relationships to improve readability. Both kinds of reports are based on a SQL-like query engine and enable the user to detect temporal dependencies⁷.

Filtering of entities and relationships may also be integrated into *System Architect* by using the integrated Microsoft Visual Basic for Applications scripting engine. A diagram type corresponding to an interval map can be achieved by manually positioning of elements. Concepts like swimlanes, which can be used to support creating such diagrams, are integrated into *System Architect* but are not available for all kind of entities.

⁷For more information on utilizing *explorer object reports* and *explorer relationship reports* see section 12.1.3.

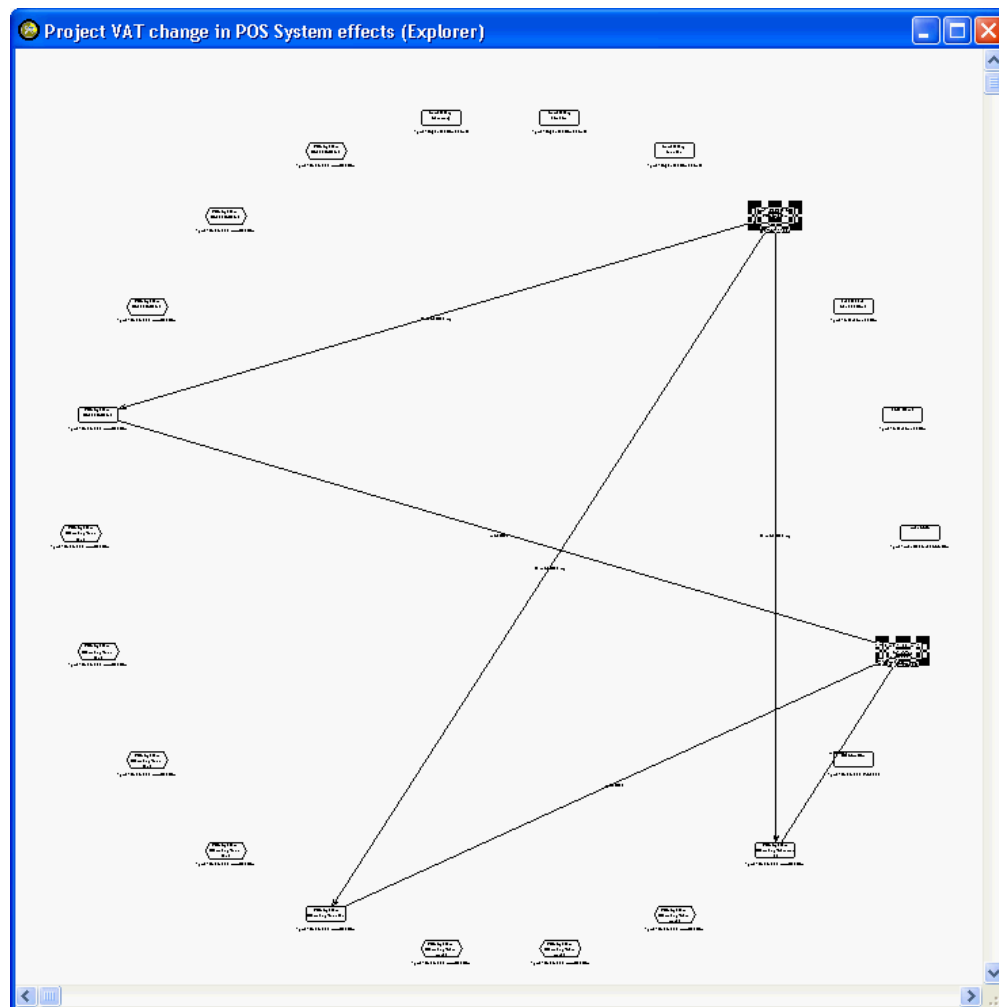


Figure 12.22: *System Architect*: impact analysis for detecting interdependencies between projects for scenario synchronization management

Creating interval maps (see figure 3.26 in section 3.3.2) visualizing the effects of a delayed project is possible by manual positioning and highlighting of elements of the visualization or by programmatically creating layout rules utilizing the integrated Microsoft Visual Basic for Applications scripting engine.

Dependencies between projects can also be detected utilizing the integrated report generator, which offers the possibility to create SQL-like queries, resulting in a text based list, a HTML document, or a dbase file. Another way to access the required data within the repository is by programming, which enables the customer to create completely customized report, e.g. as a Microsoft Word file.

The tool handling for this scenario is adequate. All data can be entered and the needed tasks can be executed.

The achievement of objectives is partially given. Interval maps visualizing dependencies between projects can be created by programming or by manual positioning and highlighting of elements. Using the explorer diagram also offers the possibility to generate a visualization of dependencies (see figure 12.22). Reports can be created using the report generator.

The **procedure consistency** is given. Synchronization management tasks can be performed with integrated functionality after the metamodel has been adapted, to contain the appropriate entities, relationships, and diagrams.

The **procedure integration** is given, as data already entered can be reused for this scenario.

Rating: 3 points for synchronization management.

12.2.4 Traceability and Strategy Management

Traceability should enable a customer to analyze and reconstruct, which goals have been derived from strategies and initiated which project to perform changes to the EA. This task can easily be performed using *System Architect* by utilizing the explorer diagram, offering the possibility to automatically generate diagrams visualizing the relationships between entities of the metamodel (see figure 12.23). Additionally there is the possibility to use another diagram, specified in the metamodel, to manually create such a visualization. The same results in a text based form can be achieved using the report generator or by programming.

Balanced scorecards can also be created using *System Architect*. Basically there are two different ways to create such diagrams. Firstly, a so called *strategy map*, which is part of the shipped standard metamodel, can be used. The advantage of this way is that *System Architect* comes with a methodology supporting the customer to create and maintain strategy maps. The disadvantage is that the

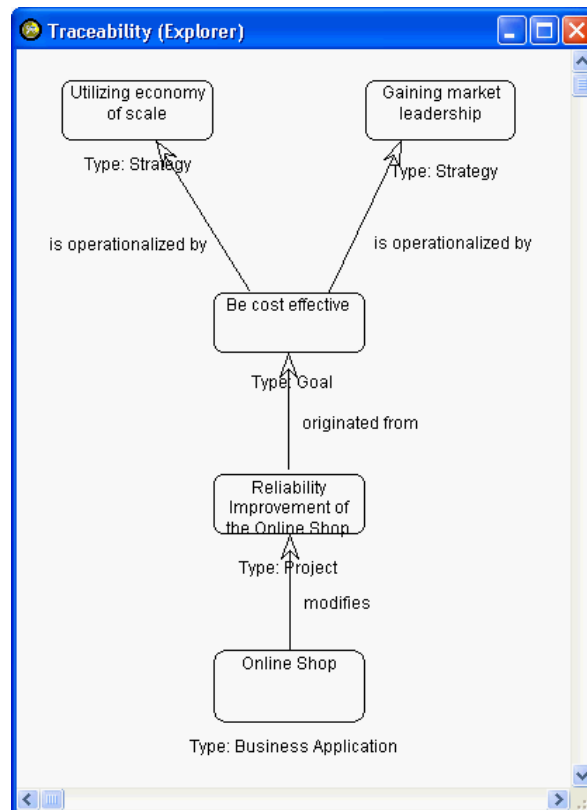


Figure 12.23: *System Architect*: explorer diagram utilized for an impact analysis to achieve traceability for scenario traceability and strategy management

customer has to completely use this predefined methodology together with its entities, attributes, and relationships, which are defined in the metamodel. As the whole metamodel may be adapted (see section 12.1.1) this drawback is of minor importance. Secondly, a completely customized diagram can be created by metamodel adaptation. This offers the possibility to create balanced scorecards according to specific requirements.

The tool handling for this scenario is intuitive. All data can be entered and the needed tasks can be executed. Strategy management may be performed using a shipped methodology or using a completely customized methodology, by adapting the metamodel.

The achievement of objectives is given. Traceability can be achieved using the explorer diagram (see figure 12.23). Balanced scorecards can be created using a strategy map or a customized diagram.

The procedure consistency is given. Traceability and strategy management tasks can be performed with integrated functionality. Additionally it is possible to completely customize the functionality for performing strategy management by using metamodel adaptation.

The procedure integration is given, as data already entered can be reused for this scenario.

Rating: 4 points for traceability and strategy management.

12.2.5 Management of Business Objects and Business Services

System Architect offers the possibility to adapt the metamodel in order to support the concepts required to perform management of business objects and business services⁸. The entities and relationships required for this scenario can be entered utilizing the *System Architect* user interface or by importing from a CSV or XML file.

These entities can be used to create a diagram visualizing the relationships between business applications, connectors, and business objects (see figure 12.24). Positioning and highlighting of elements of the visualization has to be performed manually but could also be automated by using the integrated scripting engine.

A report corresponding to figure 3.33 in section 3.3.2 cannot be created utilizing the report generator, but may be achieved using the integrated Microsoft Visual Basic for Applications scripting engine to create a Microsoft Excel file and access the repository.

The tool handling for this scenario is intuitive. All data can be entered and the needed tasks can be executed utilizing *System Architect*.

The achievement of objectives is partially given. Diagrams showing the relationships between business applications, connectors, and business objects can be created utilizing manual positioning and highlighting of elements of the visualization (see figure 12.24). The Microsoft Excel report cannot be achieved using *System Architect* functionality but may be achieved by programming.

The procedure consistency is given. Management of business objects and business services tasks can be performed with integrated functionality after the metamodel has been adapted, to contain the appropriate entities, relationships, and diagrams.

The procedure integration is given, as data already entered can be reused for this scenario.

Rating: 4 points for management of business objects and business services.

⁸According to Telelogic AB, *business objectives, policies, strategies, goals, mission, vision, tactic, rules and policies* may be graphically defined in the *enterprise direction diagram*. These objects may be related to *business processes* (services) as appropriate via parent child relationships.

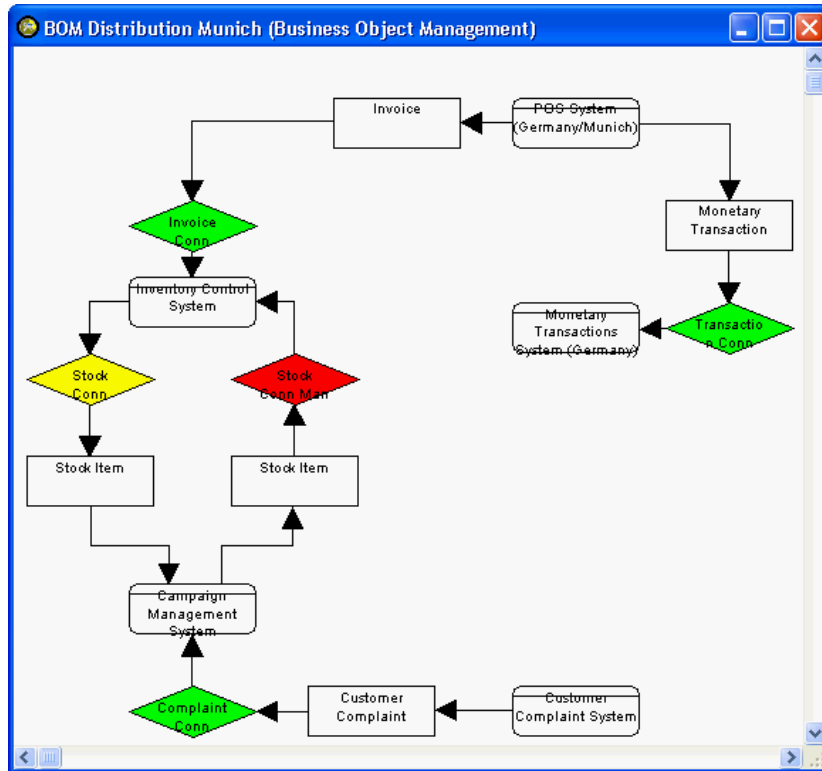


Figure 12.24: *System Architect*: diagram visualizing the relationships between business applications, connectors, and business objects for scenario management of business objects and business services

12.2.6 Application Architecture Management

Adapting the *System Architect* metamodel provides the possibility to almost completely simulate the scenario application architecture management, as all required data can be stored within the repository.

The metamodel adaptation also offers the possibility to specifically create a diagram for this scenario visualizing the standard conformity of the business applications as a cluster map (see figure 12.25).

Additionally it is possible to create the reports (see figure 12.26 and figure 12.27) visualizing the relationships between business applications, architectural solutions, and technologies used, demanded by the scenario description (see section 3.3.2).

A bar chart visualizing number of usages of architectural solutions (see figure 3.36 in section 3.3.2) cannot be created using integrated functionality, but may be achieved using the integrated scripting engine.

The tool handling for this scenario is intuitive. All data can be entered and needed tasks can be executed utilizing *System Architect*.

The achievement of objectives is mostly given. It is possible to create a cluster map visualizing the standard conformity of business applications (see figure 12.25). Additionally reports depicting conformity to architectural solutions and technologies used can be created. A bar chart can be created by using the integrated scripting engine.

