

Guided Research: Using an extended structure to document new Enterprise Architecture Management patterns

Ömer Uludag, 01.06.2015

Software Engineering for Business Information Systems (sebis)
Department of Informatics
Technische Universität München, Germany

www.matthes.in.tum.de

1

Pattern-based Approach to Enterprise Architecture (EA) Management

- Benefits of using EA Management patterns
- EA Management Pattern Catalog (EAMPC) and current concepts
- Extending the structure for documenting new concepts

2

Research approach

- Road to the EAMPC 2015
- Placement in the development of the new EAMPC

3

Research evaluation of the pre-study

- Questionnaire and data collection
- Research results

4

Exemplary EA Management pattern documentation

- Documenting an influence factor
- Documenting an architecture principle pattern

5

Reflection and Outlook

- Recapitulation of the presentation
- Directions for future research on the proposed concepts

1

Pattern-based Approach to Enterprise Architecture (EA) Management

- Benefits of using EA Management patterns
- EA Management Pattern Catalog (EAMPC) and current concepts
- Extending the structure for documenting new concepts

2

Research approach

- Road to the EAMPC 2015
- Placement in the development of the new EAMPC

3

Research evaluation of the pre-study

- Questionnaire and data collection
- Research results

4

Exemplary EA Management pattern documentation

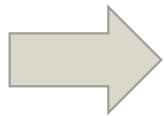
- Documenting an influence factor
- Documenting an architecture principle pattern

5

Reflection and Outlook

- Recapitulation of the presentation
- Directions for future research on the proposed concepts

- Various frameworks exist as well as EA management tools, which promise to deliver guidance for performing the EA management function.
- The approaches presented by them stay either on a level too abstract to provide realization support or are far too generic, neglecting enterprise-specific EA related concerns [Buckl et al. 2009].



The pattern-based approach to EA management tries to address the aforementioned problems by providing a concept based on patterns [Buckl et al. 2008].

The EAMPC provides a holistic and generic view on the problem of the EA management function by providing additional detail and guidance.

The EAMPC identifies the dependencies between

- Individual management *concerns*,
 - Which concern is relevant for which stakeholder?

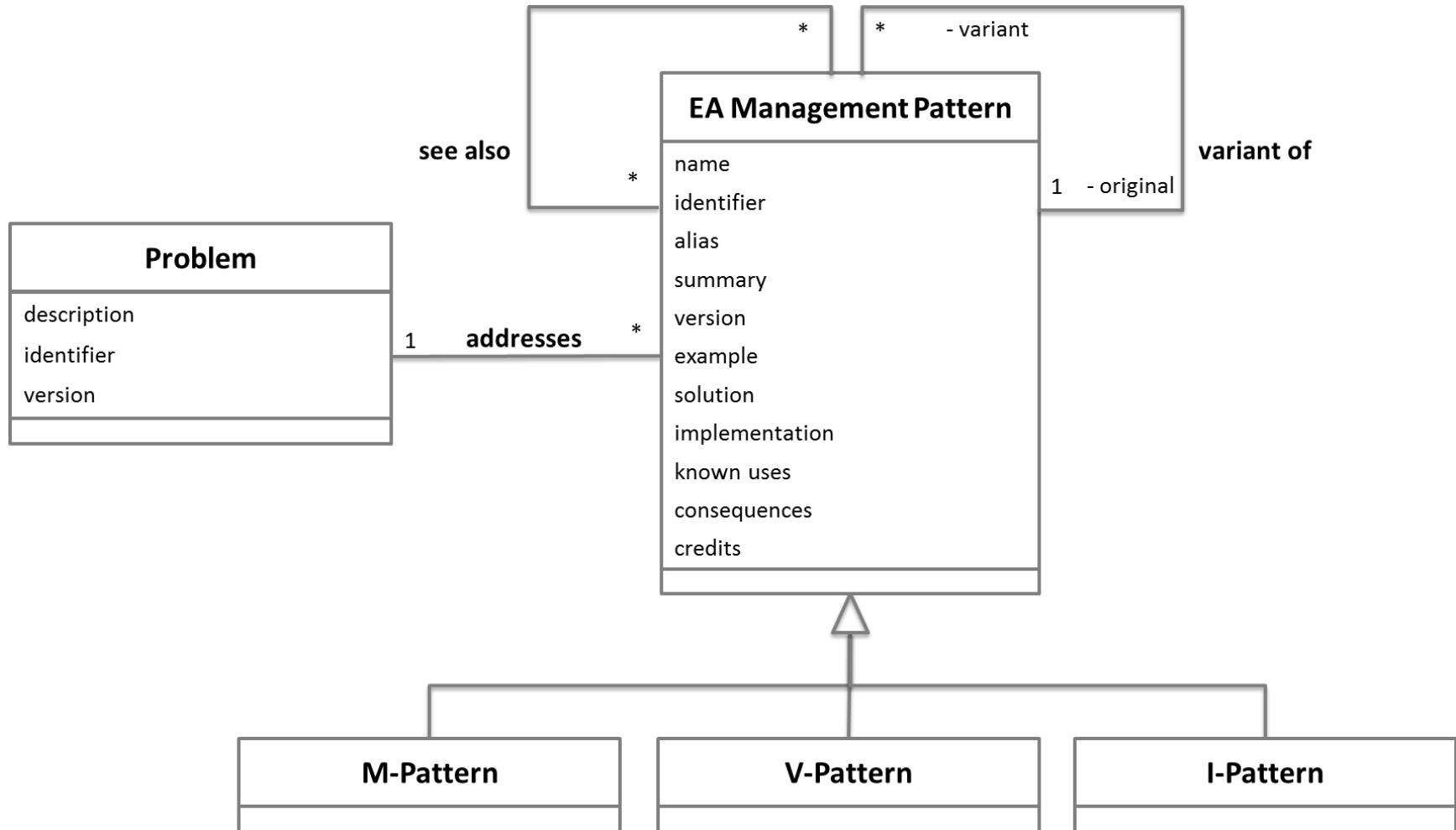
- Management *methodologies*,
 - Which activities are required to address a concern?

- Supporting *viewpoints* and
 - Which viewpoints help stakeholders to collaboratively perform these activities?

- *Information models*
 - Which information is required in order to generate a particular viewpoint?

Methodologies, viewpoints and information models are presented as EA management patterns [Buckl et al. 2008].

Conceptual model of EA management patterns



Source: based on [Ernst 2008]

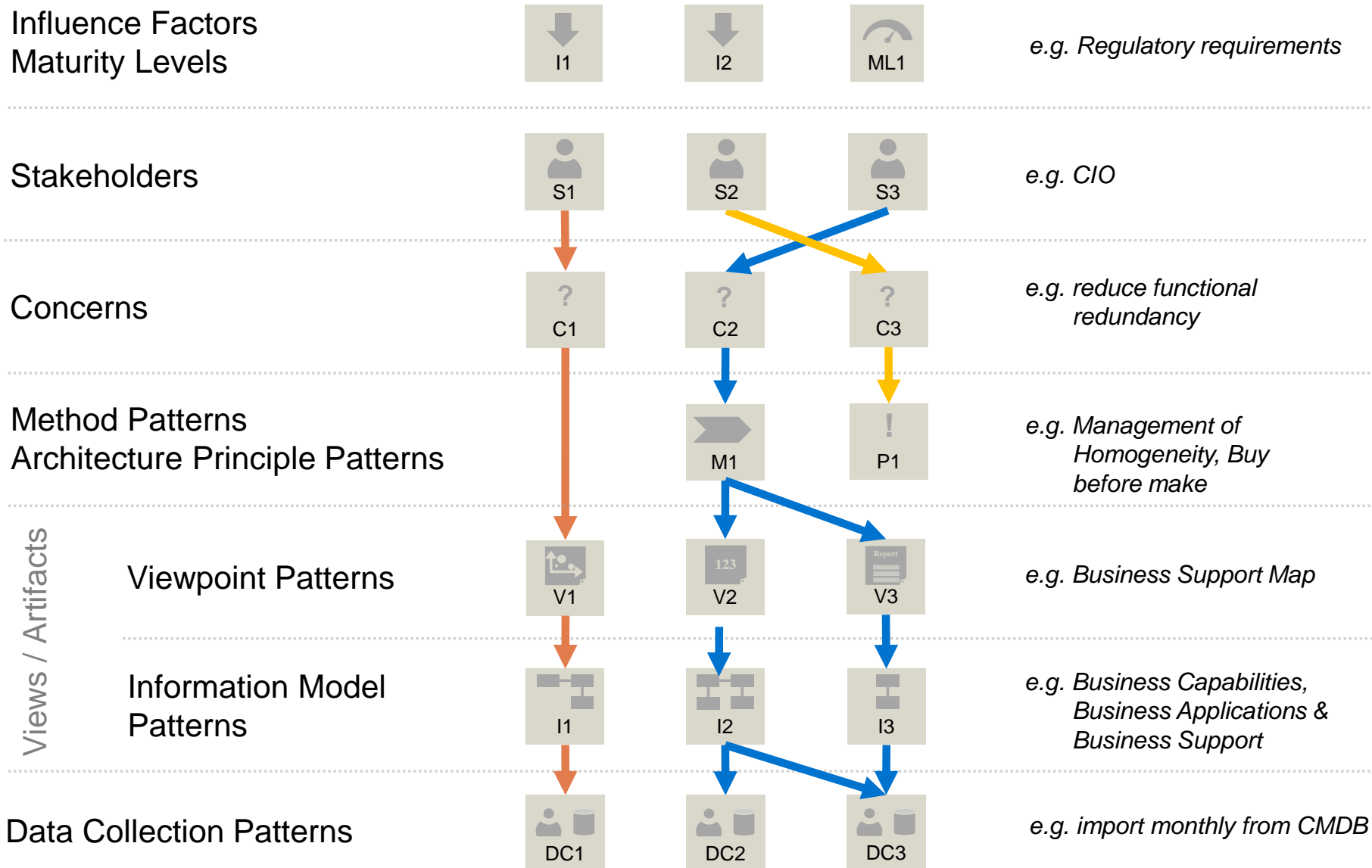
Template for documenting EA management patterns

