



# Quality Analysis of Service-Oriented Architectures

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Gebhart Quality Analysis (QA) 82

Dr. Michael Gebhart

<http://www.qa82.com>

[michael.gebhart@qa82.com](mailto:michael.gebhart@qa82.com)

# What does Gebhart Quality Analysis (QA) 82 do?

# Gebhart Quality Analysis (QA) 82

## Services Offered and Target Groups

### Quality Analysis

in the context of  
SOA and cloud

Companies running  
service-oriented  
architectures

Software producers

Consulting  
companies

### Certification

of high-quality  
services

Software  
producers

### Training

for an engineering  
methodology

IT architects of  
service-oriented  
architectures and  
services



aufgrund eines Beschlusses  
des Deutschen Bundestages



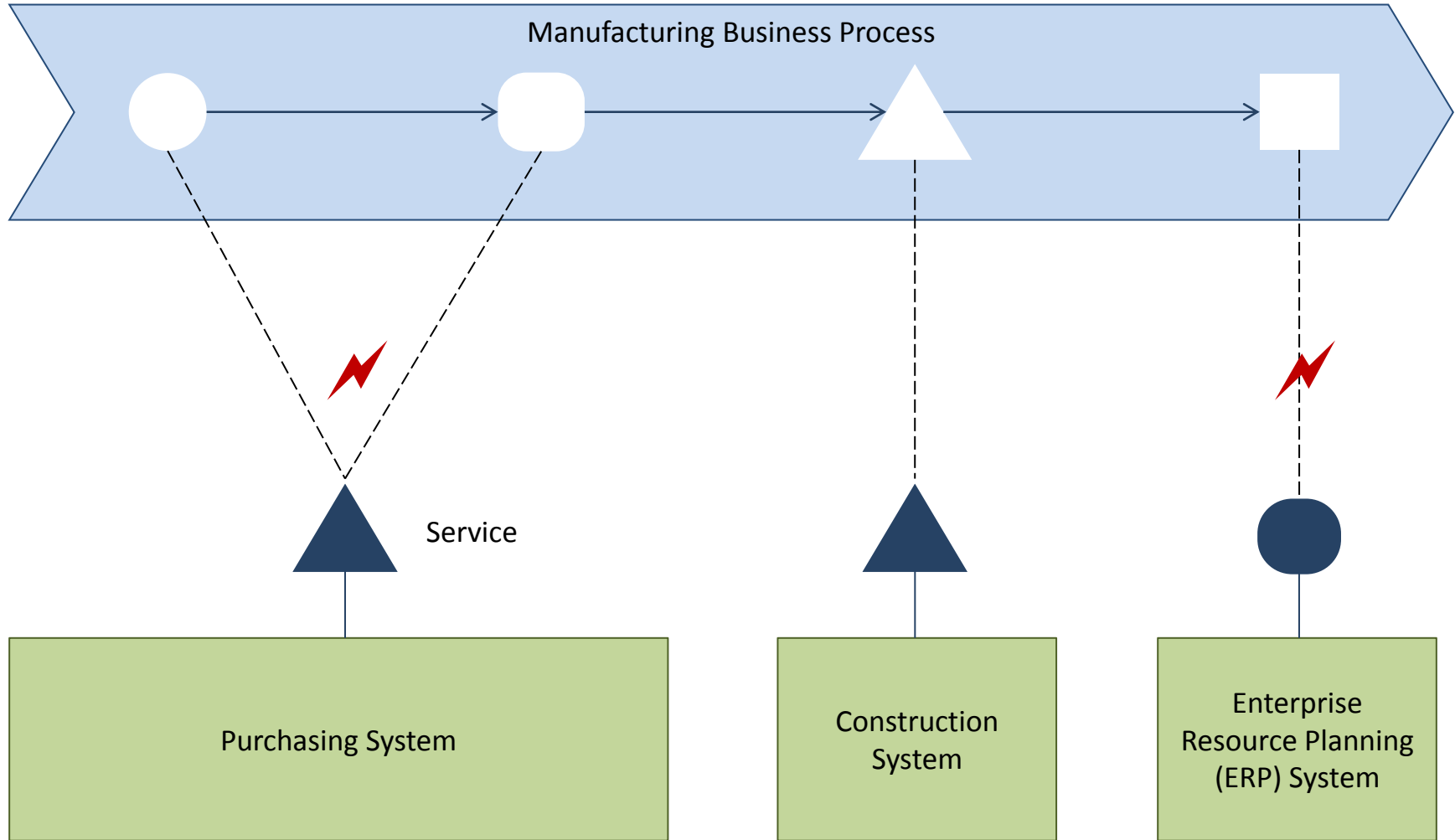
# Why do companies decide for service-oriented architectures?

