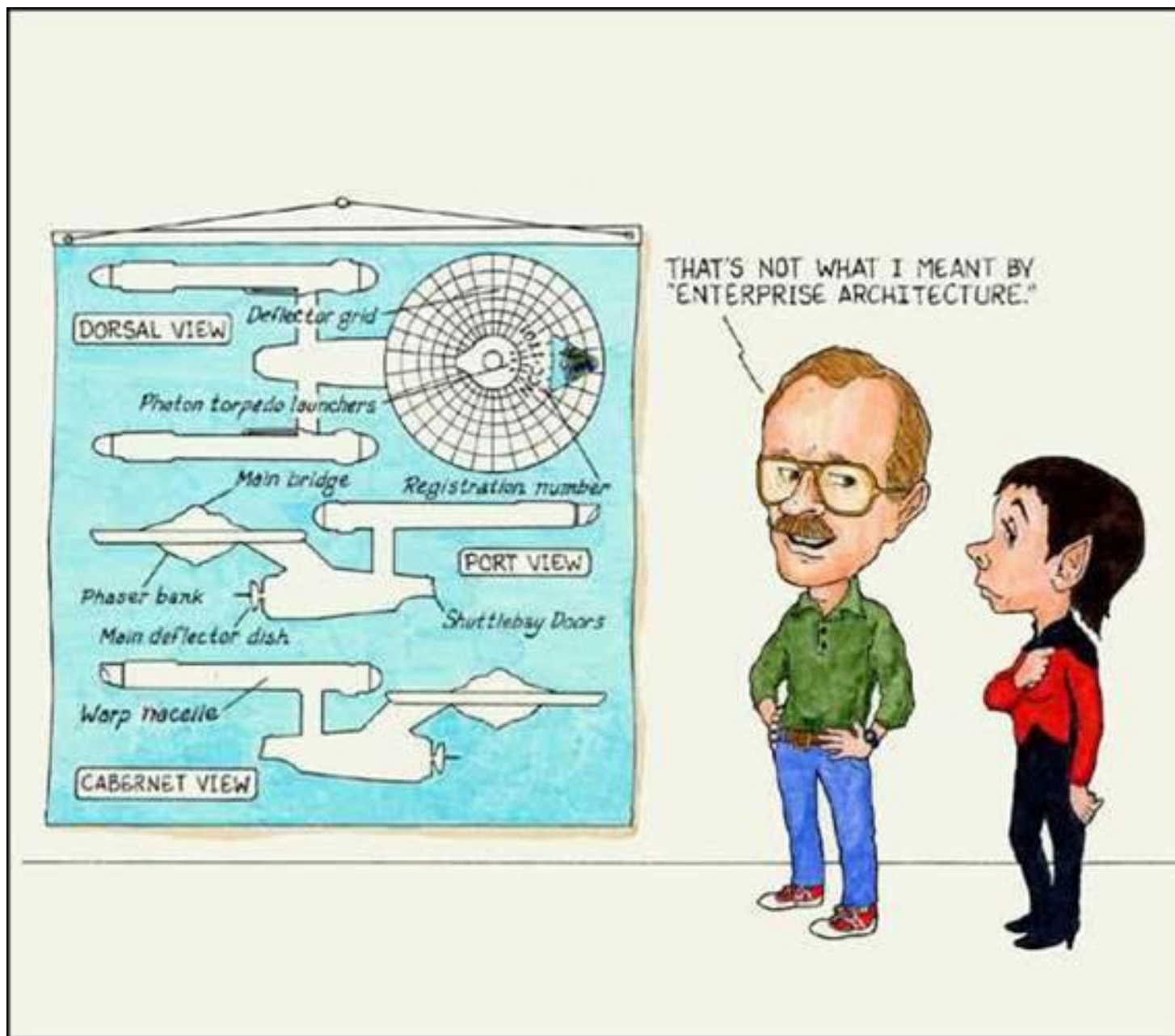


Software Engineering in Industrial Practice Enterprise Architecture



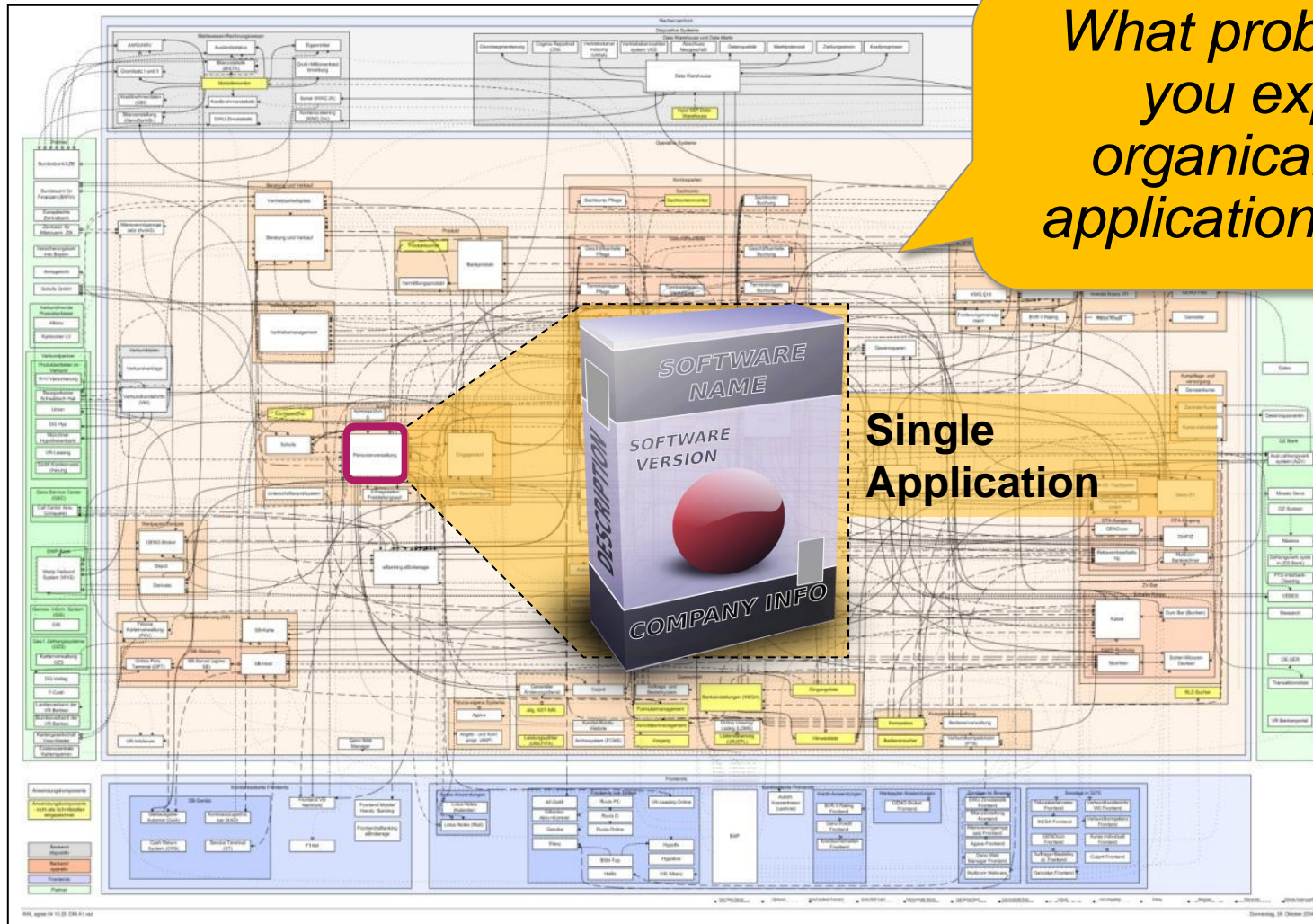
February 12th, 2016
Dr. Martin Girschick
TU Darmstadt WS2015/2016

People matter, results count.



From Single Applications to an Application Landscape

What problems would you expect in a organically evolved application landscape?



Megacity



Challenges and constraints of application landscapes are similar to those in urban planning.

Growth

- Like an organism: growth from a nucleus.
- Growth is driven by local optimization
- Initially not designed for the current size.

Historical center

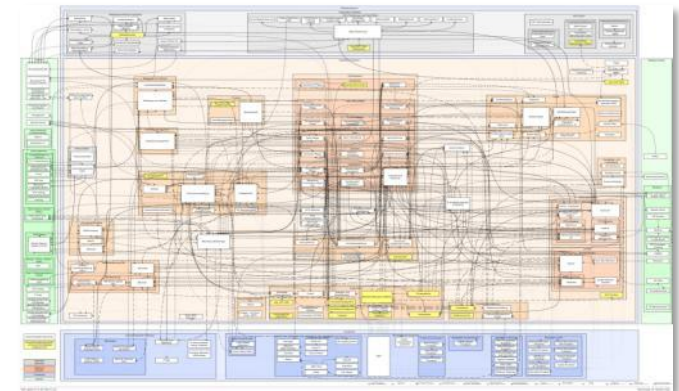
- The center has been a smaller city of it's own, designed for a smaller amount of people
 - Smaller infrastructure such as roads, etc
- Application landscapes derive from monolithic systems

Always on

- Cities are always “in use”, which makes it difficult to transform them – so are application landscapes.