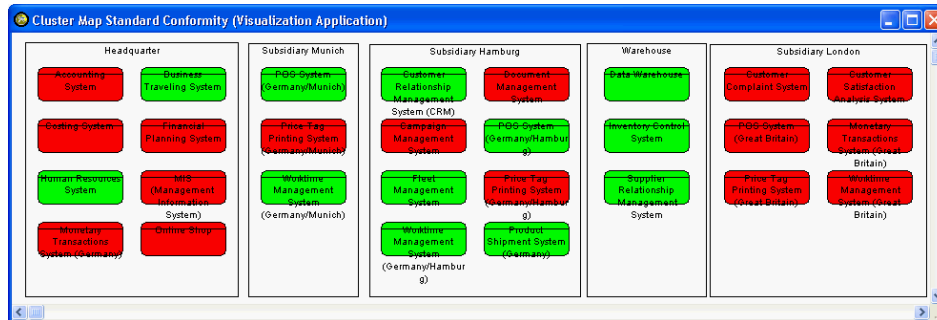


Figure 12.25: *System Architect*: diagram visualizing the standard conformity of business applications for scenario application architecture management

Name	ArchSol
Accounting System	ArchSol2b
Business Traveling System	ArchSol3
Customer Relationship Management System (CRM)	ArchSol2b
Data Warehouse	ArchSol3
Financial Planning System	ArchSol2a
Fleet Management System	

Figure 12.26: *System Architect*: report showing, which business application uses which architectural solution for scenario application architecture management

Name	ArchSol
Accounting System	Oracle 9i
Business Traveling System	Oracle 9i
Customer Relationship Management System (CRM)	Oracle 9i

Figure 12.27: *System Architect*: report showing, which business application is based on which architectural solution for scenario application architecture management

The procedure consistency is given. Application architecture tasks can be performed with integrated functionality after the metamodel has been adapted, to contain the appropriate entities, attributes, relationships, and diagrams.

The procedure integration is given, as data already entered can be reused for this scenario.

Rating: 5 points for application architecture management.

12.2.7 Infrastructure Management

Utilizing an adapted metamodel all tasks required for the simulation of this scenario can be performed. Concepts like lifecycles and dependencies between business applications and infrastructure elements can be integrated. Figure 12.28 shows a cluster map visualizing such a relationship. Additionally it shows, which database systems run out of support and should be replaced. Positions and colors, highlighting which database systems run out of support, are adapted manually. The same result could also be achieved by programming. In this case the diagram would correspond to data within the repository and would not need to be changed manually if the data of the repository changed. The same applies to the creation of an interval map visualizing the lifecycle of infrastructure elements of the EA.

12. Telelogic AB (System Architect)

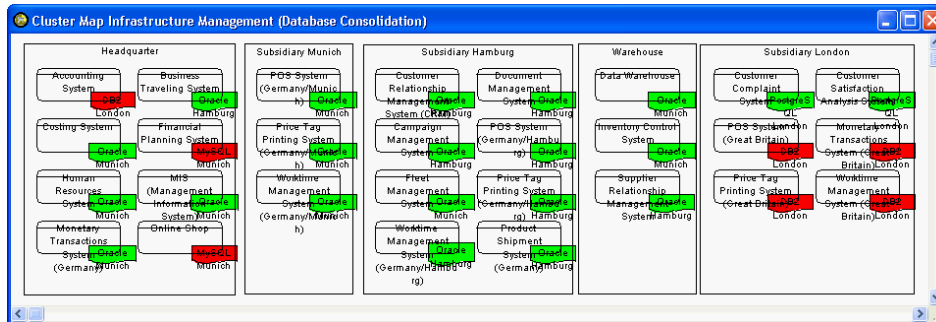


Figure 12.28: *System Architect*: diagram visualizing, which business applications use which database systems and if these run out of support for scenario infrastructure management

eatsInfrastructureApplicationUseDB		
Name	Database	Name
Accounting System	500	DB2 London
Business Traveling System	300	Oracle Hamburg
Campaign Management System	300	Oracle Hamburg
Costing System	200	Oracle Munich
Customer Complaint System	600	PostgreSQL
Customer Relationship Management System (CRM)	300	Oracle Hamburg
Customer Satisfaction Analysis System	600	PostgreSQL
Data Warehouse	200	Oracle Munich
Document Management System	300	Oracle Hamburg
Financial Planning System	100	MySQL Munich
Fleet Management System	200	Oracle Munich
Human Resources System	200	Oracle Munich
Inventory Control System	200	Oracle Munich

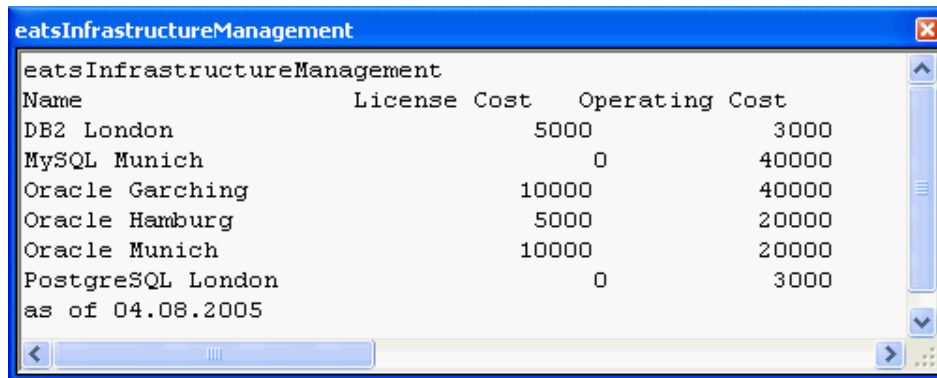
Figure 12.29: *System Architect*: report showing, which business applications use which database systems for scenario infrastructure management

Another way to perform analysis of elements of the EA is to use *analytic indicators*, e.g. it is possible to use a red traffic light to visualize a database system running out of support. These analytic indicators are based on additional attributes, which can be configured for symbol-diagram combinations, by adapting the metamodel. It is possible to use the integrated scripting engine to automatically set the additional attributes according to attribute values of the entities. Diagrams offer the possibility to show or hide analytic indicators.

Additionally *System Architect* offers the possibility to visualize dependencies between business applications and infrastructure elements utilizing the explorer diagram. This offers the possibility to automatically create diagrams without programming, e.g. immediate relatives of an entity, together with their relationship may be shown. Due to a lack of filtering possibilities these diagrams still require a certain amount of manual interaction to hide entities and relationships not needed.

To create text based reports showing the dependencies of business applications and infrastructure elements (see figure 12.29), together with costs (see figure 12.30) and lifecycles, as demanded by the scenario, the report generator may be used. Calculations, e.g. summing up costs, is possible using programming to create a report, but cannot be achieved using the report generator.

The tool handling for this scenario is intuitive. All data can be entered and the needed tasks can be executed utilizing *System Architect*.



Name	License Cost	Operating Cost
DB2 London	5000	3000
MySQL Munich	0	40000
Oracle Garching	10000	40000
Oracle Hamburg	5000	20000
Oracle Munich	10000	20000
PostgreSQL London	0	3000

as of 04.08.2005

Figure 12.30: *System Architect*: report showing the used database systems and their costs for scenario infrastructure management

The achievement of objectives is mostly given. The cluster map (see figure 12.28) demanded and the interval map visualizing lifecycles of the database systems, can be created by manually positioning and highlighting elements of the diagram. Reports about the business application systems, the used database systems, and their costs can be created using the report generator (see figure 12.29 and figure 12.30). Calculations are supported using programming for report generation.

The procedure consistency is given. Application architecture tasks can be performed with integrated functionality after the metamodel has been adapted, to contain the appropriate entities, attributes, relationships and diagrams.

The procedure integration is given, as data already entered can be reused for this scenario.

Rating: 4 points for infrastructure management.

12.3 Tool Vendor's Profile

Telelogic and System Architect

Sue Ward, Telelogic AB

About Telelogic

Telelogic ® is a leading global provider of solutions for automating and supporting best practices across the enterprise - from powerful modeling of business processes and enterprise architectures to requirements-driven development of advanced systems and software. Telelogic's solutions enable organizations to align product, systems and software development lifecycles with business objectives and customer needs to dramatically improve quality and predictability, while significantly reducing time-to-market and overall costs.

To better enable our customers' drive towards an automated lifecycle process, Telelogic supports an open architecture and use of standardized languages. As an industry leader and technology visionary, Telelogic is actively involved in shaping the future of advanced systems and software development by participating in industry organizations such as INCOSE, OMG, BPMI.org, The Open Group, Eclipse, ETSI, ITU-T, and the TeleManagement Forum.

Headquartered in Malmö, Sweden with U.S. headquarters in Irvine, California, Telelogic has operations in 18 countries worldwide. Customers include Airbus, Alcatel, BAE SYSTEMS, BMW, Boeing, DaimlerChrysler, Deutsche Bank, Ericsson, General Electric, General Motors, Lockheed Martin, Motorola, NEC, Philips, Samsung, Siemens, Sprint, Thales and Vodafone.

System Architect

- System Architect is the only complete **Enterprise Architecture** modelling tool
- System Architect's **Framework Browser** supports all popular EA frameworks including the Zachman Framework, DoDAF (C4ISR Framework), and TOGAF (The Open Group Architecture Framework) as well as FEAF and TEAF, it can also be customised to support your chosen Architectural Framework. System Architect also supports PITO's EAF4PS (Enterprise Architecture Framework for the Police Service).
- System Architect's Framework Browser supports all popular EA frameworks including the Zachman Framework, DoDAF (C4ISR Framework), and TOGAF (The Open Group Architecture Framework) as well as FEAF and TEAF, it can also be customised to support your chosen Architectural Framework. System Architect also supports PITO's EAF4PS (Enterprise Architecture Framework for the Police Service).
- System Architect provides support for **all areas of modelling**:
 - Business Process Modelling including Process Charts, BPMN, IDEF0 and IDEF3
 - Data Modelling - both logical and physical
 - Systems Modelling - including UML and Structured Analysis and Design.
- All functionality is harnessed within System Architect's extensible **multi-user repository** with native support for Microsoft VBA, promoting the sharing, reuse and communication of corporate information across the business.
- Popkin Software **Consultancy Services** provides a comprehensive range of training courses and consultancy expertise, delivered by Popkin's own team of highly qualified professionals, to help you maximise your investment.

About System Architect Licenses

Licences are provided on a concurrent basis for network use ensuring maximum use and flexibility of the tool (Please note: Standalone or laptop users working away from their network require a dedicated license). There is no limitation to the number of client installations and platforms on which System Architect is installed. System Architect licenses are not fixed to a named user or PC. Complementary products available from Telelogic:

1. SA Information Web Publisher
2. SA Simulator II
3. SA Compare
4. XML Architect
5. Doors Interface
6. C4ISR Framework
7. DoDAF ABM
8. TM Forum eTOM model
9. TM Forum SID model

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The Troux Technologies Inc. provides the EA management tool *Metis*, which has originally been developed by Computas Inc. In the following chapters the tool's evaluation concerning the axes from chapter 2.2.2 is described for the evaluated version of *Metis*. This version is *Metis Software Suite 3.6*. The tool *Metis* developed for controlling and managing enterprise architectures strongly focuses on the entities and relationships between them in models for EA management. The *Metis* suite can be decomposed into three major parts: client modeling tools, server and interface tools, and business solution templates. This evaluation concentrates on the client modeling tools, which are further distinguished here to facilitate the understanding of the tool's approach. The parts of *Metis* client modeling tools are:

- *Metis Model Browser* - a rich client for reading and viewing models in a convenient way without granting the possibility of editing data
- *Metis Model Annotator* - a rich client for adding comments and notes to a model without having possibilities of editing data
- *Metis Model Designer* (and *Metis Model Editor*) - a rich client tool for creating models, updating and deleting data, and for a wide variety of analysis functions
- *Metis Symbol Editor* - a rich client tool (part of the Model Designer) for creating object views for the entity types to be displayed
- *Metis Metamodel Developer* - a rich client tool for creating new metamodels or modifying existing ones

Most of the functionality we will be talking about in this chapter is provided by the *Metis Model Designer*, if not mentioned otherwise.

13.1 Evaluation of Specific Functionality

This section describes the results of the scenario simulation for specific functionality.

13.1.1 Configurability of the Metamodel

Metis comes bundled with the *Metis Metamodel Developer* an editor for metamodeling. The tool enables the user to create a new metamodel from the *scratch* or to adapt an existing one. Creating a new metamodel starts optionally with introducing custom data types. It continues with creating new object types with typed attributes, that support applying default values, and creating new relationship types between entities supporting relationship ends' cardinalities and role names, although the concept of assigning additional information to an association is not supported. The figure 13.1 shows the dialog to be filled out during the creation of a new entity type.

It is optionally possible to create new object views through the *Metis Symbol Editor* a drawing tool for SVG, supporting parametrized symbols, e.g. symbols with changeable color, whose values can be set programmatically while generating a diagram.