## Surveys

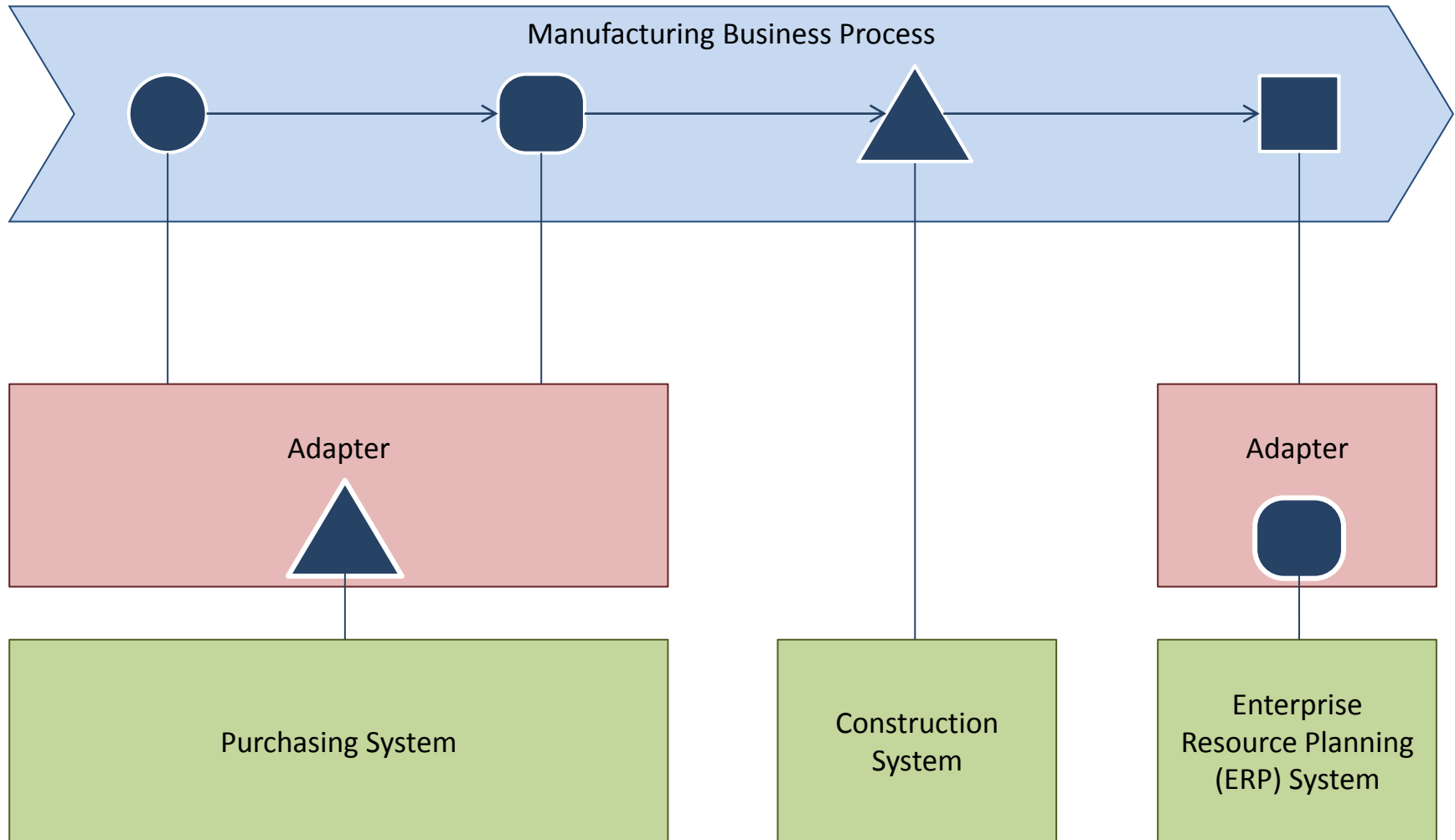
- Aberdeen Research (2007)
  - Survey of more than 150 companies in the world
  - Main driver for SOA
    - Agility and **flexibility** (62%)
    - Better services for end users (61%)
    - Reduced **operating costs** (39%)
  - Benefit achieved
    - Reduced **development costs** for new solutions (**0** - 100%)
    - Reduced **maintenance costs** (**7** - 72%)
- Software AG (2009)
  - Survey of German companies with revenue of at least 50 Mio. euro
    - Focused on financial service providers
  - Main driver for SOA
    - **Flexibility** und **Transparency** (93%)