Overview Section	
Id	An unique alphanumerical identifier
Name	A short and expressive name for the EA management pattern
Alias	Names this EA management pattern is also known as (optional)
Summary	A short summary of the EA management pattern
Version	Version number of the EA management pattern
Solution Section	
	Detailed description of the EA management pattern
Consequence Section	
	Consequences resulting from the usage of the EA management pattern (optional)

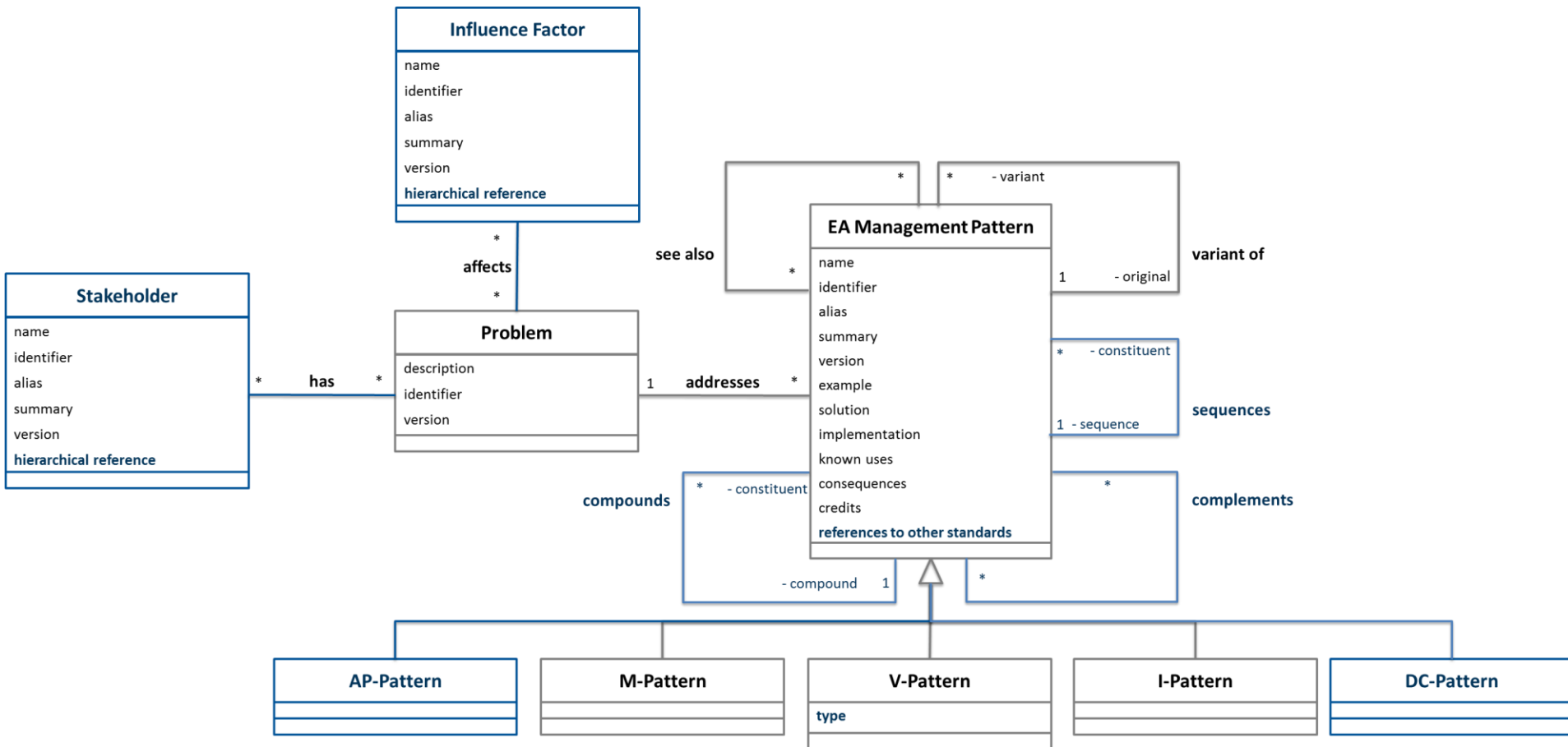
Source: based on [Buckl et al. 2008, Ernst 2008]

Extending the structure for documenting new concepts

– EAMPC 2015: Conceptual overview



Extended conceptual model of EA management patterns and EA management pattern related elements



Template for documenting EA management patterns

Overview Section

Id An unique alphanumerical identifier

Name A short and expressive name for the EA management pattern

Alias Names this EA management pattern is also known as (optional)

Summary A short summary of the EA management pattern


Version Version number of the EA management pattern

Problem Section (only for M-, AP- and V-Patterns)

The concerns a pattern addresses

Solution Section

Detailed description of the EA management pattern



References to other EA management patterns Section

A list of related EA management patterns (optional)



References to other Standards Section

A list of similar concepts of other EA management standards to the corresponding pattern (optional)

New introduced sections

Template for documenting EA management pattern related elements

Overview Section	
Id	An unique alphanumerical identifier
Name	A short and expressive name for the EA management pattern related element
EAM Topic	Corresponding EA management topic of the concern
Alias	Names this EA management pattern related element is also known as (optional)
Summary	A short summary of the EA management pattern related element
Version	Version number of the EA management pattern related element
Hierarchical Reference Section	
	A list of related EA management patterns and EA management pattern related elements (optional)

1

Pattern-based Approach to Enterprise Architecture (EA) Management

- Benefits of using EA Management patterns
- EA Management Pattern Catalog (EAMPC) and current concepts
- Extending the structure for documenting new concepts

2

Research approach

- Road to the EAMPC 2015
- Placement in the development of the new EAMPC

3

Research evaluation of the pre-study

- Questionnaire and data collection
- Descriptive survey and research results

4

Exemplary EA Management pattern documentation

- Documenting an influence factor
- Documenting an architecture principle pattern

5

Reflection and Outlook

- Recapitulation of the presentation
- Directions for future research on the proposed concepts

1. CONCEPT DEVELOPMENT

Development of an improved concept based on the experiences over 7 years

Deliverable: Improved Concept for the EAMPC 2015

3. EVALUATION

Evaluating of the new EAMPC concept with expert interviews

Deliverable: Evaluation of the EAMPC 2015 concept

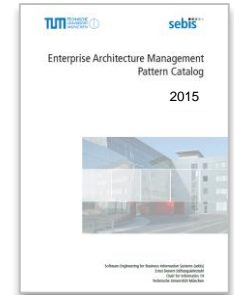
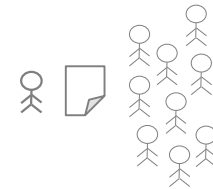
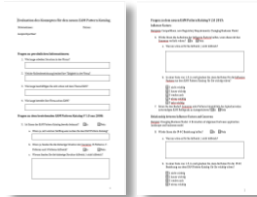
5. PUBLICATION