The figure 13.2 shows the *Metis Symbol Editor* for creating a new object view using the dialog for adding a parameter, called a *tag*, to the corresponding object view.

In a last step the metamodel is transformed into a template, that can be used for modeling. This transformation also supports optional steps like providing a user-defined help file for the particular metamodel.

Metis does not directly support versioning of metamodels; changes of the metamodel have effects on the corresponding models to the extent, that trying to edit an entity ends up in a message indicating

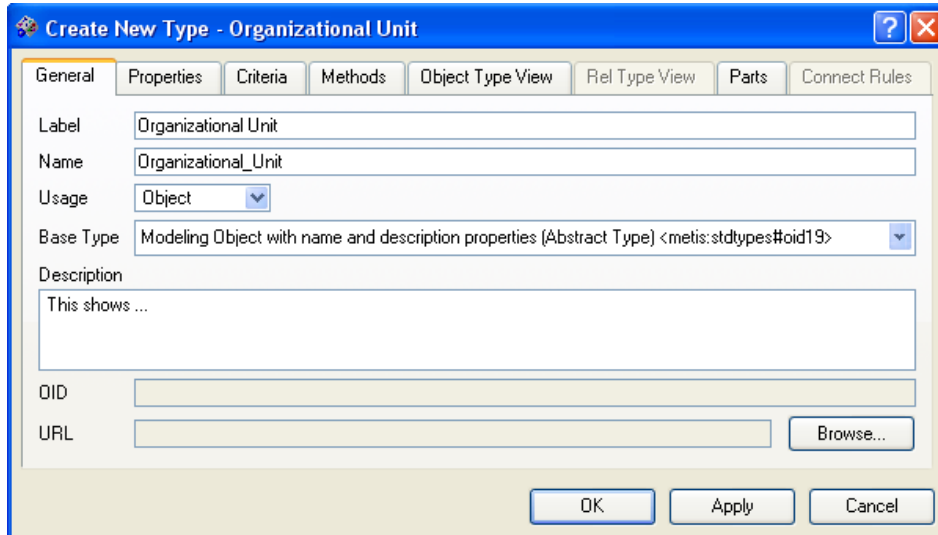


Figure 13.1: *Metis*: creating a new entity type

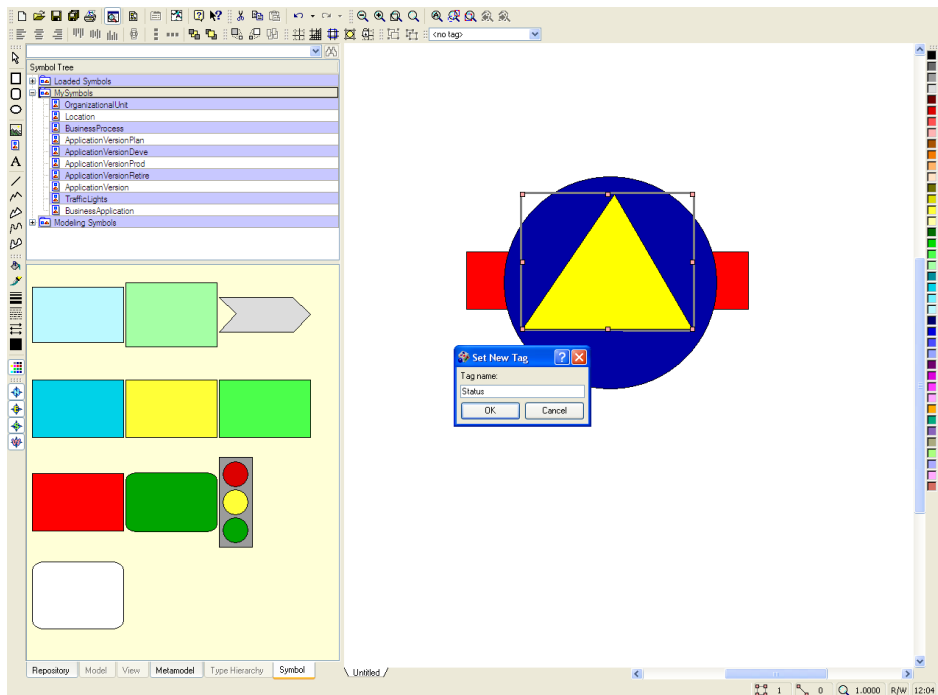


Figure 13.2: *Metis*: creating and *tagging* a new object view

that the model data is not consistent with the metamodel. This conflict is automatically resolved as far as possible by applying default values, when opening the corresponding editor dialog, while the modeler is not informed about the attributes changed or added in detail.

Rating: 5 points for configurability of the metamodel.

13.1.2 Coverage of EA Management Concepts by Predefined Metamodel

Metis ships with comprehensive sets of predefined data, entity, and relationship types, which combined contain about 500 elements. According to Troux technologies this set is sufficient to cover the concepts described in different EA management frameworks, like *Zachman*, *TOGAF*, or *FEAF* as well as concepts from domain specific modeling notations, as *BPMN* or *UML*. In the context of this survey two different sets of predefined metamodel elements were of interest, the *Generic Enterprise Modeling* and the *IT Management* set. While the first set mainly focuses on organizational or process centered aspects of EA management, the second set provides a quite detailed view on the more technical aspects of EA management.

The *Generic Enterprise Modeling* set is mainly sufficient for covering the concepts employed with the scenarios in section 13.2, although in some cases the *overloading*¹ of relationships may cause little distractions in browsing and perceiving the content of the repository. The *IT Management* set covers more technical aspects than this survey analyzes, including e.g. the concept of *abstract technologies* by using *technology functions* (compare section 3.3.2). Concepts from other metamodels may be used to augment an existing model used, which might cause the necessity of creating new relationships between those concepts.

The documentation of these entity and relationship types is available through the help system shipped with the tool and can be accessed through a comprehensive diagram as well as through the templating mechanism for a new metamodel.

Rating: 4 points for coverage of EA management concepts by predefined metamodel.

13.1.3 Support for Impact Analysis & Calculation

Metis esteems maximum configurability, enabling the user to define queries for particularly covering specific concerns, much higher than shipping predefined queries, that might not be suitable for adapted metamodels. Thus only *generic* queries, e.g. `find neighbors`, are directly available through the user interface and can be applied to any kind of visualization. This is one of the major differences of the approach for impact analysis taken by *Metis*. These analysis functions may be very useful to an user with intimate knowledge of the EA management concepts covered in the specific model, as they strongly facilitate the creation of *ad hoc* analysis.

The analysis function of *Metis* supports the traversal of several levels of relationships for performing transitive impact analysis. The creation of an *ad hoc* query, which is simply achieved through the user interface, is well supported, while further options to limit the sets of entities involved are not provided, but can be achieved by e.g. applying another query on the result set of the first one. Performing impact analysis for creating a tabular report is directly supported through *Metis*' approach of providing a *property sheet* for a set of entities selected, but is somewhat limited as the properties displayed in this sheet only are those properties common to all entity types involved.

Calculation of values from the properties cannot directly be achieved but is possible utilizing Microsoft

¹*Overloading* in this context refers to the concept of using identically named objects with different parameters.

Excel as the reports created can be conveniently exported to a data format understandable to this Microsoft product.

Rating: 3 points for impact analysis & calculation.

13.1.4 Richness of Predefined Visualization Techniques

Metis natively focuses on visualization techniques, as editing the repository and querying its data is mainly performed on diagrams. In order to support complex visualizations *Metis* ships with several shapes governing concepts useful for creating diagrams, such as swimlanes or container objects. These objects prove their resourcefulness as they provide capabilities of hiding complexity by being *closeable*. The creation of diagrams is simple and intuitive, built-in algorithms support the modeller in layouting entities represented as *nodes* and relationship represented as *edges* as known from graph theory, the relationships are laid out in *manhattan style*². These algorithms are performing the layouting of large scale application landscapes in a reasonable amount of time, comprising a depiction like the one shown in figure 13.3 consisting of 1000 applications. Further algorithms for automatically creating the missing relationships by introducing connections are present with *Metis*.

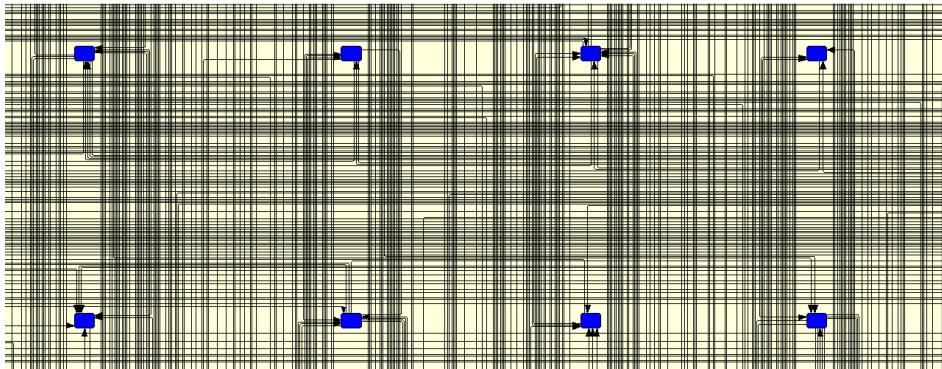


Figure 13.3: *Metis*: cutout of the automatically created diagram for a large scale landscape

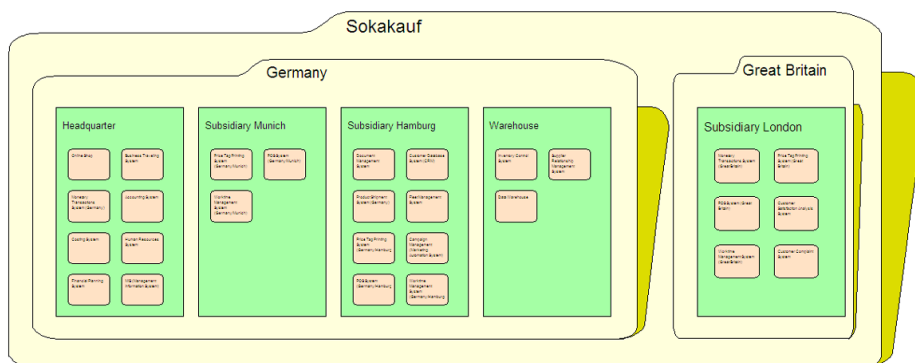


Figure 13.4: *Metis*: cluster map-like diagram

²*Manhattan style* here refers to a rectangular layouting style.

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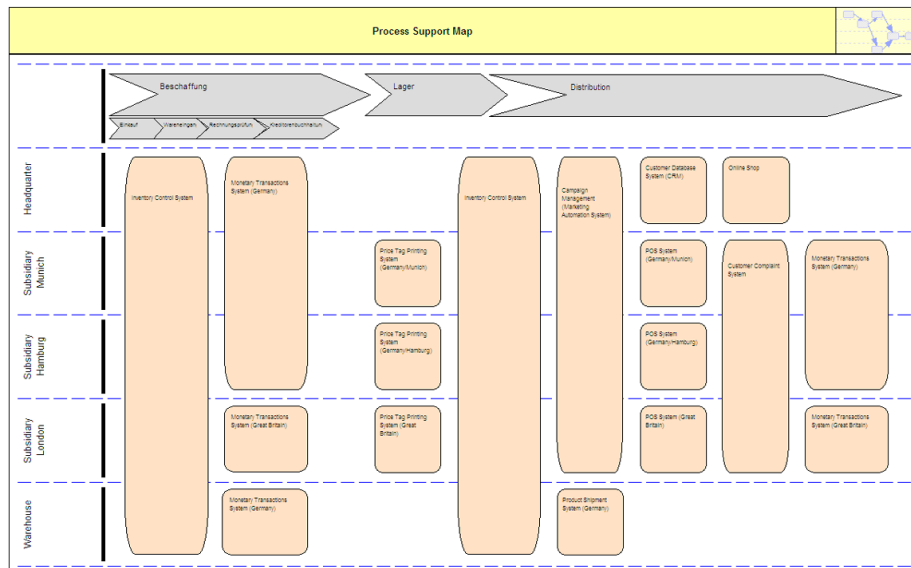


