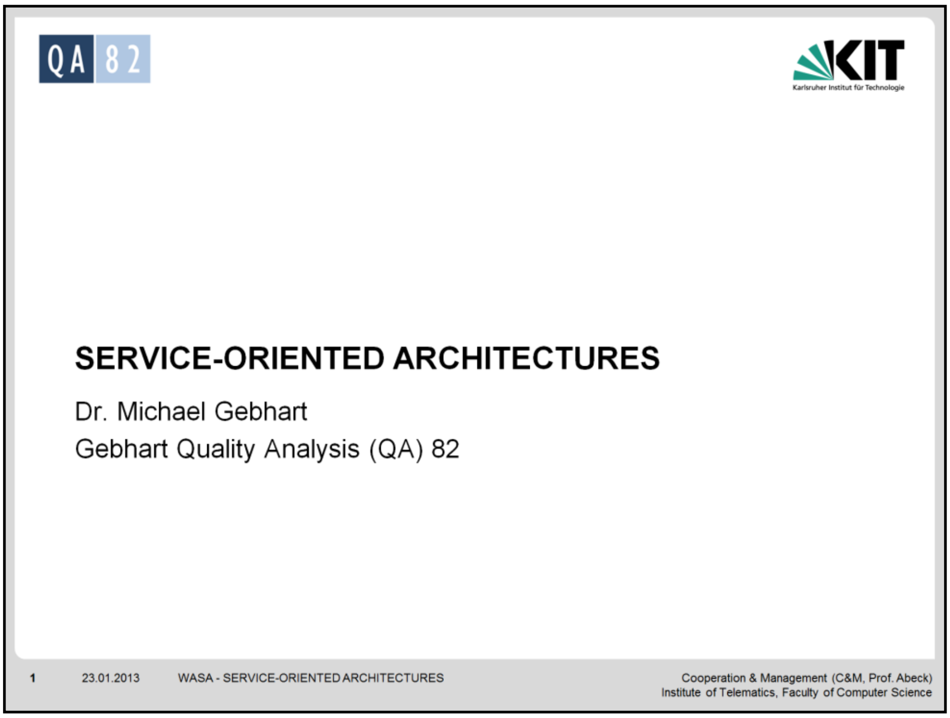

QA 82

KIT Karlsruher Institut für Technologie

SERVICE-ORIENTED ARCHITECTURES

Dr. Michael Gebhart
Gebhart Quality Analysis (QA) 82

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Cooperation & Management (C&M, Prof. Abeck)
Institute of Telematics, Faculty of Computer Science

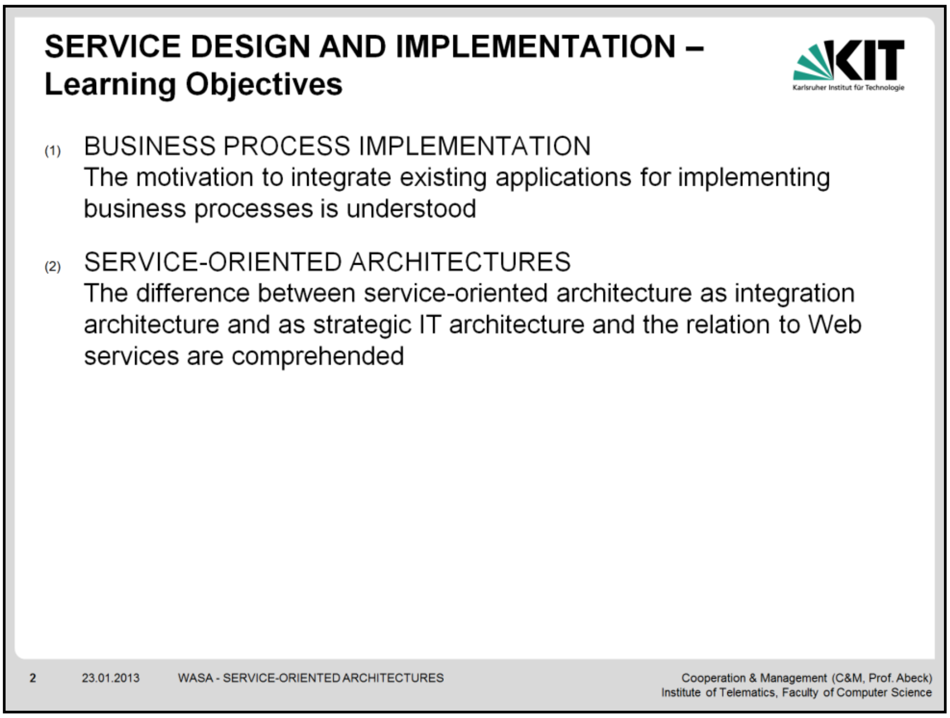
Short Description

This course unit is concerned with service-oriented architectures (SOA) as paradigm to support business processes implementation phase as part of Business Process Management (BPM) lifecycle. For that purpose different understandings of SOA are introduced. More precisely, SOA as integration architecture, as paradigm to design enterprise IT from a strategic viewpoint, and Web services are distinguished.

Keywords

Service-Oriented Architecture (SOA), Business Process Management (BPM), Web services (WS), Enterprise Service Bus (ESB)

BPM	Business Process Management
C&M	Cooperation & Management
ESB	Enterprise Service Bus
KIT	Karlsruhe Institute of Technology
SOA	Service-Oriented Architecture
WS	Web Service



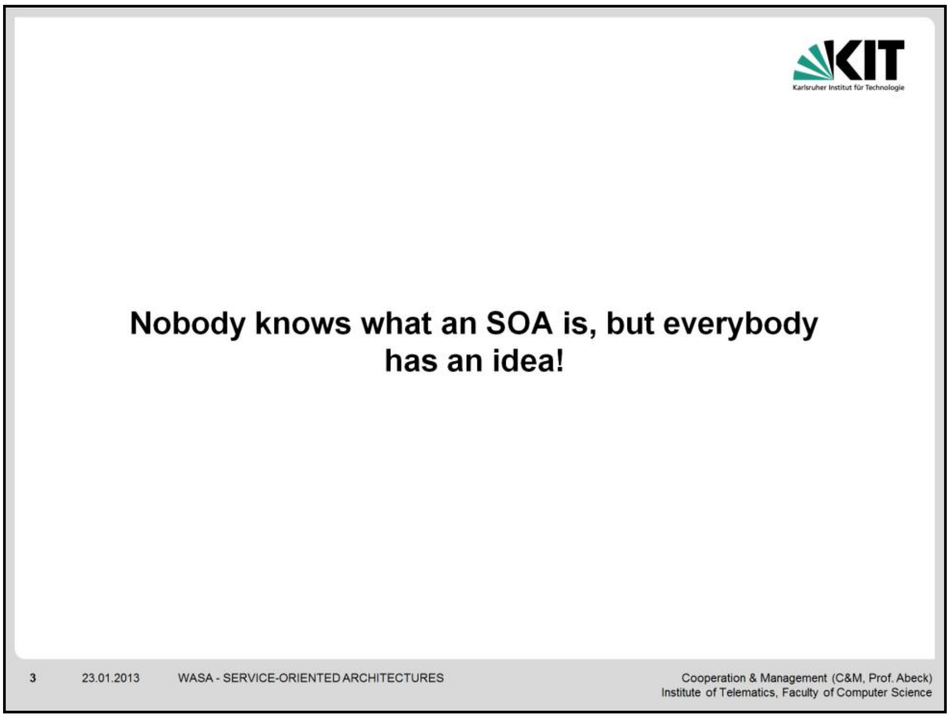
SERVICE DESIGN AND IMPLEMENTATION – Learning Objectives

(1) BUSINESS PROCESS IMPLEMENTATION
The motivation to integrate existing applications for implementing business processes is understood

(2) SERVICE-ORIENTED ARCHITECTURES
The difference between service-oriented architecture as integration architecture and as strategic IT architecture and the relation to Web services are comprehended

(1) In order to motivate the integration of existing and running applications, business process implementation as phase of business process lifecycle is introduced.

(2) In this chapter, service-oriented architectures as integration architecture and as strategic design paradigm are introduced. Furthermore, Web services and enterprise service bus as technological drivers are distinguished.



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Nobody knows what an SOA is, but everybody has an idea!

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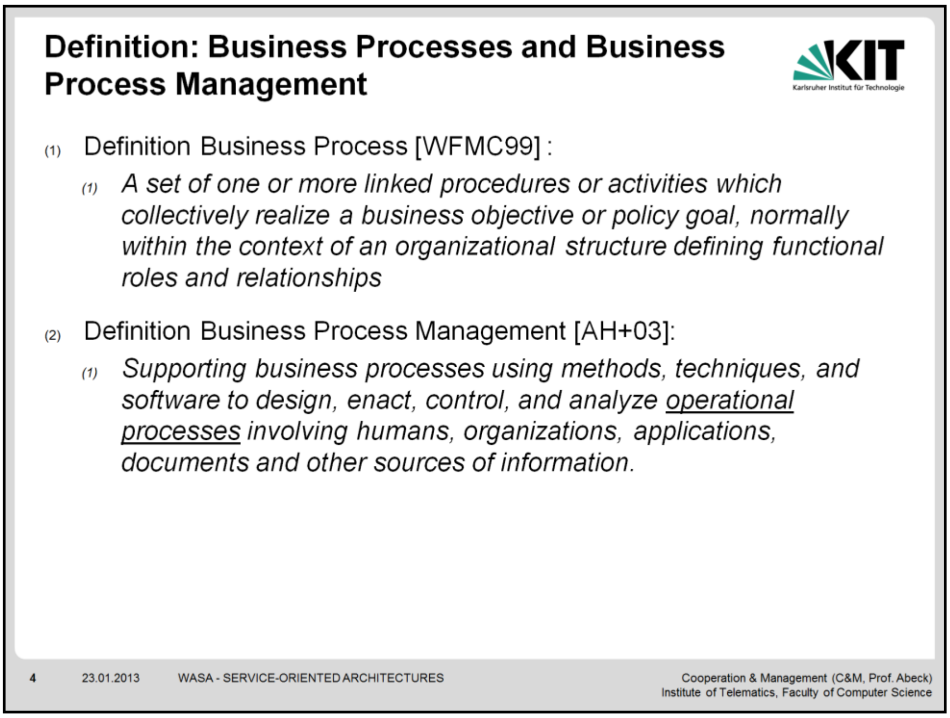
It is important to understand that there is not the one and only definition of service-oriented architecture (SOA). Nevertheless, everybody has an idea and these ideas should be comprehended.