Analysis of the survey results and publication for the new EAMPC

Deliverable: Final EAMPC 2015 Report



- Softwareforen
- CALM3
- EAMPC 2008/Wiki
- Company slides



2. DATA COLLECTION

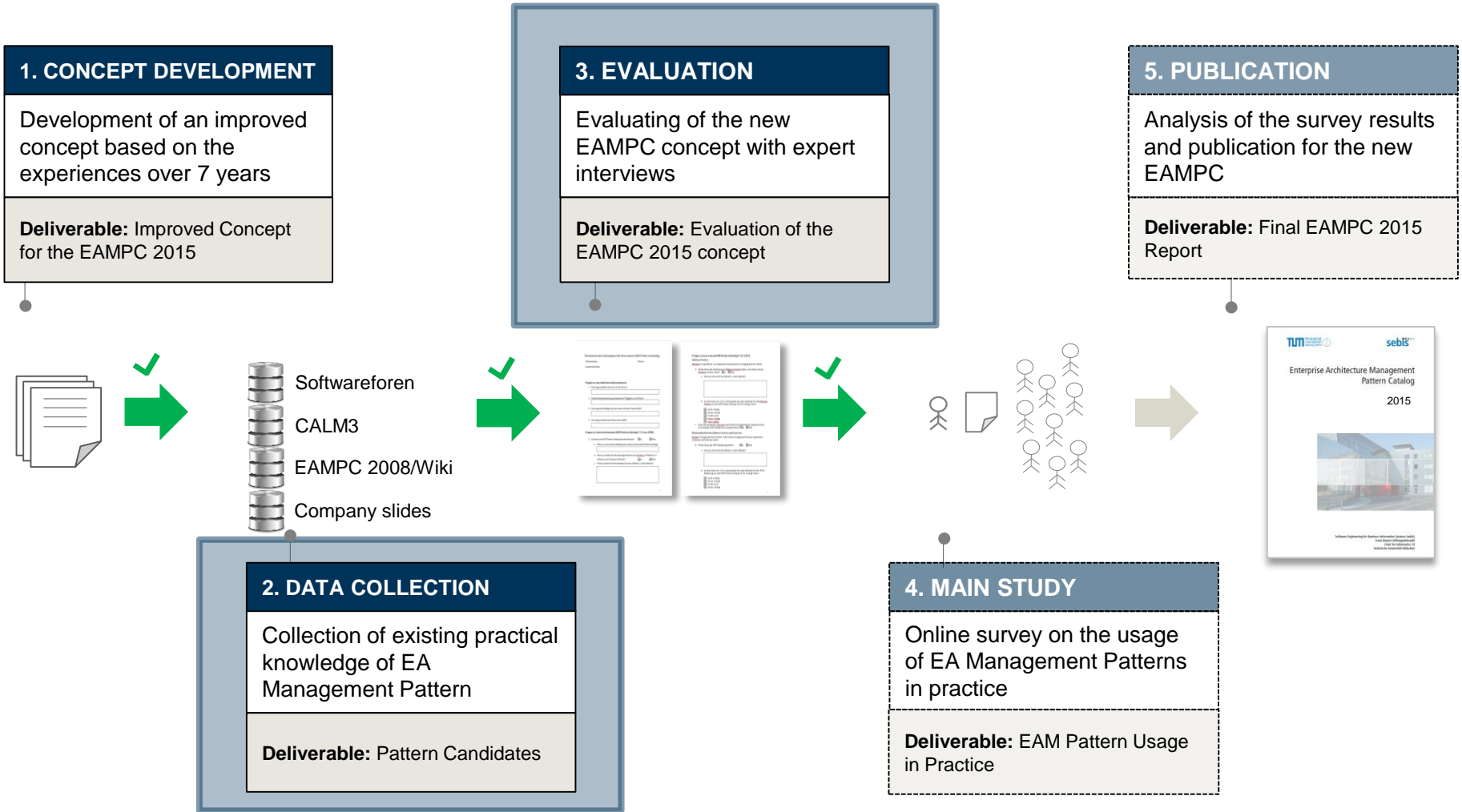
Collection of existing practical knowledge of EA Management Pattern

Deliverable: Pattern Candidates

4. MAIN STUDY

Online survey on the usage of EA Management Patterns in practice

Deliverable: EAM Pattern Usage in Practice



1

Pattern-based Approach to Enterprise Architecture (EA) Management

- Benefits of using EA Management patterns
- EA Management Pattern Catalog (EAMPC) and current concepts
- Extending the structure for documenting new concepts

2

Research approach

- Road to the EAMPC 2015
- Placement in the development of the new EAMPC

3

Research evaluation of the pre-study

- Questionnaire and data collection
- Research results

4

Exemplary EA Management pattern documentation

- Documenting an influence factor
- Documenting an architecture principle pattern

5

Reflection and Outlook

- Recapitulation of the presentation
- Directions for future research on the proposed concepts

Data was collected by means of a questionnaire that comprised four sets of questions:



General context of the respondent and company (length of employment, role of respondent in company, experience with EA management function and experience of the company with EA management function)



Four questions regarding the first version of the EAMPC (usage frequency, helpfulness of current structure of the EAMPC, etc.)

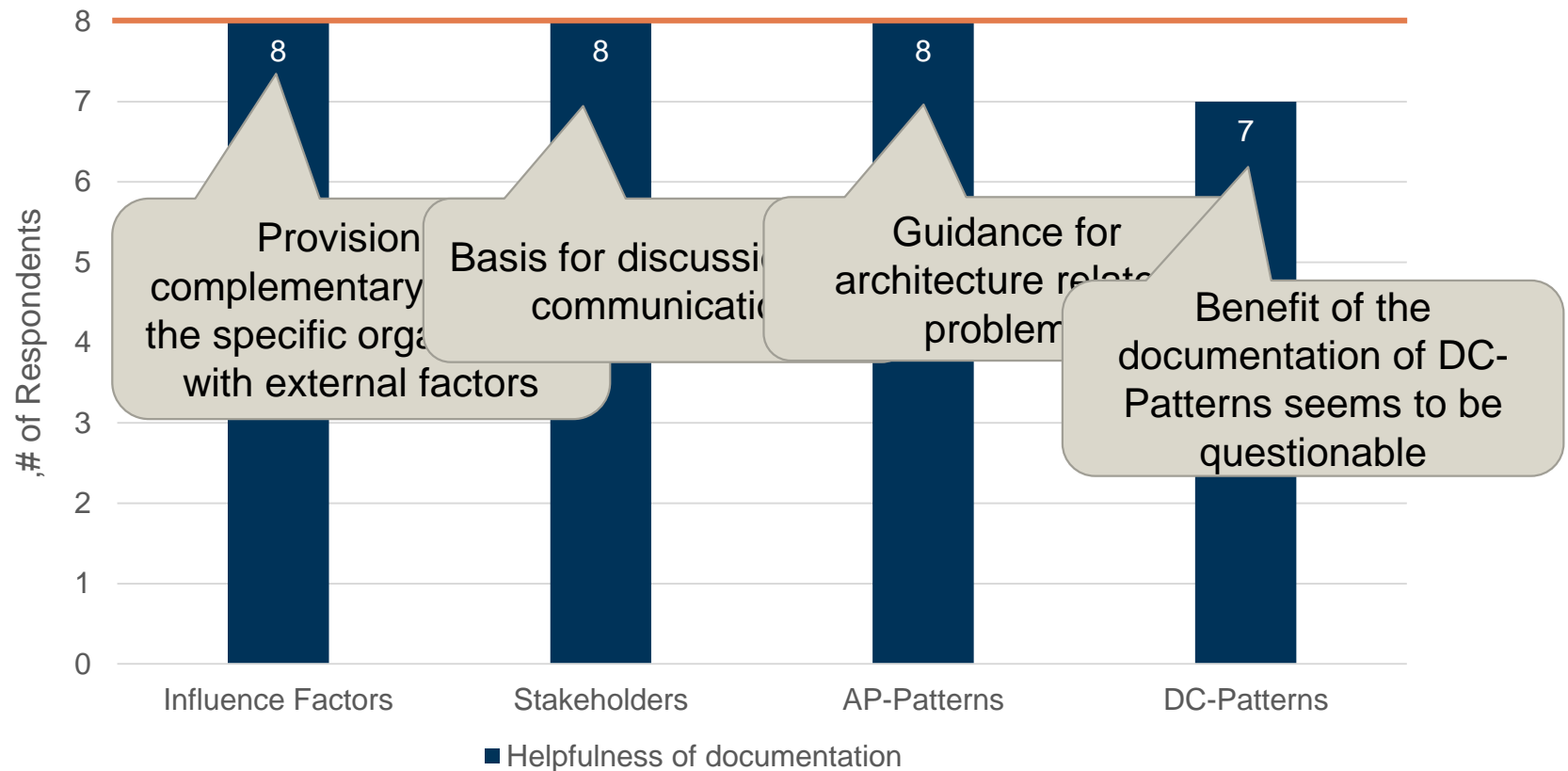


37 questions regarding the new extensions and the EAMPC concept 2015 (importance and helpfulness of documentation of a new concept, like stakeholder, influence factor or DC-Pattern, etc.)

