CONTEXT MAPPER: DSL AND TOOLS FOR DOMAIN-DRIVEN SERVICE DESIGN – BOUNDED CONTEXT MODELING AND MICROSERVICE DECOMPOSITION

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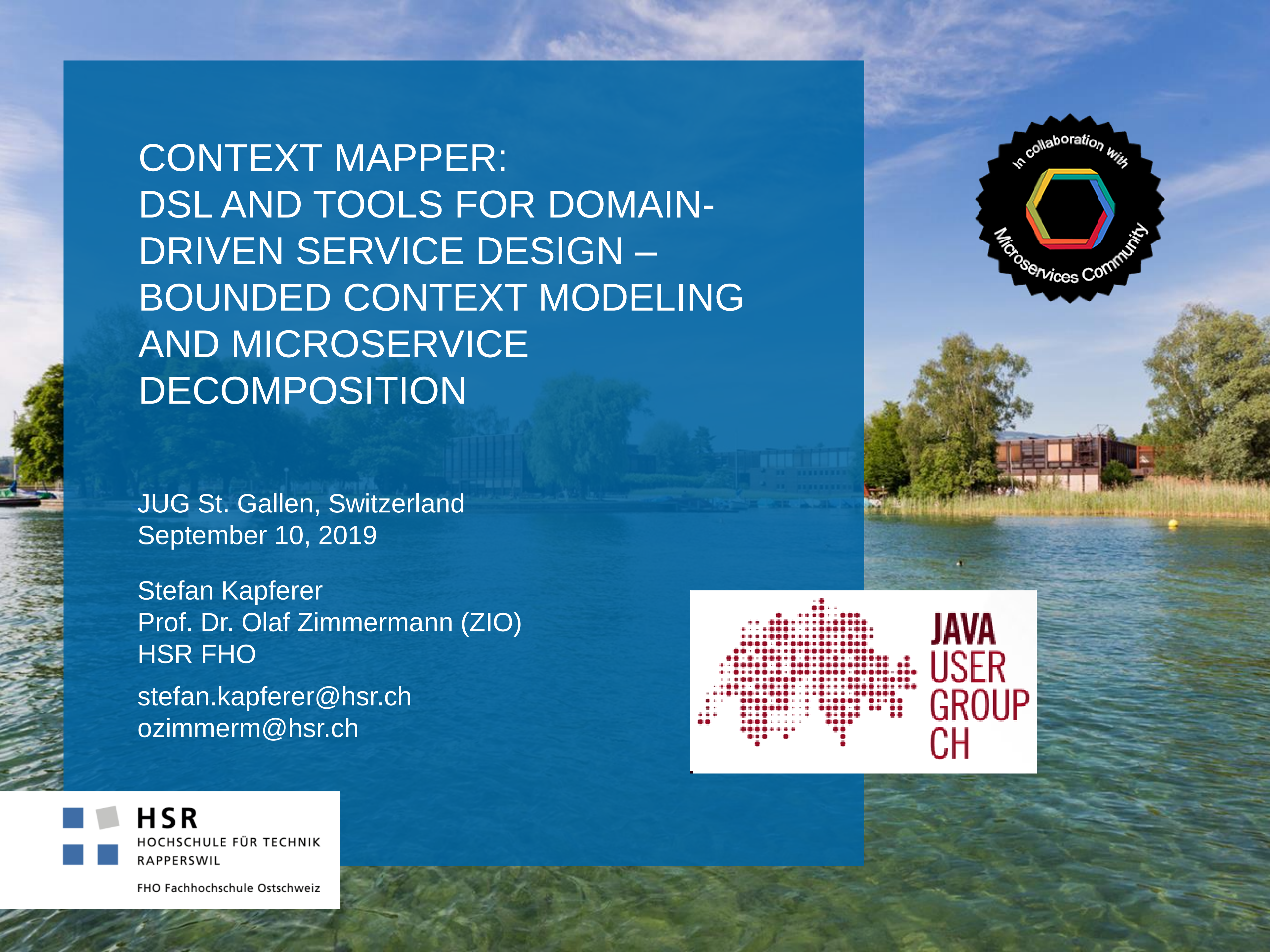
In collaboration with Microservices Community

JAVA USER GROUP CH

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz



Abstract

Service-oriented architectures and microservices have gained much attention in recent years; many companies adopt them in order to increase agility, maintainability and scalability of their systems. Decomposing an application into multiple independently deployable, appropriately sized services is challenging. With strategic patterns such as Bounded Context and Context Map, Domain-Driven Design (DDD) can support software architects and domain experts during service decomposition. However, existing architecture description languages, methods and tools do not support strategic DDD sufficiently. As a consequence, different interpretations and opinions regarding pattern applicability can be observed, and it is not always clear how the patterns can be combined. Context modeling is an ad-hoc, error-prone activity.

In this talk we present Context Mapper, an open source project providing a Domain-Specific Language (DSL) for DDD. Aiming for a clear and concise interpretation of the patterns and their combinations, we distilled a meta-model of the DDD patterns from community input. The DSL provides a light syntax to express the patterns and model DDD context maps. An Eclipse editor supports syntax highlighting, code completion, and model validation. Other tools allow designers to refactor and continuously evolve the models and generate lower-level artifacts such as service contracts. DSL and supporting tools promote iterative, incremental modeling and agile practices.

Session Outline

- **Presentation Part 1 (20 mins)**
  - Motivation
  - Brief introduction to Microservice Architectures (MSA)
  - Domain-Driven Design (DDD) and service decomposition
  - Context Mapper overview
- **Context Mapper Demo (20 mins)**
- **Presentation Part 2 (20 mins)**
  - Architectural refactoring
  - Next steps in the BizDevOps tool & practice chain:
    - Microservice Domain-Specific Language (MDSL)
    - Microservice API Patterns (MAP)
- **Q&A (15 mins)**
  - *Input and feedback appreciated – this is ongoing research!*

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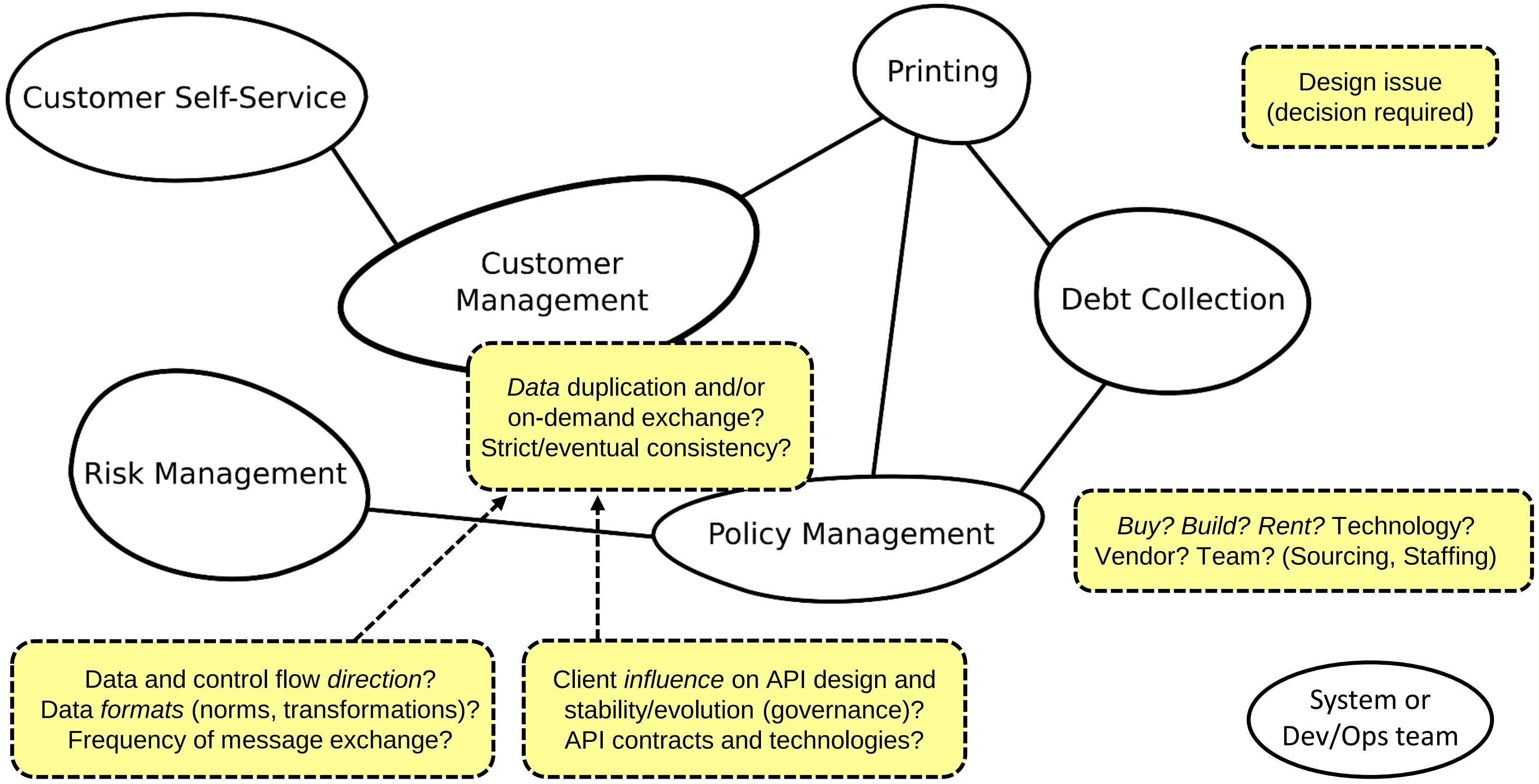
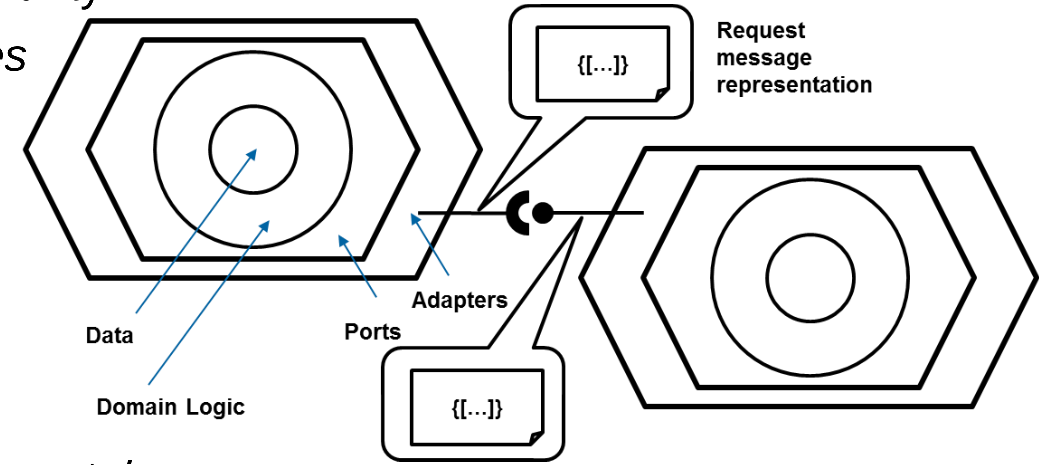
Motivating Example: "Fictitious" Insurance Application Landscape