SOA	Service-Oriented Architecture



Definition: Business Processes and Business Process Management

(1) Definition Business Process [WFMC99] :

(1) *A set of one or more linked procedures or activities which collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles and relationships*

(2) Definition Business Process Management [AH+03]:

(1) *Supporting business processes using methods, techniques, and software to design, enact, control, and analyze operational processes involving humans, organizations, applications, documents and other sources of information.*

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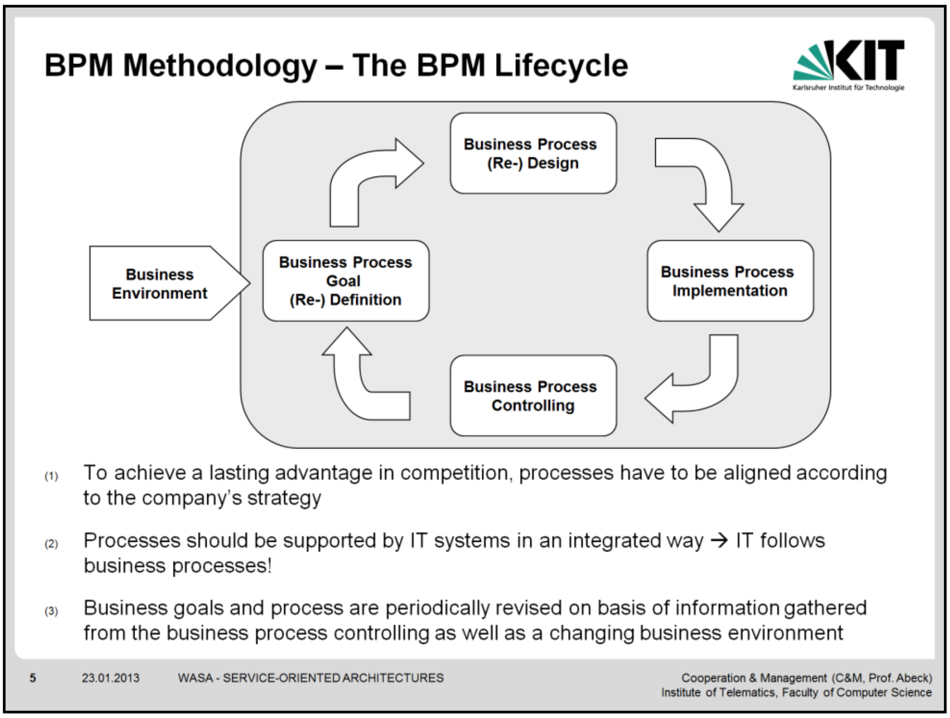
(1) As a further aspect that is not addressed by this definition, business processes may also be structured in terms of sub processes. These may be embedded into the parent business process or independent sub processes. The ladder case allows for an easy reuse of recurring process parts. In addition, business processes may also span multiple organizational structures. In this case, within the context of one organizational structure only dedicated sections of the business process (i.e. private process) are conducted. Consequently, it is necessary to also specify the interaction between several private processes in terms of a public process.

(2) The term “operational process” refers to business processes that are well-structured and therefore can be made explicit, for instance by using a modeling notation. Unstructured ad-hoc business processes, as often found on the strategic management level, are not included. For designing processes, graphical notations are commonly used. The analysis is mostly based on simulations. Here, Petri nets combined with stochastic models represent a very good foundation. For the enactment of business processes, on the one hand a formal notation for defining executable process (e.g. BPEL) is required. On the other hand, a corresponding execution engine is needed (e.g. BPEL engine).

BPEL	Business Process Execution Language

[AH+03] Wim M. P. van der Aalst, A. H. M. ter Hofstede, M. Weske: Business Process Management: A Survey, Lecture Notes in Computer Science, Band 2678, Seiten 1-12, Springer-Verlag, Berlin, 2003.
[WFMC99] WFMC. WorkflowManagement Coalition Terminology and Glossary V3 (WFMC-TC-1011). Technical report, Workflow Management Coalition, Brussels, 1999.



Business Environment
Business Process Goal (Re-) Definition
Business Process (Re-) Design
Business Process Implementation
Business Process Controlling

BPM Methodology – The BPM Lifecycle

(1) To achieve a lasting advantage in competition, processes have to be aligned according to the company's strategy

(2) Processes should be supported by IT systems in an integrated way → IT follows business processes!

(3) Business goals and process are periodically revised on basis of information gathered from the business process controlling as well as a changing business environment

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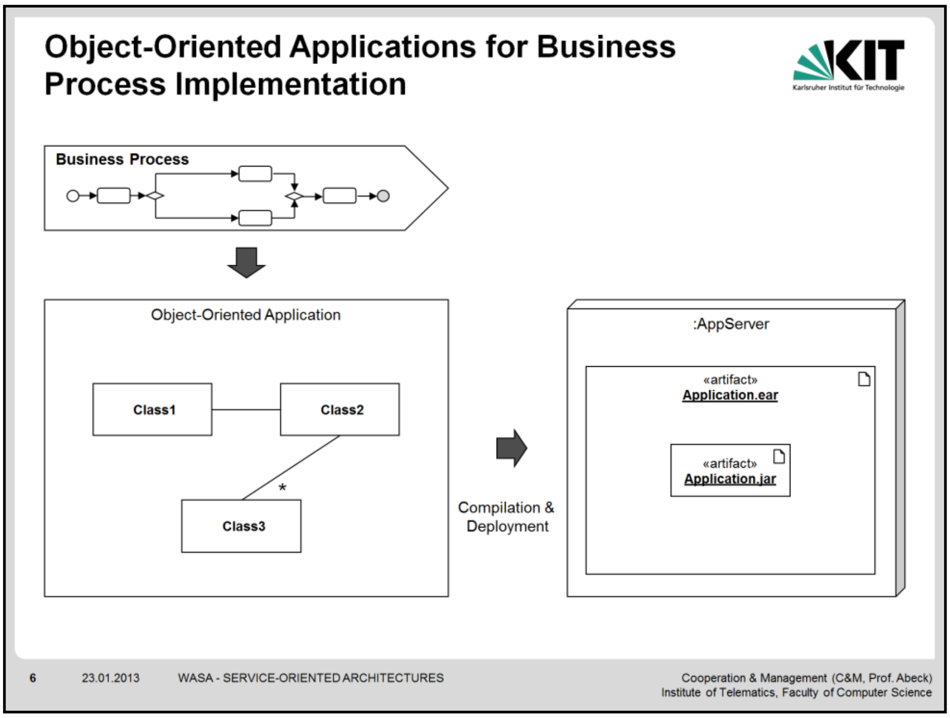
The general objective of business process management is to optimize a company's business processes in a way that on the one hand maximum efficiency is always ensured and on the other hand the processes are continuously adapted to the company's (changing) needs. The presented BPM phases are based on [AH+03] and [MR+04]. Note that we introduce a simplified BPM lifecycle and the terminology may differ slightly.

(1) To reach this objective, a company first has to define their business process goals along with corresponding measurements. To this end, the question is raised what exactly the company wants to achieve in the long term and how the degree of achievement can be measured. These business process goals are highly influenced by the business environment including the market situation and form the basis for the following activities, where the objective is pursued to align the business processes with the predefined business process goals. Hence, the business process (re-) design is mainly concerned with the analysis and optimization of the existing processes accordant to these goals.

(2) Nowadays, business processes are always supported by IT systems. Unfortunately, in most cases an integrated IT support for a business process does not exist. In fact, there are often a couple of isolated systems involved. Accordingly, business process implementation is concerned with the design of an IT support that closely follows the business process design. Additionally, the business process implementation deals with the realization of organizational changes demanded by the designed processes. This aspect is being ignored within this course unit.

(3) Business process management is a continuous activity. Therefore, in literature the term (business) process management lifecycle has been coined [MR04] . The mission is to (continuously) revise the degree of achievement of the defined business goals. This activity is referred to as business process controlling. The information/knowledge gained within this phase forms one basis for a revision of the business goals and subsequently the redesign of the business processes. But business goals may also be adjusted due to a changing business environment.

[MR04] M. zur Muehlen, M. Rosemann: Multi-Paradigm Process Management, Proc. Fifth Workshop on Business Process Modeling, Development, and Support-CAiSE Workshops, 2004.
[AH+03] Wim M. P. van der Aalst, A. H. M. ter Hofstede, M. Weske: Business Process Management: A Survey, Lecture Notes in Computer Science, Band 2678, Seiten 1-12, Springer-Verlag, Berlin, 2003.



Object-Oriented Applications for Business Process Implementation

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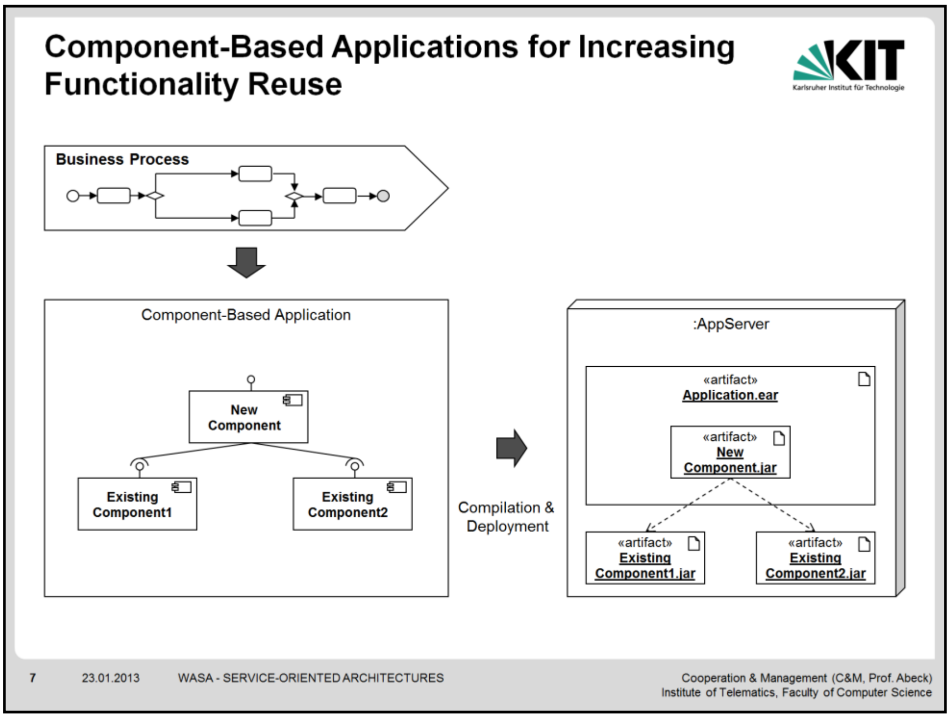
The implementation of business processes is nothing completely new and not a SOA-specific issue. With the upcoming of object-oriented programming, originally, business functionality that can be isolated used was considered. Examples are create, read, update, and delete (CRUD) operations on certain business entities, such as customers. Another aspect however is the support of entire business processes, such as logistic processes. These business processes can be implemented using object-oriented programming, for example by means of a monolithic web application. The developed object-oriented application can be compiled and deployed on an application server, such as an Java Platform Enterprise Edition (JEE) or Microsoft .NET Container.

One major weakness of this solution is the minimal level of reuse. In this scenario only functionality on a fine-grained level can be reused, such as single classes.

CRUD	Create, Read, Update, Delete
JEE	Java Platform, Enterprise Edition



Component-Based Applications for Increasing Functionality Reuse

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Business Process

Component-Based Application

New Component

Existing Component1

Existing Component2

Compilation & Deployment

:AppServer

«artifact» Application.ear

«artifact» New Component.jar

«artifact» Existing Component1.jar

«artifact» Existing Component2.jar

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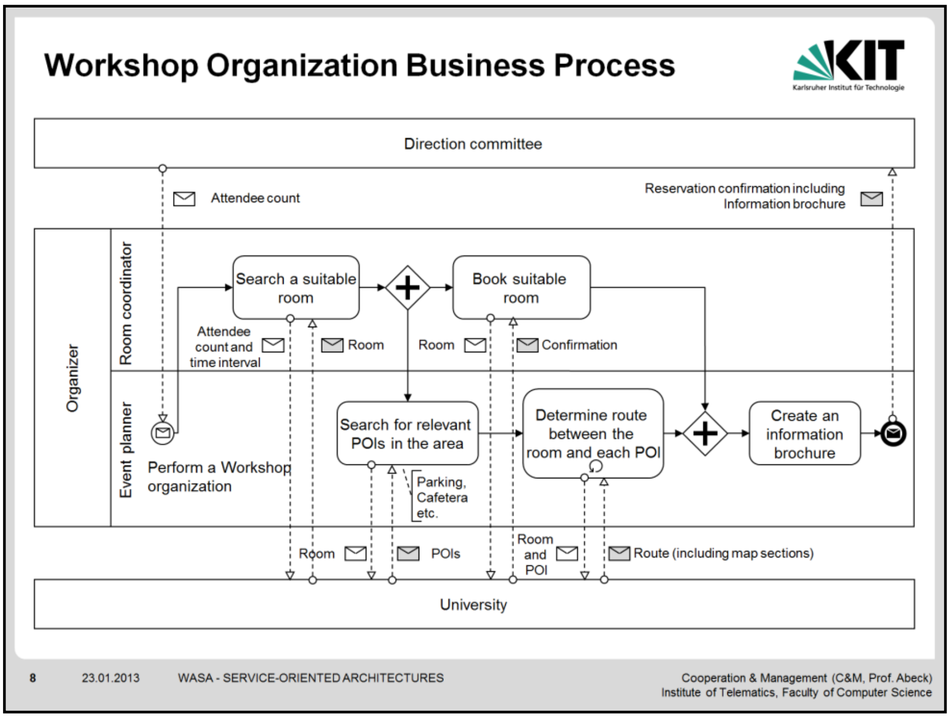
In order to increase the reuse of functionality, the component-based approach evolved. Compared to the object-oriented programming, more coarse-grained functionality can be reused. Again in this case, components are compiled and deployed on a certain application server. Even though, the components do not have to be packaged into one file, they are linked during compile time and are also executed as a whole. A new component referring to existing components do not access running functionality. The logic is executed as part of the using application. I.e. when two application require the same existing components, the logic within these components is executed twice.