Figure 13.5: Metis: process support map diagram

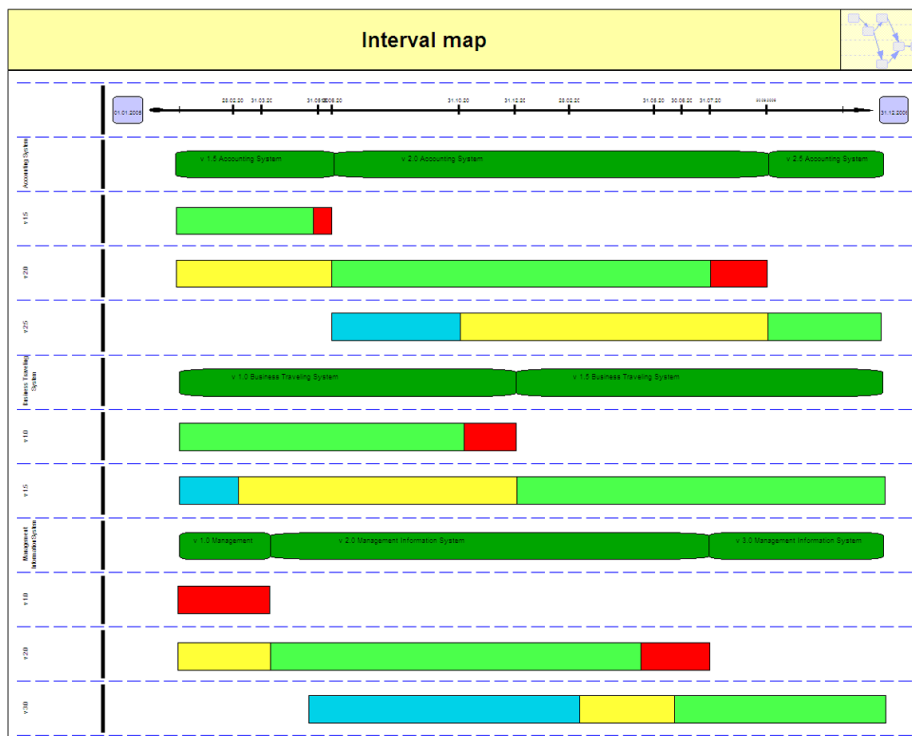


Figure 13.6: Metis: interval map diagram

As the modelling approach gathers around one main diagram, this diagram tends to grow in complexity with the increasing number of entities displayed. Additional visualizations can independently be created and managed, enabling the user to use powerful techniques for describing different views on the same landscape. Software maps without a base map for positioning (see A.2) are natively supported by *Metis* while the other maps can be created employing some manual interaction. Especially the container concept mentioned above comprises its useability when creating a *cluster map* (see figure 13.4), while the swimlane technique can be utilized in creating a *process support map* (see figure 13.5) and an *interval map* (see figure 13.6). *Swimlaning* objects not directly maps to an interconnection of those objects in the repository. The swimlane technique is only limited to one dimension of swimlanes and lacks the capability of intuitively handling objects spanning more than one lane. In such a case only the *original* lane, the object is belonging to, is payed attention to, while the other lanes overlaped are neglected when it comes to the *closing* of a lane.

Rating: 3 points for richness of predefined visualization techniques.

13.1.5 Flexibility of Visualization Techniques

Metis provides high flexibility for adapting the visualizations created, underscoring its approach to grant the user maximum control of the layout of the depictions (see e.g. figure 13.7). Direct editing in an intuitive way is natively part of this approach, allowing the user to drag and drop entities from the repository directly to the canvas. Direct adaptations to the look of an entity's depiction cannot be made, thus ensuring the consistent look of all entities of one type while trading a bit with the drawing flexibility.

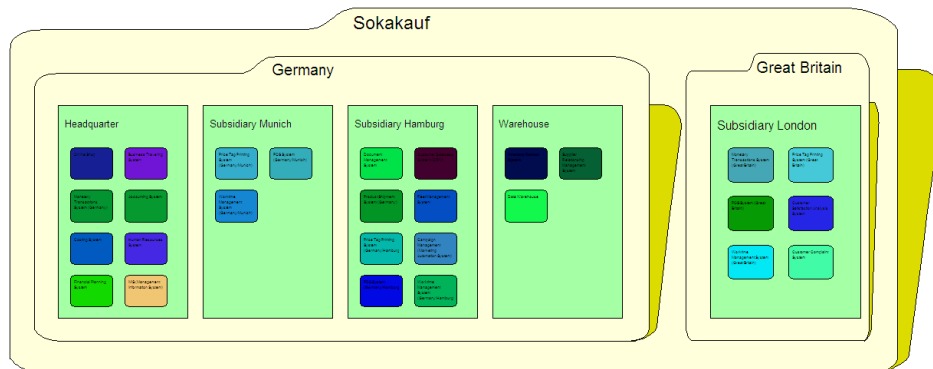


Figure 13.7: *Metis*: visualization of measures - object color created automatically using the attribute values

The visualization techniques of *Metis* are merely repository centric as mainly entities and relationships can be depicted, but no *drawing* capabilities are included. The strong connection of repository and visualization becomes further obvious regarding the *separation of concerns*³. In detail the strong coupling between the diagram and the repository reveals itself, when it comes to the different types of relationships supported. A relationship in *Metis* can either be a *normal* relation or a *part-of* relation in the repository. These different types can be visualized in the diagram in only one way - a line representing the *normal* relationship or a clustering (see A.1.1) representing a *part-of* relationship.

³*Separation of concerns* here refers to a concept well known in computer science, demanding that logically different requirements for the software are implemented in independent parts of the tool.

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This retains some potential for development that would greatly enhance the modeller's flexibility in diagramming.

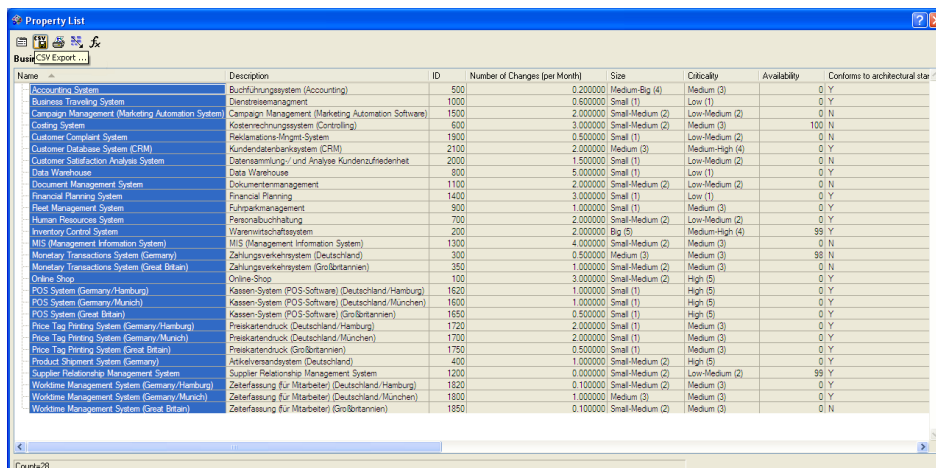
One last thing to mention regards the preservation of user changes in the visualization which is not given when automated layouting is performed. During the layouting process user changes of the object views like resizing are undone, which causes some minor distractions.

Rating: 4 points for flexibility of visualization techniques.

13.1.6 Flexibility of Reporting

Performing reporting tasks with *Metis* is mainly possible but dependent on the visual approach taken by the tool, so the main diagram containing all the entities that might be of interest is the starting point for creating a tabular report.

Creating reports in *Metis* is closely connected to diagrams, where the objects to be listed in a report can be selected by the various techniques utilized in the analysis mentioned in the section 13.1.3, especially by `find neighbors`. After having selected these entities a property list (see figure 13.8) can be created displaying all the properties of those entities. This approach gives the user control about the subset of entities to be shown and is thus a powerful filtering system. Unfortunately filtering the attributes displayed is not directly possible.



Name	Description	ID	Number of Changes (per Month)	Size	Criticality	Availability	Conforms to architectural star
Accounting System	Buchführungssystem (Accounting)	500	0.200000	Medium-Big (4)	Medium (3)	0 Y	0 Y
Business Travelling System	Dienstreisemanagement	1000	0.600000	Small (1)	Low (1)	0 Y	0 Y
Campaign Management (Marketing Automation System)	Campaign Management (Marketing Automation Software)	1500	2.000000	Small-Medium (2)	Low-Medium (2)	0 N	0 N
Costing System	Kostenrechnungssystem (Controlling)	500	3.000000	Small-Medium (2)	Medium (3)	100 N	0 N
Customer Complaint System	Reklamation/Mängel System	1500	0.500000	Small (1)	Low-Medium (2)	0 N	0 N
Customer Database System (CRM)	Kundendatenbanksystem (CRM)	2100	2.000000	Medium (3)	Medium-High (4)	0 Y	0 Y
Customer Satisfaction Analysis System	Datensammlung/ und Analyse Kundenzufriedenheit	2000	1.500000	Small (1)	Low-Medium (2)	0 N	0 N
Data Warehouse	Data Warehouse	500	5.000000	Small (1)	Low (1)	0 Y	0 Y
Document Management System	Dokumentenmanagement	1100	2.000000	Small-Medium (2)	Low-Medium (2)	0 N	0 N
Financial Planning System	Financial Planning	1400	3.000000	Small (1)	Low (1)	0 Y	0 Y
Fleet Management System	Fuhrparkmanagement	500	1.000000	Small (1)	Medium (3)	0 Y	0 Y
Human Resources System	Personalbuchhaltung	700	2.000000	Small-Medium (2)	Low-Medium (2)	0 Y	0 Y
Inventory Control System	Wareneinsatzsystem	200	2.000000	Big (5)	Medium-High (4)	59 Y	0 Y
MIS (Management Information System)	MIS (Management Information System)	1300	4.000000	Small-Medium (2)	Medium (3)	0 N	0 N
Monetary Transactions System (Germany)	Zahlungsverkehrssystem (Deutschland)	300	0.500000	Medium (3)	Medium (3)	98 N	0 Y
Monetary Transactions System (Great Britain)	Zahlungsverkehrssystem (Großbritannien)	350	1.000000	Small-Medium (2)	Medium (3)	0 N	0 Y
Online Shop	Online-Shop	100	3.000000	Small-Medium (2)	High (5)	0 Y	0 Y
POS System (Germany/Hamburg)	Kassen-System (POS-Software) (Deutschland/Hamburg)	1620	1.000000	Small (1)	High (5)	0 Y	0 Y
POS System (Germany/Munich)	Kassen-System (POS-Software) (Deutschland/München)	1600	1.000000	Small (1)	High (5)	0 Y	0 Y
POS System (Great Britain)	Kassen-System (POS-Software) (Großbritannien)	1650	0.500000	Small (1)	High (5)	0 Y	0 Y
Price Tag Printing System (Germany/Hamburg)	Preiskartendruck (Deutschland/Hamburg)	1720	2.000000	Small (1)	Medium (3)	0 Y	0 Y
Price Tag Printing System (Germany/Munich)	Preiskartendruck (Deutschland/München)	1700	2.000000	Small (1)	Medium (3)	0 Y	0 Y
Price Tag Printing System (Great Britain)	Preiskartendruck (Großbritannien)	1750	0.500000	Small (1)	Medium (3)	0 Y	0 Y
Product Placement System (Germany)	Arbeitszeitsystem (Deutschland)	400	1.000000	Small-Medium (2)	High (5)	0 Y	0 Y
Supplier Relationship Management System	Supplier Relationship Management System	1200	0.000000	Small-Medium (2)	Low-Medium (2)	59 Y	0 Y
Worktime Management System (Germany/Hamburg)	Zeiterfassung (für Mitarbeiter) (Deutschland/Hamburg)	1820	0.100000	Small-Medium (2)	Medium (3)	0 Y	0 Y
Worktime Management System (Germany/Munich)	Zeiterfassung (für Mitarbeiter) (Deutschland/München)	1800	1.000000	Medium (3)	Medium (3)	0 Y	0 Y
Worktime Management System (Great Britain)	Zeiterfassung (für Mitarbeiter) (Großbritannien)	1850	0.100000	Small-Medium (2)	Medium (3)	0 N	0 N

Figure 13.8: *Metis*: tabular report

The main caveat of this approach is revealed, when you include entities of different types in one selection. The properties displayed are then reduced to the intersection of properties common for both entity types. This may go that far, that the properties displayed are reduced to just `name` and `id`. Also this form of creating a report is not capable of including relationships between entities.

More flexible reports can be created by using a *Metis*-own query language, which has SQL-like capabilities but is not supported with an easy to use graphical user interface for creating those queries. Several kinds of calculations and more complex filtering can be performed through this query language or by utilizing an external tool like Microsoft Excel. Utilizing Microsoft Excel is quite easy with *Metis* as all the reports can be exported to csv-Files. This utilization provides the user the capability to create bar charts and similar depictions in Microsoft Excel while *Metis* does not directly support those visualizations.

Rating: 2 points for flexibility of reporting.

13.1.7 Collaboration Support

Regarding collaborative working the *Metis* suite provides the capabilities necessary mainly through the Metis server tools, namely the *Metis Team Server*. This team server's capabilities are oriented on the features a concurrent versioning system might provide, including user authentication and role management. Multiple users can work on a repository at the same time using check-in and check-out features on model level. This means locking, which in the *Metis* system is a pessimistic locking using exclusive locks, at first has granularity level *model*, thus checking out a model for editing completely locks it for other users. To provide a finer granularity for locking, the user can divide a model into *submodels* containing entities and associations. These model fragments can be locked in the same way.

A minor distraction regarding this technique is the problem, that an entity or relationship is exclusive part of one submodel, so the user cannot just edit the entities he is interested in, but has to create a submodel or in an even more complex case remerge a submodel into the whole model before creating *his* submodel. This is likely to end up in an overhead, as based on different views on the landscape not always one type of subsetting paradigm might be suitable for all views on the information model.