- **Many design issues, typically recurring**
  - per system/team, per relationship, per interface


Customer Self-Service
Printing
Design issue (decision required)
Customer Management
Debt Collection
Data duplication and/or on-demand exchange? Strict/eventual consistency?
Risk Management
Policy Management
Buy? Build? Rent? Technology? Vendor? Team? (Sourcing, Staffing)
Data and control flow *direction*? Data *formats* (norms, transformations)? Frequency of message exchange?
Client *influence* on API design and stability/evolution (governance)? API contracts and technologies?
System or Dev/Ops team

A Consolidated Definition of Microservices

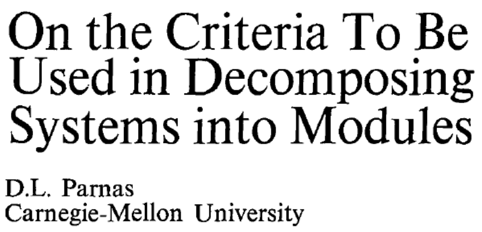
- **Microservices architectures evolved from previous incarnations of Service-Oriented Architectures (SOAs) to promote agility and elasticity**
  - *Independently deployable, scalable* and *changeable* services, each having a single responsibility
  - Modeling *business capabilities*



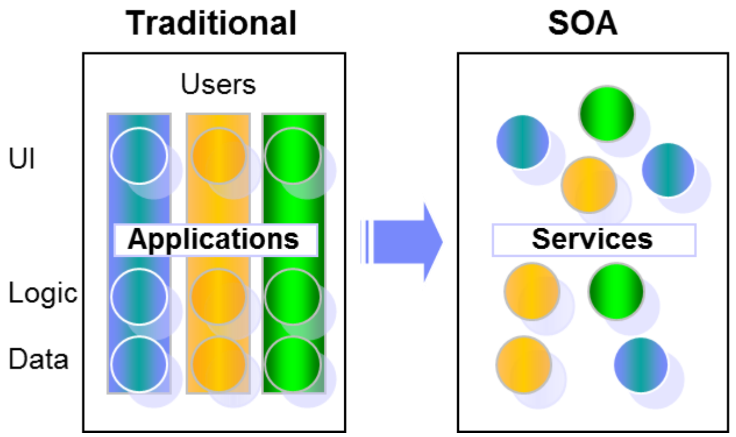
Detailed analysis: Zimmermann, O., *Microservices Tenets: Agile Approach to Service Development and Deployment*, Springer Journal of Computer Science Research and Development (2017)

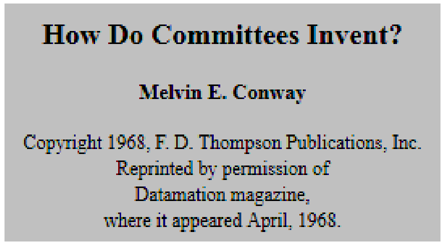
  - Often deployed in *lightweight containers*
  - Encapsulating their *own state*, and communicating via *message-based remote APIs* (HTTP, queueing), IDEALly in a loosely coupled fashion
  - Facilitating *polyglot programming and persistence*
  - Leveraging DevOps practices including decentralized *continuous delivery* and *end-to-end monitoring* (for business agility and domain observability)

Open Problem: Service Decomposition


On the Criteria To Be Used in Decomposing Systems into Modules

D.L. Parnas
Carnegie-Mellon University




How Do Committees Invent?

Melvin E. Conway

Copyright 1968, F. D. Thompson Publications, Inc.
Reprinted by permission of
Datamation magazine,
where it appeared April, 1968.

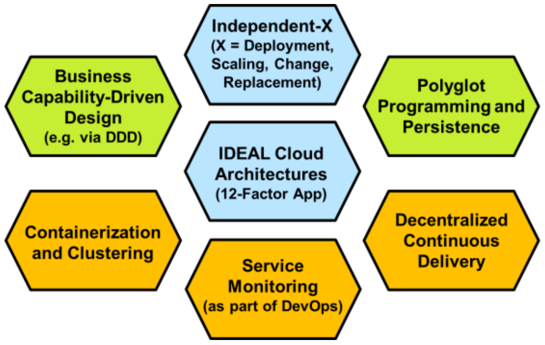
Research and Development Questions

How can systems be decomposed and cut into services (forward engineering)?
How do the applied criteria and heuristics differ
from software engineering and software architecture “classics”
such as *separation of concerns* and *single responsibility principle*?

Which methods and practices do you use? Are they effective and efficient?

Decomposition Heuristics that do not suffice

- **Two-pizza rule (team size)**
- **Lines of code (in service implementation)**
- **Size of service implementation in IDE editor**


Independent-X (X = Deployment, Scaling, Change, Replacement)
Business Capability-Driven Design (e.g. via DDD)
Polyglot Programming and Persistence
IDEAL Cloud Architectures (12-Factor App)
Containerization and Clustering
Decentralized Continuous Delivery
Service Monitoring (as part of DevOps)

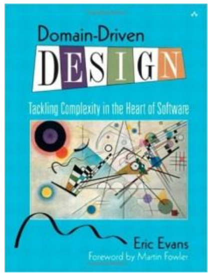
- **Simple if-then-else rules of thumb**
  - E.g. “If your application needs coarse-grained services, implement a SOA; if you require fine ones, go the microservices way” (I did not make this up!)
- **Non-technical traits, including “products not projects”**

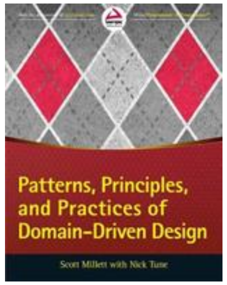
What is wrong with these “metrics” and “best practice” recommendations?

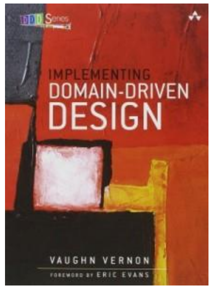
➡ Context matters, as M. Fowler pointed out at [Agile Australia 2018]
(or: one size does not fit all)

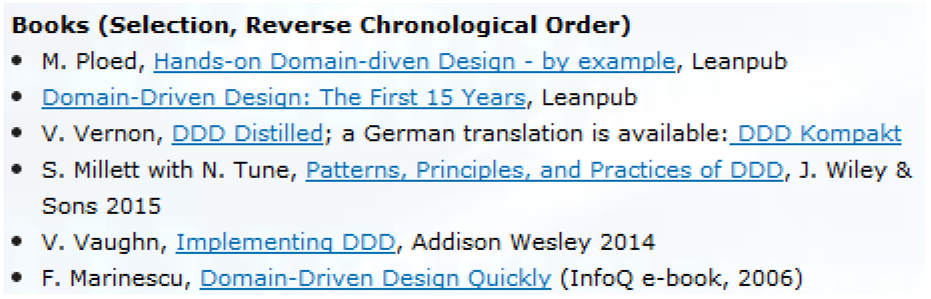
Domain-Driven Design (DDD) to the Remedy

- **Emphasizes need for modeling and communication**
  - Ubiquitous language (vocabulary) – the *domain model*
- ***Tactic DDD* – "Object-Oriented Analysis and Design (OOAD) done right"**
  - Emphasis on business logic in layered architecture
  - Decomposes Domain Model pattern from M. Fowler
  - Patterns for common roles, e.g. Entity, Value Object, Repository, Factory, Service; grouped into *Aggregates*
- ***Strategic DDD* – "agile Enterprise Architecture and/or Portfolio Management"**
  - Models have boundaries
  - Teams, systems and their relations shown in *Context Maps* of *Bounded Contexts*


Domain-Driven
DESIGN
Tackling Complexity in the Heart of Software
Eric Evans
Foreword by Martin Fowler


Patterns, Principles, and Practices of Domain-Driven Design
Scott Millett with Nick Tune

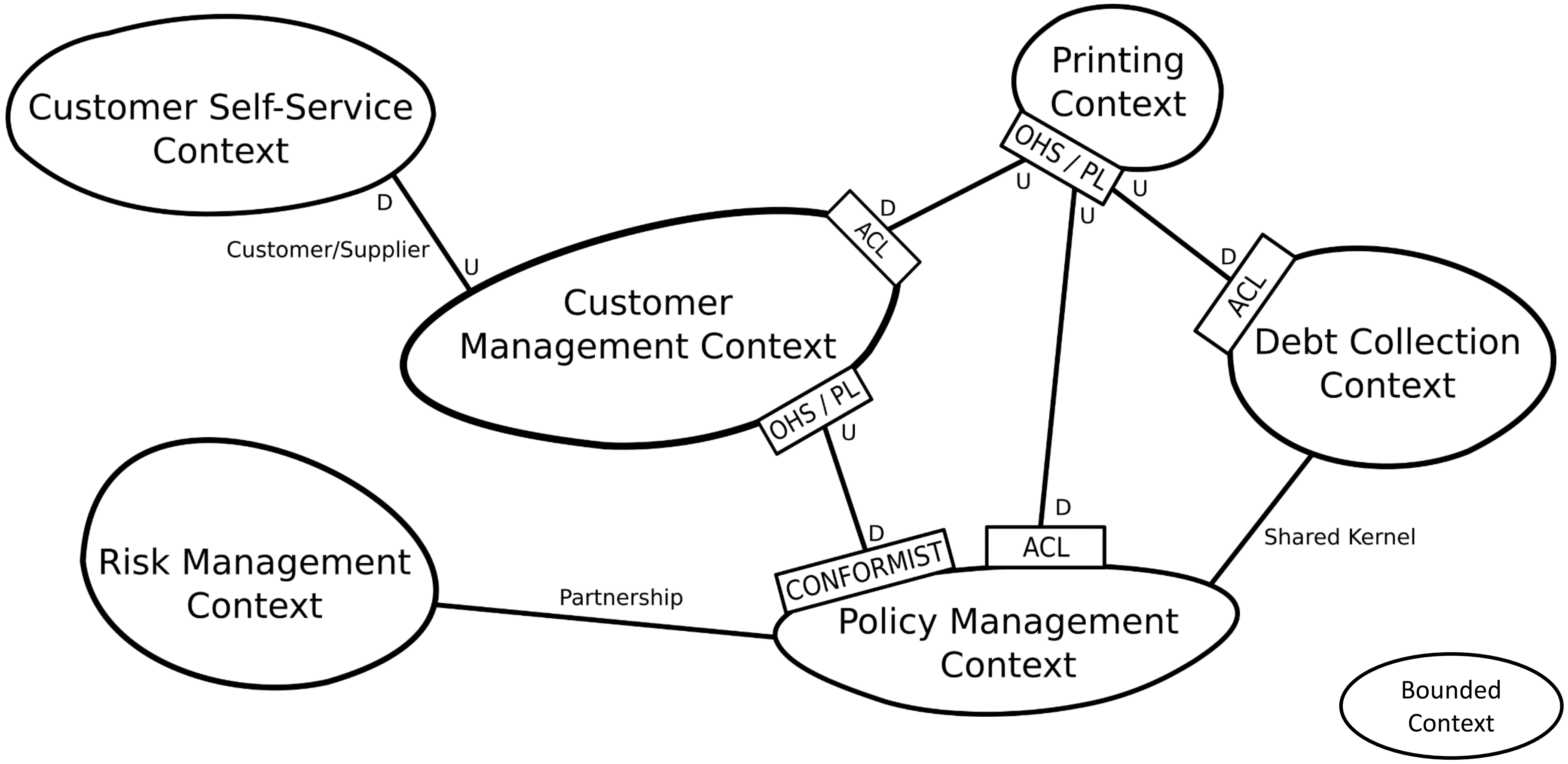



Books (Selection, Reverse Chronological Order)