Workshop Organization Business Process

KIT
Karlsruher Institut für Technologie
Direction committee
Attendee count
Reservation confirmation including Information brochure
Organizer
Room coordinator
Event planner
Search a suitable room
Book suitable room
Attendee count and time interval
Room
Room
Confirmation
Search for relevant POIs in the area
Determine route between the room and each POI
Create an information brochure
Perform a Workshop organization
Parking, Cafetera etc.
Room
POIs
Room and POI
Route (including map sections)
University

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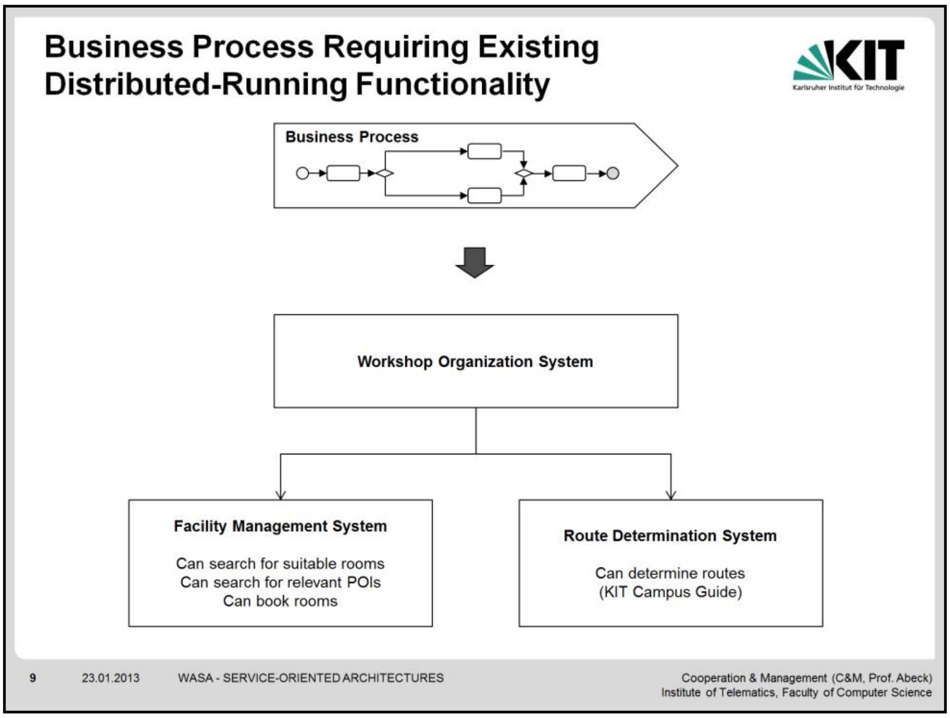
To illustrate the challenge that comes up when implementing enterprise-wide business processes, this workshop organization business process can be used. The process describes the organization of workshops by direction committee. The process is described by means of the Business Process Model and Notation (BPMN).

The direction committee calls the organizer in order to organize a workshop for a certain number of attendees. The organizer can be refined into a room coordinator and event planner. The event planner receives the message of the direction committee. After that the room coordinator is responsible for searching a suitable room for the workshop. As the workshop is expected to take place at a university, the coordinator calls the university. When he gets a suitable room, he books the room. In parallel, the event planner searches for points of interest (POI) next to the found room. Afterwards, the event planner determines the routes between the room and each POI. Also for these purposes he contacts the university. Finally, he creates an information brochure and sends it back to the direction committee.

BPMN	Business Process Model and Notation
POI	Point of Interest



Business Process Requiring Existing Distributed-Running Functionality

Business Process

Workshop Organization System

Facility Management System

Can search for suitable rooms
Can search for relevant POIs
Can book rooms

Route Determination System

Can determine routes
(KIT Campus Guide)

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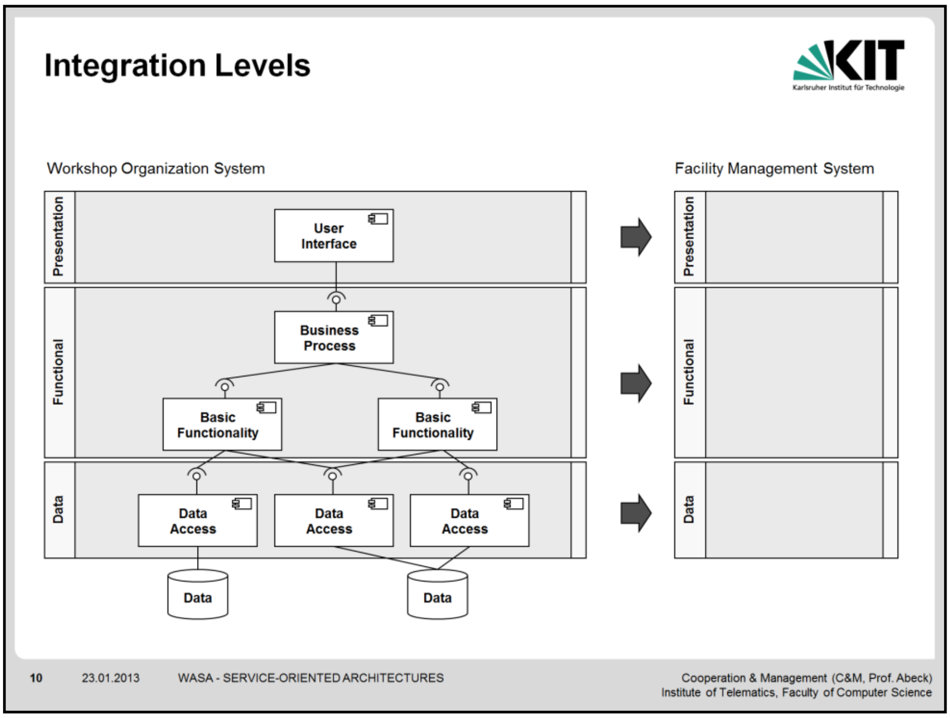
In order to implement this business process by IT, the created workshop organization system has to access functionality that is already running at the university. For example, it has to access the facility management system to search for suitable rooms and relevant POIs and to book rooms. Furthermore, the KIT Campus Guide as route determination system has to be invoked to determine routes between the booked room and the found POIs.

It is obvious that this system cannot be created as monolithic object-oriented or component-based system. The created workshop organization system is not expected to perform the necessary functionality by its own. Instead, the already running functionality is expected to be invoked. Thus, the implementation of the workshop organization process constitutes an integration scenario, i.e. existing distributed-running functionality has to be integrated into a new software system.



Integration Levels

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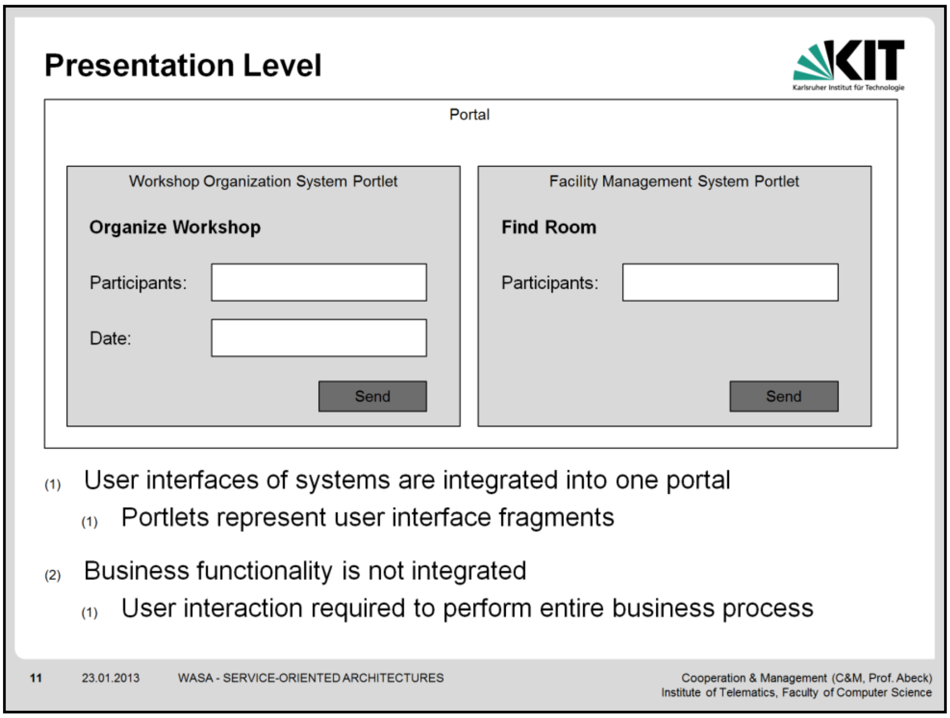
The integration of existing functionality can be performed on various levels. In this case the integration of the facility management system into the workshop organization system is described.

Assumed, both applications consist of three levels (presentation, functional, and data) an integration can be achieved on all of these three levels. I.e. in order to integrate the functionality to find a suitable room, this problem can be solved in three different ways with different results.



Presentation Level

Portal

Workshop Organization System Portlet

Organize Workshop

Participants:

Date:

Send

Facility Management System Portlet

Find Room

Participants:

Send

- (1) User interfaces of systems are integrated into one portal
  - (1) Portlets represent user interface fragments
- (2) Business functionality is not integrated
  - (1) User interaction required to perform entire business process

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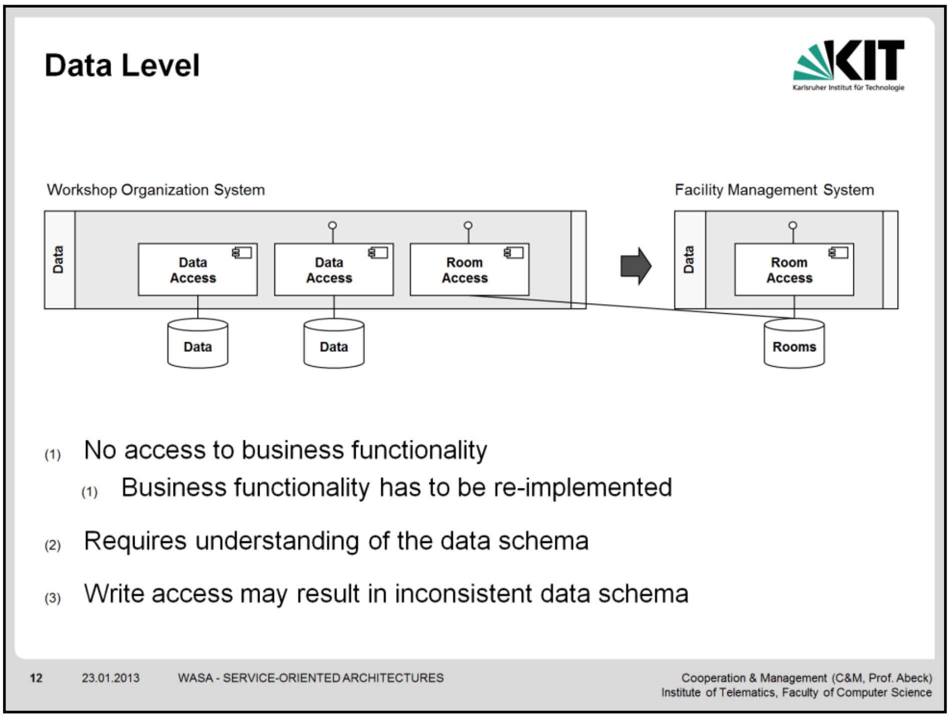
(1) For integrating the systems on the presentation layer, the user interfaces are integrated as portlets into one portal. An example is the KIT student portal that integrates several applications on the presentation layer. For that purpose, the systems that are expected to be integrated have to provide portlets for an efficient integration. Otherwise, the integration requires more manual effort: The necessary user interface fragments have to be detached from the rest of the user interface by parsing for example the HTML web page. Also URLs that handle requests on the user interface have to be adapted dynamically.