Securing the collaboration is possible through the *Metis team server* authentication and access control mechanisms. Also they are backed by secure data transmission on a SSL-supported transport protocol. For reading access to the model data *Metis* provides the *Metis Model Browser*, which just allows browsing the model, its data, and its diagrams without having editing capabilities.

Rating: 4 points for collaboration support.

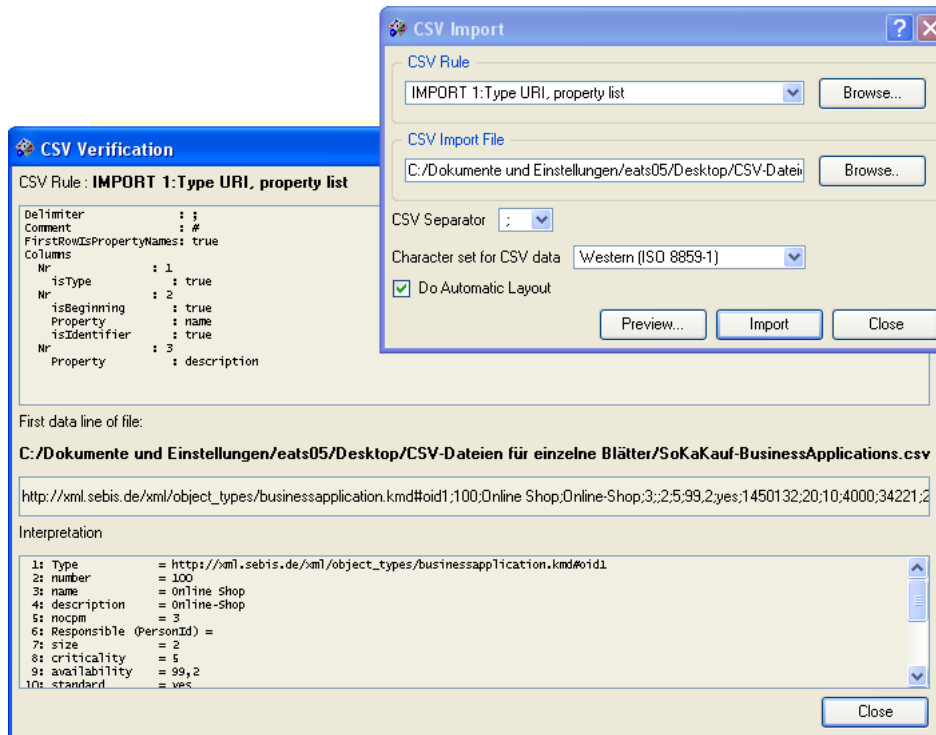
13.1.8 Import/Export & External Data Sources

Metis supports import of spreadsheet data from *comma separated value*-files (csv-files). These files have to be adapted to contain the type ids (URLs) for the object types used. The dialog for importing is clearly structured and the preview of the data to be imported is useful (see figure 13.9). Relationships can also be imported from csv-files, but more adaption of the file is necessary, as the type-ids for the affected types and the id of the relationship type has to be entered. Importing relationships is also not convenient, when they are expressed by using the entities' ids rather than their names, which might create duplicates. Importing data into *Metis* is performed *diagram centric*, which means that the data is preferably imported into the *main* diagram. After the import process *Metis* performs automated layout on this view. *Metis* further comprises capabilities for importing XML data.

Metis provides different exporting capabilities; creating a static HTML export containing zoomable diagrams and descriptions for the depicted systems is supported in a convenient way. The files generated could also be adapted to a corporate design by editing their generation templates through an external editor. Nevertheless this feature is not well documented in the help system. In addition the pages generated are not compliant with state-of-the-art HTML 4.01 or XHTML 1.0 standards released by the world wide web consortium (W3C).

The exporting capabilities of *Metis* further contain the possibility of creating xml- and csv-exports, of which the second type can optionally be exported in a manner, which utilizes reimporting (cyclic-mode). In this special case, when reimporting is needed, another part of the *Metis toolset* has its appearance, the *Metis CSV Rule Wizard*. This wizard allows adapting standard csv-import rule sets as well as creating new ones, which is necessary as the standard cyclic rule set does not support ex- and importing attributes except id, name, and description. The wizard provides the possibilities of specifying suitable rules in a convenient manner. The xml-export is not backed by creating a conforming XML schema or a data type definition (DTD).

Metis can directly access data from any Oracle based repository, thus having reading and writing access to the data on this integration level. A second way of accessing data is from the *Troux Enterprise*

Figure 13.9: *Metis*: importing and data preview dialogs

Baseline repository in a reading as well as in a writing (updating) manner. It is according to Troux Technologies possible to maintain a static subset of entities in these external repositories not having to duplicate their data. The open infrastructure of XML-import might allow any kind of xml-capable repository to be utilized, but when looking at system management tools. This integration has yet been proofed with IBM Tivoli and HP OpenView.

Rating: 3 points for import/export & external data sources.

13.1.9 Usability

Using *Metis* is a quite convenient experience, especially as *Metis* has a *suite* edition that comes bundled with several additional tools, like its *Metamodel Developer* or its *Symbol Editor*. Coming along with the tool at first is not that simple as the functionalities provided make the user interface look a bit overburdened. Thus the learning curve is steep, the help system has to compensate this and makes a good job.

Once you have got used to the system and its user interface, the user can unleash the flexibility of the tool and can accomplish many tasks in a fast way. The overall experience states *Metis* as a stable tool mainly focusing on a navigation alongside its visualizations, thus making a *main*-diagram the entry point of nearly every modeling task.

Rating: 4 points for usability.

13.2 Evaluation of EA Management Support

This section describes the results of the scenario simulation for EA management support.

13.2.1 Landscape Management

Modeling an application landscape with *Metis* is possible, the data of an *as-is* state can be imported (see figure 13.5), for supporting *planned* and *target* landscapes the metamodel has to be augmented. A visualization of the current landscape can manually be created (see figure 13.5). For visualizations of the planned or target landscapes (compare figure 3.14 or figure 3.15 in section 3.3.2) it is necessary to introduce the planned (targeted) applications manually into the visualization and to reposition them to be located *over* the applications to be retired. When this was performed depicting and switching the different status of the application landscape is conveniently possible as filtering the entities displayed after the value of a given attribute (e.g. the time of validity) is supported. Automatic highlighting of the differences between *as-is* and *planned* landscape is not directly possible, but can be performed on the level of one business support in an additional visualization.

Version Id	In Planung (von)	In Planung (bis)	In Entwicklung (von)	In Entwicklung (bis)	In Produktion (von)	In Produktion (bis)	In Ablösung (von)	In Ablösung (bis)
v 1.5 Accounting System		29-March-2005	29-March-2005	1-September-2005	1-September-2005	10-November-2006	10-November-2006	20-February-2007
v 2.0 Accounting System	29-March-2005	24-May-2005	24-May-2005	10-September-2006	10-September-2006	20-June-2007	20-June-2007	
v 2.5 Accounting System	10-September-2005	20-November-2005	29-November-2005	20-May-2007	20-May-2007			

Figure 13.10: *Metis*: report depicting the evolution of the business support over time

Creating a report of the applications in use at a given state can easily be performed. Reports (see figure 13.10) for outlining the differences can directly be created only regarding one type of business support, while deriving the differences in the support for more than one business process cannot be performed directly. It would employ a step by step creation or programming for further refining the querying results.

The tool handling is intuitive as all functions needed are easily accessible through the user interface of *Metis*.

The objectives can be achieved employing manual effort in diagram creation and performing of the determination of the differences between the different landscape statuses.

The procedure consistency is partially given, although the impact analysis employed requires profound knowledge of the metamodel.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for landscape management.

13.2.2 Project Portfolio Management

Project portfolio management can be supported by *Metis*, adapting the metamodel. A minor drawback regarding this is, that the spread of project costs over the applications affected, has to be modeled utilizing a *weak entity*⁴ rather than an *association class* (for reasons refer to section 13.1.1).

Performing an impact analysis outlining the business applications, business processes, and organizational units affected by one project can be achieved stepwise, while the *weak entity* mentioned above

⁴A *weak entity* is a concept derived from entity relationship modeling, making a relationship between two objects a new *weak* object, which can have further attributes a relation would not be capable of supporting.

has to be comprised in such an analysis. Simplifying this task might be possible utilizing programming features not tested in this survey. A comprehensive list of projects affecting the different business applications, business processes, and organizational units (compare figure 3.17 in section 3.3.2) cannot be created. The creation of a tabular report (compare figure 3.21 and figure 3.22 in section 3.3.2) based on the result of one of the queries mentioned above is easy to achieve, although it is limited to a report only containing one entity type (see chapter 13.1.6).

Calculations of project cost's spread over the applications affected cannot be performed directly but are possible utilizing Microsoft Excel (compare figure 3.20 in section 3.3.2). An impact analysis for highlighting the project interdependencies can be created easily.

Filtering the influences on the application landscape, such that only *approved* projects are concerned can be achieved utilizing programming techniques shipped with *Metis*. The creation of a portfolio matrix (compare figure 3.23 in section 3.3.2) is not directly supported by *Metis* but can be achieved by using Microsoft Excel.

The tool handling is intuitive concerning the capabilities directly reachable through the user interface of *Metis*.

The objectives can be partially achieved and employ *programming* effort in creation of filters and require the utilization of Microsoft Excel.

The procedure consistency is partially given, although the impact analysis employed requires profound knowledge of the metamodel.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for project portfolio management.

13.2.3 Synchronization Management

Synchronization management (see section 3.3.2) is partially supported by *Metis*. Timeline diagramming (gantt like visualizations) is not automatized. Visualizations of that kind can be achieved manually (compare figure 3.24 in section 3.3.2). Deriving the organizational units affected by the different projects currently executed can easily be realized by *Metis* through a transitive impact analysis concerning the affected business applications and their relationships to the organizational units they are *used at*. The result of such an impact analysis can be displayed on any visualization previously generated, e.g. a cluster map (see figure 13.11).

In general visualizations of gantt like style cannot be created without employing manual effort, instead of this most of the visualizations for this EA management task can be derived from previously created depictions by applying an impact analysis. An analysis for inquiring the projects affected by the delay of another project through their interdependencies on business application level (compare figure 3.25 in section 3.3.2), can be performed utilizing impact analysis. Tabular reports for this information (compare figure 3.27 in section 3.3.2) can easily be derived as long as they are concerning just one type of entity. Visualizations in a gantt like style cannot be generated as stated above. An impact analysis for detecting which projects may be affected by the deletion of a business application system (see figure 13.12) while not utilizing a gantt like style is also possible and can easily be generated, a tabular report can also be generated in a convenient way (see figure 13.13).

The tool handling is intuitive.

The objectives can be partially achieved. Visualizations utilizing gantt semantics for displaying temporal dependencies cannot be created directly.

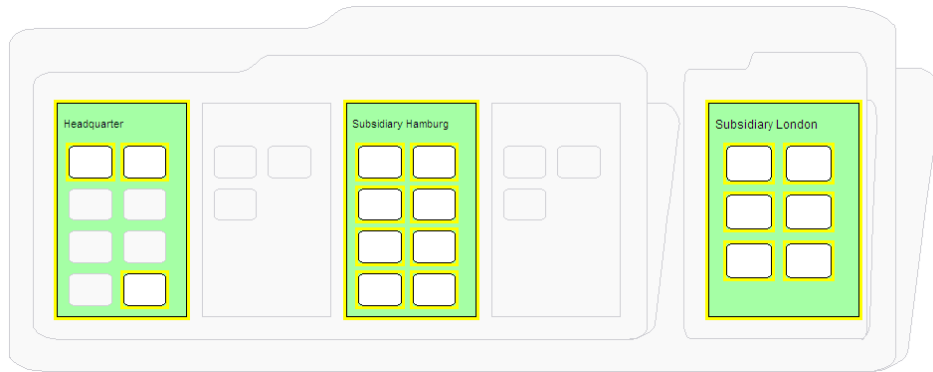


Figure 13.11: *Metis*: cluster map visualizing the business applications and organizational units affected by one project for scenario synchronization management

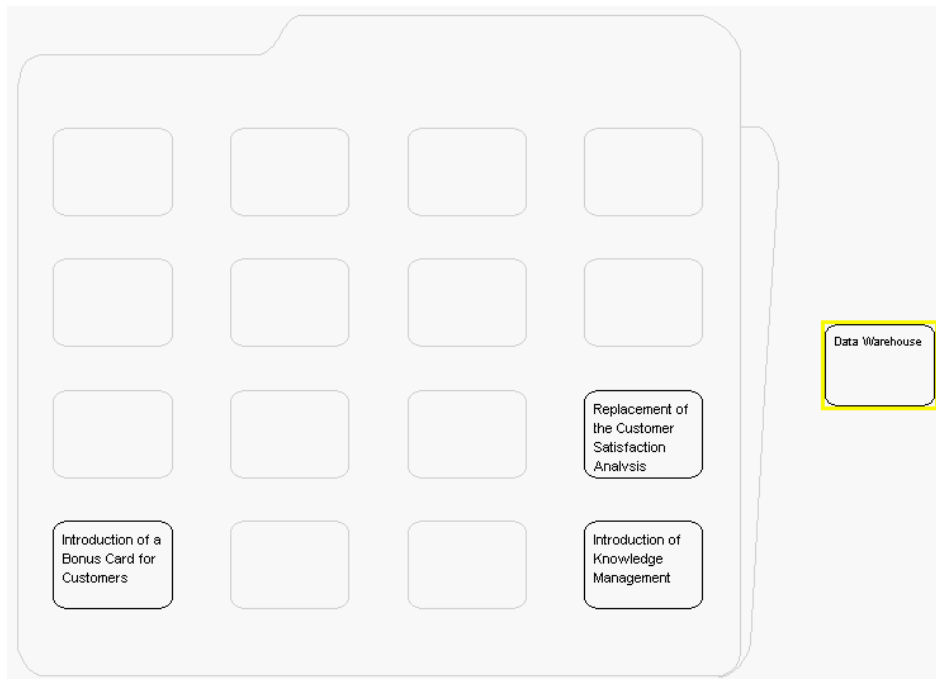


Figure 13.12: *Metis*: cluster map like visualization of the projects affected by the deletion of a business application for scenario synchronization management

Name	Description	EndTime	StartTime	Selected	Costs	Benefit	Urgency
Introduction of a Bonus Card for Customers		1-December-2005	1-November-2005	<input checked="" type="checkbox"/>	750000.000000	3	2
Introduction of Knowledge Management		15-May-2006	15-February-2006	<input checked="" type="checkbox"/>	650000.000000	3	3

Figure 13.13: *Metis*: tabular report of the projects affected by the deletion of an application for scenario synchronization management

The procedure consistency is basically given, although the impact analysis employed requires profound knowledge of the metamodel. Project delays cannot directly be reflected.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 2 points for synchronization management.