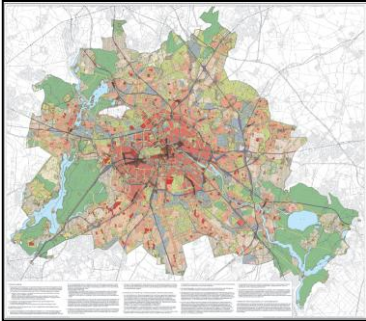
Many different stakeholders

- Contain functionality for many, sometimes contradictory purposes, which makes mediation necessary



We know from urban development the various planning tools for different objectives

Space utilization strategies/spacial investment control



Space utilization plan

Guides for subject areas such as working, living, supply and disposal



Urban development plan

Type of development (residential building, office building, etc.), specifications (height, amount of open space, etc.)



Development plan

Layout of streets, supply and disposal structures, etc.



Infrastructure plan

Strategic

Operative

Agenda

- Enterprise Architecture - overview
- **Enterprise architecture management in a nutshell**
- Quasar Enterprise – business architecture
- Quasar Enterprise – ideal application landscape
- Quasar Enterprise – managed evolution

What is an Enterprise Architecture Framework?

From Wikipedia (https://en.wikipedia.org/wiki/Enterprise_architecture_framework) :

- *An **enterprise architecture framework (EA framework)** defines how to create and use an enterprise architecture.*
- *An architecture framework provides principles and practices for creating and using the architecture description of a system.*
- *It structures architects' thinking by dividing the architecture description into domains, layers or views, and offers models ... for documenting each view.*
- *Wikipedia lists more than 40 frameworks, for example TOAF, Zachman and IAF*
- The Integrated Architecture Framework (IAF) was developed by Capgemini in 1993 and still maintained and enhanced by Capgemini.
- It provides a content framework and meta model to relate information within an enterprise architecture.

IAF Abstraction Levels: Why? What? How? With what?

Contextual

Understand! Why this initiative? Which objectives, what scope and which

Governance

Security

Business

Information

Information System (IS)