(2) In this case, the business functionality itself is not integrated. Instead the user interface is focused. I.e. when the user clicks on a button, the request is sent to the original and integrated system and the underlying business functionality is performed. In order to execute an entire business process, user interaction is necessary. For example to find suitable rooms, the user has to enter the necessary data. Afterwards, the request is sent to the facility management system. The business process flow is not automated.

HTML	HyperText Markup Language
KIT	Karlsruhe Institute of Technology
URL	Uniform Resource Locator



Data Level

Workshop Organization System
Data
Data Access
Data Access
Room Access
Data
Data
Facility Management System
Data
Room Access
Rooms

- (1) No access to business functionality
  - (1) Business functionality has to be re-implemented
- (2) Requires understanding of the data schema
- (3) Write access may result in inconsistent data schema

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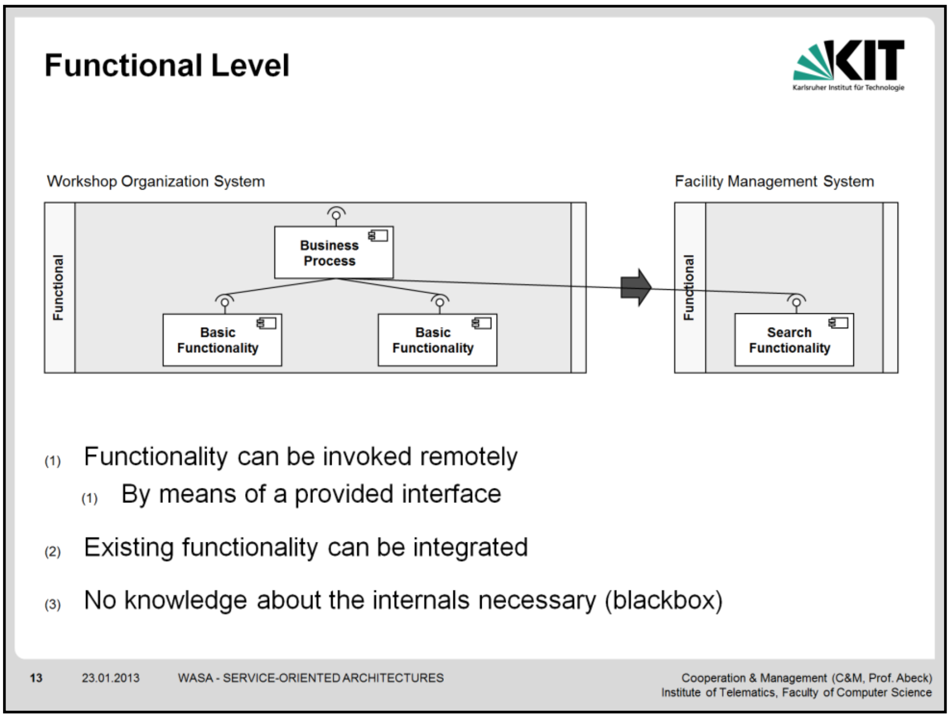
The integration on a data level can be achieved by accessing the database of another system. In this case the database that contains the rooms is accessed.

(1) As the database does not provide business functionality, the entire business logic has to be re-implemented. This means that the workshop organization system has to implement the logic that is necessary to find a suitable room.

(2) In order to access the database an understanding of the data schema is necessary. In most cases, the databases of systems can be very complex so that it takes a lot of time to understand the schema and to implement correct data accesses.

(3) When the business functionality requires to write data into the database (e.g. when booking a room), the data schema has to be understood in detail. Otherwise, changing the data might result in inconsistencies that might affect the correctness of the original system, in this case the facility management system.



Functional Level

(1) Functionality can be invoked remotely
  (1) By means of a provided interface

(2) Existing functionality can be integrated

(3) No knowledge about the internals necessary (blackbox)

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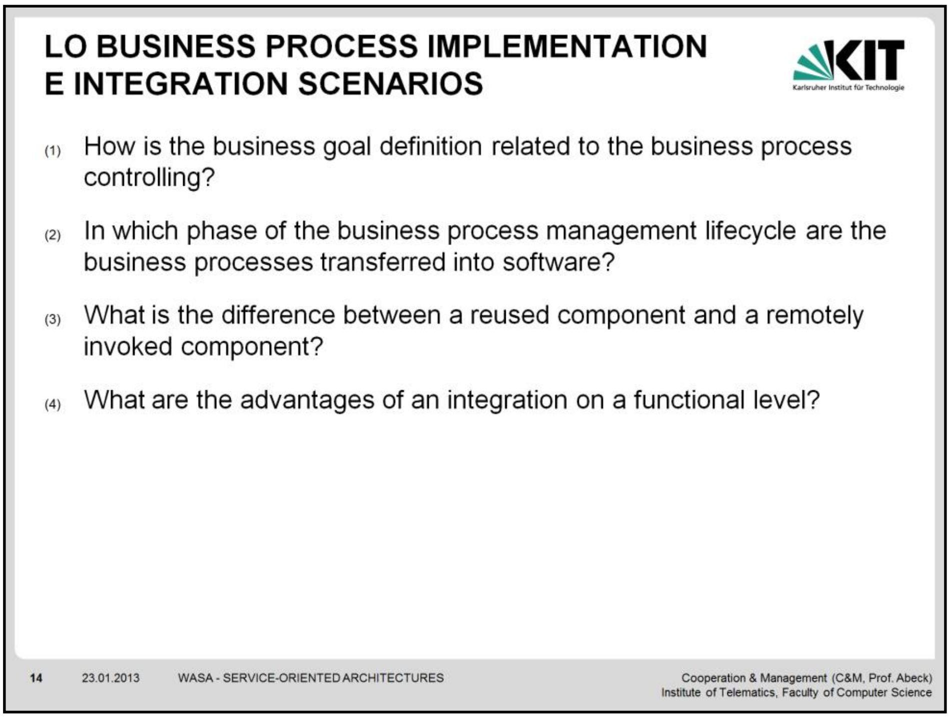
The desired integration level for this case, is the integration on a functional level.

(1) In this case the functionality to search a suitable room is invoked remotely. For that purpose, the remote system, the facility management system, provides a suitable interface with appropriate operations that can be invoked by the workshop organization system.

(2) This enables the integration of existing functionality that is already running. The functionality is still only executed at one place.

(3) The workshop organization system does not need to have any knowledge about internals, such as the underlying data schema etc. Especially when changing data (e.g. when booking a room), the data schema will be consistent as the entire business logic is reused that is concerned with keeping the data consistent. In the context of service-oriented architectures, this concept is also part of so-called lose coupling where a service consumer is not expected to have any detailed information about the internals of the service provider. This enables a fast exchange of the service provider or the underlying business logic. This is also applicable in this scenario: As business functionality is invoked on an abstract level, the integrated system can be (relatively) easily replaced compared to an integration on data level.



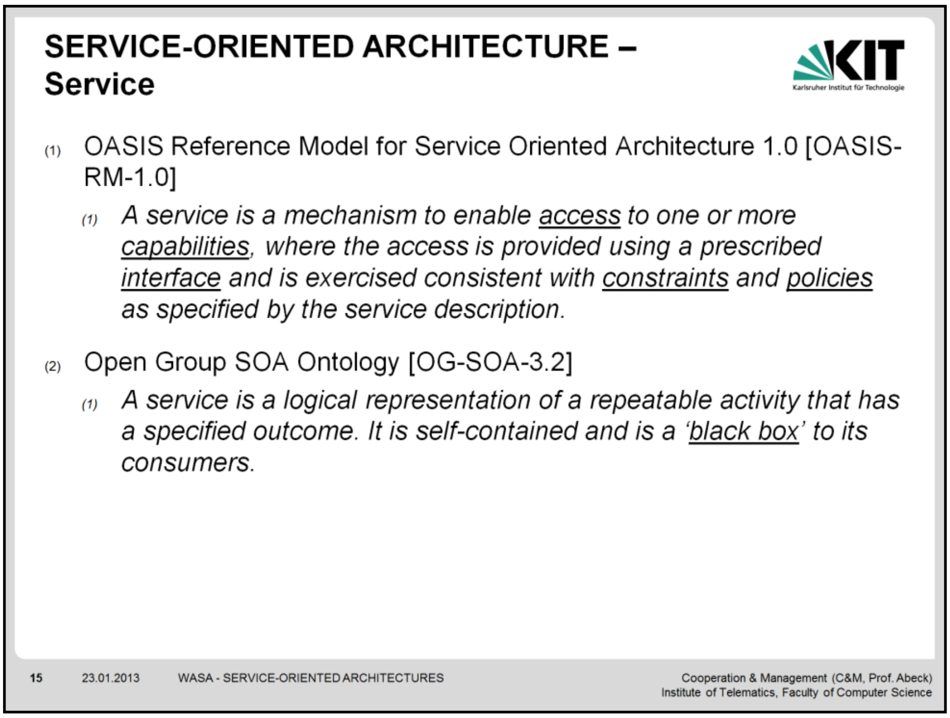
LO BUSINESS PROCESS IMPLEMENTATION E INTEGRATION SCENARIOS

(1) How is the business goal definition related to the business process controlling?

(2) In which phase of the business process management lifecycle are the business processes transferred into software?

(3) What is the difference between a reused component and a remotely invoked component?

(4) What are the advantages of an integration on a functional level?