# Why is a disciplined design of services necessary?

## Flexible Support of Business Processes

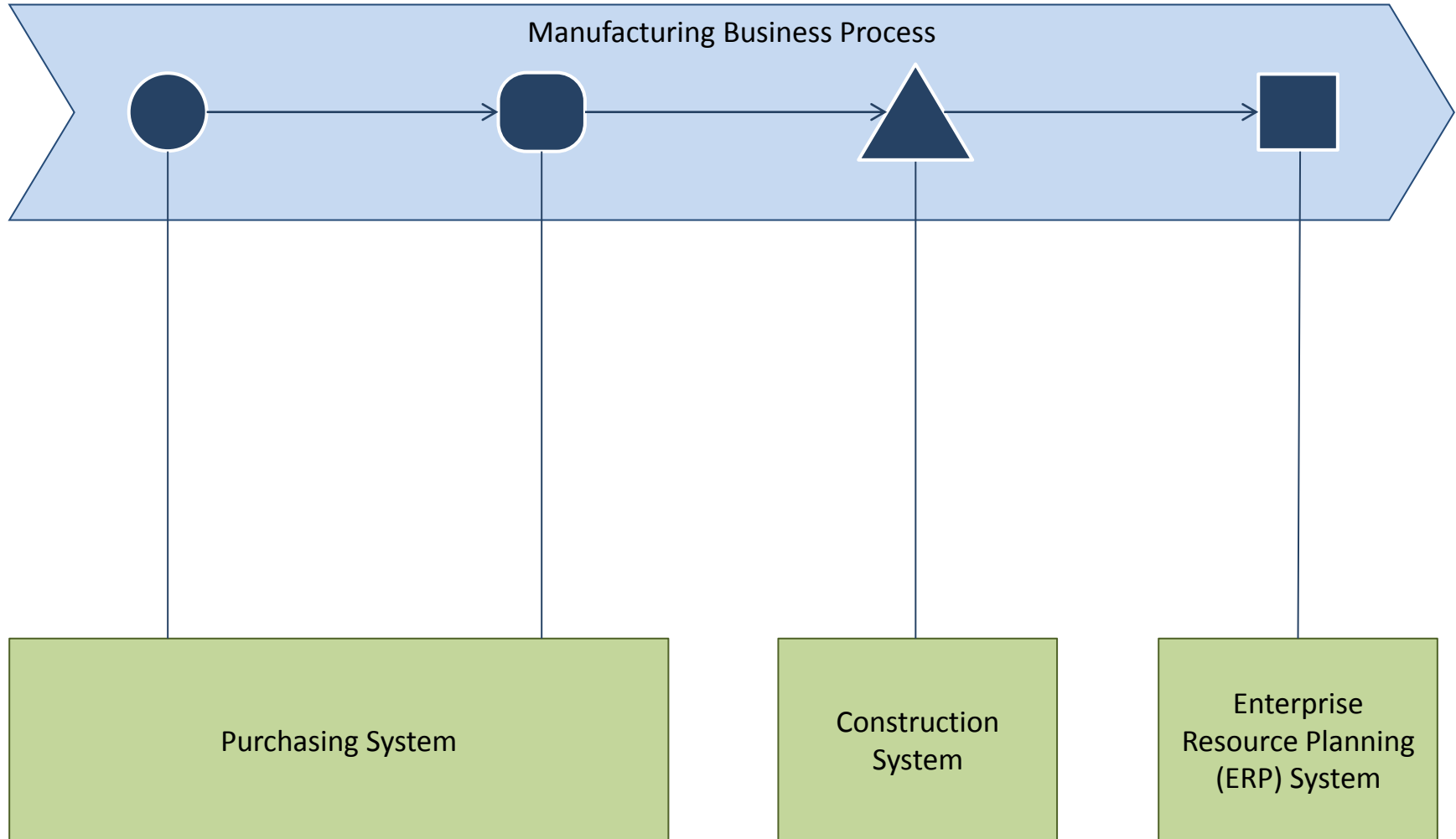




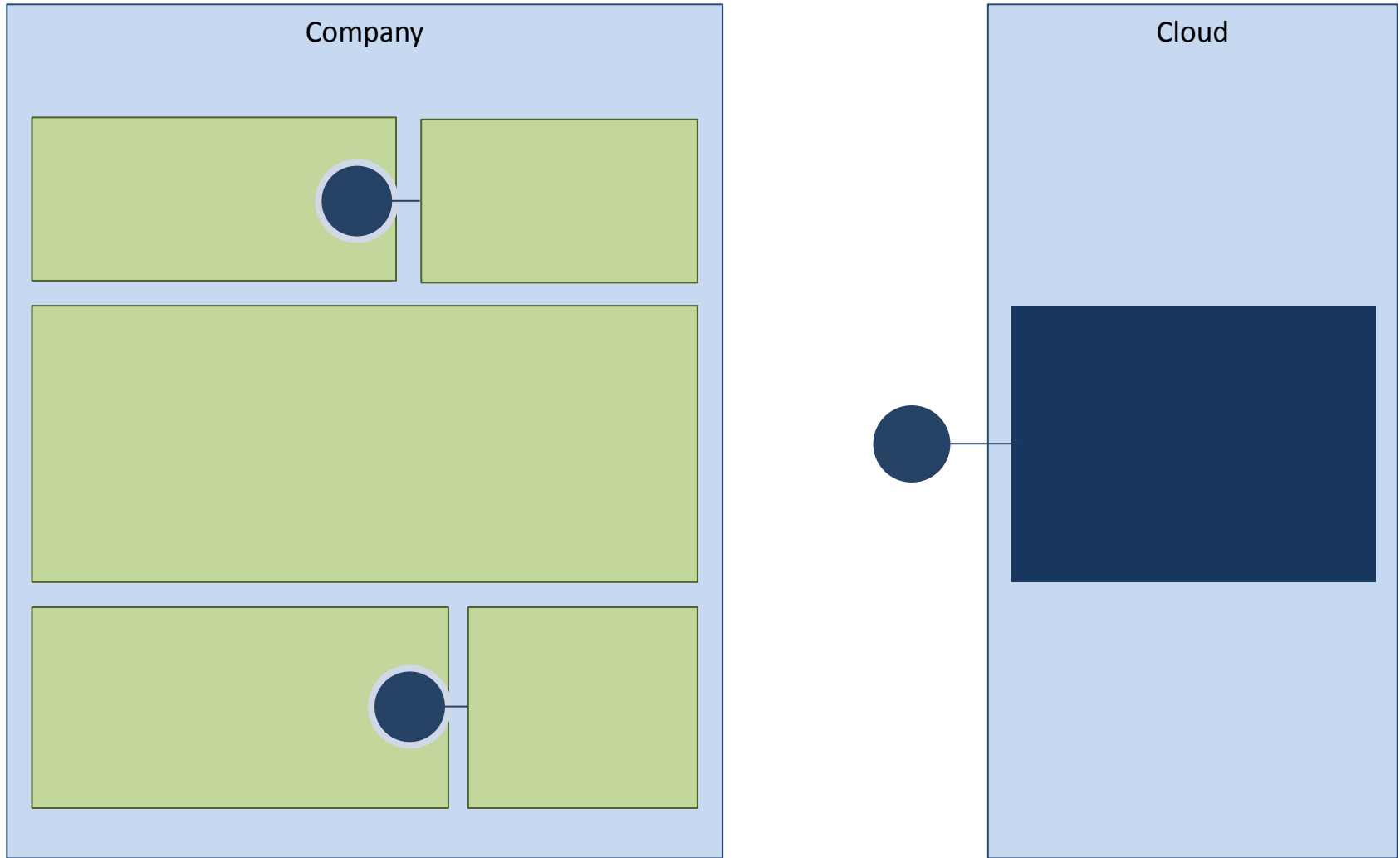


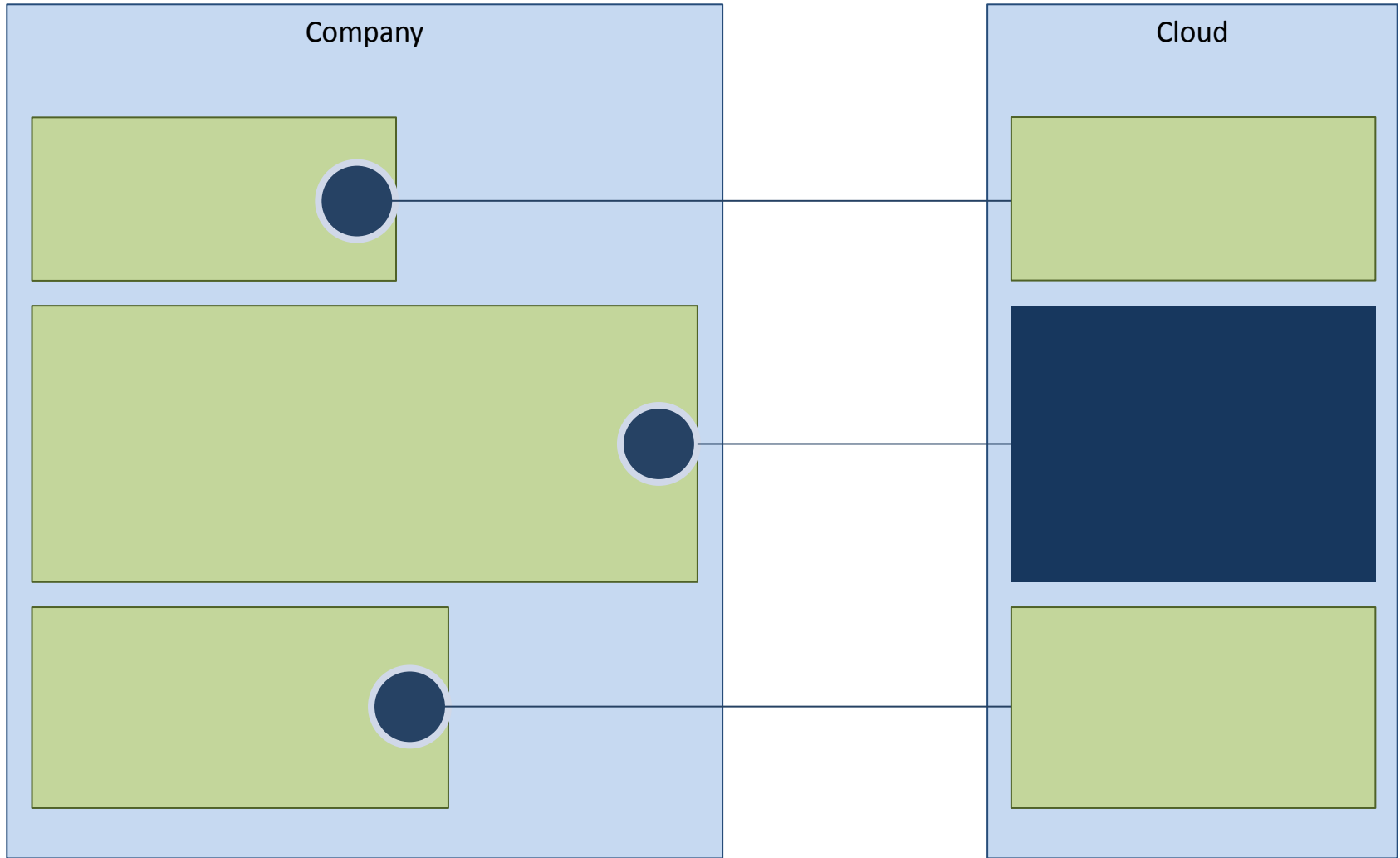
# Efficient Business Process Support

## Increases Flexibility and Maintainability

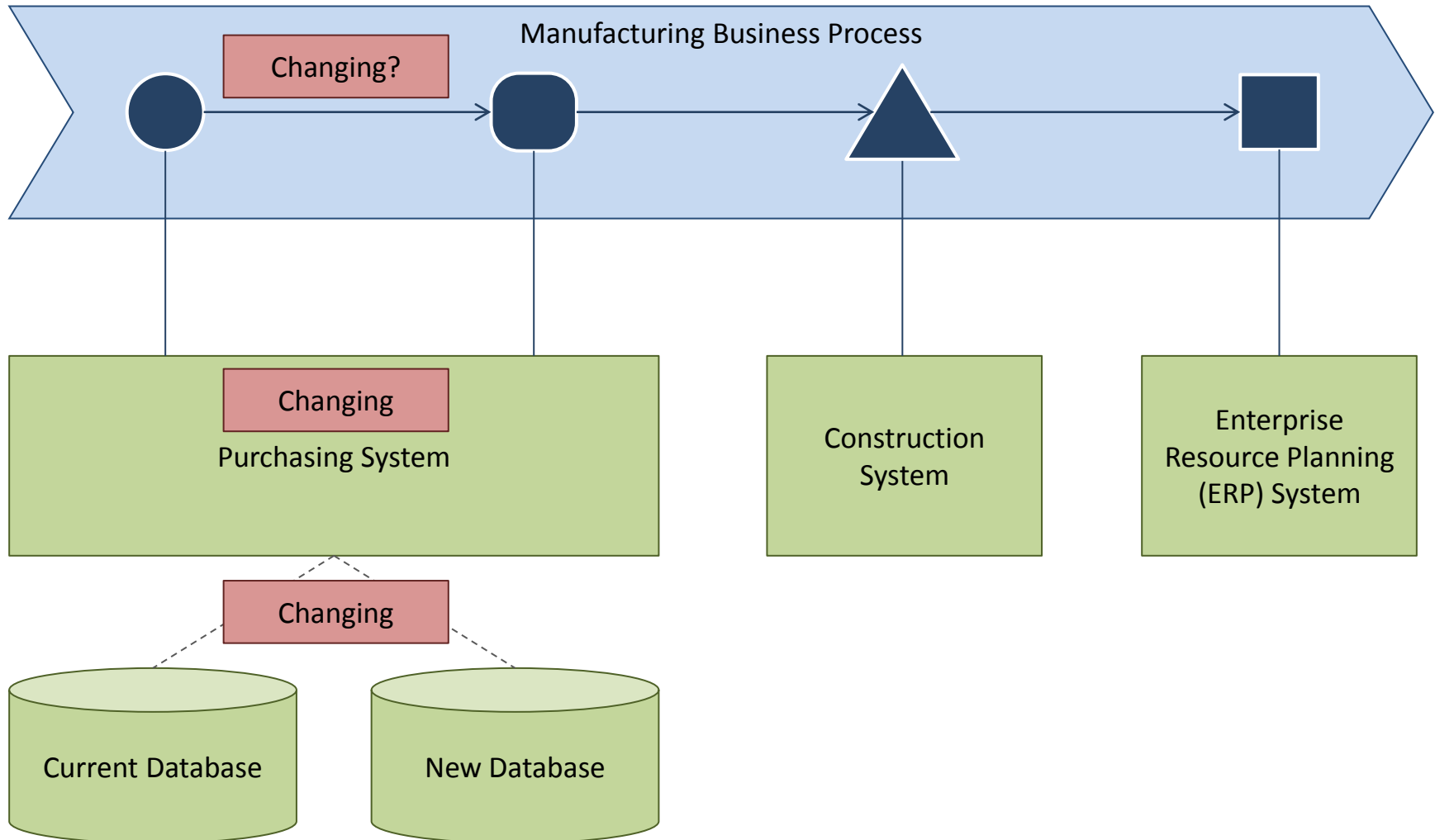


# Outsourcing of Functionality Into the Cloud and Integration of Cloud Services

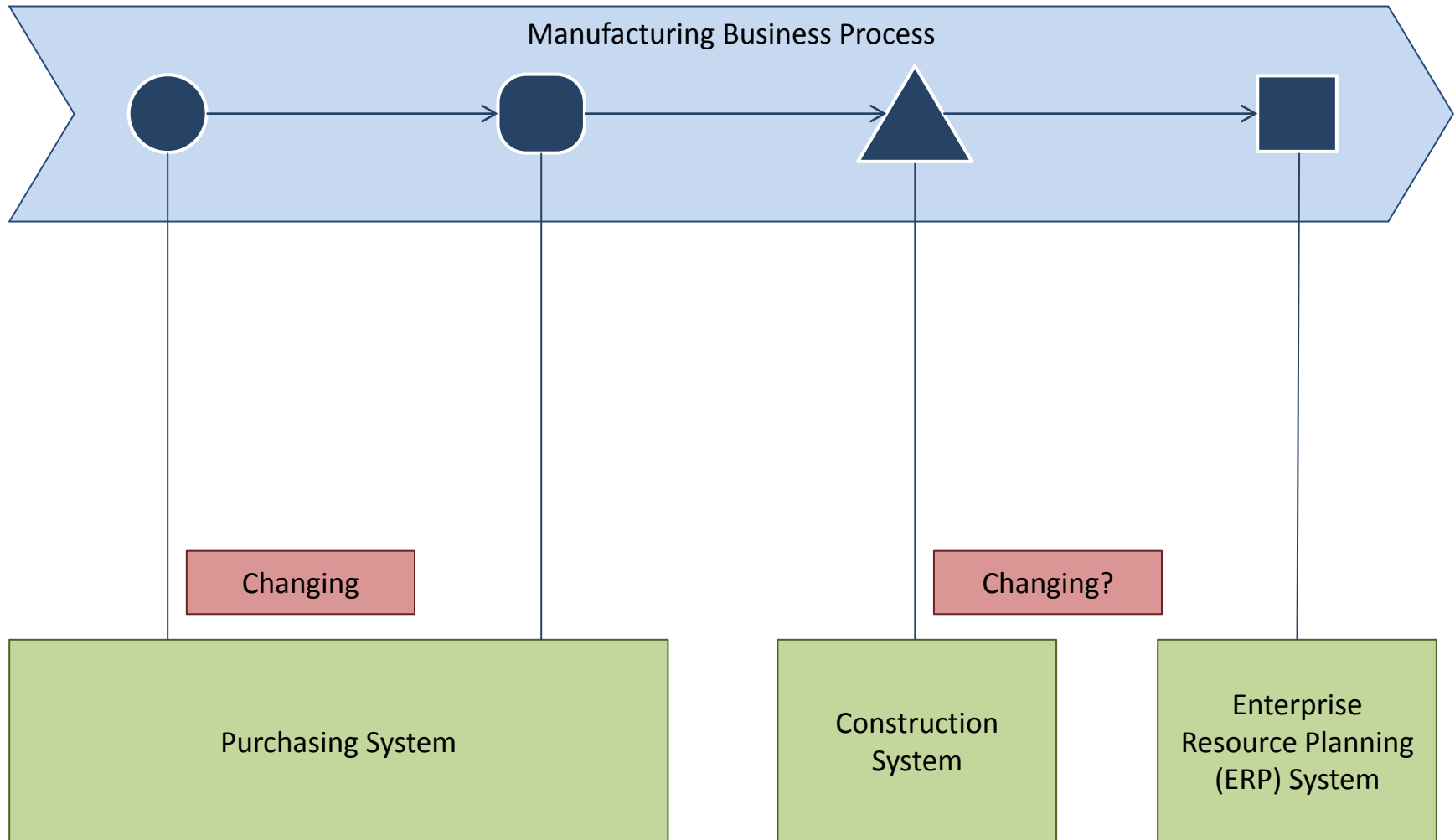




## Effects of System Changes

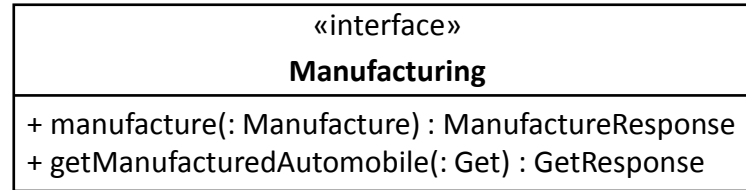


## Effects of Data Type Changes



**Conclusion: The design of services critically influences flexibility, maintainability, and cost-efficiency of IT**

**But what is “design of services”?**



- Is the service “correctly” designed?