Technology Infrastructure

Conceptual

Describe! What are the services that are required to satisfy the future

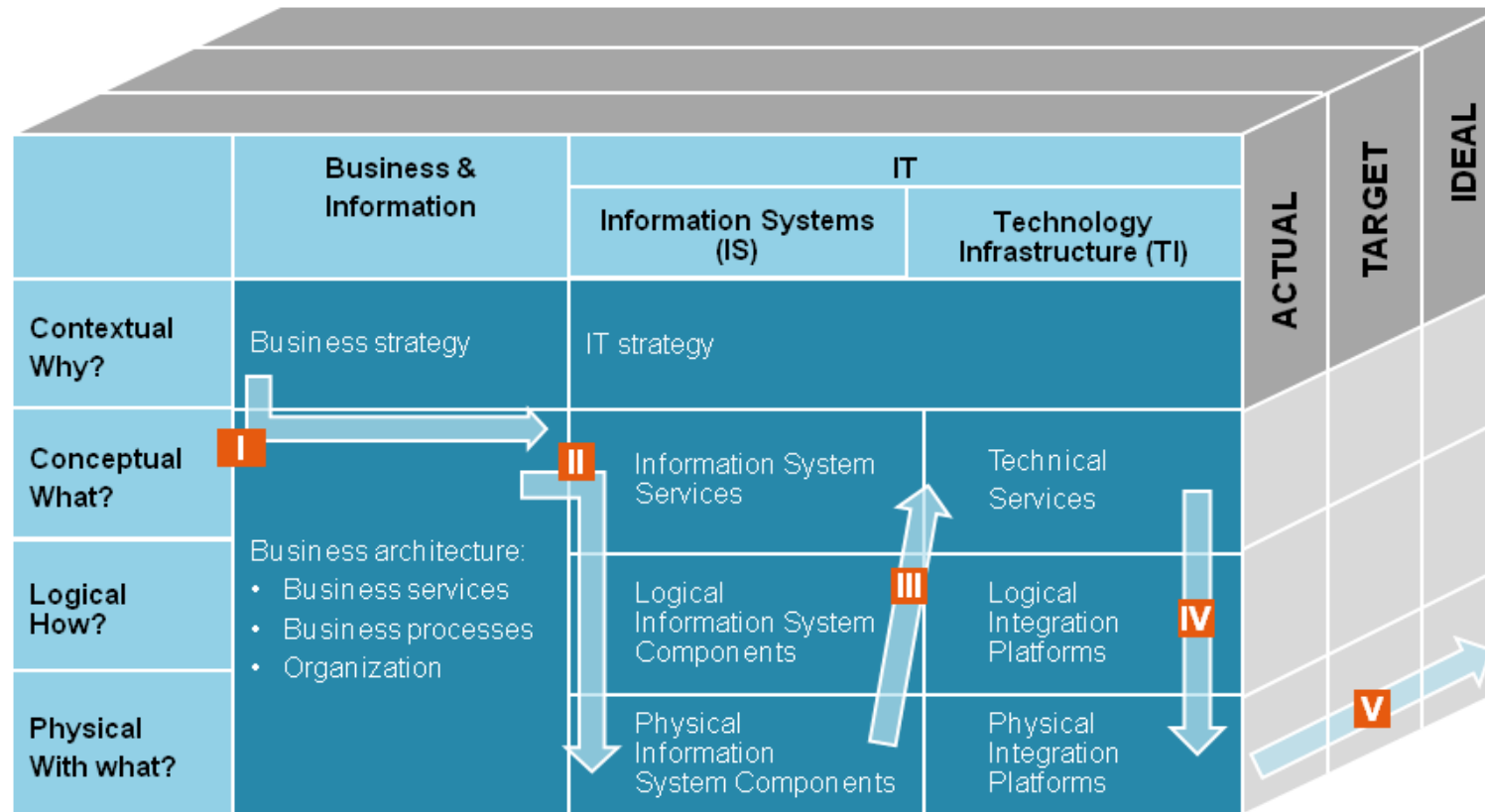
Logical

Structure! How are conceptual elements grouped into logical solution

Physical

Allocate! With what can logical solution components be realised?

IAF & Quasar Enterprise



I From the strategy to the business architecture

II From the business architecture to the ideal application landscape

III Integration

IV Integration platforms

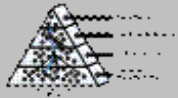
V Evolution

Quasar 3.0
(Chapter 9)

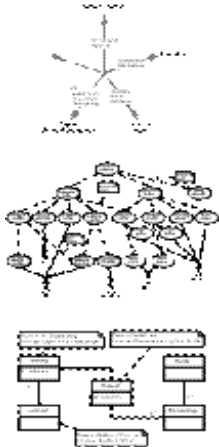
The Quasar Enterprise Approach in a Nutshell

Step 1: Understanding the business

Business

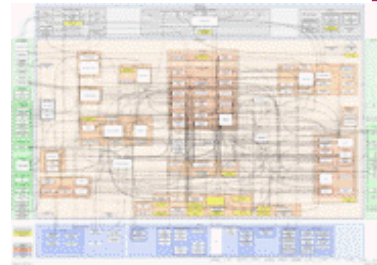


Business architecture



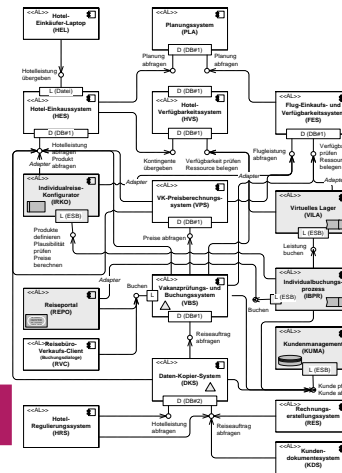
Step 3: Ascertaining and appraising the actual situation