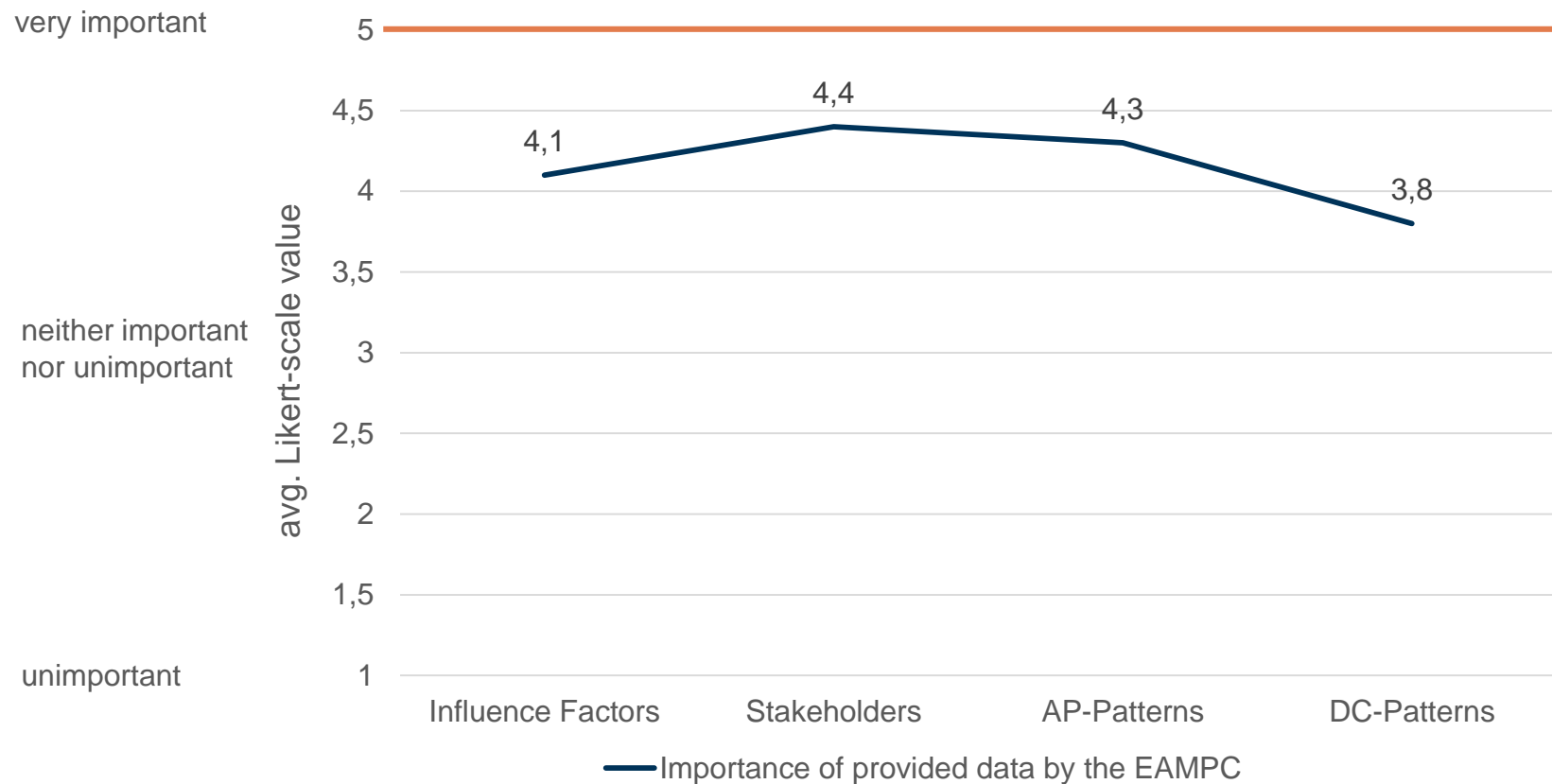


Final question with regard to further concepts, which should be implemented in the second version of the EAMPC

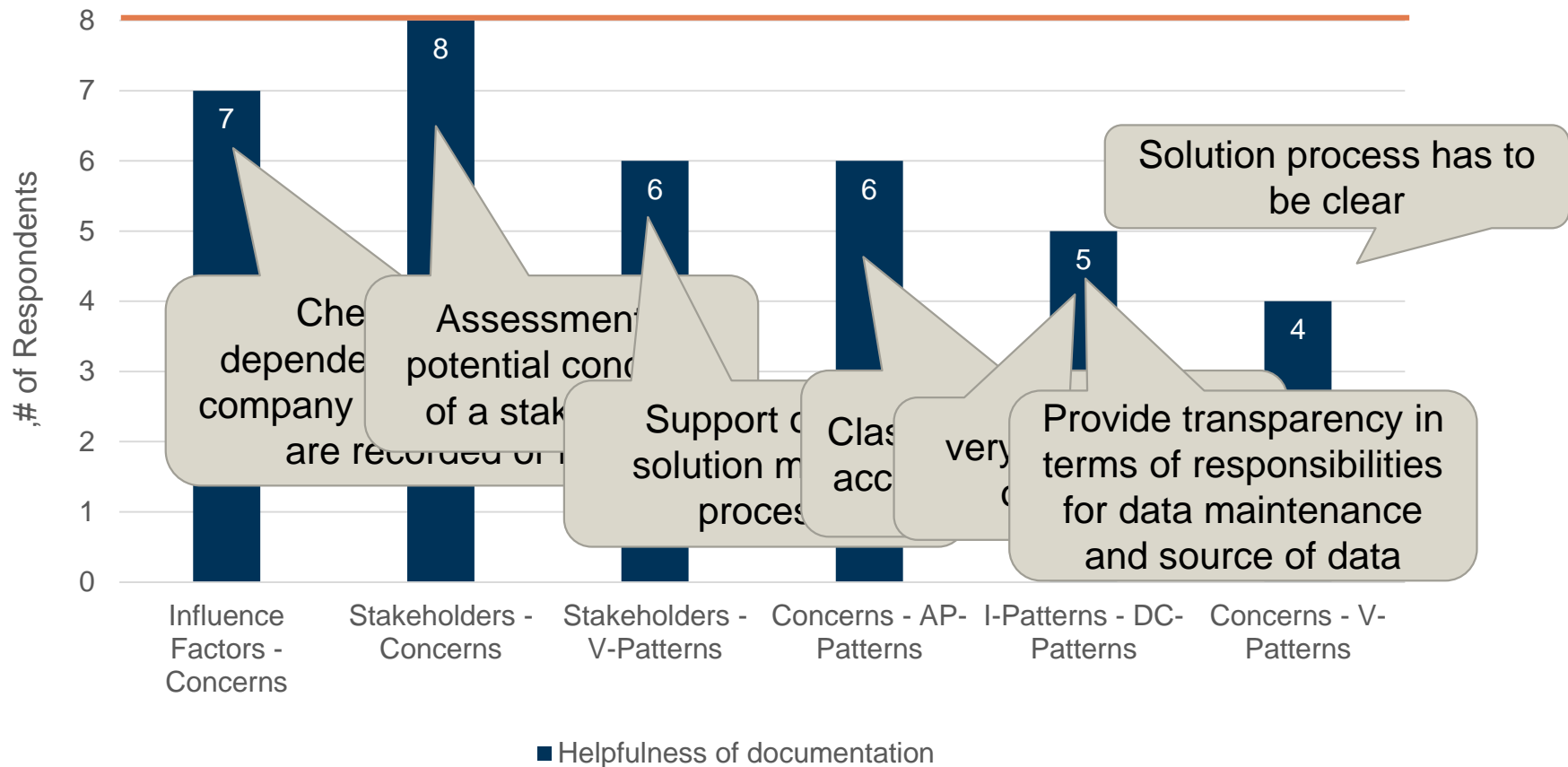
Results for documenting new EA management pattern types and new EA management pattern related elements



Results for documenting new EA management pattern types and new EA management pattern related elements



Results for documenting new relationships of EA management pattern types and new EA management pattern related elements



Results for documenting new relationships of EA management pattern types and new EA management pattern related elements