  - Specification of all necessary information, correct naming ...
  - Does this service group the “correct” set of operations?
- Which operations should be grouped?
  - Should some operations be moved into another service?
- Are the operations “correctly” designed?
  - Functional scope, naming, required parameters ...
- Are the “correct” data types chosen?
  - Usage of local / global data types, naming ...

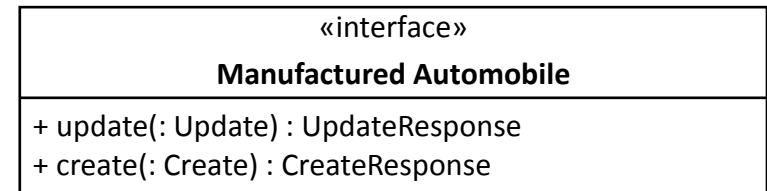
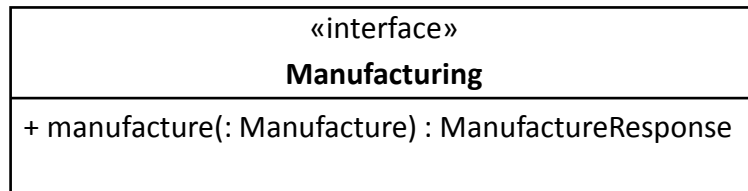


## Addition of new Functionality

+ getManufacturedAutomobile(: Get) : GetResponse



?



- Which one is the right service for this new functionality?