As Is



From As Is to Target

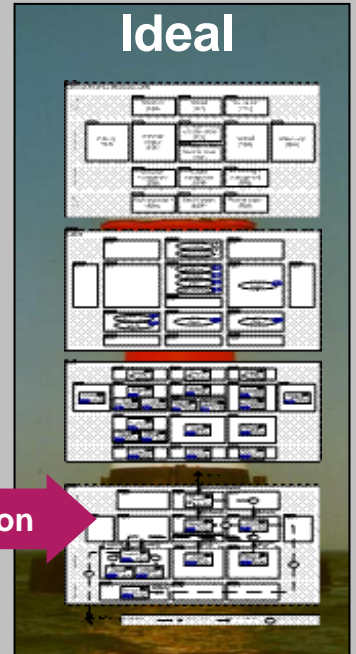
Target



Based on

Step 2: Creating the ideal

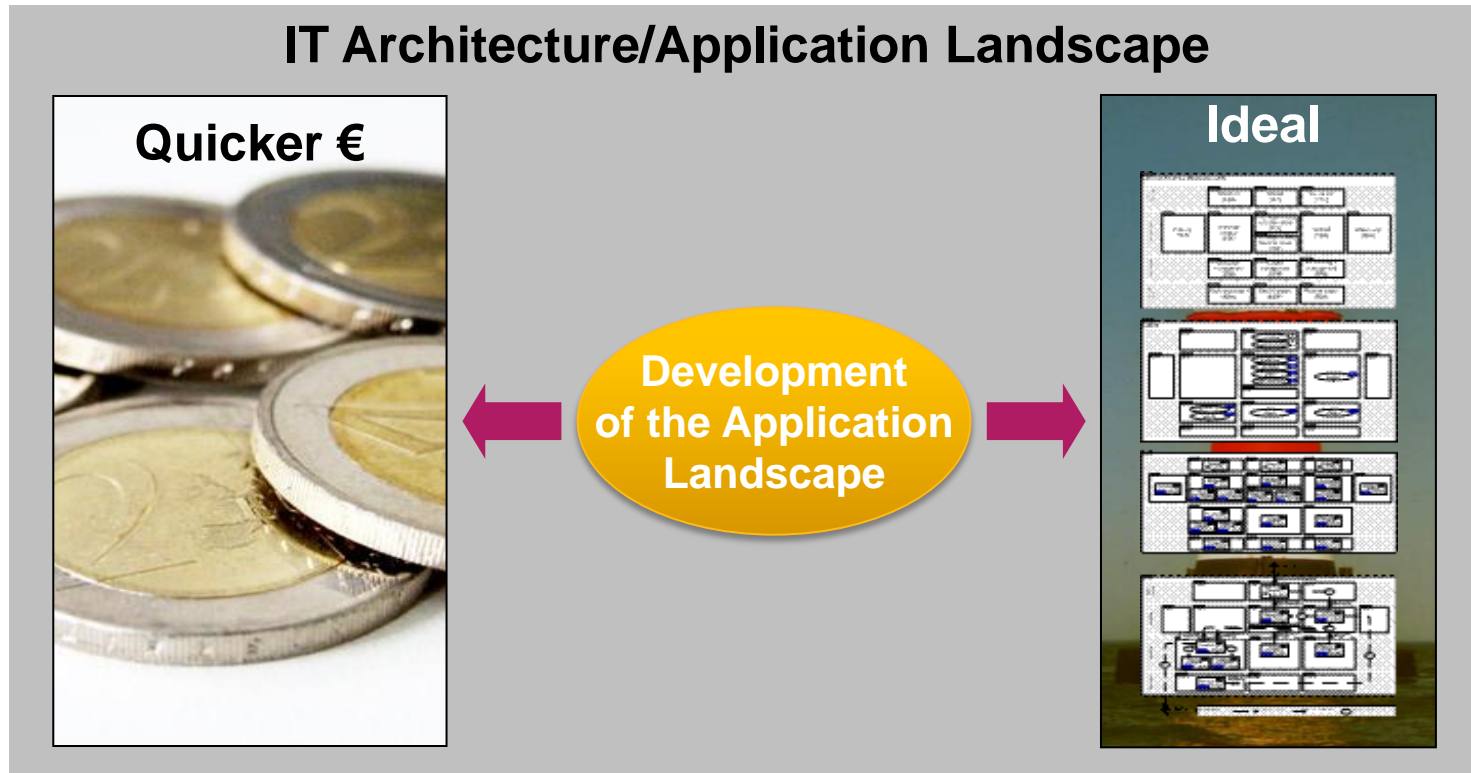
Ideal



Based on

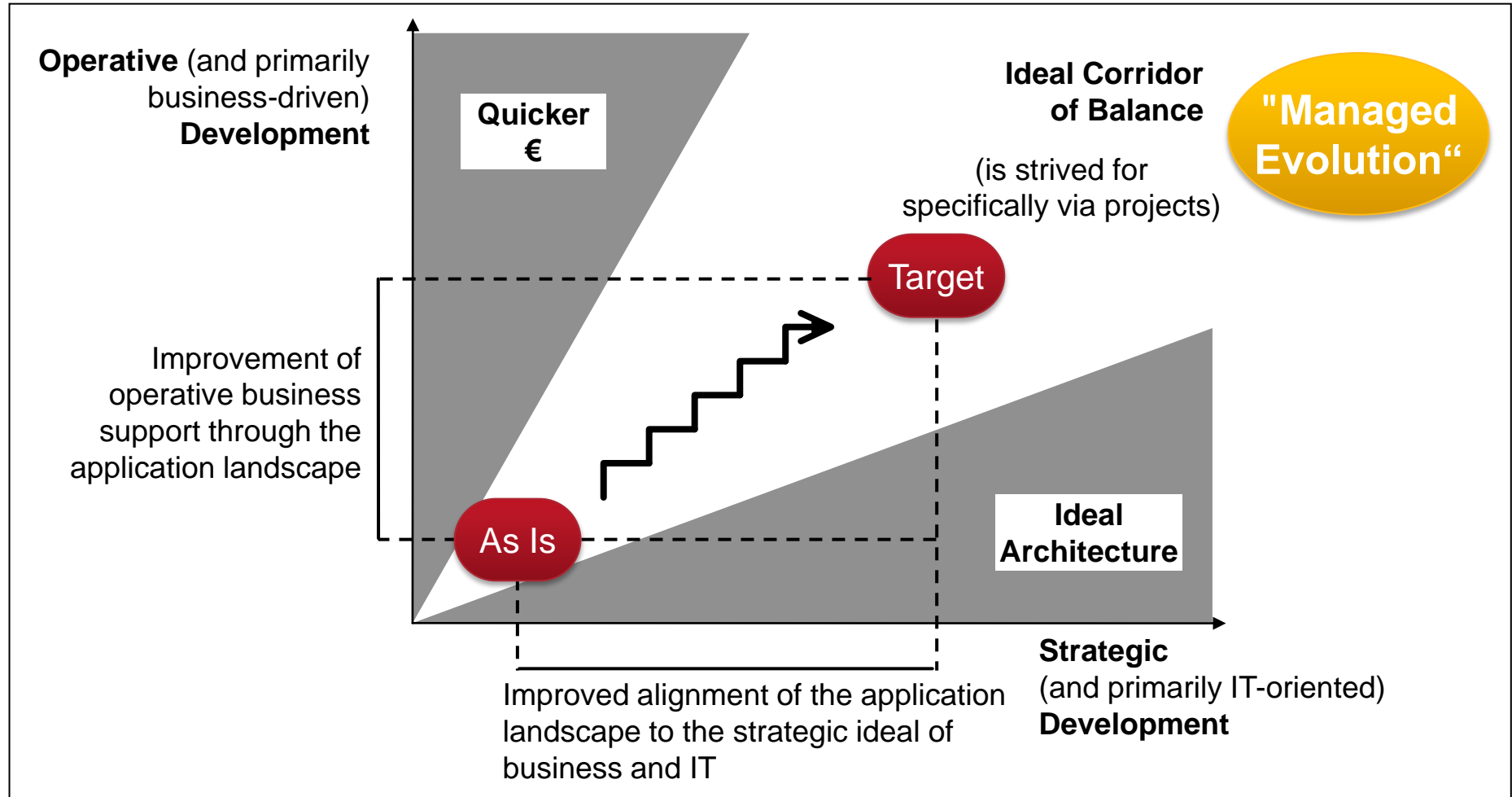
Business and ideal represent two poles - the application landscape must satisfy both as best as possible

Overview of the drivers in the design of an AL



The architect plans the development of the application landscape as a balance between these two requirements

Overview of the drivers in the design of an AL