- M. Ploed, Hands-on Domain-diven Design - by example, Leanpub
- Domain-Driven Design: The First 15 Years, Leanpub
- V. Vernon, DDD Distilled; a German translation is available: DDD Kompakt
- S. Millett with N. Tune, Patterns, Principles, and Practices of DDD, J. Wiley & Sons 2015
- V. Vaughn, Implementing DDD, Addison Wesley 2014
- F. Marinescu, Domain-Driven Design Quickly (InfoQ e-book, 2006)

A Strategic DDD Context Map with Relationships

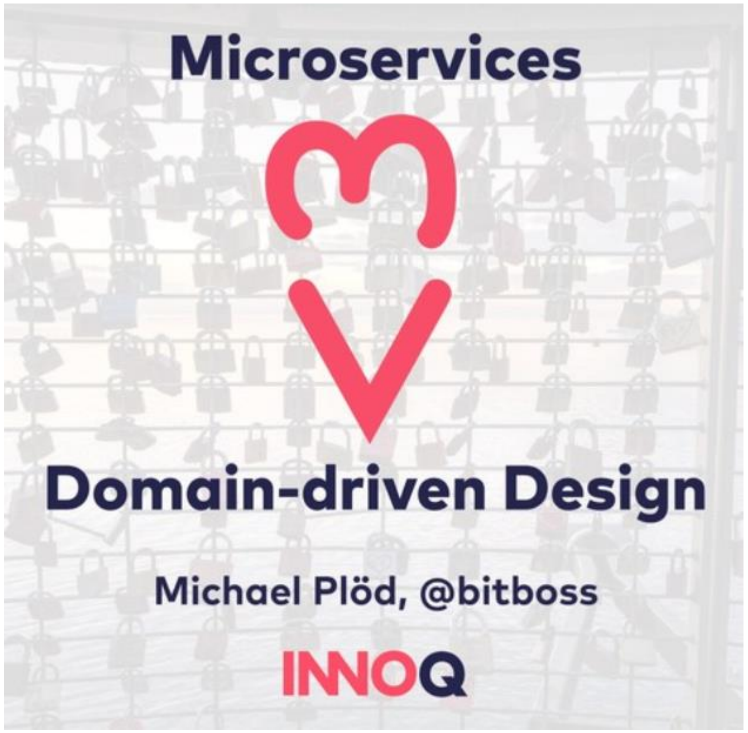
- **Insurance scenario modelled at https://contextmapper.github.io/**

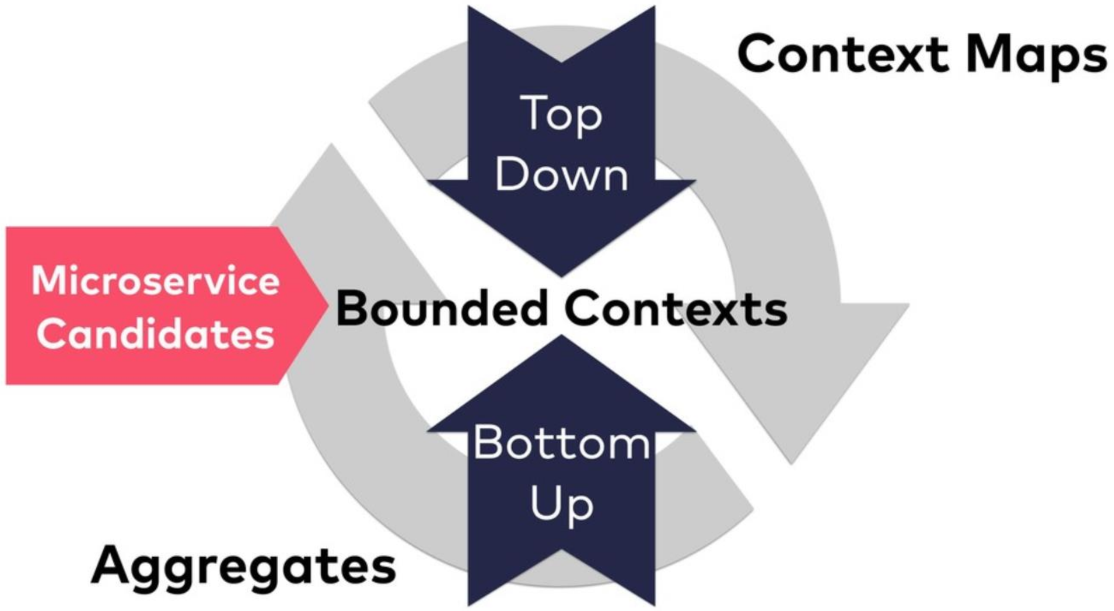


D: [Downstream](#), U: [Upstream](#); ACL: [Anti-Corruption Layer](#), OHS: [Open Host Service](#)

DDD Applied to (Micro-)Service Design

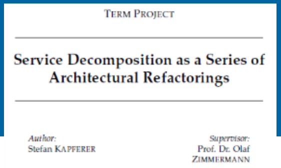
- **M. Ploed is one of the "go-to-guys" here (find him on Speaker Deck)**
  - Applies and extends DDD books by E. Evans and V. Vernon





Reference: JUG CH presentation, Bern/CH, Jan 9, 2019

DDD Applied to (Micro-)Service Design ctd., Source:


TERM PROJECT

Service Decomposition as a Series of Architectural Refactorings

Author: Stefan KAPFERER

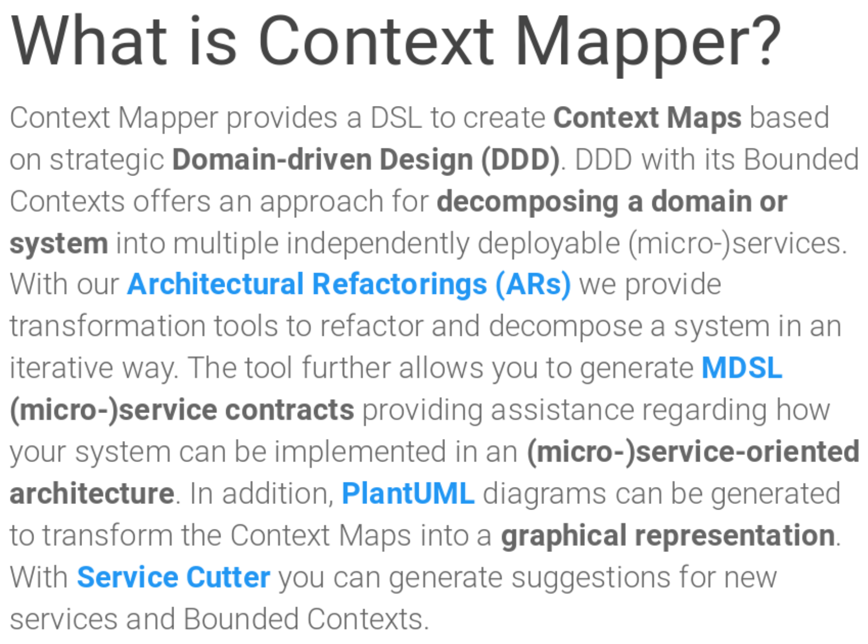
Supervisor: Prof. Dr. Olaf ZIMMERMANN

- **N. Tune and S. Millett: Designing Autonomous Teams and Services**
  - Describe how to coevolve organizational and technical boundaries to architect autonomous applications and teams based on DDD Bounded Contexts and (micro-)services.
- **O. Tigges: How to break down a Domain to Bounded Contexts**
  - Presents criteria to be used to identify Bounded Contexts.
- **R. Steinegger et al.: Overview of a Domain-Driven Design Approach to Build Microservice-Based Applications**
  - Describes a development process to build MSA applications based on the DDD concepts, emphasizing the importance of decomposing a system in several iterations.
- **A. Brandolini: Introducing Event Storming**
  - Proposes a workshop-based technique to analyze a domain and discover bounded contexts, following events through the system/business process and detecting commands, entities (and more) along the way.

From DDD to RESTful HTTP APIs

- **"Implementing DDD" book by V. Vernon (and blog posts, presentations):**
  - *No 1:1 pass-through (interfaces vs. application/domain layer)*
  - Bounded Contexts (BCs) realized by API provider: one service API and IDE project for each team/system BC (a.k.a. microservice)
  - Aggregates supply API resources (or responsibilities) of service endpoints
  - Services donate top-level (home) resources in BC endpoint as well
  - The Root Entity, the Repository and the Factory in an Aggregate suggest top-level resources; contained entities yield sub-resources
  - Repository lookups as paginated queries (GET with search parameters)
- **Additional rules of thumb (from our experience and additional sources):**
  - Master data and transactional data go to different contexts/aggregates
  - Creation requests to Factories become POSTs
  - Entity modifiers become PUTs or PATCHes
  - Value Objects appear in the custom mime types representing resources

Context Mapper: A DSL for Strategic DDD

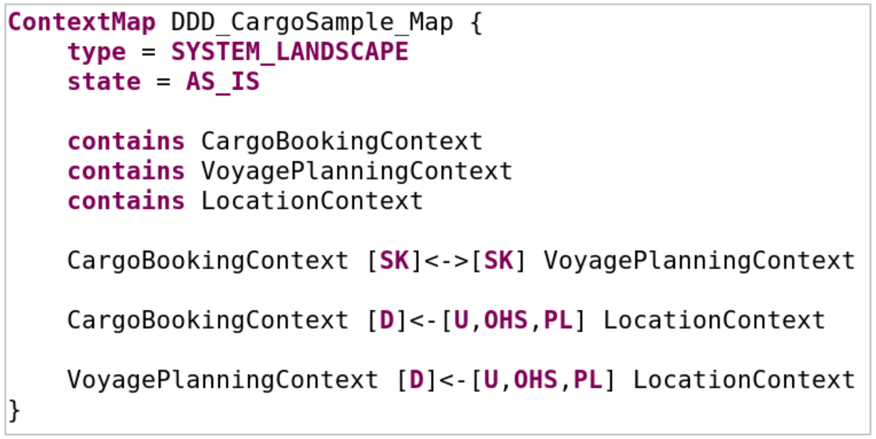


What is Context Mapper?