1

Pattern-based Approach to Enterprise Architecture (EA) Management

- Benefits of using EA Management patterns
- EA Management Pattern Catalog (EAMPC) and current concepts
- Extending the structure for documenting new concepts

2

Research approach

- Road to the EAMPC 2015
- Placement in the development of the new EAMPC

3

Research evaluation of the pre-study

- Questionnaire and data collection
- Research results

4

Exemplary EA Management pattern documentation

- Documenting an influence factor
- Documenting an architecture principle pattern

5

Reflection and Outlook

- Recapitulation of the presentation
- Directions for future research on the proposed concepts

New Business Vision (IF-5)

Overview Section

New Overview Section for EA management pattern related elements

Influence Factor Overview	
Id	IF-5
Name	New business vision
Alias	Vision change
Summary	The term “Vision” refers to a possible and desirable future state of the organization [Campbell and Yeung 1991]. Changing market situations require companies to redefine their vision. In order to contribute to the vision, the EAM has to be aligned with the business strategy.
Version	2.0

Hierarchical Reference Section

New Hierarchical Reference Section

The Influence Factor has an influence on the concerns:

- **C-34:** How does the long-term vision, the target of the application landscape, look like?
- **C-104:** Determination of existing relationships between business applications and organizational units and of way of their visualization.
- **C-147:** Way to merge two different application landscapes.

Loose Coupling of Systems or Services (AP-10)

Overview Section

AP-Pattern Overview	
Id	AP-10
Name	Loose Coupling of Systems or Services
Alias	
Summary	The service-orientation can be reached through the usage of loosely coupled services. The loose coupling of systems reduces dependencies between interface systems.
Version	2.0

Same sections for AP-Patterns as in existing EA management patterns

Same sections for AP-Patterns as in existing EA management patterns

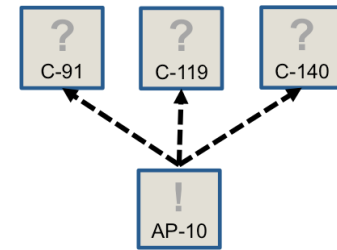
Problem Section

The Architecture Principle addresses the following concerns:

- **C-91:** The activities modifying the application landscape should be aligned to the needs, which have been specified by the defined strategies. Thereby, financial aspects and necessities dictated by the environment of the organization, e.g. via laws, regulations, etc. should be considered.
- **C-119:** Definition of target application landscape.
- **C-140:** Way to manage IT systems dependencies better and to increase flexibility in IT systems.

Solution Section

The loose coupling of systems contributes to the concerns above with the reduction of system dependencies and application landscape complexity. With this contribution, the management of dependencies between IT systems can be improved and the flexibility of IT systems can be increased (C-140). Additionally, individual services or systems are easy substitutable, and as a consequence, they are more flexible to changing business needs (C-91). Furthermore, target application landscape requirements can be ensured (C-119).



Reference to other Standards Section

New Reference to other Standards Section

See also:

- This AP-Pattern AP-10 constitutes a base for the AP-Pattern AP-17 and for the Principle 6: Service Orientation in Architecture Principles in TOGAF [The Open Group 2013].

1

Pattern-based Approach to Enterprise Architecture (EA) Management

- Benefits of using EA Management patterns
- EA Management Pattern Catalog (EAMPC) and current concepts
- Extending the structure for documenting new concepts

2

Research approach

- Road to the EAMPC 2015
- Placement in the development of the new EAMPC

3

Research evaluation of the pre-study

- Questionnaire and data collection
- Research results

4

Exemplary EA Management pattern documentation

- Documenting an influence factor
- Documenting an architecture principle pattern

5

Reflection and Outlook

- Recapitulation of the presentation
- Directions for future research on the proposed concepts

- ☑ The pattern-based approach to EA management has been developed to address typical problems of existing EA management approaches
- ☑ Current structure of the EA management pattern language prevent accessing the grown EAM body-of knowledge
- ☑ An extension of the current conceptual model of the EA management pattern language allows to access this information
 - Documentation of new EA management patterns and EA management pattern related elements
 - Documentation of new relationship types
 - Extension of current structure of EA management patterns and EA management pattern related elements
- ☑ Findings of the pre-study survey confirms the importance and helpfulness of the proposed concepts
 - Some new introduced relationships like the relationship between concerns and V-Patterns were not equally viewed as important as other introduced relationships

Directions for future research on the proposed concepts **sebis**

- ❧ The proposed documentation elements and structures have to be evaluated in the main study of this research approach
 - As the circumstances require, the proposed concepts have to be adjusted

- ❧ Classification of EA stakeholders
 - Many EA stakeholders exist, a classification may prevent inconsistencies and improve usability of the new EAMPC

- ❧ Classification of concerns based on a maturity model

- ❧ Development of a concept for assessing the cost-benefit ratio for using EA management patterns

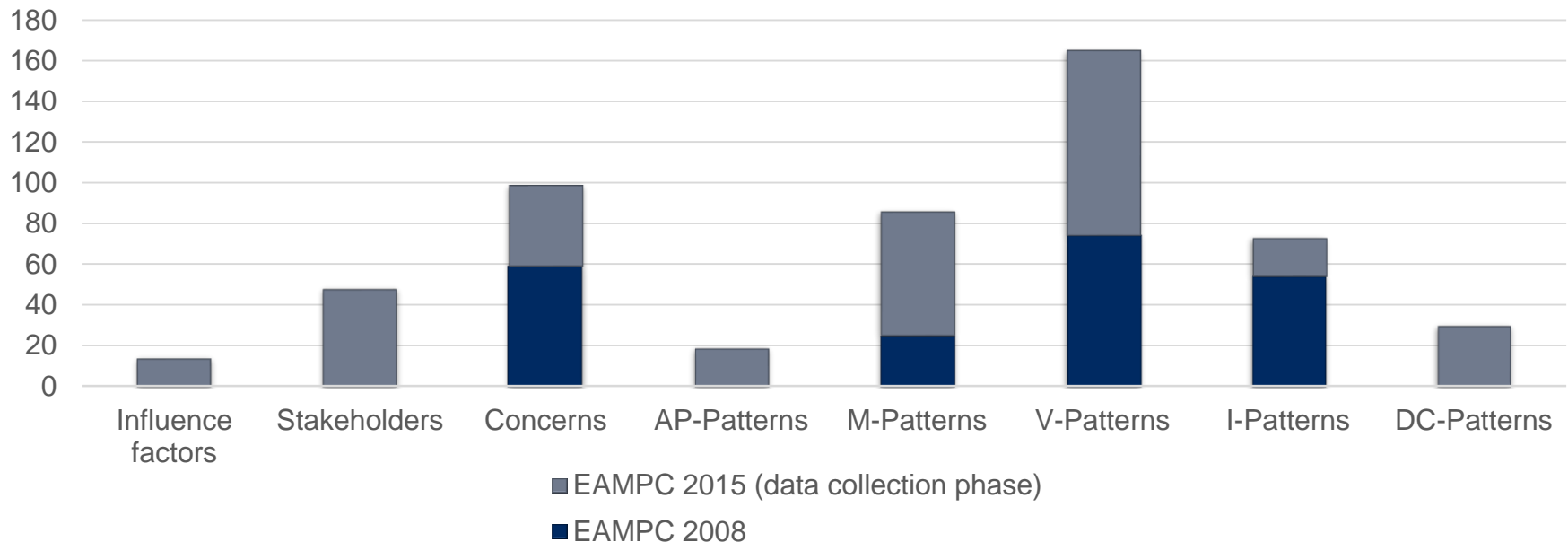
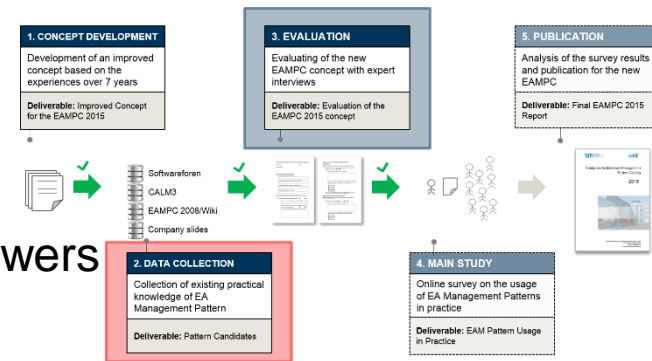


Thank you very much for your attention!
Do you have any questions?