13.2.4 Traceability and Strategy Management

Traceability and strategy management is supported by *Metis* while adaptations of the metamodel have to be made and can easily be accomplished. *Metis*' strength in performing impact analysis allows the creation of a visualization similar to a *balanced scorecard* (see figure 13.14) in an easy way using the `find neighbor` command in the main visualization.

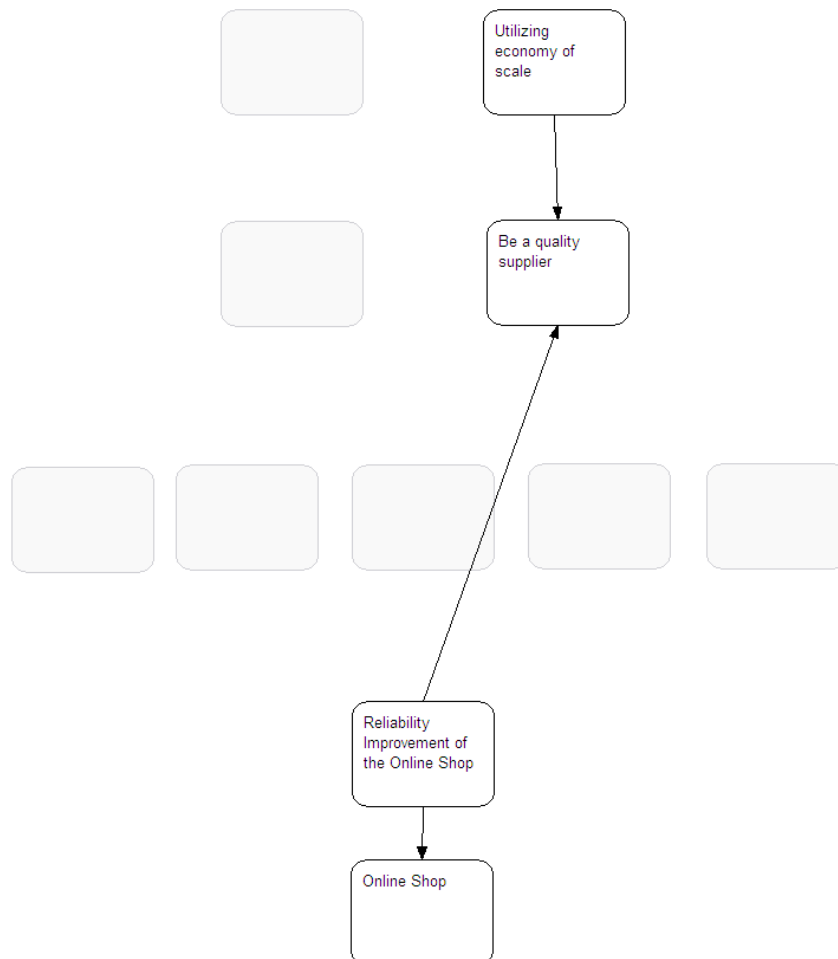


Figure 13.14: *Metis*: visualization of goals for a specific project for scenario traceability and strategy management

Nevertheless calculations concerning the achievement of a particular goal cannot be performed directly in *Metis* as linking *metrics* to a goal might be possible but cannot be used for calculation. These

calculations can be performed utilizing Microsoft Excel and can be used in creating a tabular report (compare figure 3.30 in section 3.3.2). The property list can be used as starting point for reporting the strategies and their connected goals (compare figure 3.29 in section 3.3.2), while such a report cannot be directly created from within the user interface of *Metis*. Utilizing Microsoft Excel here also gives the user maximum configurability of the reports to be created.

As importing and adapting the metamodel is easy to realize in *Metis*, the goals and strategies of the balanced scorecard were easily inserted into the model. Because of *Metis*' strength in impact analysis the visualization of the strategies for specific projects and other entities is working out fine (see image 13.14). On the other hand a detailed determination of the achievement of the goals is not supported. A visualization by using different colors or symbols is according to chapter 3.3.1 not possible. As *Metis* is not supporting calculation functions in the report, a detailed report of the achievement of the goals could not be created.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of *Metis*.

The objectives can partially be achieved directly and almost completely utilizing Microsoft Excel.

The procedure consistency is partially given, although the impact analysis employed requires profound knowledge of the metamodel.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 3 points for traceability and strategy management.

13.2.5 Management of Business Objects and Business Services

Managing the business objects used and changed by the different business applications employed in the execution of a business process step is basically supported in *Metis*. A visualization depicting links between those entities mentioned before can be created manually (see figure 13.15), but is a bit limited due to the fact, that attributes cannot be used in e.g. changing the color of an object view, which might be useful in displaying the *connectors* shown. Thus the full semantic extent of an *interconnection*⁵ between business applications cannot be visualized.

Filtering the visualization to display the *client-server* connections in a matrix diagram (compare figure 3.32 in section 3.3.2) is possible, but employs some manual layouting effort. Deriving a tabular report displaying this connections (compare figure 3.33 in section 3.3.2) is not directly possible, but can be achieved utilizing Microsoft Excel.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of *Metis*.

The objectives can be achieved directly or utilizing Microsoft Excel.

The procedure consistency is partially given, although the impact analysis employed requires profound knowledge of the metamodel.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 4 points for management of business objects and business services.

⁵*Interconnection* in this context refers to a directed and annotated link between two or more business applications communicating with each other.

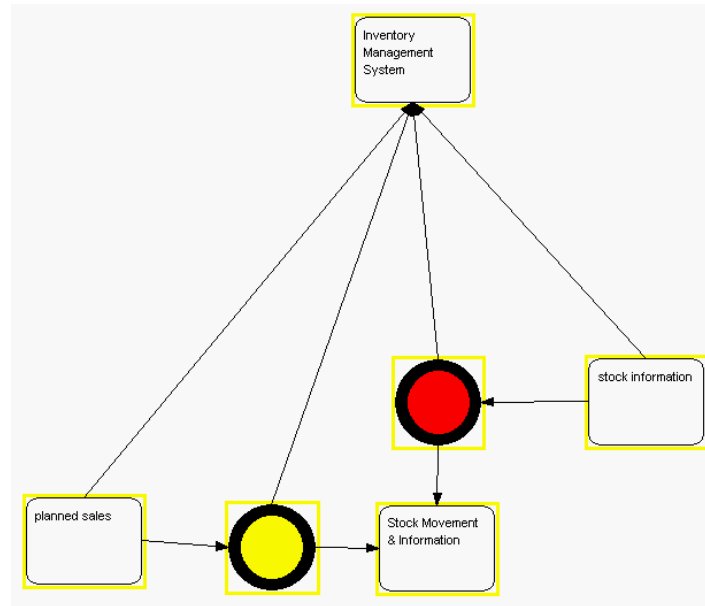


Figure 13.15: *Metis*: cutout of a visualization of the business object flows for scenario management of business objects and business services

13.2.6 Application Architecture Management

Application architecture management is conveniently supported in *Metis*, most of the concepts employed with this task are incorporated in the predefined metamodel, further concepts can easily be introduced. Deriving which business applications are based (and thus compatible) with a specific *architectural solution* (for explanation of this concept refer to section 3.3.2) can be easily performed on any visualization utilizing impact analysis with `find neighbors` and `highlight` (see figure 13.16).

A report displaying the applications and their corresponding architectural solutions can be created (compare figure 3.35 in section 3.3.2), but is not available in a fully *textual* version directly through the user interface of *Metis* (see figure 13.17). To achieve a more textual representation Microsoft Excel has to and can conveniently be utilized using the csv-export.

Microsoft Excel has further to be utilized when bar charts showing the occurrence of the different

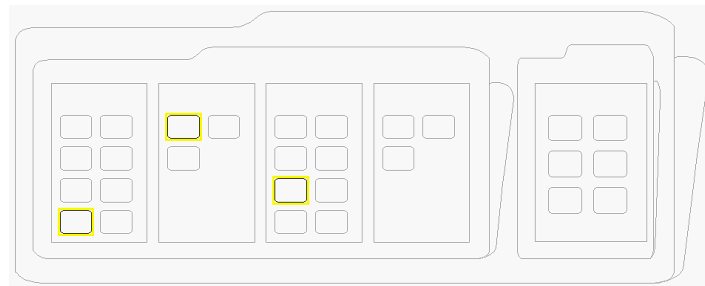


Figure 13.16: *Metis*: cluster map highlighting the applications compatible with a specific architectural solution for scenario application architecture management

Model View Main	Selection	ArchSol1a	ArchSol1b	ArchSol2a	ArchSol2b	ArchSol3
Selection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accounting System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Business Traveling System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Campaign Management (Marketing Automation Syst	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Financial Planning System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fleet Management System	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Human Resources System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Inventory Management System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
MIS (Management Information System)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Online Shop	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PDS System (Germany/Hamburg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PDS System (Germany/Munich)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PDS System (Great Britain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Price Tag Printing System (Germany/Hamburg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Price Tag Printing System (Germany/Munich)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Price Tag Printing System (Great Britain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Product Shipment System (Germany)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Supplier Relationship Management System	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Worktime Management System (Germany/Hamburg)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 13.17: *Metis*: relationship matrix reporting the business applications and their corresponding architectural solutions for scenario application architecture management

blueprint architectures (compare figure 3.36 in section 3.3.2) shall be created, as *Metis* does not directly support diagramming in that way.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of *Metis*.

The objectives can be achieved directly or utilizing Microsoft Excel.

The procedure consistency is partially given, although the impact analysis employed requires profound knowledge of the metamodel.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 4 points for application architecture management.

13.2.7 Infrastructure Management

Infrastructure management is supported by *Metis*, as the concepts employed with this task are incorporated very detailed in the predefined metamodel (ITM). Adaptations to match our approach of infrastructure management can easily be performed. Evaluating the impact the retirement of database systems has on the application landscape can easily be performed by selecting the databases remaining and performing an impact analysis. This analysis can be applied to any visualization, e.g. the main view (see figures 13.18 and 13.19) or to a process support map (see figure 13.20). *Annotating* the graphical representations of the application systems (as shown in figure 3.37 in section 3.3.2) is not directly possible using repository data.

A gantt like visualization of the support periods of the databases in use (compare figure 3.39 in section 3.3.2), cannot be directly created using the repository data, but can be achieved employing some manual effort using the timeline diagramming provided by *Metis*.