Context Mapper provides a DSL to create **Context Maps** based on strategic **Domain-driven Design (DDD)**. DDD with its Bounded Contexts offers an approach for **decomposing a domain or system** into multiple independently deployable (micro-)services. With our **Architectural Refactorings (ARs)** we provide transformation tools to refactor and decompose a system in an iterative way. The tool further allows you to generate **MDSL** **(micro-)service contracts** providing assistance regarding how your system can be implemented in an **(micro-)service-oriented architecture**. In addition, **PlantUML** diagrams can be generated to transform the Context Maps into a **graphical representation**. With **Service Cutter** you can generate suggestions for new services and Bounded Contexts.

- **Eclipse plugin, based on:**
  - Xtext, ANTLR
  - Sculptor (tactic DDD DSL)
- **Creator: S. Kapferer**
  - Term projects @ HSR FHO

CONTEXT MAPPER



```
ContextMap DDD_CargoSample_Map {
    type = SYSTEM_LANDSCAPE
    state = AS_IS

    contains CargoBookingContext
    contains VoyagePlanningContext
    contains LocationContext

    CargoBookingContext [SK]<->[SK] VoyagePlanningContext

    CargoBookingContext [D]<-[U,OHS,PL] LocationContext

    VoyagePlanningContext [D]<-[U,OHS,PL] LocationContext
}
```

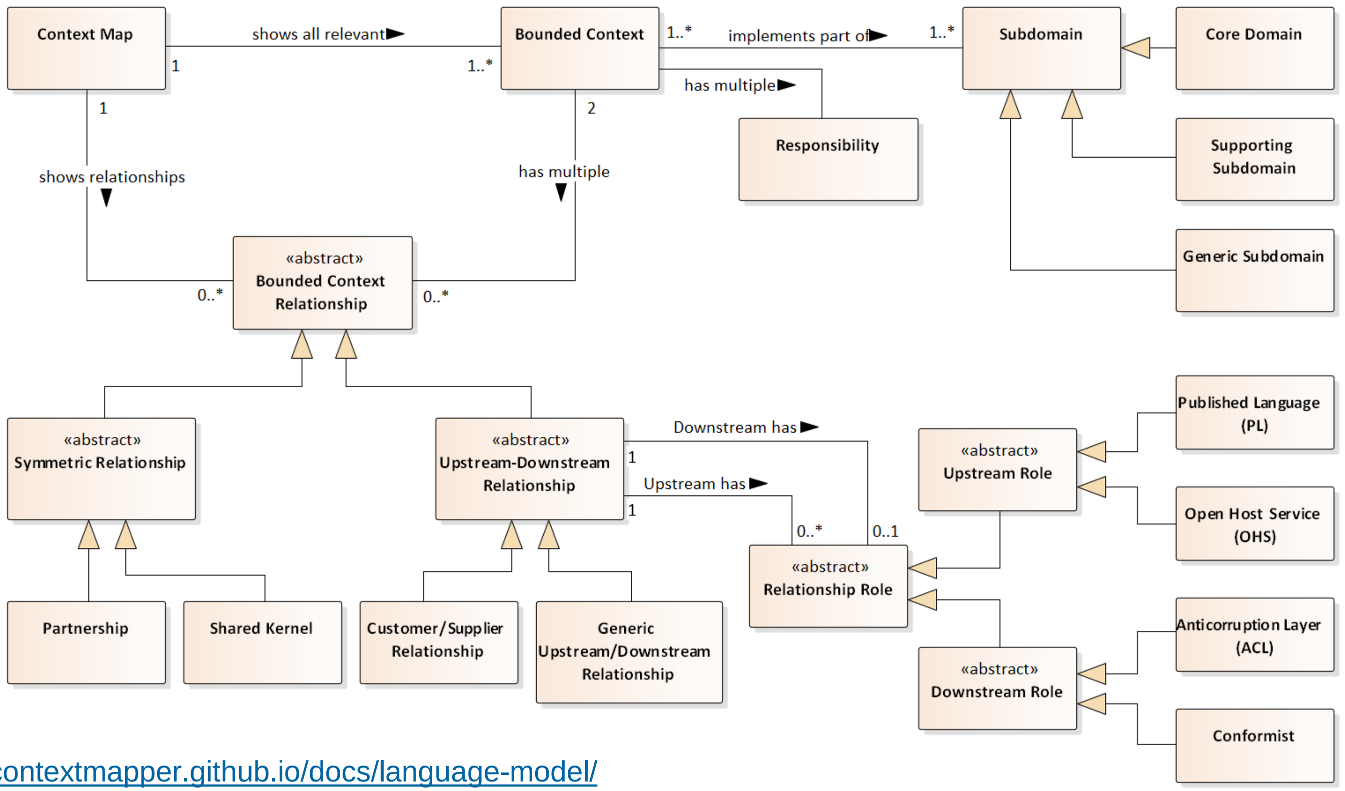
SK: Shared Kernel, **PL:** Published Language
D: Downstream, **U:** Upstream
ACL: Anti-Corruption Layer, **OHS:** Open Host Service

Session Outline

- **Presentation Part 1 (20 mins)**
- ***Context Mapper Demo (20 mins)***
  - *Part 1: DSL (Editing, Validations)*
  - *Part 2: Code Generation (PlantUML, MDSL)*
  - *Part 3: Architectural Refactorings (ARs)*
- **Presentation Part 2 (20 mins)**
  - Architectural refactoring
  - Next steps in the BizDevOps tool & practice chain:
    - Microservice Domain-Specific Language (MDSL)
    - Microservice API Patterns (MAP)
- **Q&A (15 mins)**

Context Mapper: Meta-Model and Semantic Rules

- **Goal: provide clear and concise interpretation of the strategic DDD patterns – and valid combinations of them**



Reference: https://contextmapper.github.io/docs/language-model/

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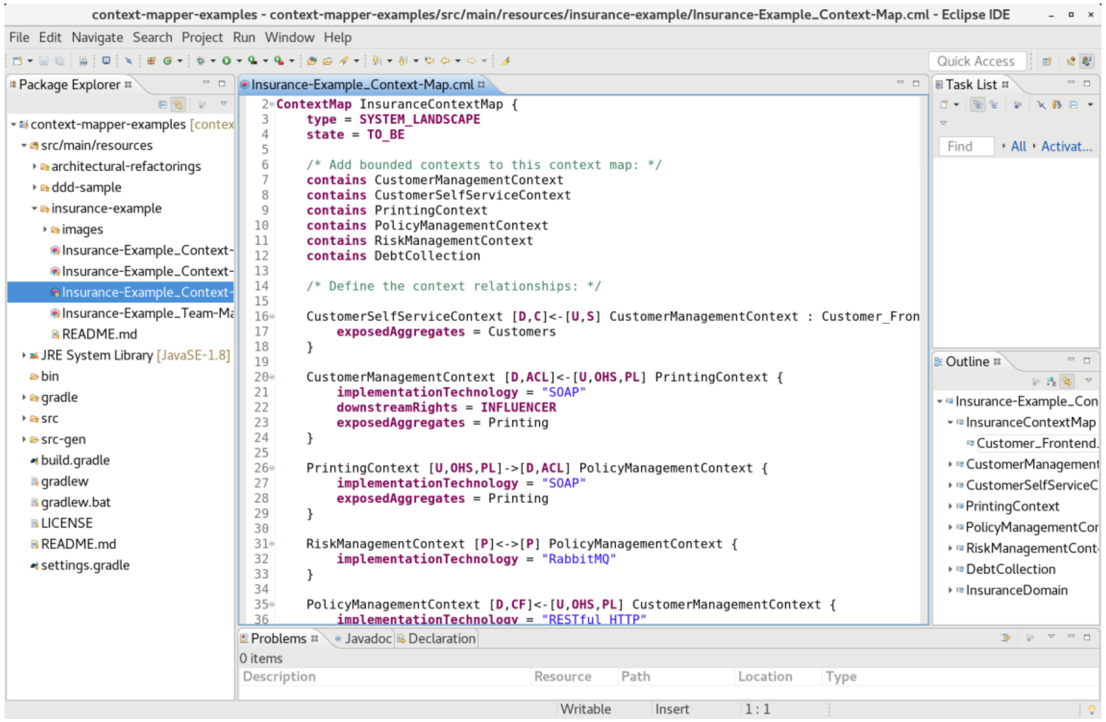
FHO Fachhochschule Ostschweiz

IFS INSTITUTE FOR SOFTWARE

Context Mapper: DSL implements Meta-Model and Semantics

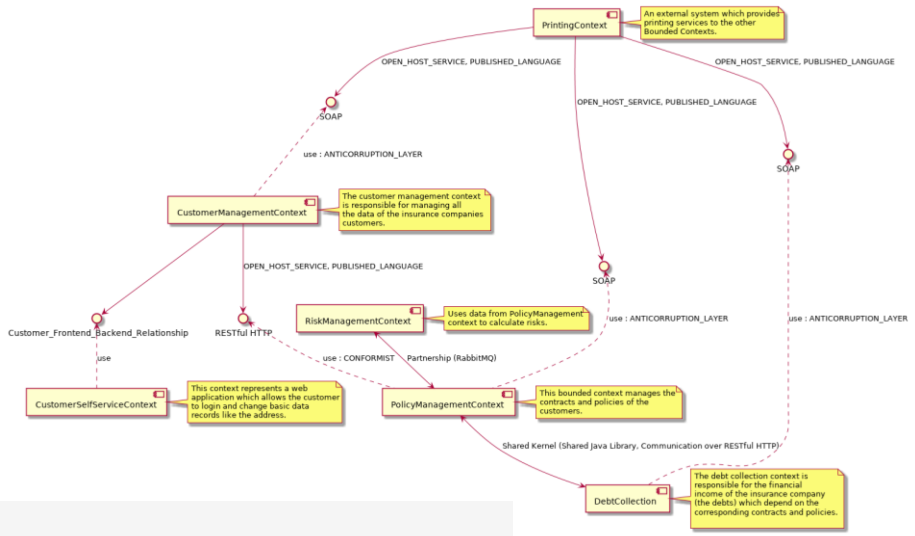
- **A Domain-Specific Language (DSL) for DDD:**
  - Formal, machine-readable DDD Context Maps via *editors and validators*
  - Model/code *generators* to convert models into other representations
  - Model transformations for *refactorings* (e.g., “Split Bounded Context”)