- More important: Why? What is the impact of a certain decision?

# How should services be designed?

# From Strategic Goals to Quality Attributes

Referring to the Design of Services

Maintainability

Flexibility

Strategic Goals

Quality Attributes



Loose Coupling

Autonomy

Discoverability

Unique Categorization

# Complex Verification of Quality Attributes

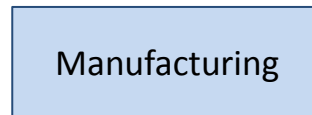
## Interpretation Required



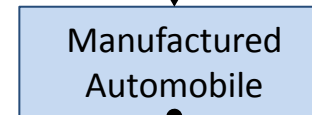
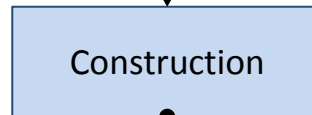
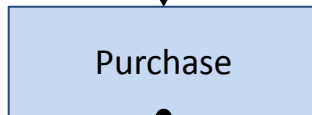
Loose coupling means...  
Autonomy is ...  
A Service is discoverable, if ...  
...

Description

Application



Loosely coupled?



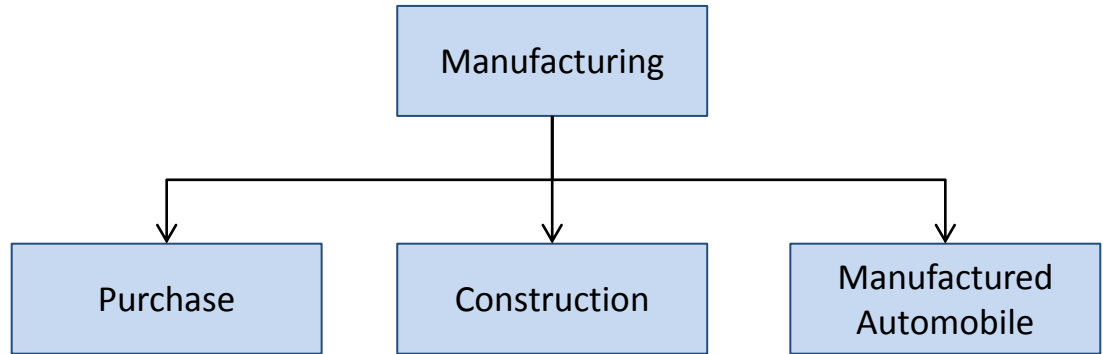
Uniquely categorizable?