SERVICE-ORIENTED ARCHITECTURE – Service

(1) OASIS Reference Model for Service Oriented Architecture 1.0 [OASIS-RM-1.0]

- (1) *A service is a mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface and is exercised consistent with constraints and policies as specified by the service description.*

(2) Open Group SOA Ontology [OG-SOA-3.2]

- (1) *A service is a logical representation of a repeatable activity that has a specified outcome. It is self-contained and is a 'black box' to its consumers.*

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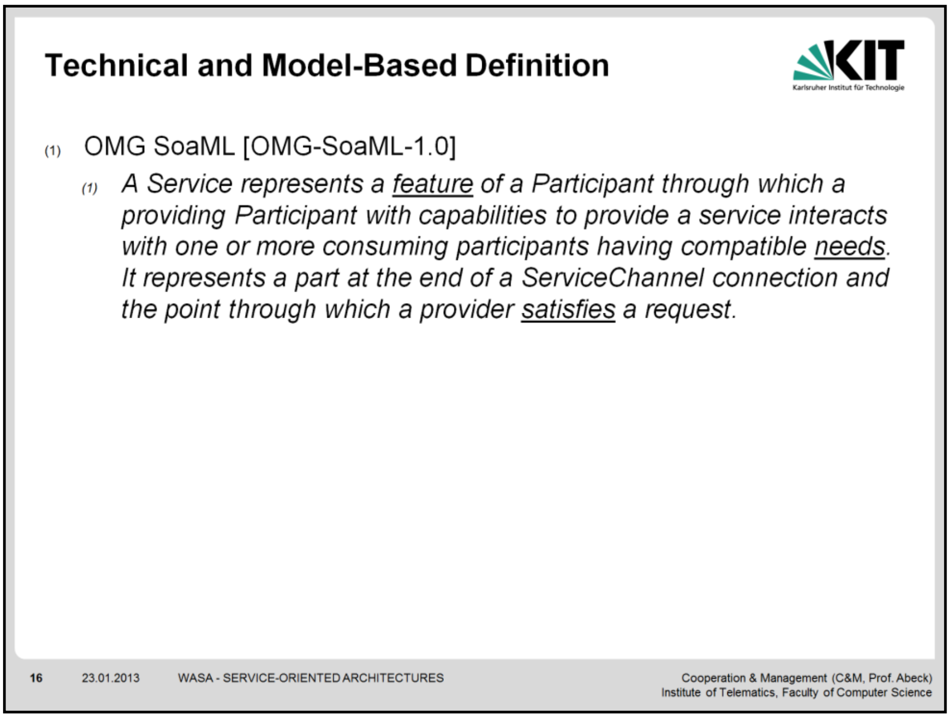
[OASIS-RM-1.0] Organization for the Advancement of Structured Information Standards: Reference Model for Service Oriented Architecture, Version 1.0, http://docs.oasis-open.org/soa-rm/v1.0/soa-rm.pdf, 2006.
[OG-SOA-3.2] Open Group: Service-Oriented Architecture Ontology, Version 3.2 Draft, https://collaboration.opengroup.org/projects/soa-ontology/documents/22766/SOA_ontology_public_draft_3_2.pdf, 2009.

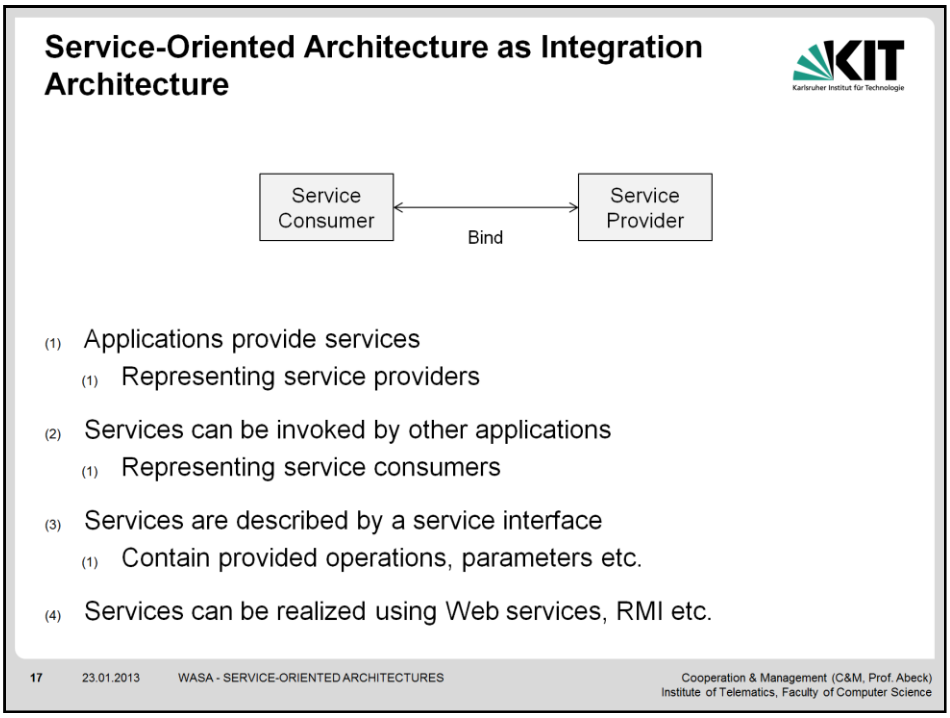


Technical and Model-Based Definition

(1) OMG SoaML [OMG-SoaML-1.0]

- (1) *A Service represents a feature of a Participant through which a providing Participant with capabilities to provide a service interacts with one or more consuming participants having compatible needs. It represents a part at the end of a ServiceChannel connection and the point through which a provider satisfies a request.*

[OMG-SoaML-1.0] Object Management Group: Service oriented architecture Modeling Language, Version 1.0.1, http://www.omg.org/spec/SoaML/1.0.1/PDF, 2012.



Service-Oriented Architecture as Integration Architecture

Service Consumer

Bind

Service Provider

- (1) Applications provide services
  - (1) Representing service providers
- (2) Services can be invoked by other applications
  - (1) Representing service consumers
- (3) Services are described by a service interface
  - (1) Contain provided operations, parameters etc.
- (4) Services can be realized using Web services, RMI etc.

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The integration on a functional level is one challenge that can be solved by means of a service-oriented architecture. The provided and running functionality is offered as service.

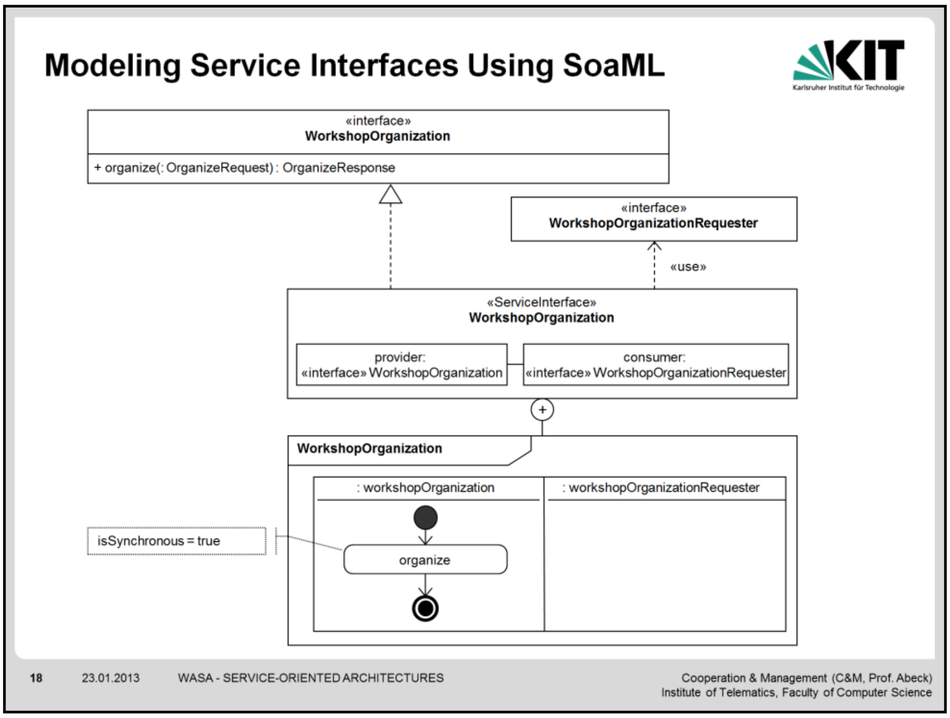
(1) The application providing this service represents the service provider.

(2) Other services can invoke provided services and the underlying applications represent service consumers.

(3) A service interface describes the service. For example it determines provided operations, the contained parameters and data types. Furthermore, operations the service consumer has to provide for receiving callbacks are defined.

(4) A service represents an abstract concept that can be realized by several technologies. Examples are Remote Method Invocation (RMI) or Web services. In latter case, the interface is described by means of Web Services Description Language (WSDL). Whilst RMI requires Java to realize the implementation logic, Web services do not require a certain technology. For example, Web services can be implemented using Java or .NET.

RMI	Remote Method Invocation
WSDL	Web Services Description Language



Modeling Service Interfaces Using SoaML

«interface»
WorkshopOrganization
+ organize(: OrganizeRequest) : OrganizeResponse

«interface»
WorkshopOrganizationRequester

«use»

«ServiceInterface»
WorkshopOrganization
provider: «interface» WorkshopOrganization
consumer: «interface» WorkshopOrganizationRequester

WorkshopOrganization
: workshopOrganization
: workshopOrganizationRequester
organize
isSynchronous = true

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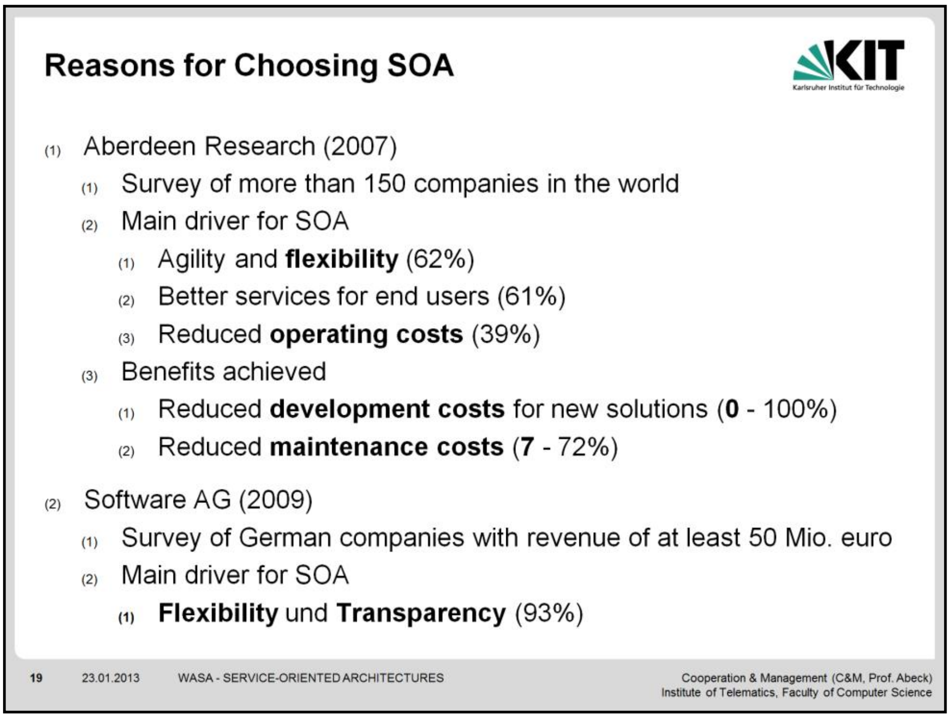
With Service oriented architecture Modeling Language (SoaML) a language for the specification of services has been standardized.

In SoaML, an element ServiceInterface exists that correlates with the conceptual understanding of a service interface. A ServiceInterface can comprise a technical interface that the service provides and a required technical interface that a service consumer has to provide in order to receive callbacks. A technical interface is a collection of signatures of operations. The signature contains the name of the operation, the parameters and their respective names and parameter types, and the return type of the operation. The types used here can be either primitive (i.e. atomic) or, as preferred in the context of service-oriented architecture, complex message types. Additionally, a ServiceInterface can and should interactions between the service provider and service consumer by means of an interaction protocol.

SoaML	Service oriented architecture Modeling Language

[OMG-SoaML-1.0] Object Management Group: Service oriented architecture Modeling Language, Version 1.0.1, http://www.omg.org/spec/SoaML/1.0.1/PDF, 2012.



