Final Presentation

Master's Thesis – Collaborative Development of Open APIs - Status Quo and Ideas for Improvements

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Motivation

- An average of 2019 new APIs is added every year (Santos 2019). Some companies which provided APIs have made a huge business successes from their APIs, like **eBay** which generates 60 % of their income thorough APIs (Iyer and Subramaniam 2015) or **Amazon** that in 2016 had 33 open APIs with more than 300 different mashups (Evans and Basole 2016).
- The majority of successful APIs are distributed among companies that are born-digital, but others like Walmart in 2016 had only one API with only one mashup integrating their API. Evans and Basole 2016).
- The most important technology challenge for the API is the need for standardization, described as "the need to establish standards for how APIs are developed and maintained within the organization" (Smartbear 2019).

Problem statement

- **The need for standardization** shows the need to identify the current state of API development processes, their similarities and differences. That way, a holistic picture on API development processes could be seen, together with gaps that currently exist.
- Another challenge that was identified was that **many companies do not collaborate with external users** and create provider-driven API that does not fulfill the consumer's needs (Bondel et al. 2019) from (Smith 2018). This challenge is not very common in the researches carried out until now and therefore needs to be additionally analyzed for its importance among experts in the field of open APIs.
- Finally, standardization of APIs in terms of processes is incomplete if implemented only on processes, as together with business assets **stakeholders are an integral part of API value chain** (Glickenhouse and England 2016).

Research questions

RQ 1 ***What are current challenges during Open API development?***

RQ 2 ***What are the phases that the development processes of Open APIs should contain?***

RQ 3 ***What stakeholders are involved in the collaborative development of open APIs?***

RQ 4 ***How could collaboration during Open API development be improved?***

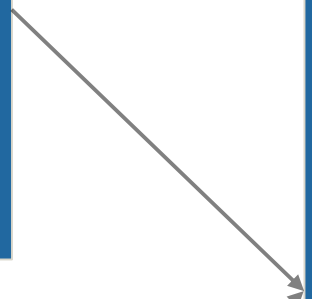
Research Approach

Extensive Literature Review

- Analysis of the academic literature
- Open Web Search
- Answering RQ2 and RQ3

Semi-Structured Interviews

- Carrying out and performing qualitative analysis of semi-structure interviews
- Answering RQ 1
- Discussing and widening the literature review results of RQ2 and RQ3



Ideas for improvements

- Combining and analyzing findings from literature review and semi-structured interviews
- Based on answers and gaps found in RQ1, RQ2 and RQ3 finding the potential improvement ideas, with the focus on collaboration – answering RQ4

Theoretical foundations - Summary

- APIs that were in focus for this thesis:
  - **Web APIs** - Web APIs refer to APIs over the web which can be accessed using the HTTP protocol. (RapidAPI 2019)
  - **Open APIs** – APIs that are offered to all interested developers, not only internally or to partners.
  - **Managed APIs** - APIs that have a lifecycle from its creation to its retirement. (Siriwardena 2014)
- Collaboration types that were in focus for this thesis were based on 3c model from (Ellis et al. 1991)
  - **Communication** - „the interrelated behavior of two or more people and their interaction with the goal of transmitting information and understanding the content.“ (Leimeister 2014).
  - **Coordination** - the matching of decentralized actions and decisions of interdependent organizational units on the basis of suitable communication processes with regard to the optimal fulfillment of the goals.“ (Leimeister 2014).
  - **Cooperation** - „the activity of two or more individuals, which is consciously planned and coordinated with one another to ensure the achievement of the goals of each individual involved to the same extent “(Leimeister 2014).