Autonomous?

Discoverable?

# Changes Require Repeatedly Complex Analysis

Review of all Services necessary



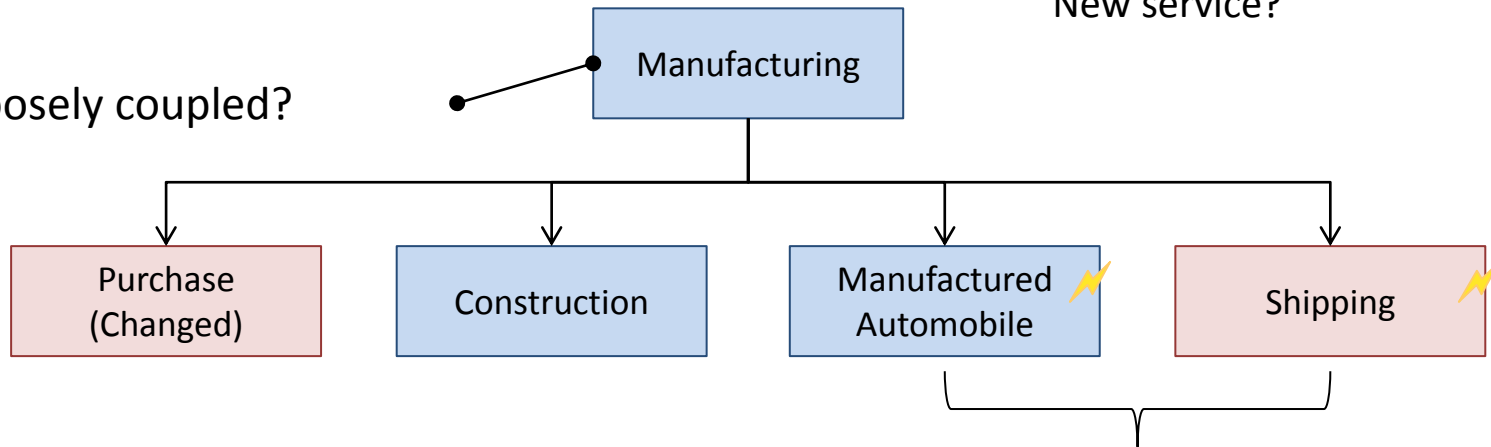
Currently

Changes



Addition of new functionality.  
New service?

Still loosely coupled?

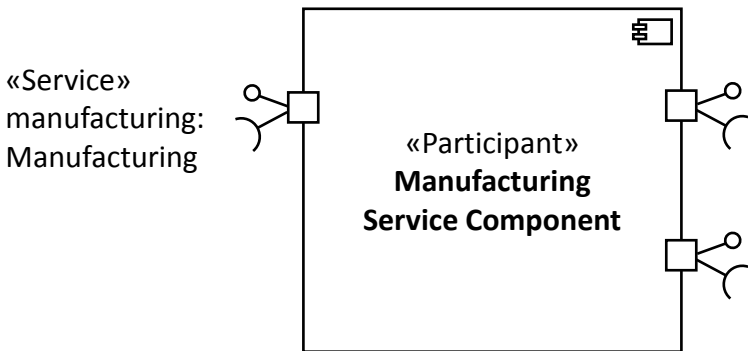
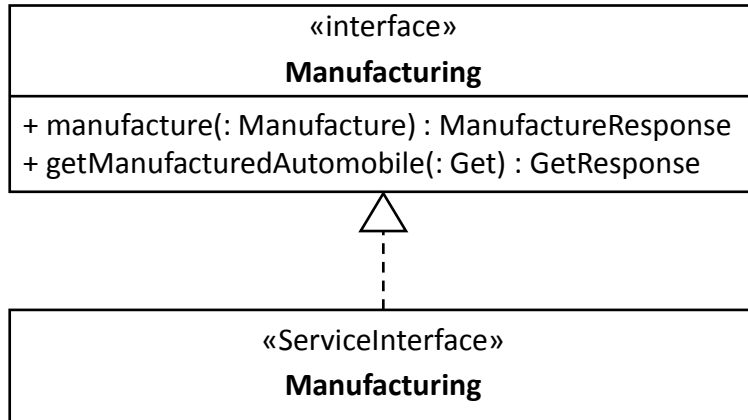


Direct access to manufactured automobiles.  
Not obvious when considering single services only.

# How can the good design of services be verified?

# Specifying Architecture as a Whole

## Application of SoaML as UML Profile



### Advantages

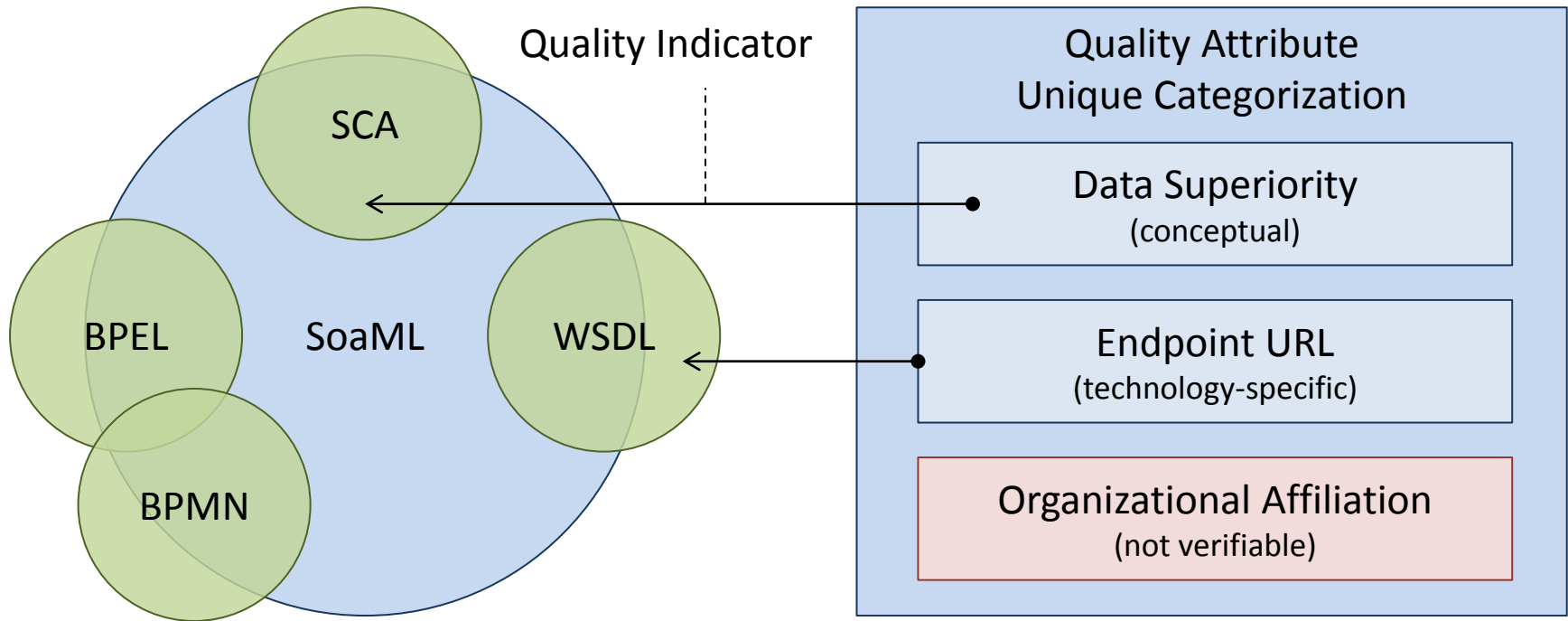
- Standard for specifying service-oriented architectures
- Clear terminology and semantics
  - Basis for correct determination of quality attributes
- Platform-independent description
  - Instrument stable over time
- Holistic view on the architecture
  - Generates transparency
- Application during design phase
- Tool support