Reasons for Choosing SOA

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

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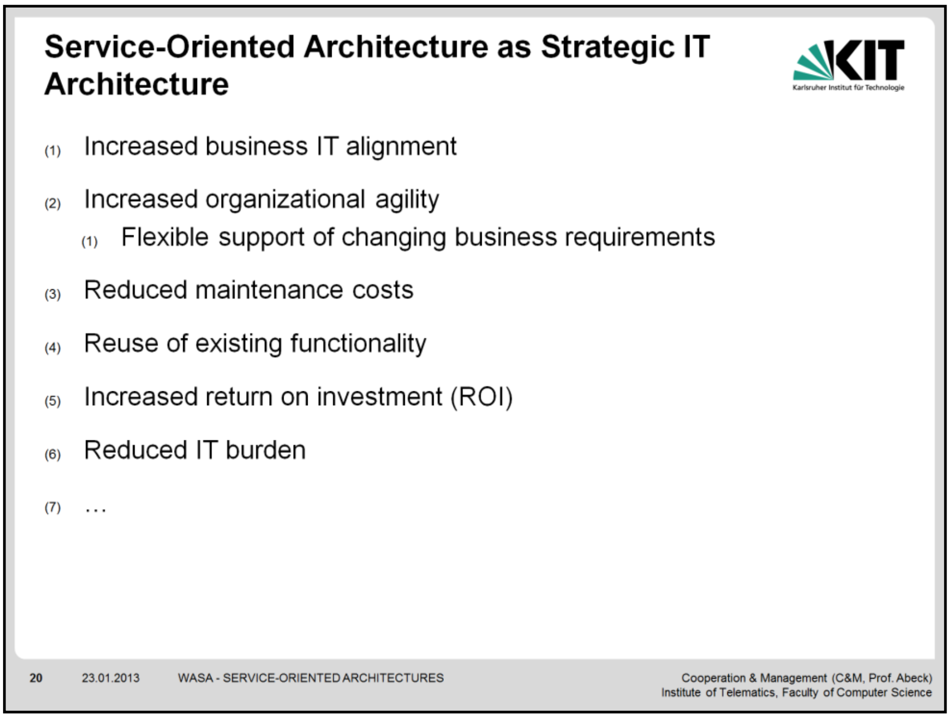
Both surveys show that the main drivers for service-oriented architectures are not mainly integration scenarios but strategic goals, such as increased flexibility and maintainability. So, obviously service-oriented architectures are more than integration architectures. This awareness helps to understand the difference between this architecture paradigm and enterprise application integration (EAI): Service-oriented architectures can be seen as one way to solve EAI challenges. However, service-oriented architectures go beyond. They constitute a paradigm to design enterprise IT from a strategic viewpoint.

EAI	Enterprise Application Integration

[Sc07] Andreas Schaffry: Von Web Services zur Middleware-SOA, 2007. http://www.cio.de/strategien/methoden/845163/.
[St09] Bärbel Strothmann: Die Finanzbranche denkt um, 2009. http://www.geldinstitute.de/data/beitrag/Artikel-Die-Finanzbranche-denkt-um_3508862.html.



Service-Oriented Architecture as Strategic IT Architecture

(1) Increased business IT alignment

(2) Increased organizational agility

  (1) Flexible support of changing business requirements

(3) Reduced maintenance costs

(4) Reuse of existing functionality

(5) Increased return on investment (ROI)

(6) Reduced IT burden

(7) …

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When considering service-oriented architectures from a strategic viewpoint, certain goals are associated with this paradigm.

(1) Designing services that fulfill certain business needs may help to align business and IT for achieving business objectives.

(2) The organization is more agile as the IT can more efficiently respond to changing business requirements.

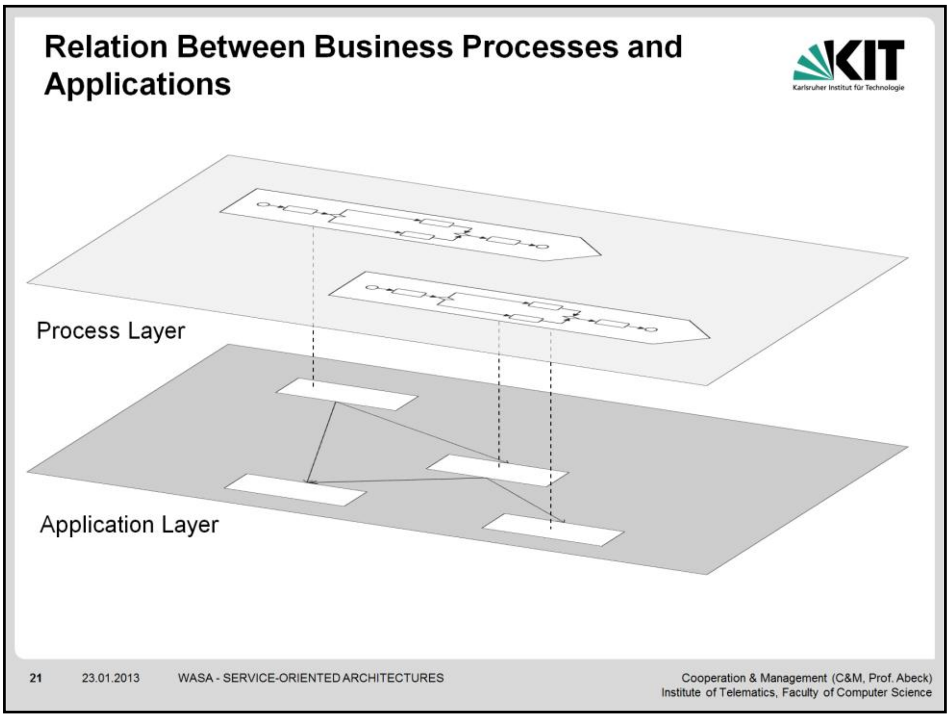
(3) For example things that belong together are part of one service. Furthermore, certain functionality is only kept within one reused service and services are loosely coupled so that they can be easily changed or replaced.

(4) Existing functionality can be easily reused as service.

(5) New functionality can be easily created and is highly reused.

(6) The IT costs can be reduced.

In order to achieve these goals several challenges have to be considered. One example is the design of services and their interfaces that highly influences these goals from a technical perspective.



Relation Between Business Processes and Applications

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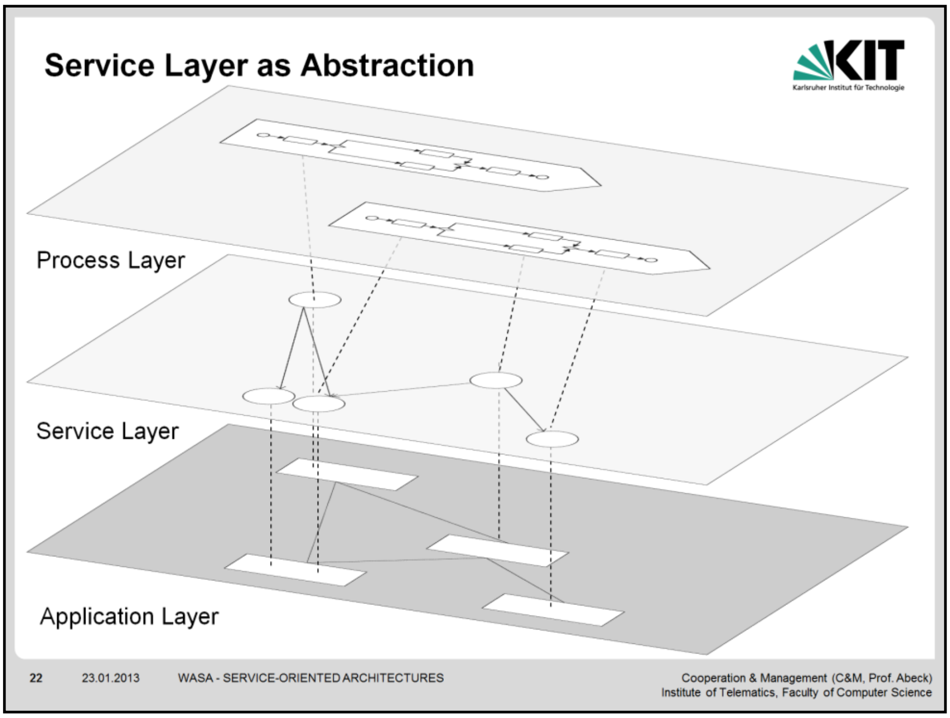
The consideration of service-oriented architectures from a strategic viewpoint requires a new understanding of IT. According to the current understanding business processes are supported by applications. These applications provide some functionality that fulfills certain business needs.

According to this understanding, services that are provided by these applications are simply technical interfaces that realize the communication between applications.



Service Layer as Abstraction

Process Layer

Service Layer

Application Layer

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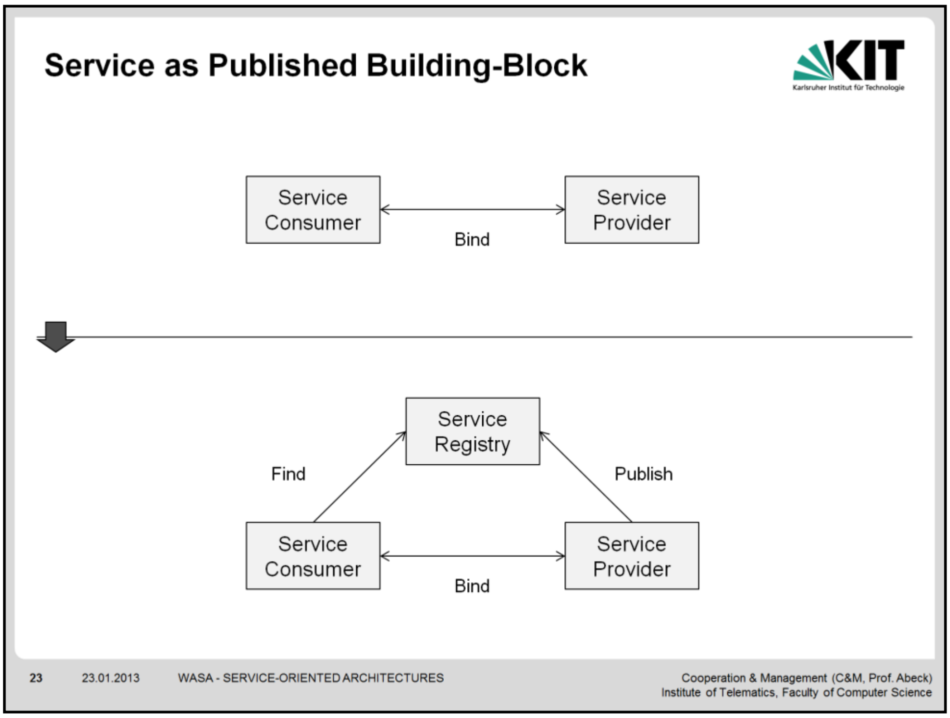
When considering service-oriented architectures from a strategic view, services represent an abstraction of the IT and their application. This abstraction is more aligned with the business and hides the underlying IT.

Also when considering dependencies, the dependencies between applications regarding their communication is transferred onto dependencies between services. The applications are only service providers and consumers and represent the implementation of certain business logic. But when structuring the IT service landscape mainly the service layer is considered.