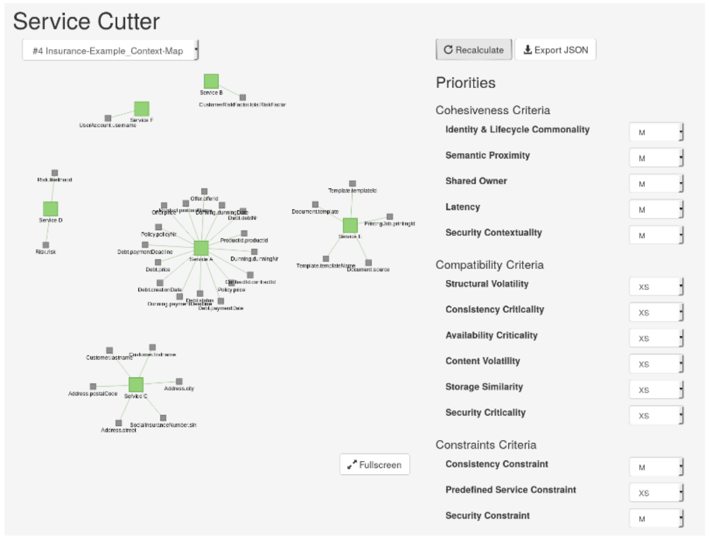


```
ContextMap InsuranceContextMap {
    type = SYSTEM_LANDSCAPE
    state = TO_BE

    /* Add bounded contexts to this context map: */
    contains CustomerManagementContext
    contains CustomerSelfServiceContext
    contains PrintingContext
    contains PolicyManagementContext
    contains RiskManagementContext
    contains DebtCollection

    /* Define the context relationships: */

    CustomerSelfServiceContext [D,C]<-[U,S] CustomerManagementContext : Customer_Fron
        exposedAggregates = Customers
    }

    CustomerManagementContext [D,ACL]<-[U,OHS,PL] PrintingContext {
        implementationTechnology = "SOAP"
        downstreamRights = INFLUENCER
        exposedAggregates = Printing
    }

    PrintingContext [U,OHS,PL]->[D,ACL] PolicyManagementContext {
        implementationTechnology = "SOAP"
        exposedAggregates = Printing
    }

    RiskManagementContext [P]<->[P] PolicyManagementContext {
        implementationTechnology = "RabbitMQ"
    }

    PolicyManagementContext [D,CF]<-[U,OHS,PL] CustomerManagementContext {
        implementationTechnology = "RESTful HTTP"
```

Context Mapper: Generators (DDD DSL as Input)

- **PlantUML generator**
  - Generate graphical representations of model
- **Service Cutter input generator**
  - Use structured approach to identify service candidates
  - Term project/bachelor thesis at HSR FHO
- **MDSL service contract generator**
  - Generate technology-agnostic (micro-)service contracts from Bounded Contexts/Aggregates


PrintingContext
An external system which provides printing services to the other Bounded Contexts.
OPEN_HOST_SERVICE, PUBLISHED_LANGUAGE
OPEN_HOST_SERVICE, PUBLISHED_LANGUAGE
OPEN_HOST_SERVICE, PUBLISHED_LANGUAGE
SOAP
SOAP
SOAP
use : ANTICORRUPTION_LAYER
CustomerManagementContext
The customer management context is responsible for managing all the data of the insurance companies customers.
OPEN_HOST_SERVICE, PUBLISHED_LANGUAGE
Customer_Frontend_Backend_Relationship
RESTful HTTP
RiskManagementContext
Uses data from PolicyManagement context to calculate risks.
use : ANTICORRUPTION_LAYER
use : ANTICORRUPTION_LAYER
use
use : CONFORMIST
Partnership (RabbitMQ)
CustomerSelfServiceContext
This context represents a web application which allows the customer to login and change basic data records like the address.
PolicyManagementContext
This bounded context manages the contracts and policies of the customers.
Shared Kernel (Shared Java Library, Communication over RESTful HTTP)
DebtCollection
The debt collection context is responsible for the financial income of the insurance company (the debts) which depend on the corresponding contracts and policies.



Priorities

Cohesiveness Criteria

Identity & Lifecycle Commonality	M
Semantic Proximity	M
Shared Owner	M
Latency	M
Security Contextuality	M

Compatibility Criteria

Structural Volatility	XS
Consistency Criticality	XS
Availability Criticality	XS
Content Volatility	XS
Storage Similarity	XS
Security Criticality	XS

Constraints Criteria

Consistency Constraint	M
Predefined Service Constraint	XS
Security Constraint	M

http://servicecutter.github.io/

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- **Presentation Part 1 (20 mins)**
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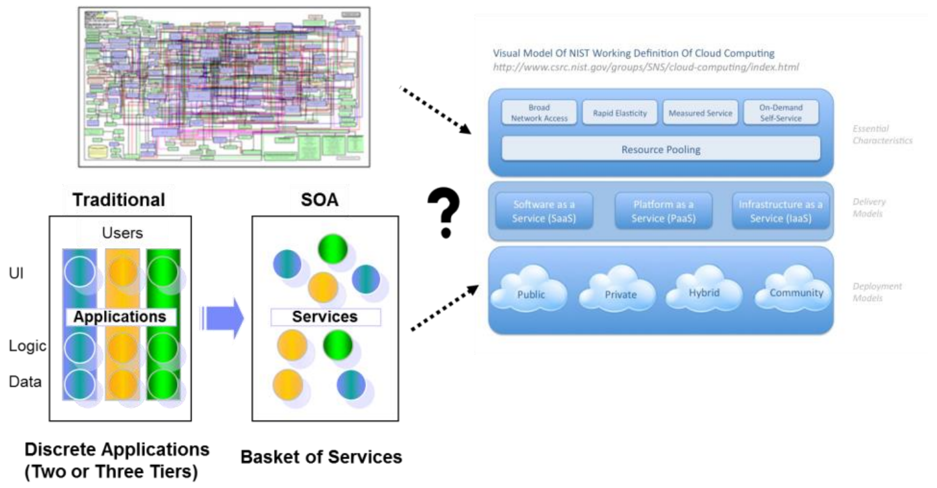
- ***Presentation Part 2 (20 mins)***
  - *Architectural refactoring*
  - *Next steps in the BizDevOps tool/practice chain:*
    - *Microservice Domain-Specific Language (MDSL)*
    - *Microservice API Patterns (MAP)*
- **Q&A (15 mins)**

Open Problem: Refactoring to Microservices


Traditional
Users
UI
Applications
Logic
Data
Discrete Applications (Two or Three Tiers)
SOA
Services
Basket of Services
?
Visual Model Of NIST Working Definition Of Cloud Computing
http://www.csrc.nist.gov/groups/SNS/cloud-computing/index.html
Broad Network Access
Rapid Elasticity
Measured Service
On-Demand Self-Service
Resource Pooling
Essential Characteristics
Software as a Service (SaaS)
Platform as a Service (PaaS)
Infrastructure as a Service (IaaS)
Delivery Models
Public
Private
Hybrid
Community
Deployment Models

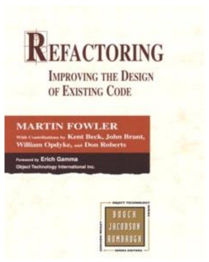
Research and Development Questions

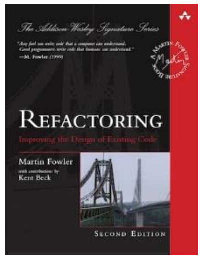
How to *migrate* a modular monolith to a services-based cloud application (a.k.a. cloud migration, brownfield service design)?
Can "micro-migration/modernization" steps be called out?

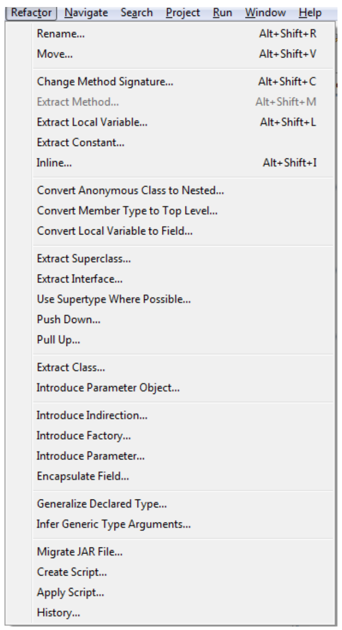
Which techniques and practices do you employ? Are you content with them?

Code Refactoring vs. Architectural Refactoring

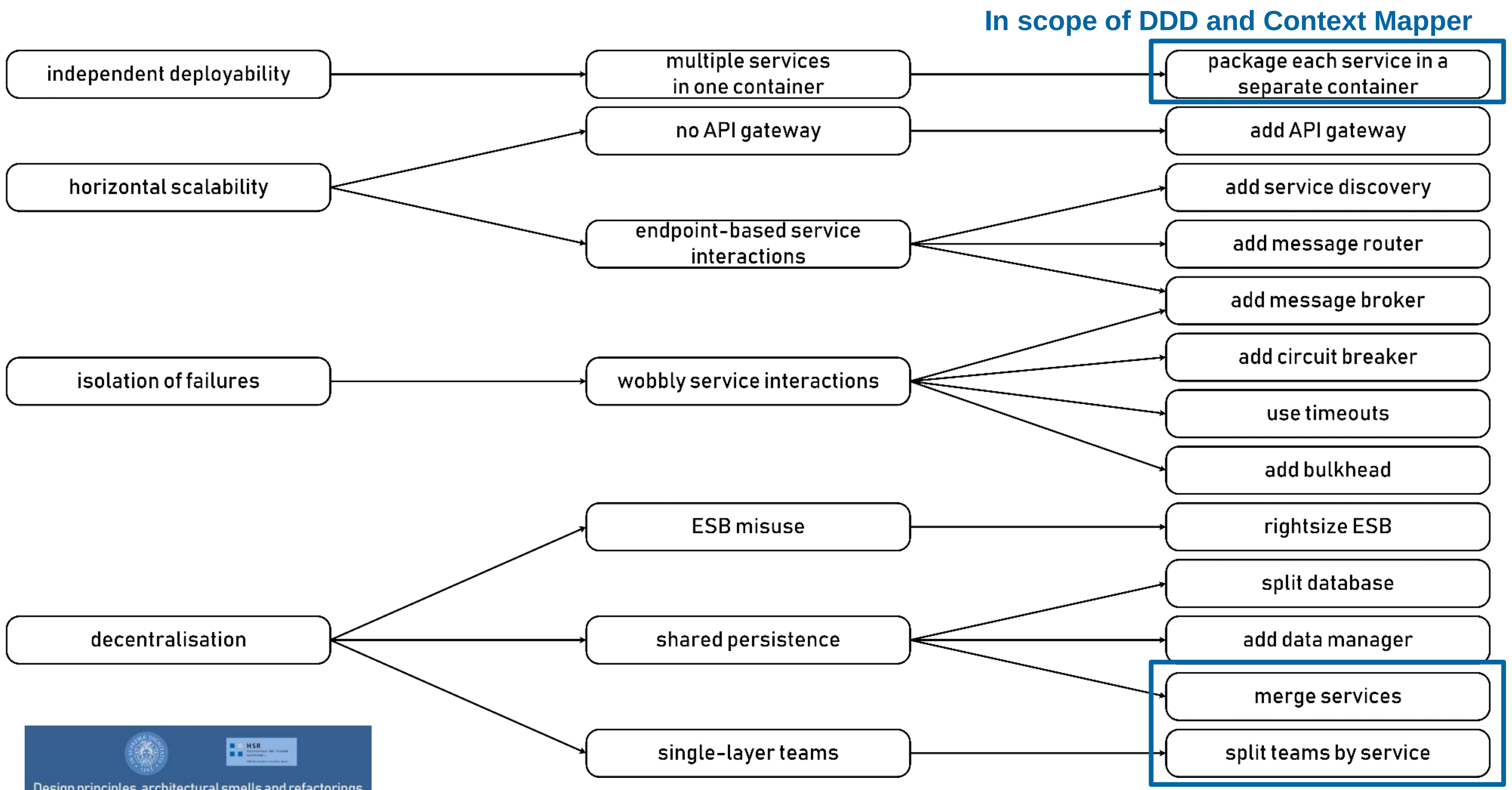
- **Refactoring are “small behavior-preserving transformations” (M. Fowler 1999)**
- **Code refactorings such as “extract method”:**
  - Operate on Abstract Syntax Tree (AST)
  - Based on compiler theory, so well understood and automation possible (e.g., in Eclipse Java/C++)
  - Catalog and commentary:
    - http://refactoring.com/ and https://refactoring.guru/
- ***Architectural refactorings* are different:**
  - Resolve one or more bad architectural smells, have impact on quality attributes
    - Bad architectural smell: suspect that architecture is no longer adequate (“good enough”) under current requirements and constraints (may differ from original ones)
  - Are carriers of reengineering knowledge (patterns?)
  - Can only be partially automated