13. Troux Technologies, Inc. (Metis)

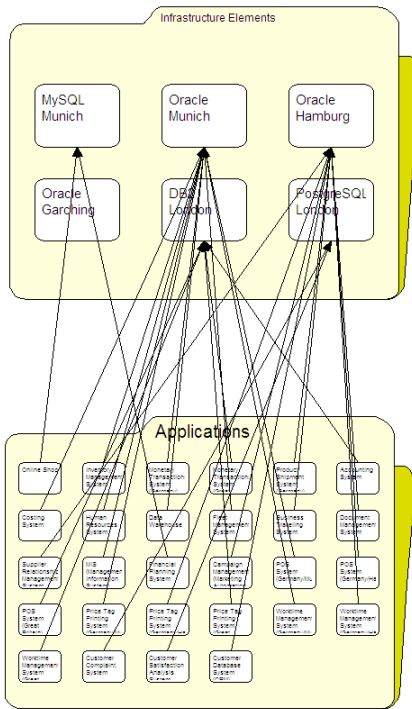


Figure 13.18: *Metis*: cutout of main diagram for scenario infrastructure management

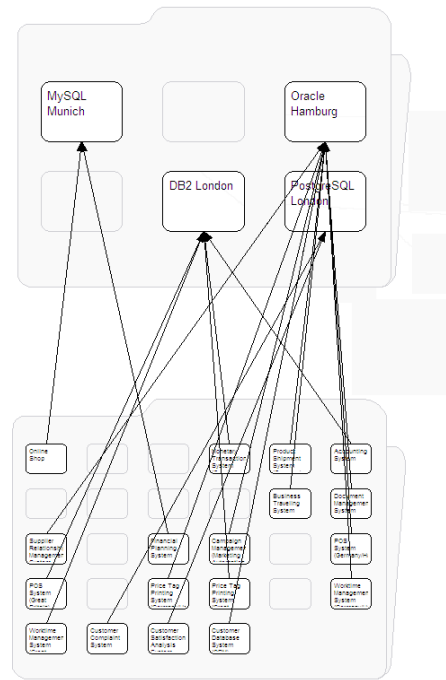


Figure 13.19: *Metis*: highlighting of affected databases and business applications for scenario infrastructure management

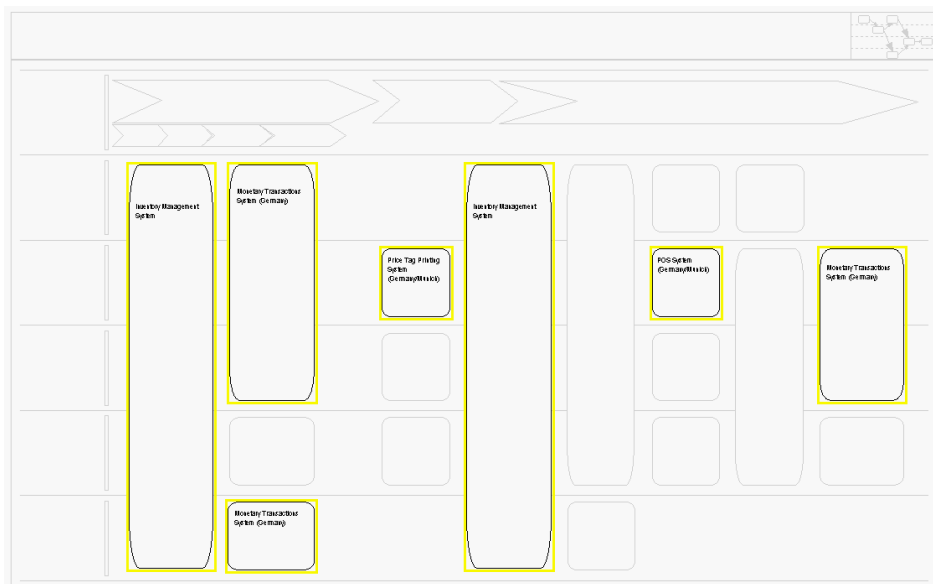


Figure 13.20: *Metis*: process support map depicting the affected business application systems for scenario infrastructure management

The creation of tabular reports concerning the business application systems and their database usage (compare figure 3.40 in section 3.3.2) is not directly achievable through the user interface of *Metis* as it would employ *transitive* reporting. Utilizing Microsoft Excel such a report could be created. A tabular report of the database support periods can easily be accomplished utilizing the **property list** action on the set of databases. This report can also be sorted by, e.g. the column *end of support*.

The tool handling is intuitive when concerning the capabilities directly reachable through the user interface of *Metis*.

The objectives can be partially achieved directly or almost completely utilizing Microsoft Excel.

The procedure consistency is given, although the impact analysis employed requires profound knowledge of the metamodel.

The procedure integration is given, as data previously entered can be re-used in the simulation of this scenario.

Rating: 4 points for infrastructure management.

13.3 Tool Vendor's Profile

Vendor Disclaimer

The software product evaluated in this study was Metis v3.6. In January 2005 Computas Technology AS and Troux Technologies Inc merged and now operate under the latter name. The first integrated product, Metis Enterprise 5.0 was released in July 2005 and offers significant enhancements and functionality over Metis 3.6. Some of key additional features of Metis Enterprise 5.0 are:

- Object-oriented repository for data storage offering increased scale
- Full web based access for reading, editing and populating data
- High granular (at object attribute level), role based access through portal
- Automated non-invasive data collection
- Significantly enhanced standard reporting capability through Cognos ReportNet suite (OEM in product)
- Flexible export of data as XML, PDF, Word and Excel format

Corporate Overview

Corporate governance and regulatory compliance pressures are forcing CIOs to run IT more like a business. As a result, management of the business side of IT-including services management, business/IT services alignment, regulatory and standards compliance-now drives the CIO agenda. However, with key IT information kept siloed and hidden away, most business-side initiatives in these areas are failing. Only Troux helps Global 1000 customers aggregate siloed IT information, providing complete visibility into the business/IT architecture. Solutions from Troux can reduce annual IT spend at least by 2-4 percent, with demonstrable results in as little as 90 days and a payback on investment within 12 months.

The Troux IT Governance suite of products includes:

Enterprise Architecture and Planning, which provides Enterprise Architects with the software and best practices they need to chart a course from an "as-is" EA to a desired, future "to-be" EA state.

Services Portfolio Management, which empowers IT organizations to drive up to 10% service cost reductions through cataloging and reducing the complexity of the overall IT service program.

Application Portfolio Optimization, which provides the technology and best practices to manage the lifecycle of all applications in the enterprise portfolio, driving millions in cost savings.

The Metis[®] Enterprise Modeling System, which enables you to manage enterprise complexity by building comprehensive, holistic and maintainable views of the elements, components, knowledge and interrelationships in your organization. The resulting Metis model then gives you the power to visualize, analyze and query the organization as a whole, from an Enterprise Architecture perspective.

Troux's IT Governance Platform has been created to meet the end-to-end information foundation needs of the largest and most sophisticated commercial and government organizations. To that end, the platform is architected to meet the requirements for a complete IT Governance solution. All required components are integrated into a single platform that provides the IT baseline and information management foundation for Troux's IT Governance Suite. The key components and their capabilities are:

Metis Client Tools: Powerful visual modeling, analytic and presentation capabilities that deliver integrated text and graphic-based models to a wide variety of roles.

Metis Enterprise Architecture Framework: An extensible structured model that defines a consistent vocabulary for describing the complex nature of the enterprise.

Metis Team Server: A scalable model storage system supporting multi-user model-level collaboration and version control.

Metis Enterprise SDK: A web services-based API for integration and application development.

Portal: Configurable web-based user interface providing secure, role-based information access and presentation.

Reporting System: An enterprise class query and reporting product for delivery of rich business analytics.

Metis Collection: Framework for management of automated and agentless "Extract, Transform and Load" operations.

Policy Management: Enables the creation, management and application of digital governance policies to the information in the Metis Enterprise Repository.

Metis Enterprise Repository: A highly scalable and secure object store for all instances of objects and relationships, and their associated properties.

Based in Austin, Texas, Troux Technologies serves the Global 1000 marketplace. For more information, please visit www.troux.com

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Enterprise architecture management is still an evolving management area. The approaches to EA management differ not only between companies who have already established or started establishing an EA management process, they also differ in the support EA management tools are offering.

A common sense of what EA management is about and is not about does not exist yet, leading to the different approaches of the tools analyzed. In section 3 we tried to give a brief introduction to EA management, which is based on our discussions with the partners of this survey and their requirements for an adequate EA management tool support. The following will sum up these approaches and the lessons learned, ending with a small discussion of *aligning business and IT*.

14.1 Approaches of EA management tools

Approaches of the tools analyzed in this survey differ. The *metamodelling approach* gives the customer the possibility to adapt the model to individual needs. Capabilities of these tools in metamodelling vary, some tools adhere to the concepts of MOF [OMG04b] while other pursue their own metamodelling approach, which sometimes leads to inconveniences as these approaches often lack major metamodelling concepts. Hence adapting the metamodel also needs an adaptation of the visual representations, the diagrams and the reports these capabilities also have to be considered, when choosing a tool. Finally, the coverage of EA management concepts by the shipped metamodels is of relevance, when searching for an adequate EA management tool. Customers may use existing metamodels as a starting point, extending these models with concepts needed, but not implemented in the shipped metamodel.

Other tools obey the *methodology driven approach*, meaning that the diagrams shipped and the metamodel implemented do have a predefined and *documented* semantics. These tools weaken the aspect

of metamodelling and only allow minor changes to the existing metamodel. These minor changes can be done by customers, more complex modification concerning the metamodel need the help of consultants. In order to weaken this constraint generic attributes are implemented to satisfy some individual requirements.

The third approach of the tools analyzed is a *process driven approach*, which may be seen as an extension of the methodology driven one, leading to an approach, which ships with a methodology and extends the methodology by a management process. This management process links the different models and introduces a procedure, which guides the user fulfilling EA management tasks. Like tools using the methodology driven approach only minor changes to the metamodel are intended.

Another approach pursues the idea of using existing data sources for EA management and may be named *integration approach*. The information in existing data sources are reused, linked and integrated leading to a holistic view on multiple data sets. Especially transformation and mapping capabilities are needed to follow this approach.

We have to mention that this classification of the approaches is not sharp, a tool may be between boundaries. Therefore we do not only distinguish in the kivi axes between *coverage of EAM concepts by predefined metamodel* and *configurability of the metamodel*. We also consider the *procedure integration* and *procedure consistency* for each EA management scenario building the axes of the kivi diagram for *EA Management support*.

Also the metamodelling approaches of the tools differ. Some vendors are delivering comprehensive metamodels covering different aspects of an EA¹, others are providing smaller metamodels, which can be adapted and extended by the user. Both approaches may need additional consulting support by the vendor or consulting partners, not only to adapt the metamodel, but also for identifying aspects relevant for specific usage scenarios due to a lacking standard for a comprehensive but modular EA metamodel.

Other interesting information about the capabilities of each tool can be derived from the different axes in the executive summary (see section 2). Additionally it has to be mentioned that none of the tools analyzed can gather information automatically. This does not refer to the tool's capability of importing information from other data sources (like HP OpenView, IBM Tivoli, or Microsoft Systems Management Server), but to the capability of using spiders or agents identifying e.g. applications or interconnections. We do not believe that this feature is important for an EA management tool, but the importing capabilities for integrating parts of these information are quite interesting.

14.2 Lessons Learned and Critical Reflection

As mentioned above the approaches to EA management taken by the different tools vary widely. Nevertheless some general strengths and weaknesses apply to most of the tools evaluated in this survey, which at the first look might be quite surprising. On the one hand a majority of the tools is equipped with an object-oriented repository, which in some cases almost completely adheres to the concepts of MOF [OMG04b] as mentioned above. This well understood paradigm enables the vendors or, if a *metamodelling approach* is taken, the actual customer to conveniently represent the concepts employed to support EA management. On the other hand methods for applying queries or creating views on the data covered in these repositories are rather limited in many tools. This fact seems to be of some interest, as SQL – also a well understood concept – already provides concepts in this area, that may at least partially be applied to object-oriented repositories.

Going deeper into the realization of the repositories the tools are backed on, an interesting fact can be

¹See especially the kivi axis *coverage of EAM concepts by predefined metamodel* and *configurability of the metamodel*.

uncovered: almost every tool utilizes a different schema² for exporting and importing data provided. A common schema for data exchange, that to us seems to be an important feature for integrating EA management especially concerning the gathering of information (see section 3.1.1), could not be spotted. These formats obviously do not have a *common base* and thus cannot be seen as a starting point for an integration. Also the ownership of data has to be considered, when discussing integration scenarios. An EA management tool is not always or should not always be the owner of all information needed for EA management, e.g. business process models or project information may reside in external data sources. This information therefore either needs a synchronization process or should be read-only in the EA management tool.

As we also regard the overall quality of data, including that data has to be up-to-date, as a major challenge in EA management, we highly estimate the option supporting distributed data entry throughout a company. Workflow and collaboration support in many of the analyzed EA management tools still retains room for improvements, especially concerning approval mechanisms, alerting functionalities, etc.

While modeling the data can be the first step toward managing the EA, it is also important to use this information for making decisions. The data collected has to be preprocessed, e.g. filtered, combined, structured, and formatted in order to be represented in an easily perceivable way. Many of the project partners involved in this survey have developed their own graphical representation of the information they are interested in. In this regard it is one of the most interesting and surprising lessons learned, to discover how limited and especially inflexible most tools' visualization capabilities are. Although the data from the repository can often be used for creating shapes on a diagram, the relationships and attributes often cannot be used for modifying, positioning, or laying out these shapes. Here we suppose the biggest potential for improvement, as the requirements we gathered and the capabilities the tools do actually provide differ strongly.