Service as Published Building-Block

Service Consumer

Bind

Service Provider

Service Registry

Find

Publish

Service Consumer

Bind

Service Provider

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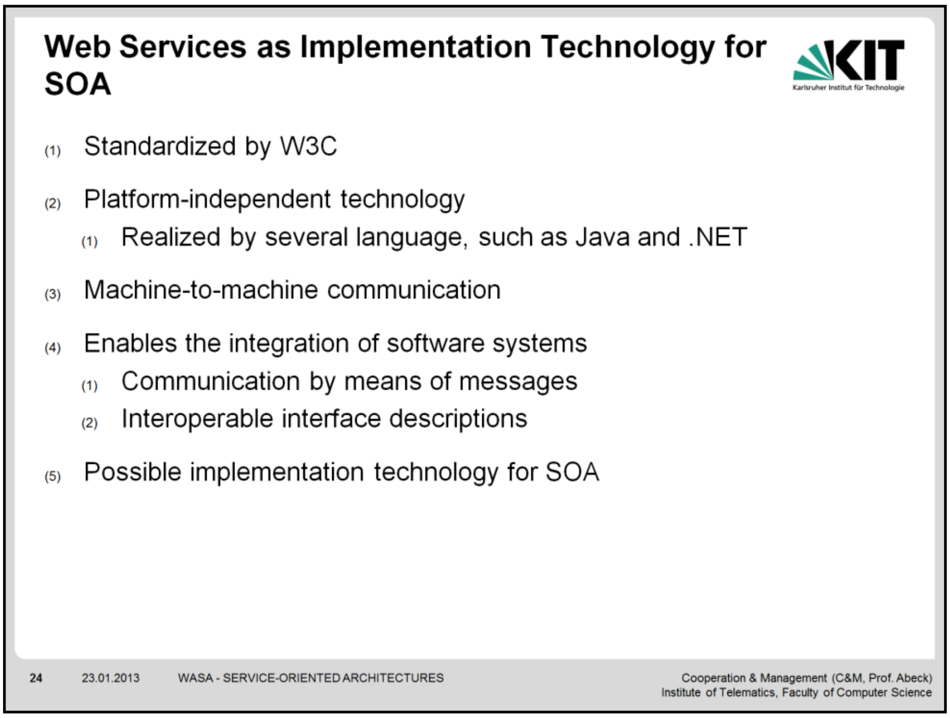
As the service layer illustrated, the concept of a service is more than an interface for integrating applications. It is an abstract description of certain functionality and constitutes a building-block of the IT.

Consequently, it is handled as self-contained artifact resulting in a description of service-oriented architectures that is well-known in literature.

A service provider publishes provided services within a service registry as central repository for services. A service consumer can find desired services within this registry and bind to the appropriate service provider.

[DJ+05] Wolfgang Dostal, Mario Jaeckle, Ingo Melzer, Barbara Zengler: Service-orientierte Architekturen mit Web Services, Elsevier Spektrum Akademischer Verlag, 2005.



Web Services as Implementation Technology for SOA

(1) Standardized by W3C

(2) Platform-independent technology

  (1) Realized by several language, such as Java and .NET

(3) Machine-to-machine communication

(4) Enables the integration of software systems

  (1) Communication by means of messages

  (2) Interoperable interface descriptions

(5) Possible implementation technology for SOA

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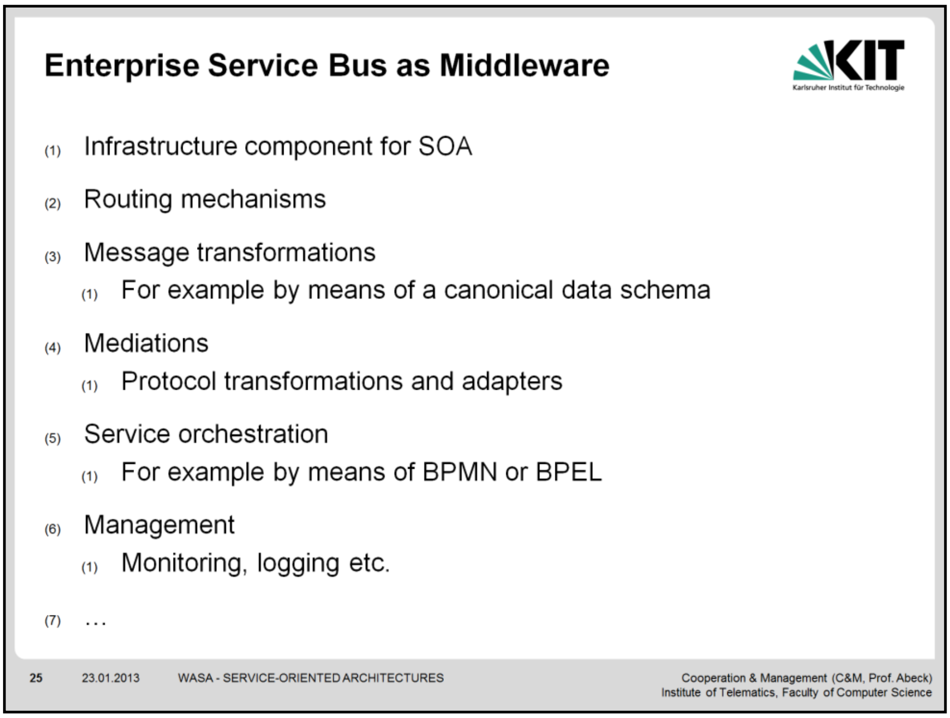
(2) Web services can be developed by means of several languages. In some languages, such as Java and .NET, the necessary functionality is part of the core libraries and does not require third-party libraries.

(3) Web services are not meant for interaction with humans. It is only for a machine-to-machine communication, i.e. the documents exchanged are not expected to be readable by humans.

(4) Web services can be used as integration mechanism. The interface can be described by WSDL and the payload can be exchanged using SOAP over HTTP.

(5) Web services are a possible technology for implementing service-oriented architectures. Actually, they even are an essential driver for the success of service-oriented architectures today.

HTTP	Hypertext Transfer Protocol
SOAP	Simple Object Access Protocol
WSDL	Web Services Description Language



Enterprise Service Bus as Middleware

(1) Infrastructure component for SOA

(2) Routing mechanisms

(3) Message transformations
   (1) For example by means of a canonical data schema

(4) Mediations
   (1) Protocol transformations and adapters

(5) Service orchestration
   (1) For example by means of BPMN or BPEL

(6) Management
   (1) Monitoring, logging etc.

(7) …

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(1) An enterprise service bus (ESB) represents an infrastructure component for implementing SOA. Even though it is often used as starting point for SOA projects, it is not SOA.

(2) Routing mechanisms enable the routing of messages to certain services depending on their content, based on rules or policies, or statically specified.

(3) Message transformations are necessary to map messages sent in a certain format into the format of the called target service.

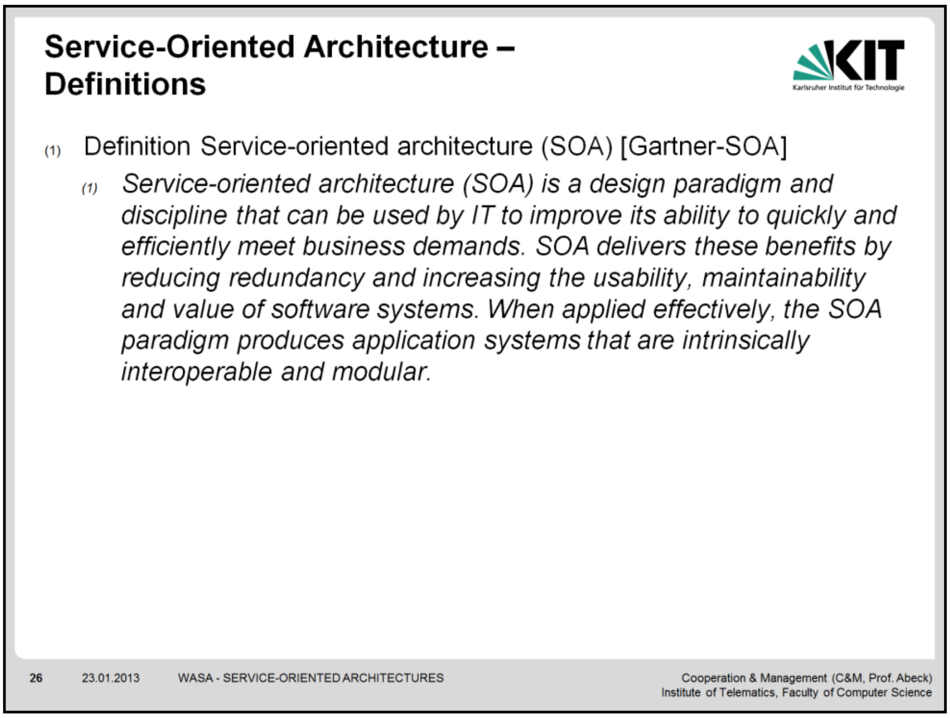
(4) In order to map underlying protocols and different interface languages, mediation is required using adapters.

(5) Most enterprise service busses include an orchestration engine to realize business processes. As orchestration languages mostly the Business Process Execution Language (BPEL) and Business Process Model and Notation (BPMN) are supported.

(6) Management functionality, such as monitoring service calls, logging etc., are necessary to ensure the fulfillment of Service Level Agreements (SLA).

(7) Today, an ESB is used as central infrastructure component providing even more functionality than mentioned on this slide. For example security concerns and Complex Event Processing (CEP) are focused by some ESB.

BPEL	Business Process Execution Language
BPMN	Business Process Model and Notation
CEP	Complex Event Processing
ESB	Enterprise Service Bus
SLA	Service Level Agreement

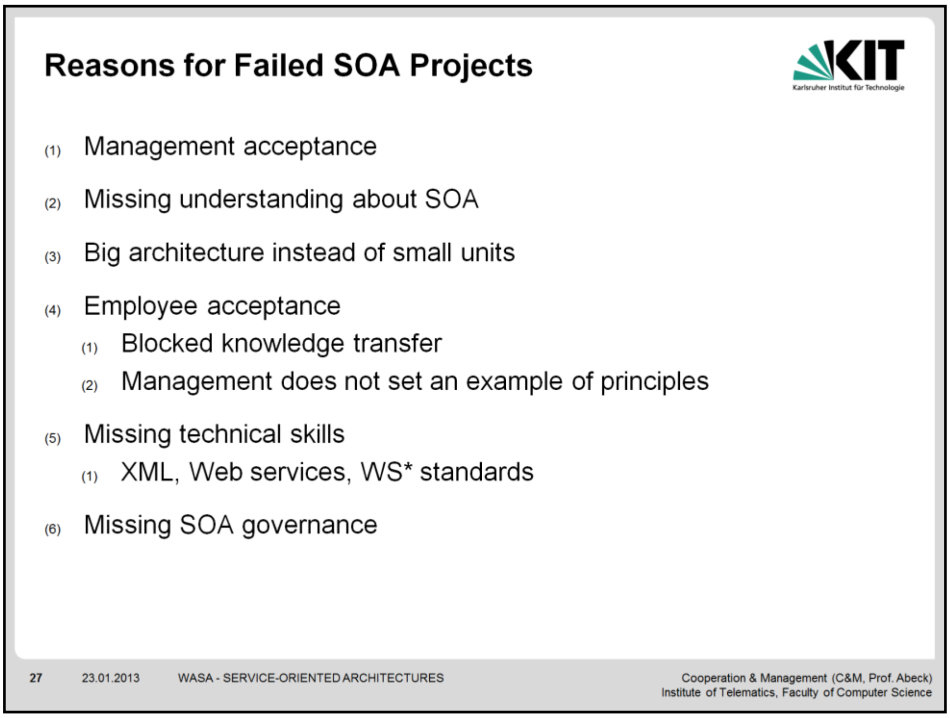


Service-Oriented Architecture – Definitions

(1) Definition Service-oriented architecture (SOA) [Gartner-SOA]

- (1) *Service-oriented architecture (SOA) is a design paradigm and discipline that can be used by IT to improve its ability to quickly and efficiently meet business demands. SOA delivers these benefits by reducing redundancy and increasing the usability, maintainability and value of software systems. When applied effectively, the SOA paradigm produces application systems that are intrinsically interoperable and modular.*

[Gartner-SOA] Gartner: IT-Glossary, Service-Oriented Architecture (SOA). http://www.gartner.com/it-glossary/service-oriented-architecture-soa/.



Reasons for Failed SOA Projects

(1) Management acceptance

(2) Missing understanding about SOA

(3) Big architecture instead of small units

(4) Employee acceptance
  - (1) Blocked knowledge transfer
  - (2) Management does not set an example of principles

(5) Missing technical skills
  - (1) XML, Web services, WS* standards

(6) Missing SOA governance

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As a service-oriented architecture is not only a technical topic the reasons why projects may fail are diverse.