Refactor Navigate Search Project Run Window Help
Rename... Alt+Shift+R
Move... Alt+Shift+V
Change Method Signature... Alt+Shift+C
Extract Method... Alt+Shift+M
Extract Local Variable... Alt+Shift+L
Extract Constant...
Inline... Alt+Shift+I
Convert Anonymous Class to Nested...
Convert Member Type to Top Level...
Convert Local Variable to Field...
Extract Superclass...
Extract Interface...
Use Supertype Where Possible...
Push Down...
Pull Up...
Extract Class...
Introduce Parameter Object...
Introduce Indirection...
Introduce Factory...
Introduce Parameter...
Encapsulate Field...
Generalize Declared Type...
Infer Generic Type Arguments...
Migrate JAR File...
Create Script...
Apply Script...
History...

From Biz and Dev to Ops: Bad Smells and Refactorings



Design principles, architectural smells and refactorings for microservices: A multivocal review

Antonio Brogi, Davide Neri, Jacopo Soldani
University of Pisa, Italy

Olaf Zimmerman
HSR FHO, Switzerland

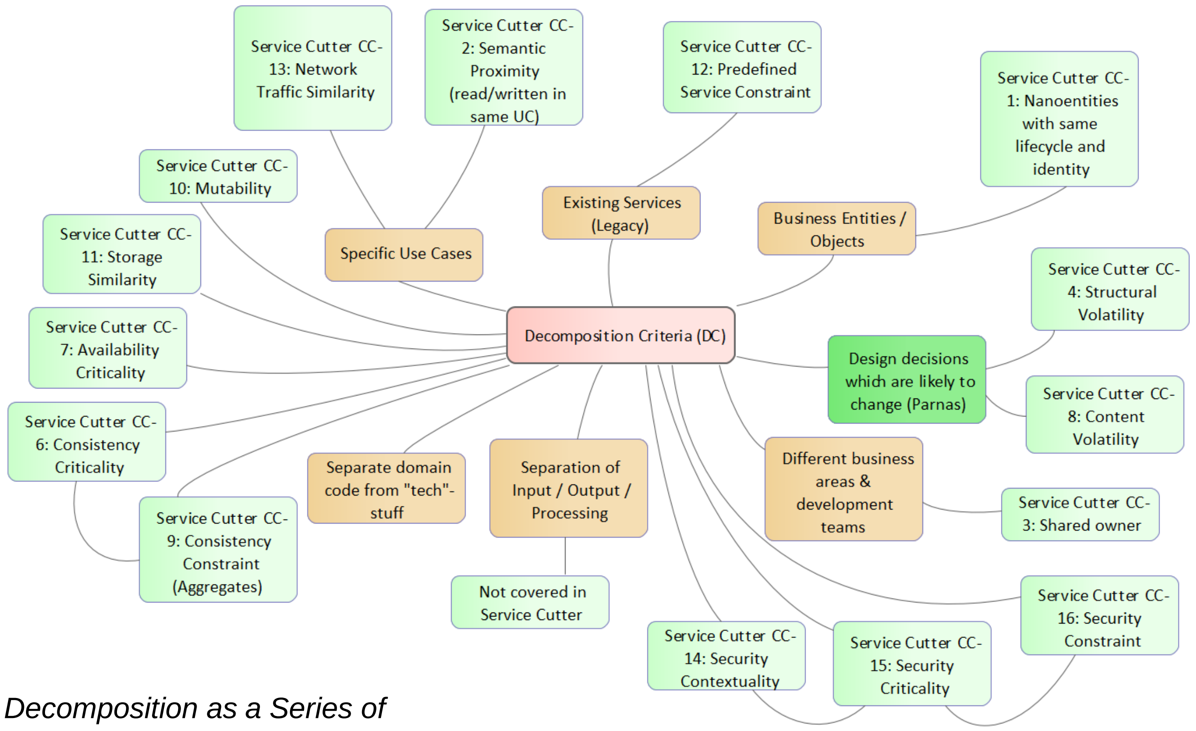
SummerSoc
20 june 2019, Crete, Greece

davide.neri@di.unipi.it

Reference: Brogi, A., Neri D., Soldani, J., Zimmermann, O., *Design Principles, Architectural Smells and Refactorings for Microservices*: A Multivocal Review. CoRR abs/1906.01553 and Springer SICS (2019) (online, report PDF, short presentation)

Context Mapper: Refactor by Decomposition Criteria (DC)?

- **As a first step, we collected Decomposition Criteria (DC):**
  - From literature and own experience; criteria catalog in Service Cutter

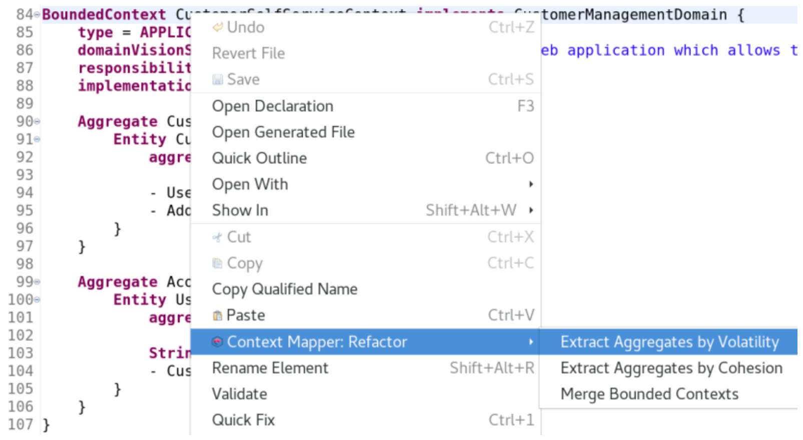


Decomposition Criteria (DC)
Service Cutter CC-13: Network Traffic Similarity
Service Cutter CC-2: Semantic Proximity (read/written in same UC)
Service Cutter CC-12: Predefined Service Constraint
Service Cutter CC-1: Nanoentities with same lifecycle and identity
Service Cutter CC-10: Mutability
Specific Use Cases
Existing Services (Legacy)
Business Entities / Objects
Service Cutter CC-11: Storage Similarity
Service Cutter CC-4: Structural Volatility
Service Cutter CC-7: Availability Criticality
Design decisions which are likely to change (Parnas)
Service Cutter CC-8: Content Volatility
Service Cutter CC-6: Consistency Criticality
Separate domain code from "tech"-stuff
Separation of Input / Output / Processing
Different business areas & development teams
Service Cutter CC-3: Shared owner
Service Cutter CC-9: Consistency Constraint (Aggregates)
Not covered in Service Cutter
Service Cutter CC-16: Security Constraint
Service Cutter CC-14: Security Contextuality
Service Cutter CC-15: Security Criticality

Reference: *Service Decomposition as a Series of Architectural Refactorings*, Stefan Kapferer, student research project HSR FHO 2019 (thesis PDF)

Context Mapper: Architectural Refactorings (ARs)

- **Architectural Refactorings (ARs) then derived from mined/observed *Decomposition Criteria (DC)***
  - Compiled from literature and own experience
  - Decompose (*split*, *extract*) and compose (*merge*) DDD bounded contexts and aggregates.



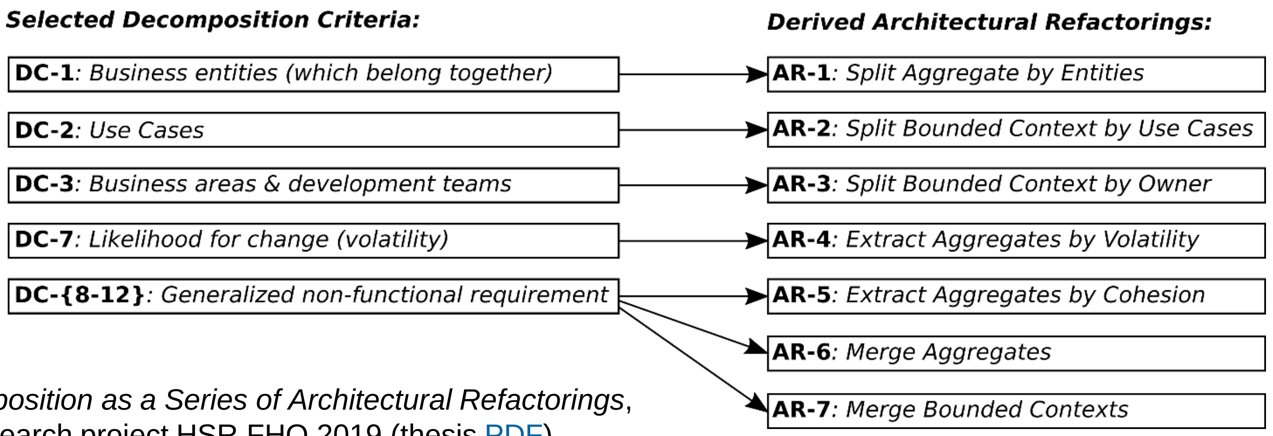
```
BoundedContext Cu                                   tomerManagementDomain {
    type = APPLIC
    domainVisionS                                   eb application which allows t
    responsibilit
    implementatio

    Aggregate Cus
        Entity Cu
            aggre

            - Use
            - Add
        }
    }

    Aggregate Acc
        Entity Us
            aggre

            Strin
            - Cus
        }
    }
}
```


Selected Decomposition Criteria:
DC-1: *Business entities (which belong together)*
DC-2: *Use Cases*
DC-3: *Business areas & development teams*
DC-7: *Likelihood for change (volatility)*
DC-{8-12}: *Generalized non-functional requirement*
Derived Architectural Refactorings:
AR-1: *Split Aggregate by Entities*
AR-2: *Split Bounded Context by Use Cases*
AR-3: *Split Bounded Context by Owner*
AR-4: *Extract Aggregates by Volatility*
AR-5: *Extract Aggregates by Cohesion*
AR-6: *Merge Aggregates*
AR-7: *Merge Bounded Contexts*

Reference: *Service Decomposition as a Series of Architectural Refactorings*, Stefan Kapferer, student research project HSR FHO 2019 (thesis PDF)

How to find suited granularities and achieve loose coupling?