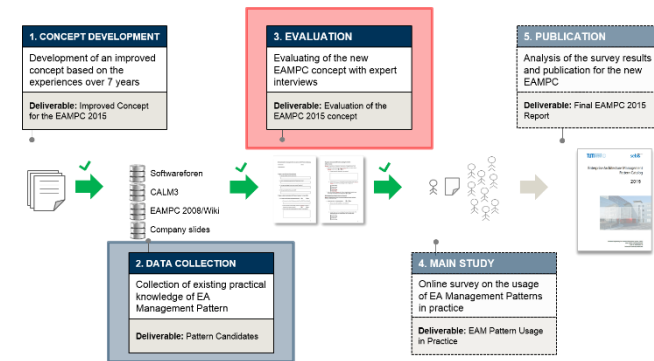
Backup – Placement in the development of the new EAMPC – data collection phase

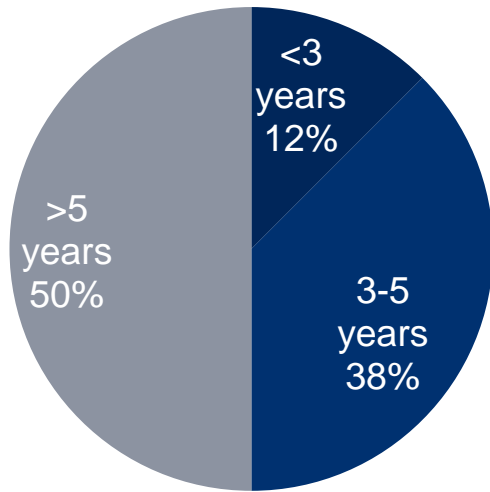
- The *data collection phase* was performed from February to March 2015.
- Slide sets of **50 different companies** are analyzed
- **13 companies** from Softwareforen with detailed answers



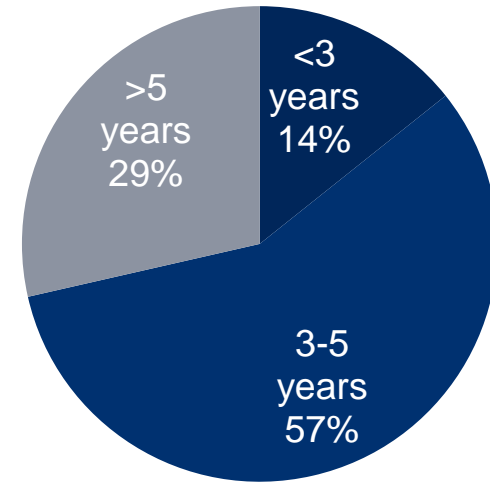
Backup – Placement in the development of the new EAMPC – evaluation phase

- The *evaluation phase* was performed from March to April 2015.
- It includes the creation of a questionnaire in order to evaluate the proposed concepts
- Totally, 8 companies replied to the survey
 - Companies, which have already participated in the Softwareforen Datenerhebung in 2014
 - Further organizations that partook in Softwareforen 2015 in Leipzig





Distribution of EA management function experience of respondents participating in the survey



Distribution of EA management function experience of organizations participating in the survey

➔ Majority of survey participants are well experienced in the field of the EA Management function

➔ Majority of organizations participating in the survey are to some degree experienced in the field of EA management function

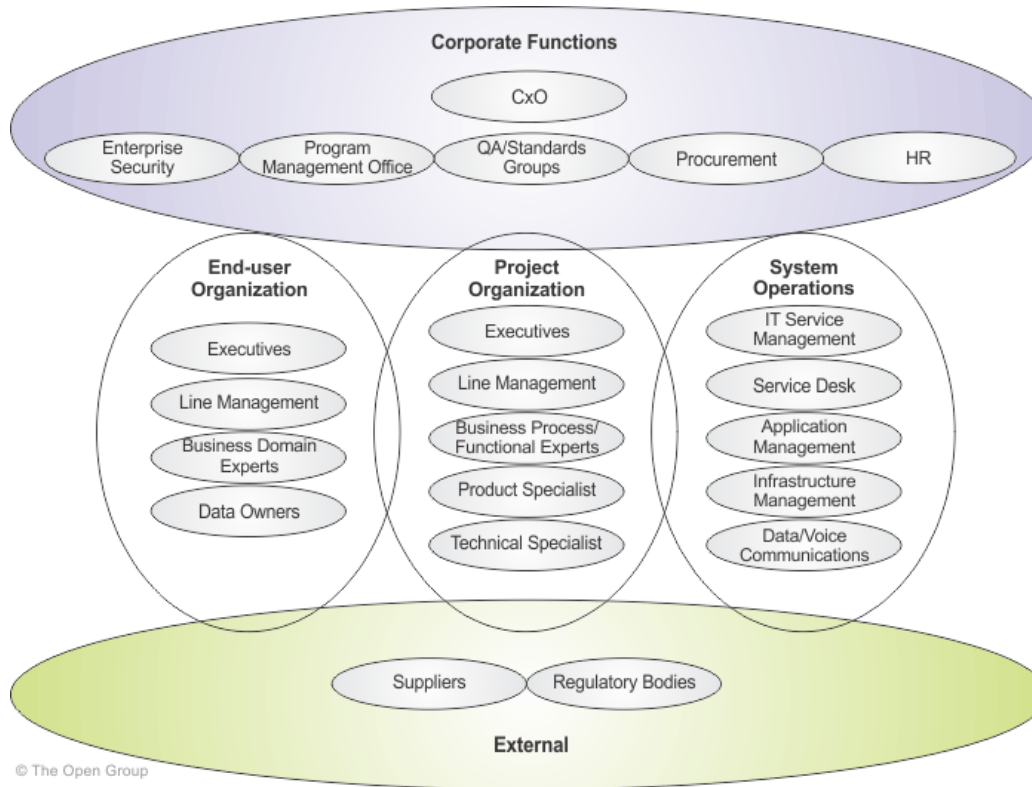
Further findings on

- Influence Factors
 - **5 of 8** respondents do not see the necessity to categorize concerns or EA management patterns regarding the typical EA management function maturity level.

- DC-Patterns
 - **5 of 8** respondents prefer the selection of alternative 2 for the creation of a DC-Pattern: One DC-Pattern per one class of an I-Pattern.

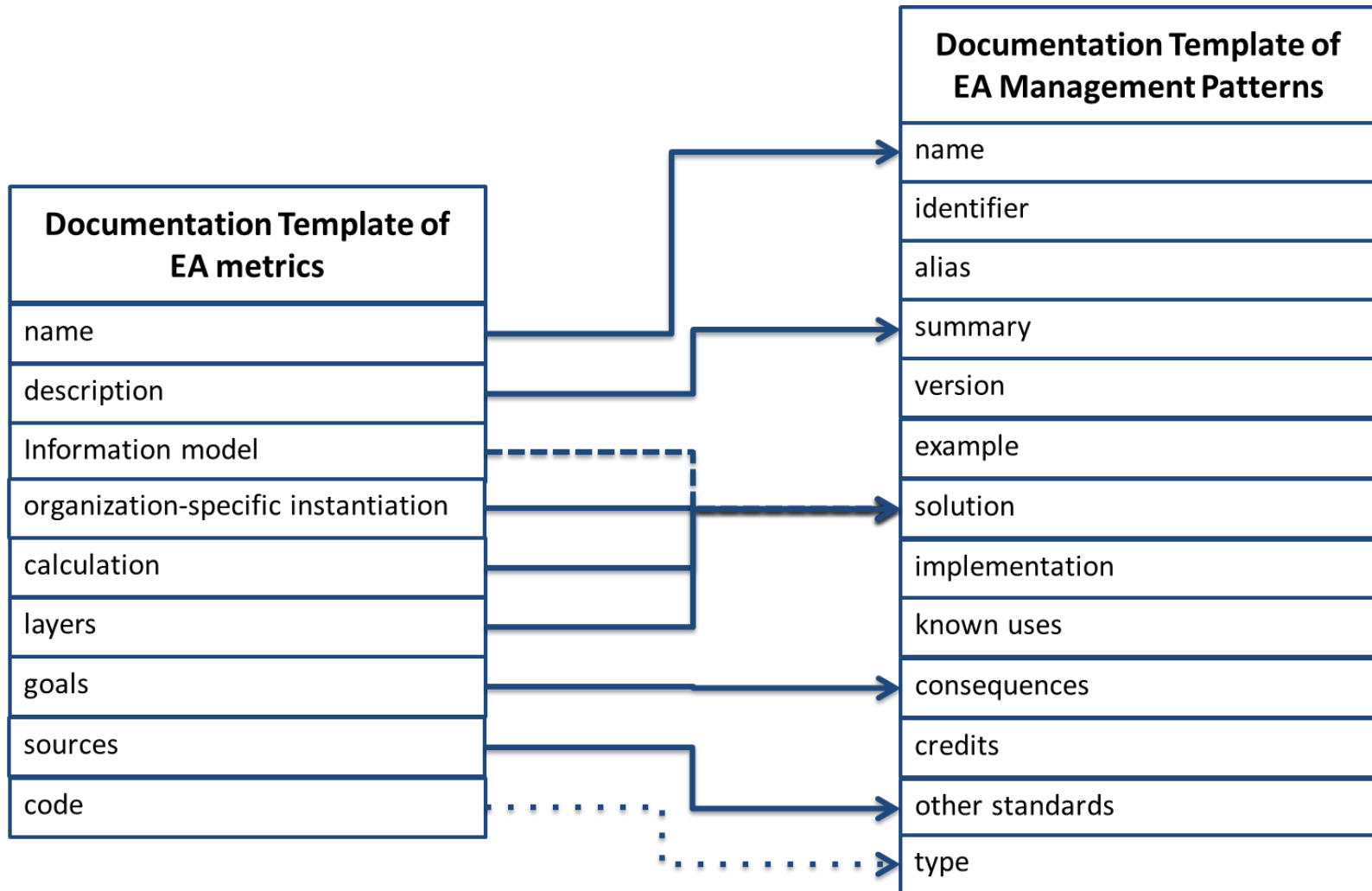
- V-Pattern extension
 - **6 of 8** respondents perceive the extension of V-Patterns as **helpful**.
 - The respondents view data provided by the EAMPC for the extended V-Patterns in some degree as important (avg. Likert scale value: **3.7**).