Interviews

- 11 Semi-structured interviews with industry experts
- 30-45 minutes long
- Five open-ended, research related questions

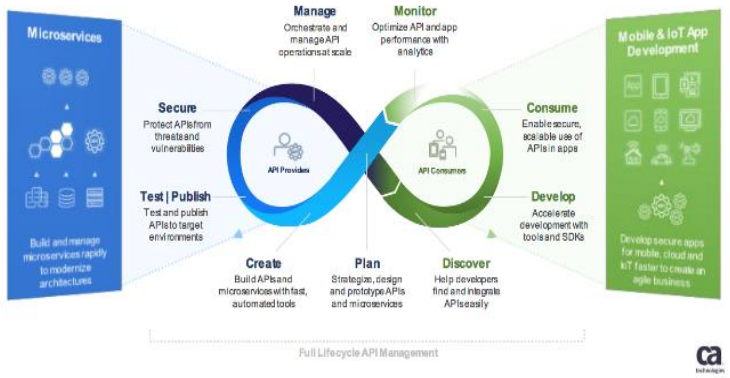
Interviewee ID	*Role*	*Industry*	*Experience*	*Provider / Consumer*
I1	Software Developer	Education	3 years	API Consumer
I2	Software Developer	Legal	9 years	API Consumer
I3	Developer Experience Director	E-Commerce	20 years	API Provider
I4	API Engineer	Video Streaming	10 years	API Provider
I5	Software Developer	Automotive Industry	2.5 years	API Consumer, API Provider
I6	Director of Applied Technology Research	Business Information Systems	30 years	API Consumer
I7	Software Developer	E-Commerce	3 years	API Consumer
I8	Integration Architect	Fashion Retail	12 years	API Provider
I9	Product Manager	API Tooling	4 years	API Provider
I10	Software Developer	IT Software Industry	5 years	API Consumer
I11	Technical Lead	IT Software Industry	8 years	API Provider

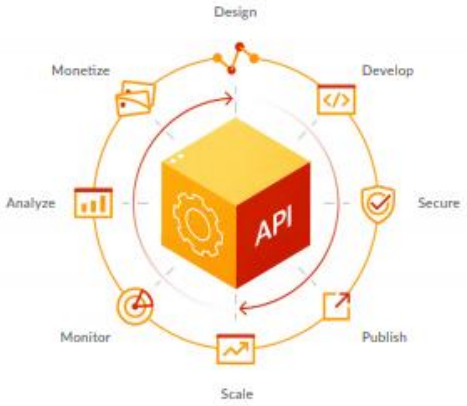
Identified challenges during Open API development lifecycle

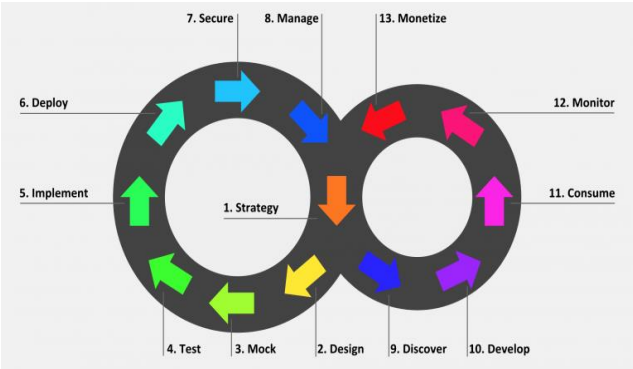
- Lack of knowledge about consumers and their requirements
- Lack of consumer involvement in the design
- Lack of mechanism for systematic feedback
- User experience should be the priority
- Change management
- Security and privacy
- Monitoring and analytics
- Documentation
- Legal issues

Literature review

- As stated by (Kopecky and Aziz 2016) there the area of Web API Management lacks the precise definitions and there is very little academic research done in this area, therefore the experience from business providers and certain books which include topic of API Lifecycle and processes were researched.
- After detailed literature review, a total number of **13** processes and **7** role divisions was identified. These come from API Management books and companies that have API Management platforms.
- Identified processes and role divisions varied in their: Types of sources, levels of details, naming conventions.