Context

We have decided to go the SOA and/or microservices way. We use DDD for domain modeling and agile practices for requirements elicitation.

Research and Development Problems:

How to identify/specify an adequate number of API endpoints and operations?

How to design message representation structures
so that API clients and API providers are loosely coupled
and meet their (non-)functional requirements IDEALly?

Which patterns, principles, and practices do you use (code first, contract first)? Do they work well?

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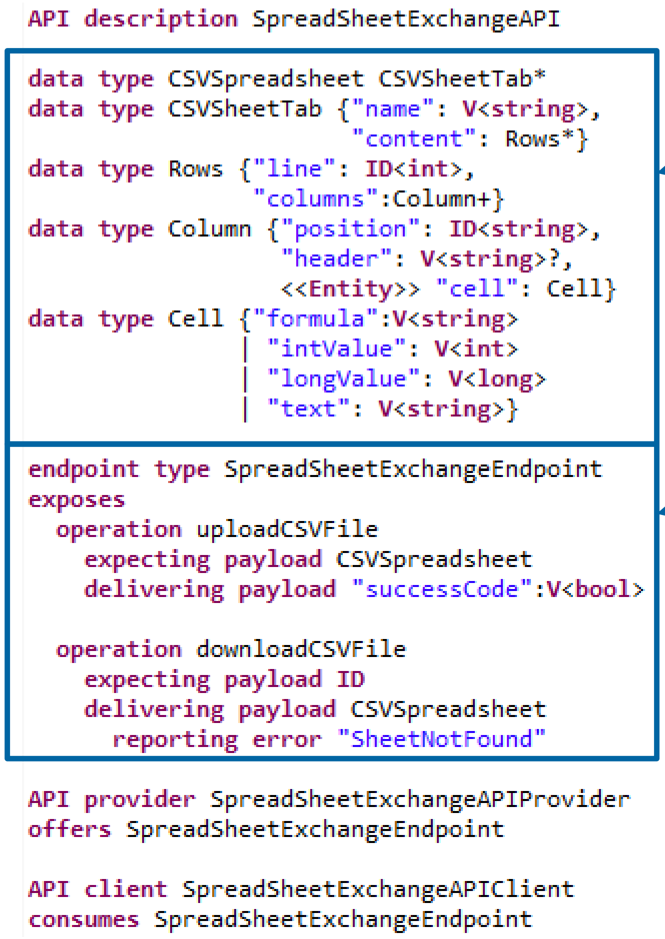
Contracts in Microservice Domain-Specific Language (MDSL)



```
API description SpreadSheetExchangeAPI

data type CSVSpreadsheet CSVSheetTab*
data type CSVSheetTab {"name": V<string>,
                       "content": Rows*}
data type Rows {"line": ID<int>,
                "columns":Column+}
data type Column {"position": ID<string>,
                  "header": V<string>?,
                  <<Entity>> "cell": Cell}
data type Cell {"formula":V<string>
               | "intValue": V<int>
               | "longValue": V<long>
               | "text": V<string>}

endpoint type SpreadSheetExchangeEndpoint
exposes
  operation uploadCSVFile
    expecting payload CSVSpreadsheet
    delivering payload "successCode":V<bool>

  operation downloadCSVFile
    expecting payload ID
    delivering payload CSVSpreadsheet
      reporting error "SheetNotFound"

API provider SpreadSheetExchangeAPIProvider
offers SpreadSheetExchangeEndpoint

API client SpreadSheetExchangeAPIClient
consumes SpreadSheetExchangeEndpoint
```

- **Data contract**
  - Compact, technology-neutral
  - Inspired by JSON, regex
- **Endpoints and operations**
  - Elaborate, terminology from MAP domain model
    - Abstraction of REST resource
    - Abstraction of WS-* concepts
- **API client, provider, gateway; governance (SLA, version, …)**

How does this notation compare to Swagger/JSON Schema and WSDL/XSD?

Reference: https://socadk.github.io/MDSL/index

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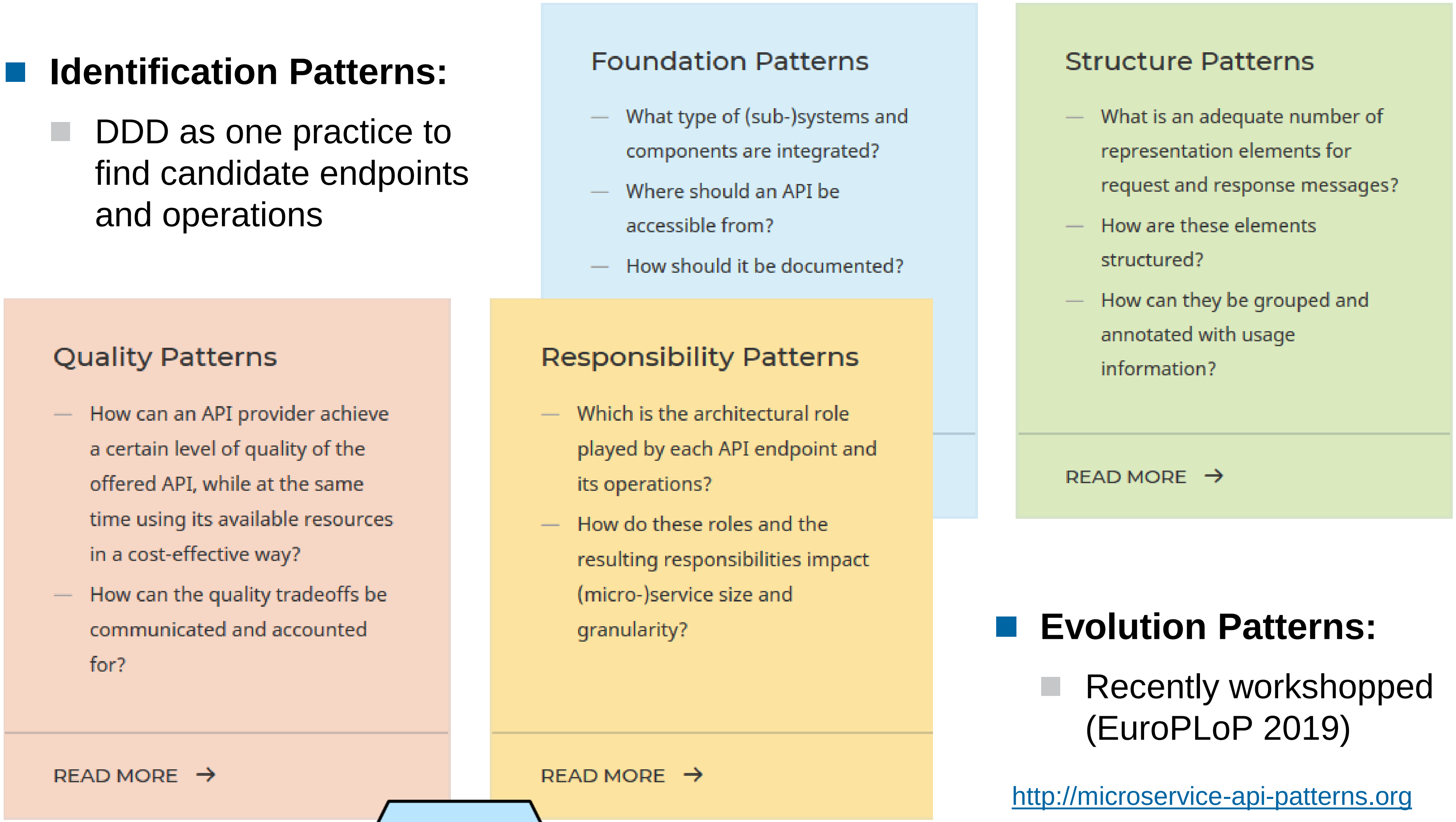
Microservice API Patterns (MAP) Categories

europlop

- **Identification Patterns:**
  - DDD as one practice to find candidate endpoints and operations



Foundation Patterns

— What type of (sub-)systems and components are integrated?

— Where should an API be accessible from?

— How should it be documented?

Structure Patterns

— What is an adequate number of representation elements for request and response messages?

— How are these elements structured?

— How can they be grouped and annotated with usage information?

READ MORE →

Quality Patterns

— How can an API provider achieve a certain level of quality of the offered API, while at the same time using its available resources in a cost-effective way?

— How can the quality tradeoffs be communicated and accounted for?

READ MORE →

Responsibility Patterns

— Which is the architectural role played by each API endpoint and its operations?

— How do these roles and the resulting responsibilities impact (micro-)service size and granularity?