### Disadvantages

- Non-consideration of technology specifics
  - Combination as solution possible
- Complex specification required

# Determination of Verifiable Quality Indicators

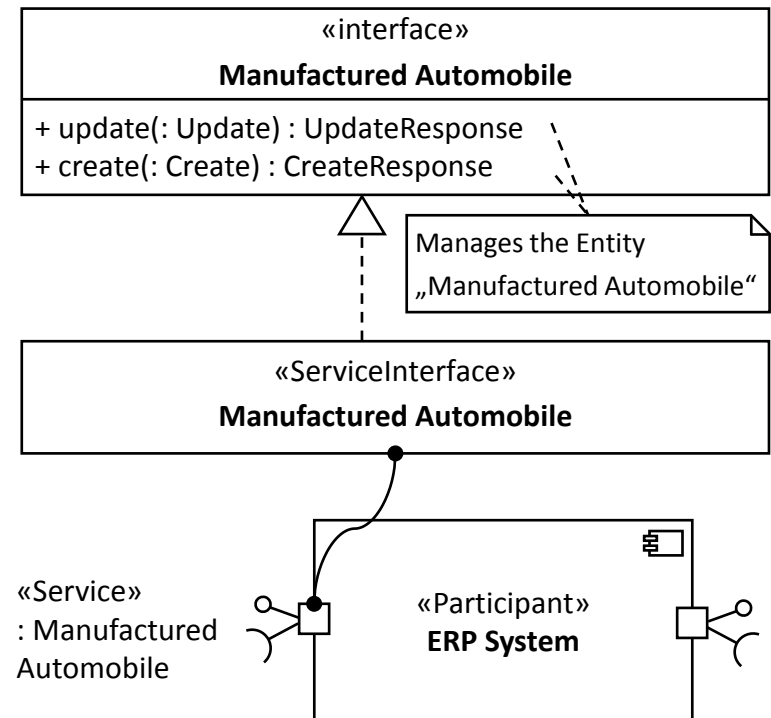
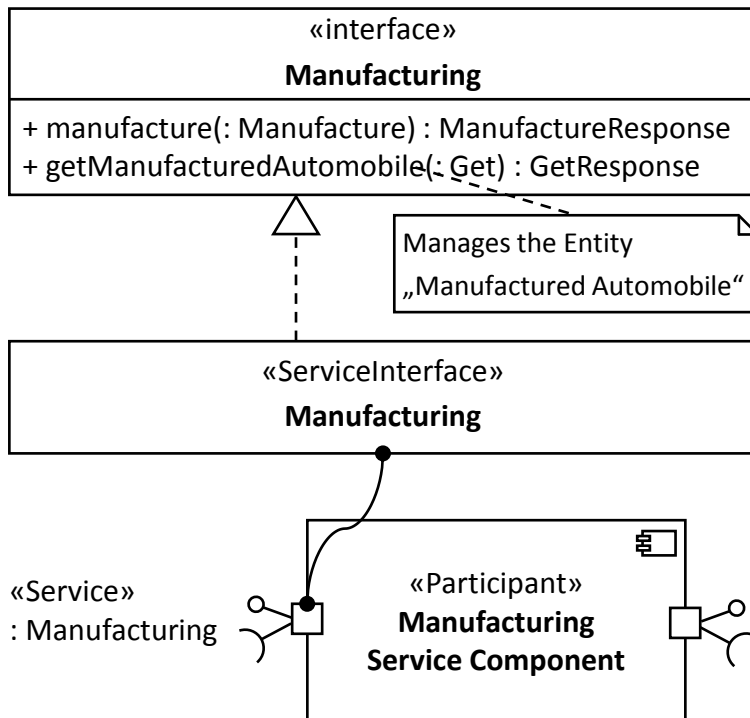
## Focus on SoaML for Architecture Description





## Verification of Data Superiority

- Data Superiority: A service that manages an entity exclusively manages this entity
  - Overview over the entire architecture required → SoaML
  - After changing the design a repeatedly verification is necessary



$$DS(s) = 1 - \frac{\left| \begin{array}{l} MBE \left( O \left( RI(SI(s)) \right) \right) \cap \\ MBE \left( O \left( RI \left( SI(ALL_S \setminus s) \right) \right) \right) \end{array} \right|}{\left| MBE \left( O \left( RI(SI(s)) \right) \right) \right|}$$

$$DBTF(s) = \frac{\left| BF \left( O \left( RI(SI(s)) \right) \right) \right|}{\left| O \left( RI(SI(s)) \right) \right|}$$

$$NCCDT(s) = \frac{\left| NCC \left( DT \left( P \left( O \left( RI(SI(s)) \right) \right) \right) \right) \right|}{\left| DT \left( P \left( O \left( RI(SI(s)) \right) \right) \right) \right|}$$