sources:
Layer7, ApiGee, RedHat

API Development Processes - Phases

Source	Source Type	API Strategy	Design	Mock / Simulate	Build	Test	Secure	Publish	Document	Onboard and Engage	Marketing	Version	Monitor and Analyze	Monetize	Retirement Plan
			Phase												
(Bell et al. 2018)	Book		✓		✓	✓	✓	✓				✓	✓		
(Broadcom 2017)	Web Article	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		
(Google 2018)	Book		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
(Massé 2019)	Web Article	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
(De 2017)	Book	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	
(B. C. Doerrfeld et al. 2015)	Book	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
(Axway 2019)	Web Article	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
(Patni 2017)	Book		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
(Vester 2017)	Brochure		✓	✓	✓	✓	✓	✓				✓	✓		✓
(Akana 2015)	Book	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	
(Arnny 2017)	Brochure		✓	✓	✓	✓	✓	✓		✓		✓	✓		
(TIBCO 2019)	Brochure		✓		✓	✓	✓	✓	✓			✓	✓		
(TransparentData 2019)	Web Article		✓		✓	✓	✓	✓				✓	✓		

Current state of the collaboration – from Inteviews

Results of this question appeared as in a very interesting form - **all** of our interviewed experts from the API provider side have done the collaboration with their consumers, while **none** of our interviewed experts from the API consumer side ever had a chance to be involved in any kind of collaboration besides solving the concrete issues in integrating the API, which were solved through different forums or issue tickets. That was explained by:

Provider side:

- More efficiency
- Consumers are still involved

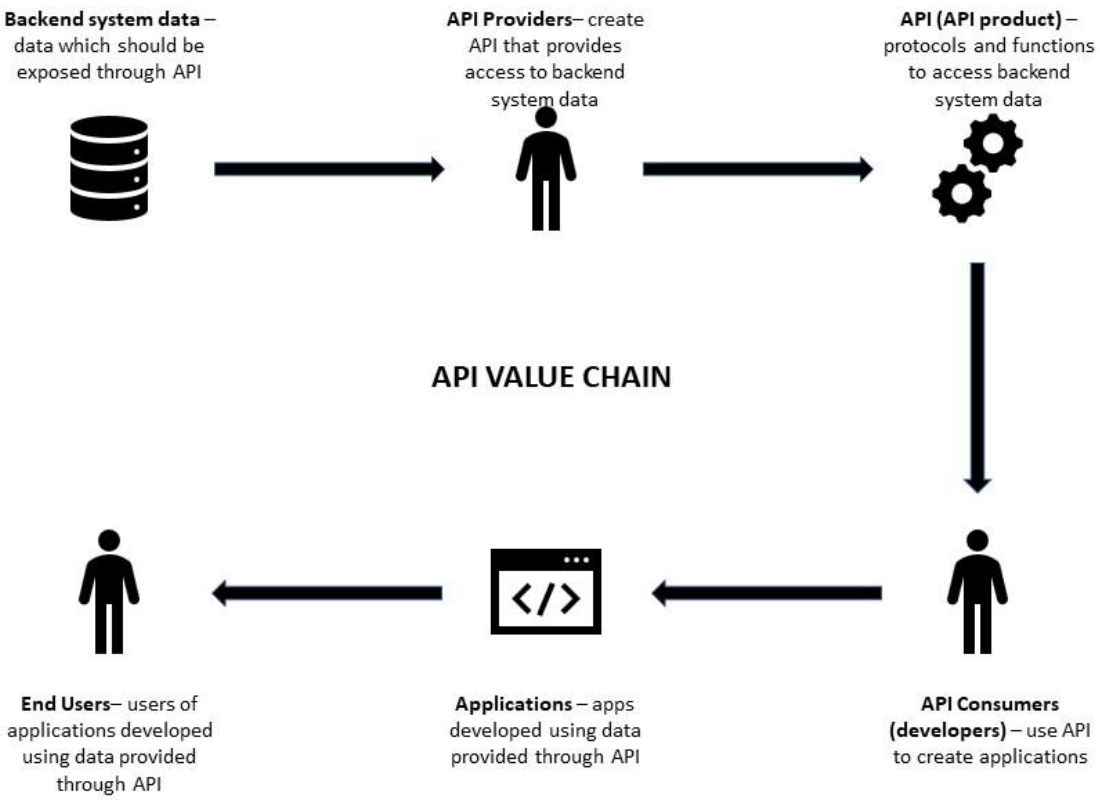
Consumer side:

- Lack of visibly offered collaboration mechanisms
- Existence of alternatives for the API

API Processes – Research Summary - Collaboration

Phase	Collaborative? (Literature)	Collaborative? (Interviews)
API Strategy	✓	✓
Design	✓	✓
Mock / Simulate	✓	✓
Build	✗	✗
Test	✗	✓
Secure	✗	✗
Publish	✗	✗
Document	✗	✓
Onboard and Engage	✓	✓
Marketing the API	✓	✓
Version	✓	✓
Monitor & Analyze	✗	✗
Monetize	✓	✓
Retirement Plan	✓	✓

API Value Chain



API Provider Team - Roles

Source	Source Type	API Product Manager	API Architect	API Developer	API Evangelist	API Champion	Service Manager	Technical Writer	API Support/Operations	Quality Assurance	Sercurity Architect	Marketing / Branding	Analyst	Legal
		Role												
(Bell et al. 2018)	Book	✓	✓	✓			✓			✓				
(Akana 2015)	Book	✓		✓	✓			✓	✓					
(Google 2018)	Book	✓	✓	✓	✓	✓								
(Zhu et al. 2014)	Web Article	✓		✓						✓				
(Preibisch 2018)	Book	✓	✓	✓				✓	✓	✓	✓			
(Jacobson et al. 2012)	Book	✓		✓	✓					✓		✓		✓
(Womack 2016)	Web Article	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	

API Provider roles involved in collaboration – from Interviews

Developer – primarily identified as roles which should collaborate with consumers on technical issues, but also some of the interviewees saw them directly involved in collaboration, mostly as the role that has a lot of technical knowledge and someone who can easily understand with developers from the consumer side .

API Product Manager - this role that combines technical and management skills is seen as the most important collaborative role. This should be the main role to work with consumers when it comes to new functionalities, and to strategical decisions about the existing functionalities and endpoints.

API Evangelist - a special role dedicated to working with external developers community did not appear often as needed during the interviews. Seen as important but only once the API is mature enough, or as a special role needed from the first day, with the potential to relax the workload of developers and architect.

API Architect - this is a role that is often covered by other team members like a developer, and it covers collaboration mainly when it comes to the design, both initially and in versioning processes.

Support and operation - Role in the API team which should communicate and react on consumer tickets was seen as important, often covered by developers too, but once it exists it is collaborative by nature.

Legal - Identified as the collaborative role only once, this role should collaborate with users who have different legal requirements and law systems in their countries, like in the case of GDPR.

Ideas for Improvements

Improvement idea 1: Get to know your consumer better – conduct market research to identify groups of consumers that can be interested in the API and that can help identify the requirements better.

Improvement idea 2: Think about monetization as early as in the API Strategy phase – even if API is not planned to be monetized immediately.

Improvement idea 3: More is less – spend more time on strategy and design early in the lifecycle than on change management later in the lifecycle.

Improvement idea 4: Encourage smaller-scale consumers to take part in collaboration – do not collaborate only with larger-scale partners.

Improvement idea 5: Outside-in documentation involving consumers – make your documentation interactive, implement, and reward the consumer efforts in documentation improvement.

Improvement idea 6: Focus on management topics together with technical – constantly improve your API development process.

Improvement idea 7: Have clear roles dedicated to collaboration with consumers – create a stable group of team members that combine technical and business roles to collaborate with consumers.

Limitations and future work

Limitations:

- Lack of reflated scientific work and structured API processes
- Limited number of interviews
- Improvement ideas not validated
- Pandemic of coronavirus

Future work:

- Validation of improvement ideas through concrete use cases with business partners.
- Usage of identified process phases and roles to analyze them in different perspectives.
- Similar researches in the future as challenges change dramatically on few years basis.

Discussion

Thank you! Time for discussion!

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