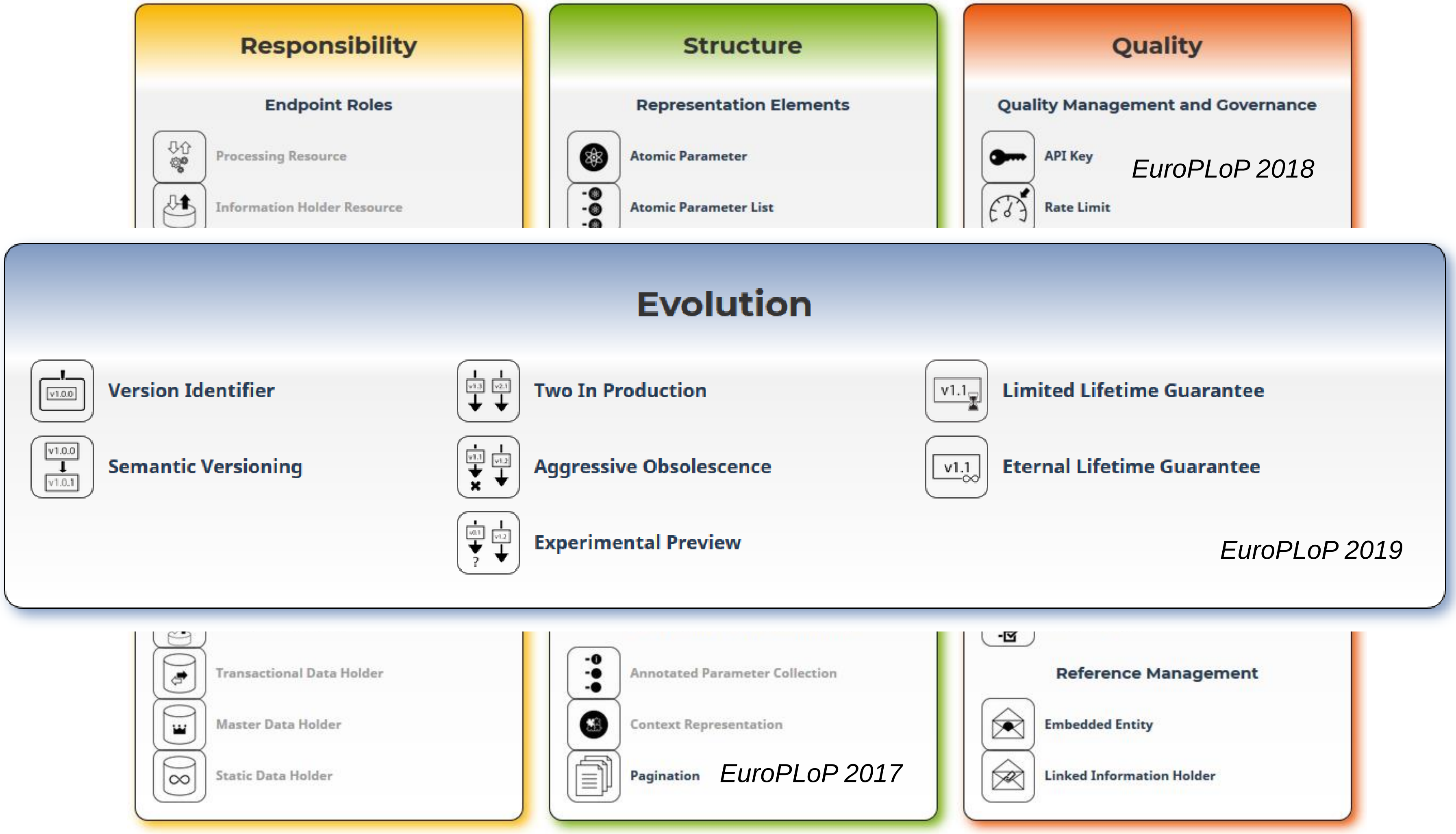
READ MORE →

- **Evolution Patterns:**
  - Recently workshopped (EuroPLoP 2019)

http://microservice-api-patterns.org

Microservice API Patterns (MAP)

Microservices API Patterns (MAP): Patterns by Category



Responsibility

Endpoint Roles

- Processing Resource
- Information Holder Resource
- Transactional Data Holder
- Master Data Holder
- Static Data Holder

Structure

Representation Elements

- Atomic Parameter
- Atomic Parameter List
- Annotated Parameter Collection
- Context Representation
- Pagination

EuroPLoP 2017

Quality

Quality Management and Governance

- API Key
- Rate Limit

EuroPLoP 2018

Reference Management

- Embedded Entity
- Linked Information Holder

Evolution

Version Identifier	Two In Production	Limited Lifetime Guarantee
Semantic Versioning	Aggressive Obsolescence	Eternal Lifetime Guarantee
	Experimental Preview	

EuroPLoP 2019

Microservice API Patterns (MAP)

http://microservice-api-patterns.org

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Vision: Agile Tools for BizDevOps (in DDD and MSA Context)

	Selected (Agile) Practices (*our focus here*)	**Tools (*our proposal*)**
Biz	Enterprise Architecture/SAFe *Strategic DDD (System Decomposition)*	*Context Mapper*
	User Story Telling, Mapping, Splitting Event Storming, Tactic DDD	Business as Usual (BaU): whiteboard/flipchart, C4, drawing tool, issue tracker
Dev	*API Design*: abstract/conceptual, platform-specific (contract first, code first)	*MDSL Editor & Linter* *(with MAP Decorators)* Open API Specification (f.k.a. Swagger), AsyncAPI, …
	Service Implementation and Integration	BaU, e.g. Spring Boot, Spring MVC, RabbitMQ, Kafka, etc.
Ops	CI/CD Pipelining, Monitoring, …	BaU, e.g. GitLab, Cloud tools, Docker, Kubernetes

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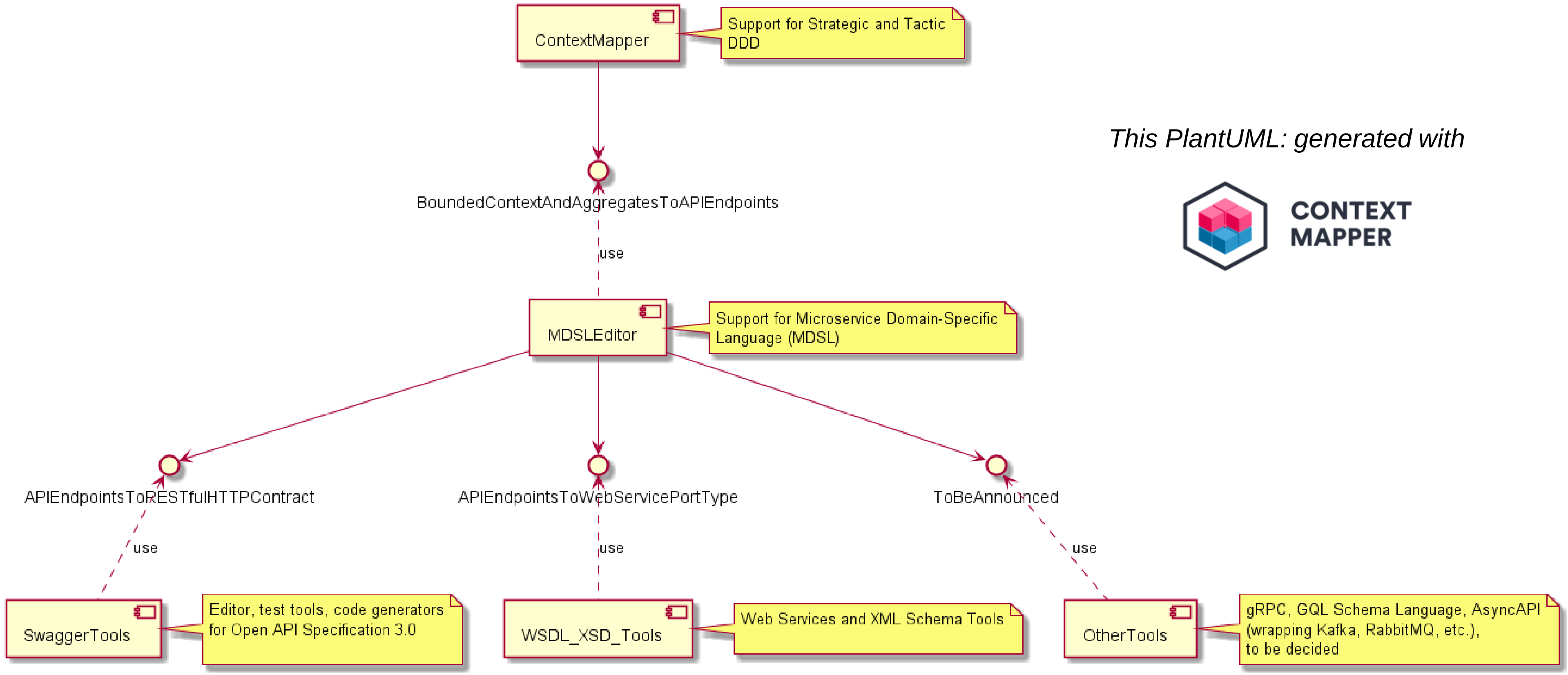
DDD Context Map for our Tools


ContextMapper
Support for Strategic and Tactic DDD
BoundedContextAndAggregatesToAPIEndpoints
use
MDSLEditor
Support for Microservice Domain-Specific Language (MDSL)
APIEndpointsToRESTfulHTTPContract
APIEndpointsToWebServicePortType
ToBeAnnounced
use
use
use
SwaggerTools
Editor, test tools, code generators for Open API Specification 3.0
WSDL_XSD_Tools
Web Services and XML Schema Tools
OtherTools
gRPC, GQL Schema Language, AsyncAPI (wrapping Kafka, RabbitMQ, etc.), to be decided

This PlantUML: generated with

CONTEXT MAPPER

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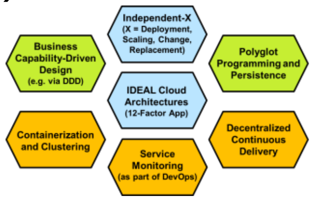
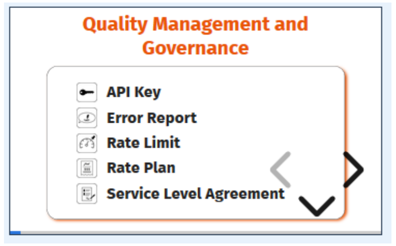
Summary and Outlook

- **Microservices have many predecessors (evolution not revolution)**
  - Implementation approach for, and sub-style of, SOA (7 tenets)
    - More emphasis on autonomy and decentralization (of decisions, of data ownership), less vendor-driven
    - Automation advances and novel target environments


Business Capability-Driven Design (e.g. via DDD)
Independent-X (X = Deployment, Scaling, Change, Replacement)
Polyglot Programming and Persistence
IDEAL Cloud Architectures (12-Factor App)
Containerization and Clustering
Service Monitoring (as part of DevOps)
Decentralized Continuous Delivery

- **Context Mapper (open source/term thesis projects @ HSR)**
  - DSL for modeling strategic DDD Context Maps
  - Tool support to evolve models iteratively (ARs)
  - PlantUML, Service Cutter, and MDSL generation
- **Microservice Domain-Specific Language (MDSL) for service contracts**
- **Microservice API Patterns (MAP) language & website**
  - 20+ patterns, sample implementation, tutorial


Quality Management and Governance

- API Key
- Error Report
- Rate Limit
- Rate Plan
- Service Level Agreement

Thank you very much! Let's move on to Q&A and discussion…

Feedback appreciated…

- **Did we catch the essence of strategic DDD (context mapping)?**
- **Is the DDD DSL expressive enough, but also easy to understand?**
- **Is anything missing in terms of functionality?**
  - Which decomposition criteria do you use when cutting/carving services?
  - Which architectural refactorings would you like to see in future versions?
  - Which model transformations and code generators would be valuable?
    - E.g. should we look into reverse transformations (from code to DSL)?
- **Can you envision to apply Context Mapper, MDSL, MAP in practice?**
  - Do tools and notations have the potential to improve productivity & quality?
  - What are critical success factors for adoption (NFRs)?
- **Which API design patterns and contract language features are missing?**