The most important paradigm for designing application landscapes is service oriented architecture.

What is SOA?

Understanding of SOA

Variant A

- *Specific technology (such as web services)*
- *Software engineering concepts that form the basis for technologies such as web services*

No new term is necessary here:

- Component, interface and operation are well-known and defined terms

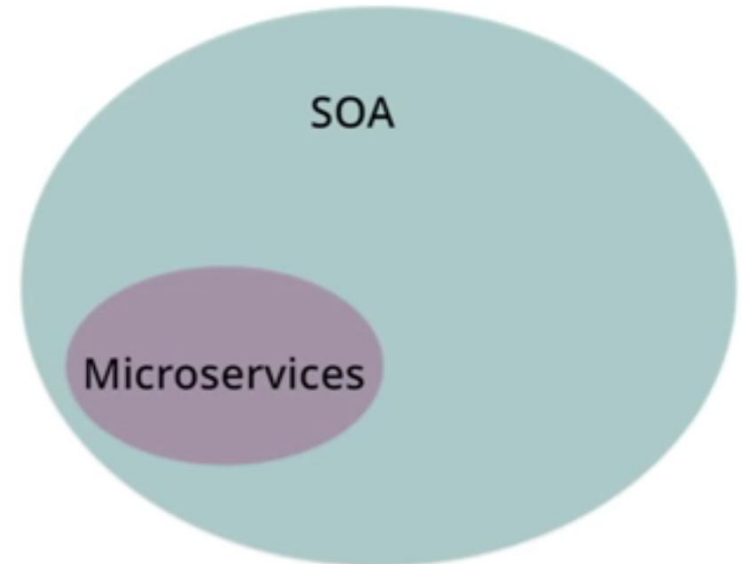
Variant B: Paradigm

- *In order to first structure the business of a company,*
- *In order to then derive from the business corporate architecture the architecture of the IT application landscape*