QA82 Architecture Analyzer

Quality Aspect	Manufacturing	Element	Value	Normalized	Completeness	Rating	Details
* Service Quality	Manufacturing		51.25%	93.75%	Unknown	⌵	
* Unique Categorization						⌵	
* Autonomy						⌵	
* Discoverability		Owner: Automotive Manufacturer 8.3.5.Service Design-Application 5.2				⌵	
* Loose Coupling	Manufacturing		0,00%	75,00%	Unknown	⌵	
* Service Quality	Distribution	Owner: Automotive Manufacturer 8.3.5.Service Design-Application 5.2	52,96%	93,75%	Unknown	⌵	
* Unique Categorization	Distribution	Owner: Automotive Manufacturer 8.3.5.Service Design-Application 5.2	70,83%	100,00%	Satisfactory	⌵	
Common Business Entity Usage	Distribution	Owner: Automotive Manufacturer 8.3.5.Service Design-Application 5.2	1,00	100,00%	100,00%	Excellent	⌵
Division of Business-related and Technical Functionality	Distribution	Owner: Automotive Manufacturer 8.3.5.Service Design-Application 5.2	1,00	100,00%	100,00%	Excellent	⌵

$$FNSI(s) = \frac{\left| FN(SI(s)) \right|}{\left| SI(s) \right|}$$

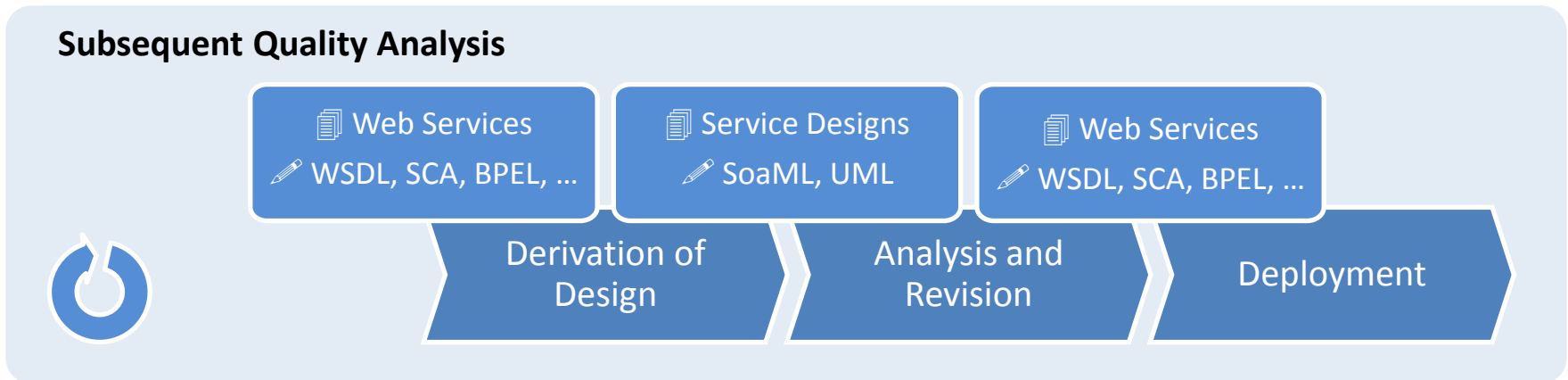
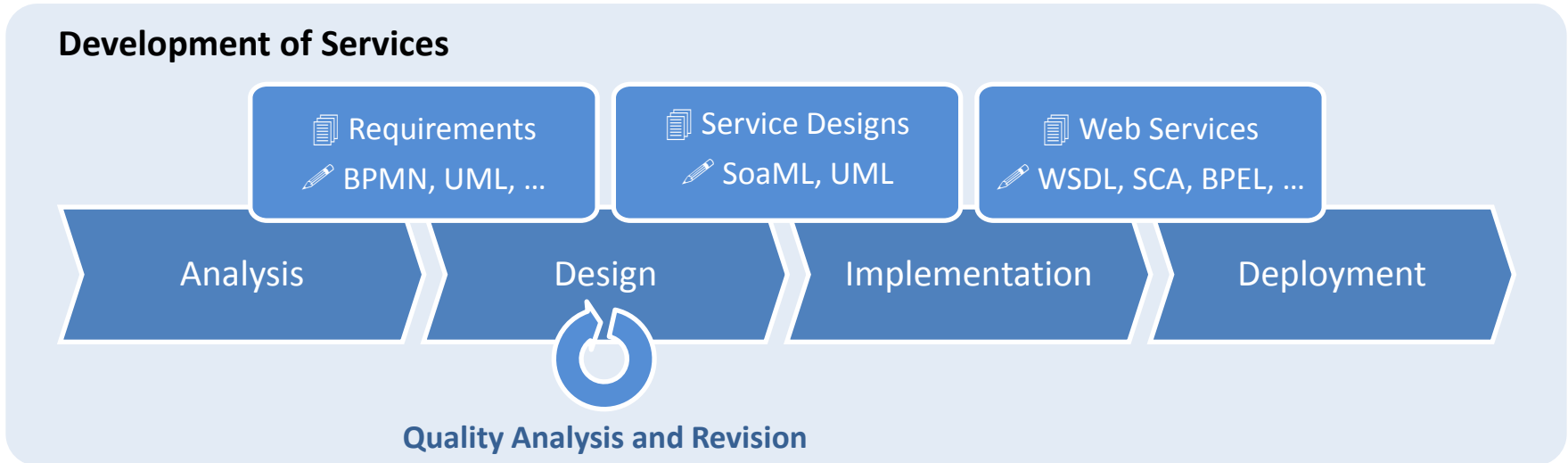
$$DANF(s) = \frac{\left| AF \left( O \left( RI(SI(s)) \right) \right) \right|}{\left| O \left( RI(SI(s)) \right) \right|}$$

$$ASYNC(s) = \frac{\left| ASO \left( IP(SI(s)) \right) \cap LRO \left( O \left( RI(SI(s)) \right) \right) \right|}{\left| LRO \left( O \left( RI(SI(s)) \right) \right) \right|}$$

$$CBEU(s) = \frac{\left| OUBE \left( CMP \left( O \left( RI(SI(s)) \right), MOUBE \left( O \left( RI(SI(s)) \right) \right), UBE \left( O \left( RI(SI(s)) \right) \right) \right) \right) \right|}{\left| O \left( RI(SI(s)) \right) \right|}$$

# Application of Quality Analysis

## During Service Development or Subsequently



- Quality analysis in the context of SOA is a broad field
- From a software perspective especially the design of services is important
- Quality indicators enable the determination of quality attributes
- SoaML enables the specification of the architecture as a whole
  - Holistic analyses
  - Unambiguous semantics enables the specification of metrics
- QA82 Architecture Analyzer (tooling) enables the automatic calculation of metrics
  - Efficient analyses
  - Fast impact analyses of architecture changes
- Both quality analyses during service development and subsequently possible

**There is still a lot to do...  
Let's go!**



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<http://www.qa82.com>

<http://www.qa82.de> (German)



Dr. Michael Gebhart

[michael.gebhart@qa82.de](mailto:michael.gebhart@qa82.de)

**Quality Analysis** in the context of SOA and cloud

**Certification** of high-quality Services

**Training** for an engineering methodology based on SoaML

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