14.3 Aligning Business and IT

As stated in section 3 one of the main efforts of EA management is the *alignment of business and IT*. But by now mainly IT departments, especially IT strategy departments, started to care about the EA and are trying to establish a management process.

The IT community has changed from a *mystic science* working in secrecy with specialists not willing to share their knowledge to a perceivable business supporter or even business enabler. Process frameworks like ITIL (IT Infrastructure Library) or MOF (Microsoft Operations Framework) started to establish a common terminology and understanding about IT support and operations. SLAs (Service Level Agreements) and Incident Management, just to name two examples, have changed the understanding of IT support and how IT *services* should be created and managed.

But what's about the business part? An automotive company produces and sells cars. A financial service provider acting in the retail sector sells products like loans, accounts, or saving plans to its customers. Asking for the link between these products and the IT, the answer is typically: "A business processes is supported by a business application system." But caring about the EA is more than just caring about the business support of one or more business process. The evolution, especially the planned evolution of a whole architecture, the enterprise architecture, should be driven by both sides, business *and* IT.

IT started the holistic architecture process due to different reasons: Two main reasons are the complexity of IT, which evolved over the last decades and the cost cutting in the IT sector/departments, which leads to the need to identify cost-saving potentials. Business is *earning* the money, selling products, and goods. IT *only* spends parts of these earnings to support the business being more effective

²The format may be e.g. XML, but the XML schema, which defines the structure of the data, varies widely.

14. Summary

and efficient during production. Therefore the business should be more interested in taking part in the EA management process, especially if this process should take into consideration and be driven by the organization as a whole.

Software Map Types

A software map is a graphical representation of the application landscape or of a subset thereof. Software maps can e.g. be used for documenting and planning the application landscape or analyzing the architecture in a graphical, intuitive, and easily understandable way.

As cartography deals with communicating spatial relationships, it tries to ensure that the description used in communicating evokes a visual image of these relationships in the reader's mind that is similar to the one intended by the creator. This is best achieved by providing a visual representation of the information, called a *map* [Ro95].

Software cartography utilizes the concepts offered by cartography for visualizing application landscapes. Similar to the cartographic concepts a software map is also composed of a base map and layers visualizing different aspects of the entities depicted. But translating all cartographic concepts to a methodology for graphical representations of application landscapes cannot be performed directly and without further refinement.

The aspects for describing an application landscape are found throughout the enterprise architecture, differing from e.g. *business processes*, *organizational units*, or *infrastructure elements*. But there is no specific subset of these aspects, that excels all the other subsets, thus being an intuitively derivable system of *dimensions* for software cartography. In cartography the spatial dimensions building e.g. topographic base maps are these prominent characteristics.

Therefore no particular base map suitable for all kind of concerns can be found, leading to a high number of different visualizations currently in use. After analyzing various software maps we were able to identify four different software map types differentiated by the kind of base map they are utilizing. The software map types can further be categorized into two groups:

- Software maps with a base map for positioning - utilizing the concept of using the position of an element to transport (formally) defined information
- Software maps without a base map for positioning - performing ad-hoc positioning of the elements

Appendix A.1 will introduce software maps with a base map for positioning, appendix A.2 maps without a base map for positioning. Further information about software cartography and software

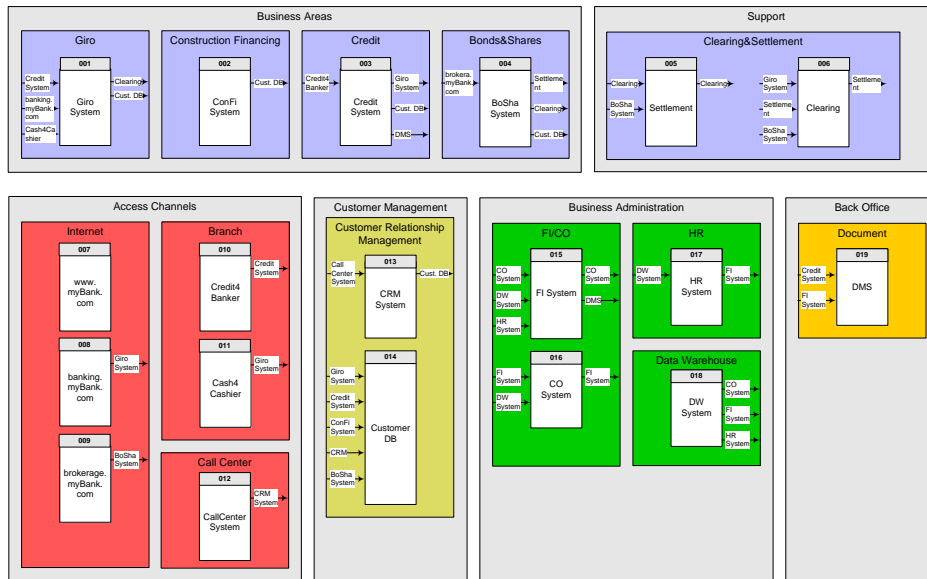


Figure A.1: *Software maps: cluster map example*

maps can be found in [MW04a, MW04b, LMW04a] and online: <http://wiki.softwarekartographie.de>.

A.1 Software Maps with a Base Map for Positioning

The position of an element on the base map is a very important concept in cartography, an attribute derived from the topographic position of the object represented. Thus the position is transporting a particular information. This concept is also used for software maps with a base map for positioning, as the position of an element transports a defined meaning.

The software maps with a base map for positioning can further be categorized by their central aspects:

- Cluster Map (see appendix A.1.1)
- Process Support Map (see appendix A.1.2)
- Interval Map (see appendix A.1.3)

A.1.1 Cluster Map

A *cluster map* is a software map utilizing positioning to show how applications are grouped to larger logical units, by *clustering* the graphical representations of the applications into the representation of the logical unit.

Logical units can be *organizational units*, *functional areas*, *geographic locations*, etc. A possibility to distinguish logical units is using a color code as shown in figure A.1.

The cluster map determines the relative position of the elements but does not prescribe the absolute position of the representation of e.g. an application. The position of the representations of the logical units in respect to the other logical units carries no information, layout optimizations to minimize

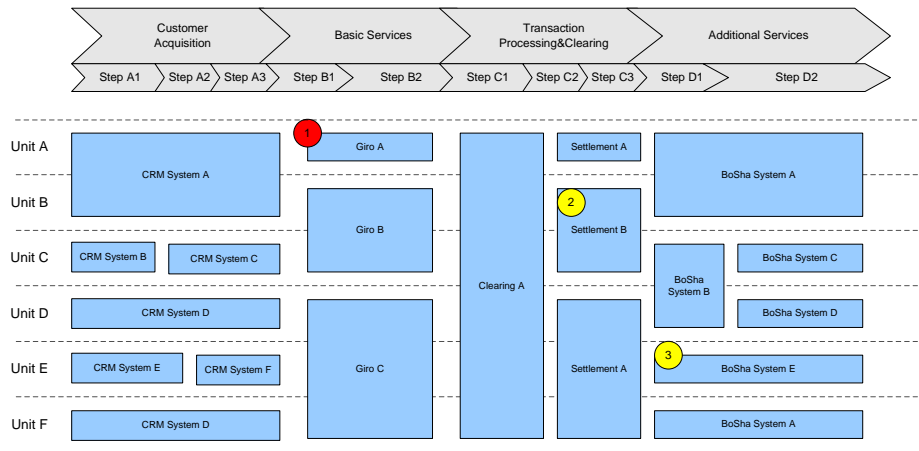


Figure A.2: *Software maps: process support map example 1*

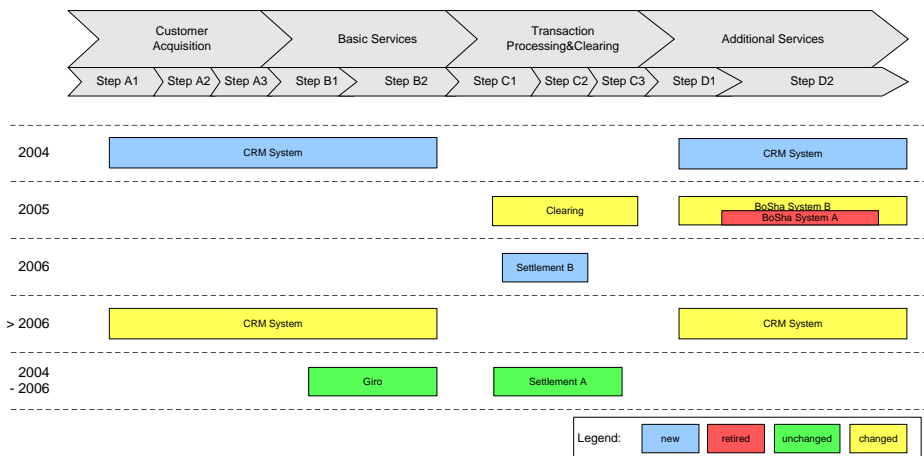


Figure A.3: *Software maps: process support map example 2*

the space required or based on semantic conventions - e.g. positioning customer contact system left, supplier contact systems right, are commonly used.

A.1.2 Process Support Map

A *process support map* is a software map utilizing positioning to show, which business processes are supported by which applications.

The process chain is seen as a linearly ordered sequence of processes, which is typically only possible for *high-level* views on the process chain (levels 0 to 3). This process chain makes up the x-axis. The y-axis is build using distinguishable elements e.g. organizational units or the type of system (operative, administrative, etc.).

The process support map shown in figure A.2 depicts the business process support by applications at different organizational units, thus stressing two different types of integration regarding an application,

A. Software Map Types

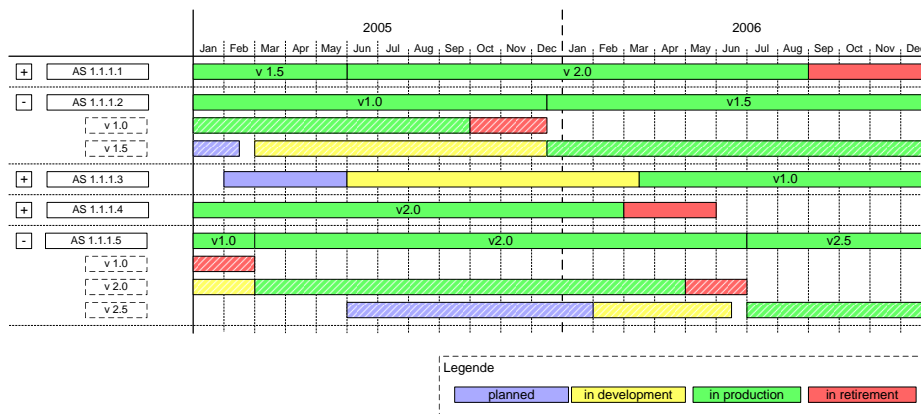


Figure A.4: *Software maps*: interval map example

which can be visually perceived:

Horizontal integration, meaning that at least two subsequent business processes are supported by the same application in one organizational unit. This can be depicted by extending the rectangles representing the effected applications in horizontal directions.

Vertical integration, meaning that two or more organizational units are using the same application for a given business process. Vertical integration can be visualized by vertically extending the rectangle representing the application, if the effected organizational units are neighbors in the visualization.

The process support map from figure A.3 is covering the evolution of the application systems supporting the given business process steps by aligning the applications along the y-axis using planning periods. The information if an application is to be introduced, changed, or replaced is further transported utilizing color coding.

A.1.3 Interval Map

An *interval map* is a software map closely related to gantt-diagrams, as it utilizes bars for representing the time span of e.g. projects or life-cycle phases of applications.

An interval map focuses on the aspect of time, which is used for calculating the position of map symbols along the x-axis, the y-axis is used distinguishing applications (see figure A.4).

On the base map of this map bars are showing the usage of different versions of applications in different time intervals. Hierarchical structures on the y-axis can provide the possibility for showing e.g. projects changing applications or organizational units responsible for applications.

A.2 Software Maps without a Base Map for Positioning

In addition to the map types introduced in appendix A.1 there also exist software maps not utilizing the base map for positioning the elements.

Therefore positioning does not need to convey a specific information in these maps, establishing a closer relation to other graphical representations, e.g. UML class diagrams, ER diagrams, or diagrams

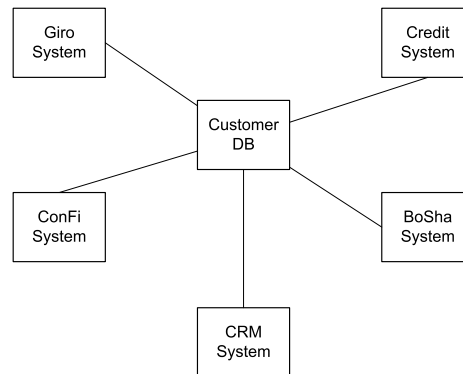


Figure A.5: *Software maps*: map without a base map for positioning

using graph layouts. Positioning rules for ad-hoc maps might be e.g. minimizing the number of lines crossing or distributing the elements equally on the diagram's canvas. Such a map can look like figure A.5.

This map type is often used in carrying out specific tasks as impact analysis, generating depictions of application landscapes or subsets of them especially for such a task.

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