This understanding of SOA is used from here on in

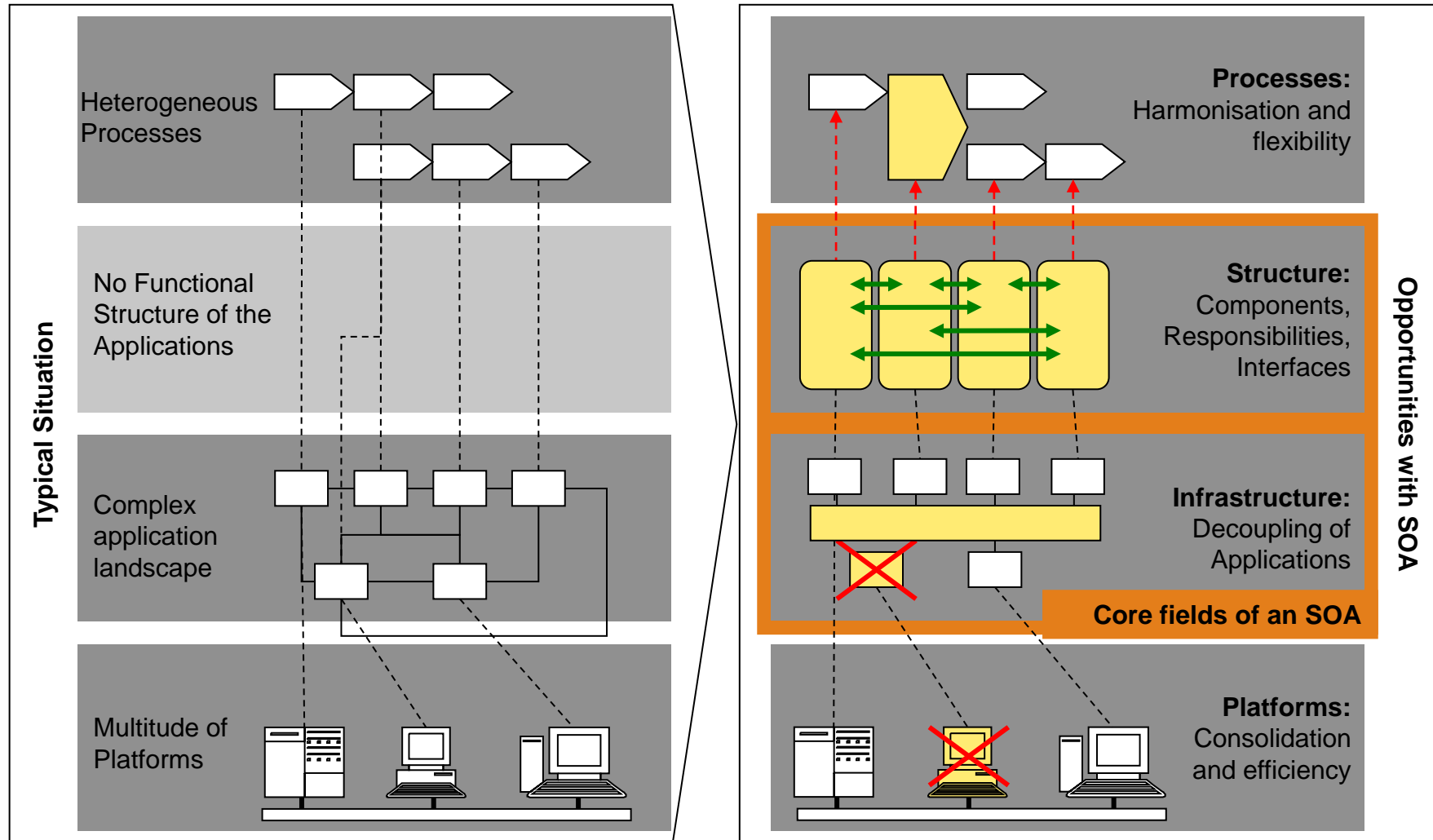
SOA versus Microservice Architectures

- Microservices are hyped at the moment
- Some people say, it's the same as SOA
- It all depends on the definition!
- Some key aspects
 - Homogenic vs. Heterogenic architectures
 - More automation, continuous deployment
 - What is a better fit for a company and its processes
- See <https://www.youtube.com/watch?v=wgdBVIX9ifA&feature=youtu.be&t=13m10s> for a reasonable explanation of the differences (I recommend watching the whole video)



Service-oriented architecture is the approach for continued development of the application landscape