Backup – EA stakeholder classification by ADM's stakeholder management




Source: [The Open Group 2013]

Backup – Template for mapping EA metrics onto V-Patterns



Source: Based on [Buckl et al. 2008, Matthes et al. 2012]

- **Select maturity model**, which should be applied or which already is in usage in the organization.
- **Determine maturity level** the company has reached in the EA management function to reduce the number of potential concerns.
- **Select concerns in maturity level** and thereby select EA management patterns addressing the existing concerns. If a concern can be addressed by multiple EA management patterns, then the EA management pattern, which best fits the company's context, has to be identified.
- **Select additional EA management patterns** is equal to the same step described in preceding approach [Ernst 2010].



In order to apply the maturity model-based approach for selecting EA management patterns, the maturity levels of the respective model can be documented as influence factors.

Backup – Example documentation of a stakeholder

CIO (S-4)

Overview Section

Stakeholder Overview	
Id	S-4
Name	CIO
Alias	CTO, CIO Management Board
Summary	The Chief Information Officer (CIO) is defined as the highest-ranking IS executive who typically exhibits managerial roles requiring effective communication with top management, a broad corporate perspective in managing information resources, influence on organizational strategy, and responsibility for the planning of IT to fit with a company's competitive environment [Grover et al. 1993].
Version	2.0

Hierarchical Reference Section

The Stakeholder has the following concern:

- **C-167:** Context-sensitive information need.

This Stakeholder uses the viewpoints:

- **V-61:** Technical Project Portfolio Overview
- **V-114:** Product and Process Individuality Matrix

Backup – Example documentation of a concern

Concern C-170

Overview Section

Concern Overview	
Id	C-170
EAM Topic	
Summary	Identification of types and relationships which are used in the modeling of an enterprise architecture.
Version	2.0

Hierarchical Reference Section

The concern is addressed by the M-Pattern:

- **M-116:** Creation of an integrated Enterprise Architecture Meta-Model

This concern is addressed by the following viewpoint:

- **V-111:** Enterprise Architecture Meta-Model Overview

Creation of an integrated Enterprise Architecture Meta-Model (M-116)

Overview Section

M-Pattern Overview	
Id	M-116
Name	Creation of an integrated Enterprise Architecture Meta-Model
Alias	
Summary	This M-Pattern describes the way for the creation of a meta-model of the enterprise architecture on high abstraction view.
Version	2.0

Problem Section

The M-Pattern addresses the following concerns:

- **C-170:** Identification of types and relationships which are used in the modeling of an enterprise architecture.
-

Backup – Example documentation of an M-Pattern

Solution Section

This M-Pattern suggests the creation of an enterprise architecture meta-model, which contains all relevant enterprise architecture objects and describes the relation of this objects among themselves on abstraction level. For this purpose, initially, the used architecture objects are identified. These are for instance the organizations, business processes, business applications, information flows, business objects, business domains or services. In a next step, the relationships between these objects have to be determined. In the last step, the architecture objects are clustered in to specific domains. The domains can be classified across different aspects:



- Differentiation in diverse architecture levels, such as functional architecture level, infrastructure application level and services level
- Differentiation in technology hierarchy levels, such as business layer, application layer, and infrastructure layer

The purpose of this M-Pattern can be tool-driven or demand-driven. In the first case, an EAM repository models the intended enterprise architecture objects with their relationships. It also provides the possibility to adjust the enterprise architecture objects easily. In the latter case, the information models of the architecture objects are derived by the requirements of the EAM and based on them, an integrated meta-model of the architecture objects can be generated. In this instance, the UML notation can be used in order to create the architecture meta-model. For the representation of the architecture objects, a typical rectangle with a name description can be used. For the specification of the relationships UML associations and multiplicities can be utilized. The edges represent the relationships. To prevent the complexity of the meta-model only the necessary architecture objects and their relationships should be taken into account. Otherwise the model becomes less abstract and the intention of the meta-model gets lost.

Backup – Example documentation of an M-Pattern

The M-Pattern uses the following viewpoints:

- **V-111:** Enterprise Architecture Meta-Model Overview

The V-Pattern V-111 represents the created architecture meta-model with all of its components and their relationships among themselves.

Consequence Section

As a consequence of this M-Pattern all relevant architecture objects and their relationships have to be identified and be set in correlation.

Reference to other Standards Section

See also:

Chapter 34 Content Metamodel in TOGAF provides information for the creation and management of an enterprise architecture meta-model [The Open Group 2013].

Backup – Example documentation of a V-Pattern

Complexity Measurement Dashboard (V-118)

Overview Section

V-Pattern Overview	
Id	V-118
Name	Complexity Measurement Dashboard
Alias	
Summary	The complexity measurement dashboard juxtaposes functional domains in opposition to the analyzed technological aspects in order to determine the complexity of an application landscape.
Version	2.0

Problem Section

The V-Pattern addresses the following concern:

- **C-124:** Reducing and measurement of application landscape complexity.
-

Backup – Example documentation of a V-Pattern

Solution Section

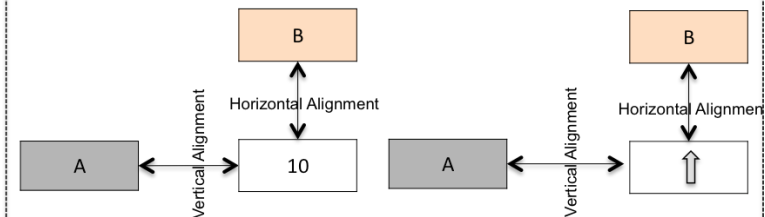
		IT Complexity Indicators					
		Number of Applications	Number of Information Flows	Standard Conformity	Number of Infrastructure Elements	Functional Scope	Functional Redundancy
Functional Domains	Core Business Objects	20	40	5	5	4	3
	Sales	15	35	3	3	5	2
	Business Operations & Services	10	30	3	3	4	1
	Transaction Processing	2	12	1	2	2	0
	Group Sharing	3	18	2	2	3	1
	Corporate Services	5	20	2	3	1	3
	Total	55	155	16	18	19	10

Legend

Map Symbols

A	Functional Domain
B	Technology Aspect
C	Total Complexity Indicator Value
↑	Positive History Change
—	Non History Change
↓	Negative History Change

Visualization Rules

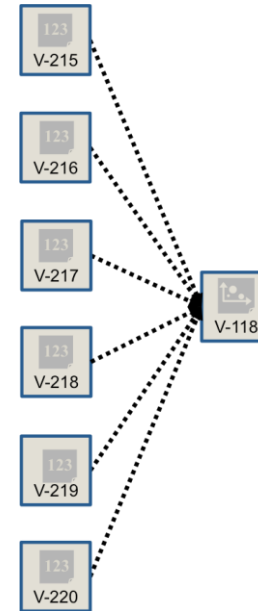


The IT Complexity Indicator (B) has an Complexity Indicator Value (10) for the Functional Domain (A)

The IT Complexity Indicator (B) has has a Positive History Change for the Functional Domain (A)

Backup – Example documentation of a V-Pattern

After the analysis of application landscape complexity indicators (M-70), they are listed as IT complexity indicators which then can be linked with the corresponding functional domains. For each functional domain and complexity indicator, a value for the complexity is listed. Additionally, a history of the complexity change is also provided. As a result, this V-Pattern visualizes the total complexity of the application landscape.