(1) Sometimes SOA projects are initiated by the technical responsibilities. However, as a SOA project may target the entire IT and the business processes of the organization, the support of all employees is necessary. Without acceptance of the management, this support cannot be achieved.

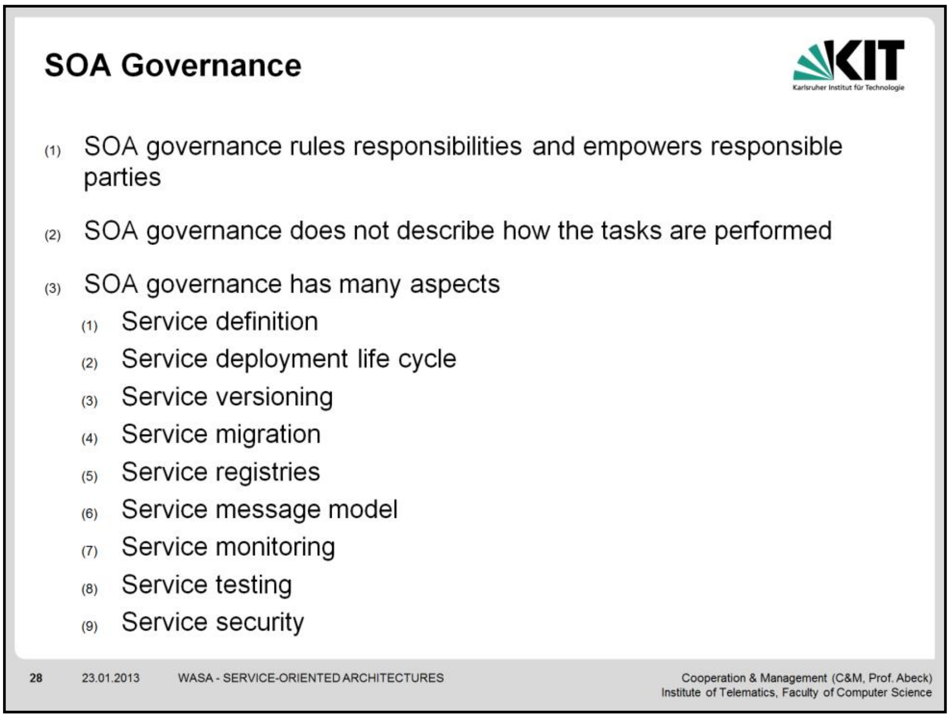
(2) Sometimes the meaning of SOA has not been understood and was not correctly communicated.

(3) Sometimes projects start with a big architecture, i.e. with the entire enterprise IT architecture. Nevertheless, starting with small units has been identified as a more promising approach.

(4) As employees are expected to transfer their knowledge, they also risk to become superfluous. That is why employees sometimes block the necessary knowledge transfer. Also they have to be motivated by the management that should set an example of these principles.

(5) As Web services are a complex technology, IT architects and developers have to provide more than basic skills.

(6) One often named reason is a missing SOA governance.



SOA Governance

(1) SOA governance rules responsibilities and empowers responsible parties

(2) SOA governance does not describe how the tasks are performed

(3) SOA governance has many aspects
   - (1) Service definition
   - (2) Service deployment life cycle
   - (3) Service versioning
   - (4) Service migration
   - (5) Service registries
   - (6) Service message model
   - (7) Service monitoring
   - (8) Service testing
   - (9) Service security

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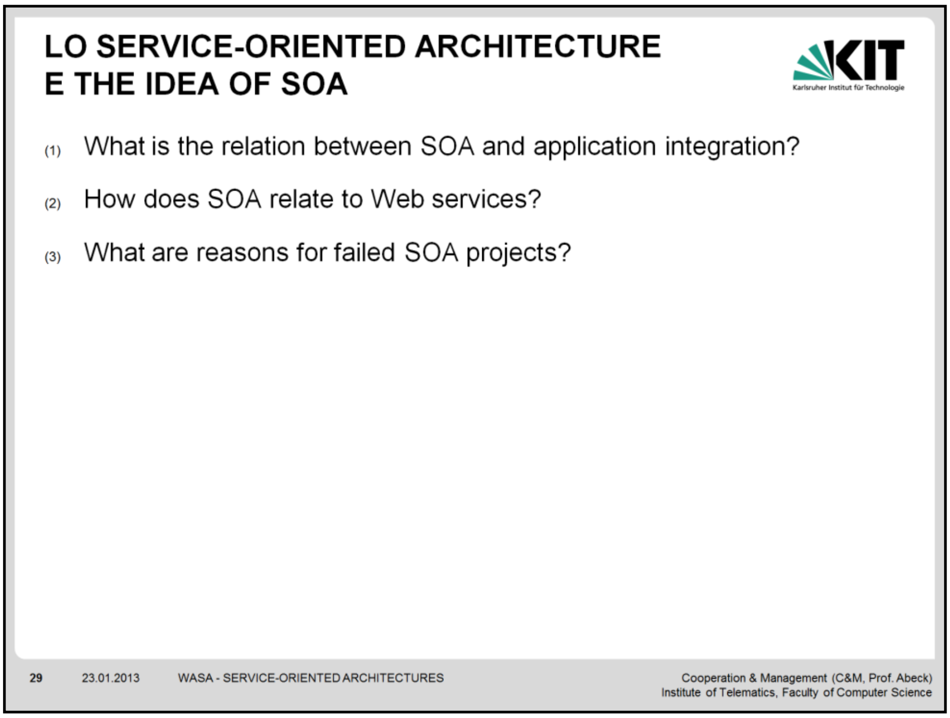
In order to understand the complexity of the service design phase, it has to be classified under a more general concept, the SOA governance.

(1) SOA governance is an important aspect when an SOA has to be established. It determines who is responsible for making decisions and what decisions need to be made.

(2) While it rules who has to do what, it does not determine how these tasks should be done. Management on the other side is the process of making and implementing the decisions that are assigned to a specific responsibility.

(3) According to [Wo06], SOA governance includes several aspects. For each of the aspects responsibilities are determined by SOA governance. This means that without SOA governance it is not defined for instance who is responsible for the design of new services or who cares about service versioning. Without these responsibilities a working SOA is hard to realize. Without any information or central decision new services could be created or even deactivated. This may lead to a lot of unmaintained services or broken service dependencies.

[Wo06] Bobby Woolf: Introduction to SOA governance, IBM Developer Works, 2007.
[PH06] Michael P. Papazoglou, Willem-Jan van den Heuvel: Service-Oriented Design and Development Methodology, Int. J. of Web Engineering and Technology (IJWET) 2006.

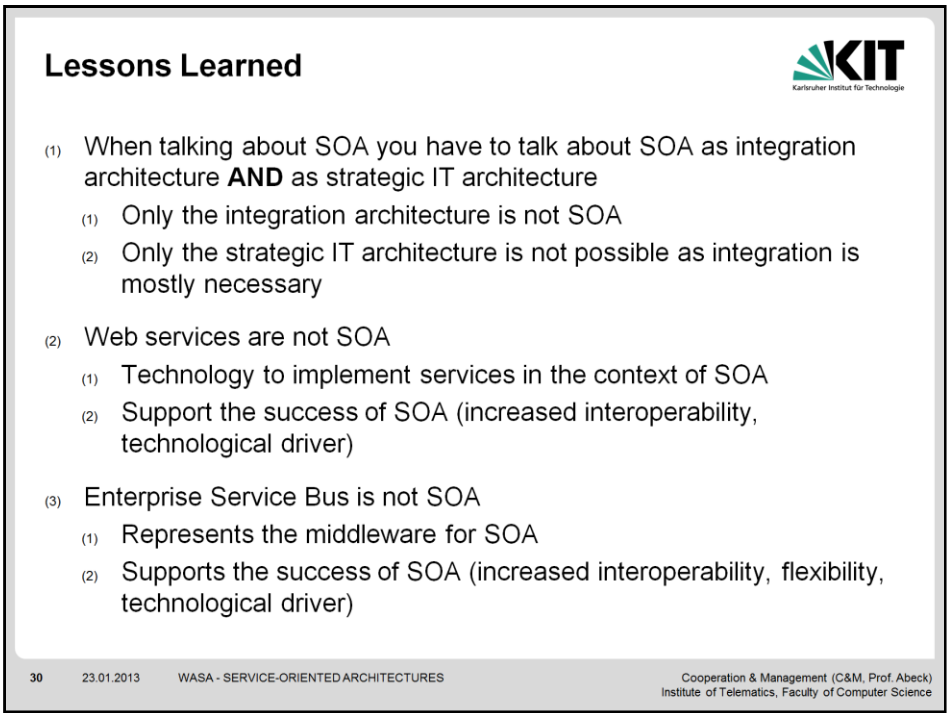


LO SERVICE-ORIENTED ARCHITECTURE
E THE IDEA OF SOA

(1) What is the relation between SOA and application integration?

(2) How does SOA relate to Web services?

(3) What are reasons for failed SOA projects?



Lessons Learned

(1) When talking about SOA you have to talk about SOA as integration architecture **AND** as strategic IT architecture

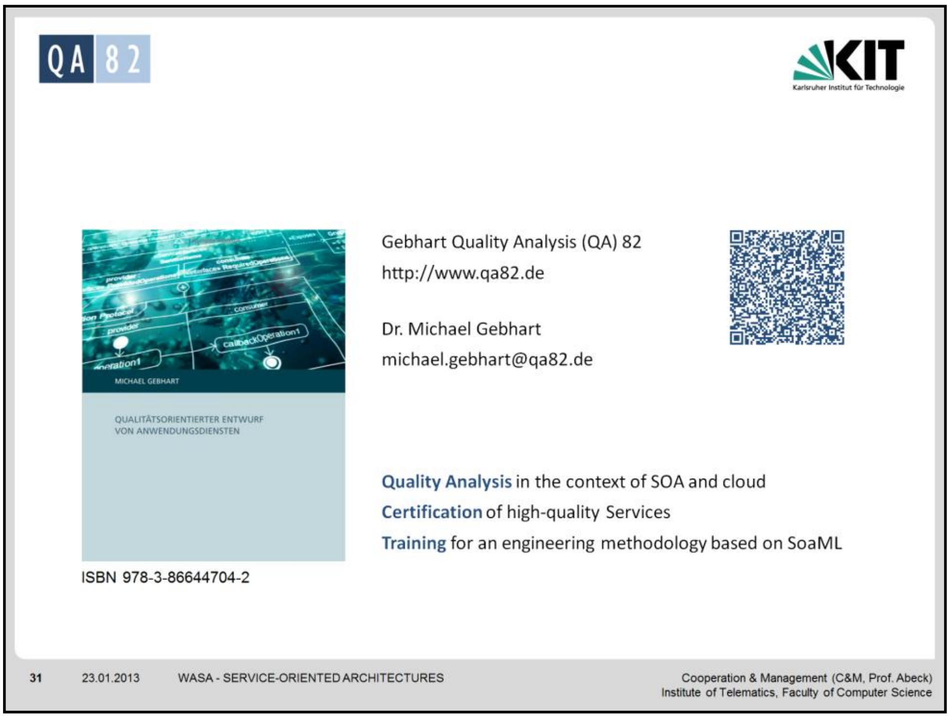
- (1) Only the integration architecture is not SOA
- (2) Only the strategic IT architecture is not possible as integration is mostly necessary

(2) Web services are not SOA

- (1) Technology to implement services in the context of SOA
- (2) Support the success of SOA (increased interoperability, technological driver)

(3) Enterprise Service Bus is not SOA

- (1) Represents the middleware for SOA
- (2) Supports the success of SOA (increased interoperability, flexibility, technological driver)



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