Consequence Section

This V-Pattern represents a composite pattern for application landscape complexity aspects. Possible V-Patterns, which can be used as a composition for this composite pattern are the following:

- **V-215:** Number of Applications
- **V-216:** Number of Information Flows
- **V-217:** Standard Conformity
- **V-218:** Number of Infrastructure Elements
- **V-219:** Functional Scope
- **V-220:** Functional Redundancy

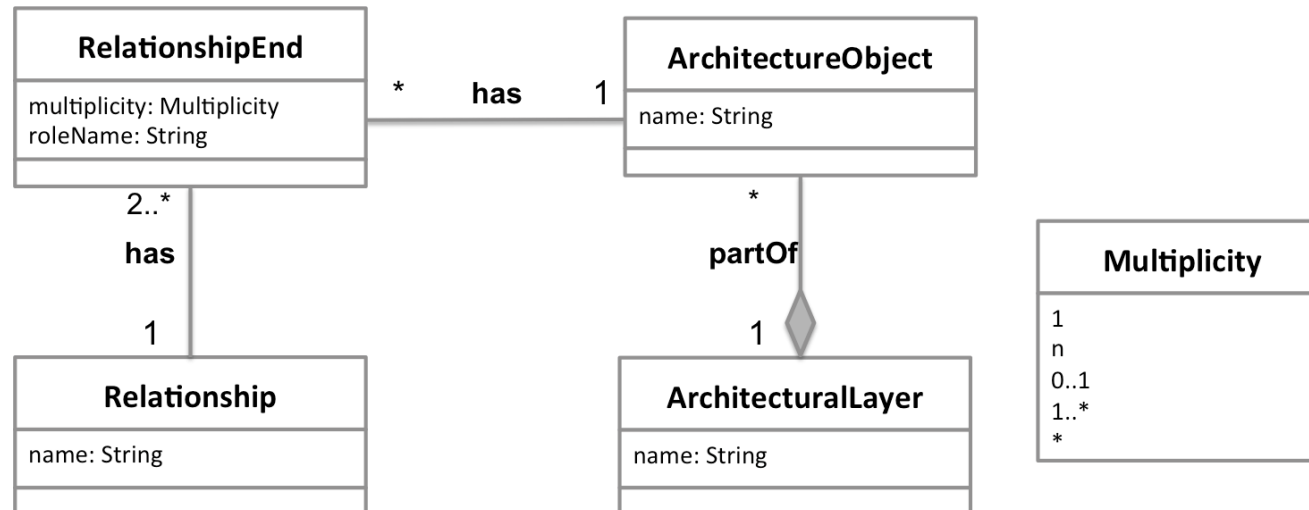
Backup – Example documentation of an I-Pattern

Architecture Objects and Architecture Object Relationships (I-101)

Overview Section

I-Pattern Overview	
Id	I-101
Name	Architecture Objects and Architecture Object Relationships
Alias	
Summary	This I-Pattern contains the information model for architecture meta-objects and their relationships.
Version	2.0

Solution Section



Backup – Example documentation of an I-Pattern

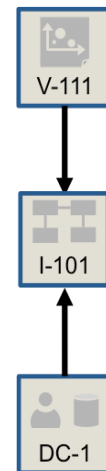
- **ArchitecturalLayer:** Describes a logical grouping into areas relevant to architecture levels or technology architecture level, e.g. application layer, infrastructure layer.
- **ArchitectureObject:** An ArchitectureObject specifies the architecture meta-object, e.g. business application, business process, business objects or business domains.
- **Multiplicity:** A multiplicity specifies the number of possible occurrences of an element.
- **Relationship:** A relationship describes a connection between elements.
- **RelationshipEnd:** A relationshipEnd specifies the multiplicity of elements that can be connected to it and defines the role name of the connected elements.

This I-Pattern contains the required Information Models for the V-Pattern:

- **V-111:** Enterprise Architecture Meta-Model Overview

The I-Pattern is provided by the DC-Pattern:

- **DC-1:** Relationship End
- **DC-2:** Relationship
- **DC-3:** Architecture Object
- **DC-4:** Architectural Layer



Backup – Example documentation of a DC-Pattern

Capability (DC-6)

Overview Section

DC-Pattern Overview	
Id	DC-6
Name	Capability
Alias	
Summary	This DC-Pattern contains the class Capability for the I-Pattern Domain Model (I-100).
Version	2.0

Solution Section

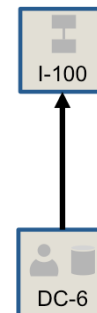
The data maintenance for the class Capability is done manually. The enterprise architect provides the data source for required information for this DC-Pattern. The data is updated ad hoc, or when attributes of the class Capability are changed or new ones are added.

The following stakeholder is responsible for data maintenance:

- **S-45:** Enterprise Architect

Capabilities are used by the following I-Pattern:

- **I-100:** Domain Model



Concrete new EAMPC Concept	Questions for evaluating a new specific EAMPC Concept
Influence factors, stakeholders, AP-Patterns, DC-Patterns, and V-Pattern extension	<ul style="list-style-type: none"> ▪ Q1: Would the documentation of the new concept, e.g. influence factors, help you, if it would be linked with e.g. concerns? ▪ Q2: Why it would be useful/not useful for you? ▪ Q3: On a 5-level a Likert scale ranging from “not important” (1) through “very important” (5), how important would be the data, e.g. influence factors provided by the EAMPC?
Influence factors	<ul style="list-style-type: none"> ▪ Q4: Do you see the necessity to categorize concerns or EA management patterns regarding the typical EA management function maturity level?
DC-Patterns	<ul style="list-style-type: none"> ▪ For the creation of DC-Patterns, there exist the following two alternatives: <ul style="list-style-type: none"> ▪ Alternative 1: 1 DC-Pattern pro I-Pattern ▪ Alternative 2: 1 DC-Pattern per one class of an I-Pattern ▪ Q5: Which alternative do you would prefer? ▪ Q6: What is your reasoning for your selection?
Relationships (RSs) between influence factors & concerns, RSs between stakeholders & concerns, RSs between stakeholders & V-Patterns, RSs between concerns & AP-Patterns, RSs between I- & DC-Patterns, and RSs between concerns & V-Patterns	<ul style="list-style-type: none"> ▪ Q7: Would the relationship between, e.g. relationship influence factors and concerns help you? ▪ Q8: Why it would be useful/not useful for you? ▪ Q9: On a 5-level a Likert scale ranging from “not important” (1) through “very important” (5), how important would be the data, e.g. relationship between influence factors and concerns provided by the EAMPC?

References

- Sabine Buckl, Alexander M. Ernst, Josef Lankes, and Florian Matthes. 2008. Enterprise Architecture Management Pattern Catalog (version 1.0, February 2008). Chair for Informatics 19 (sebis), Technische Universität München, Munich, Germany.
- Sabine Buckl, Alexander M. Ernst, Florian Matthes, René Ramacher, and Christian M. Schweda. 2009. Using Enterprise Architecture Management Patterns to complement TOGAF. In *Proceedings of Enterprise Distributed Object Computing Conference*. IEEE Computer Society, Los Alamitos, CA, USA, 34–41.
- Andrew Campbell and Sally Yeung. 1991. Brief case: Mission, vision and strategic intent. In *Long Range Planning*, 24, 4 (1991), 145–147.
- Alexander Ernst. 2008. Enterprise Architecture Management Patterns. In *Proceedings of the 15th Pattern Languages of Programs*. ACM, New York, NY, USA, 1–20.
- Alexander Ernst. 2010. *A Pattern-Based Approach to Enterprise Architecture Management*. Ph.D. Dissertation, Technische Universität München, Munich, Germany.
- Varun Grover, Seung-Ryul Joeng, William J. Kettinger, and Choong C. Lee. 1993. The Chief Information Officer: A Study of Managerial Roles. *Journal of Management Information Systems*, 10, 2 (1993), 107–130.
- Florian Matthes, Ivan Monahov, Alexander Schneider, and Christopher Schulz. 2012. EAM KPI Catalog (version 1.0). Chair for Informatics 19 (sebis), Technische Universität München, Munich, Germany.
- The Open Group. 2013. TOGAF Version 9.1, First edition, Third impression. Zaltbommel: Van Haren Publishing.