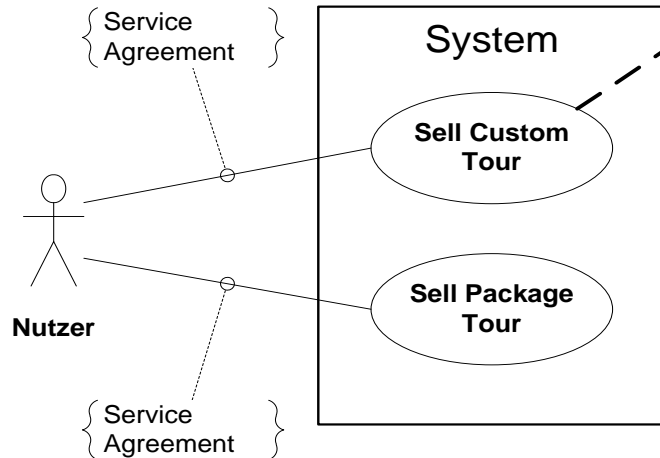
Service orientation: Bridge between business and IT



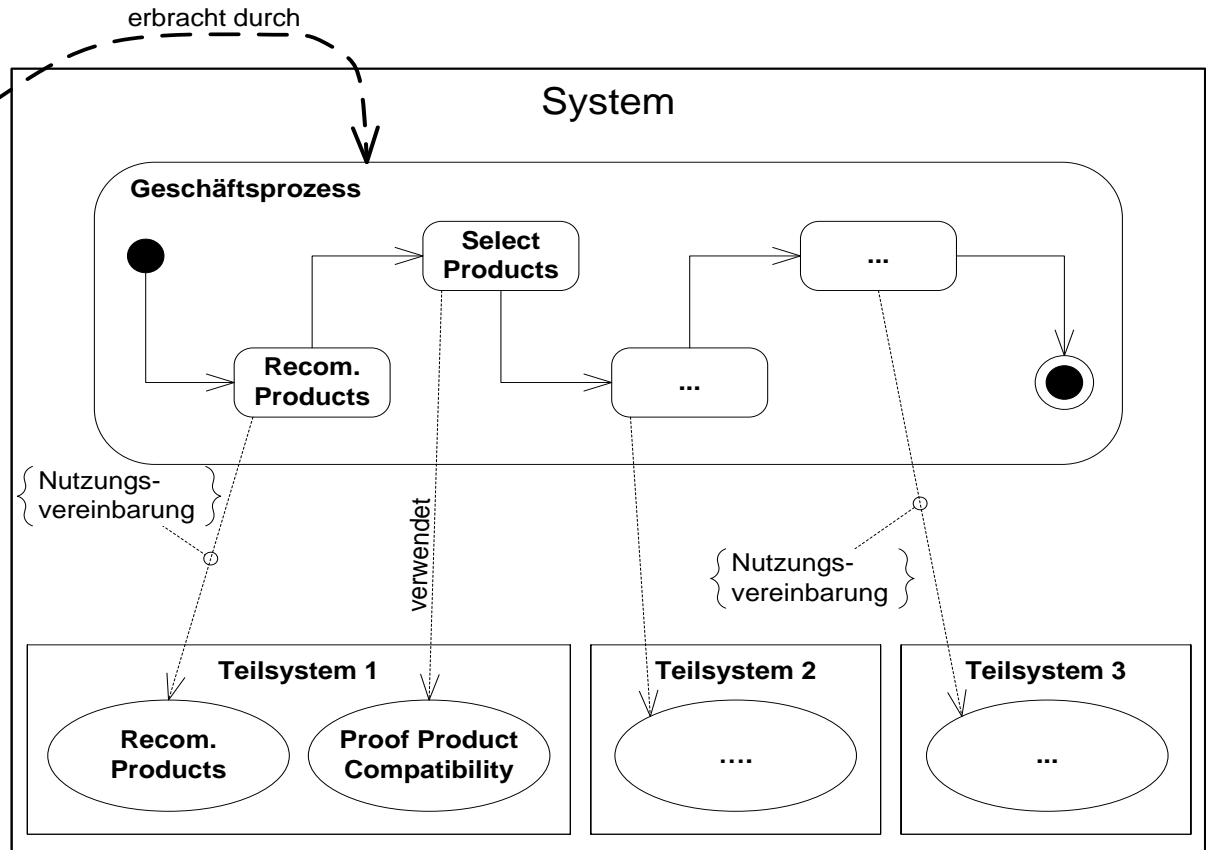
What is a service actually? Strict concentration on the definition of the system service to be provided

Service orientation: External view of a system

Looking at the System
from the outside



Looking the Inside of a System
(Detaillierung Service A)



Business services as modules of the business architecture form the ideal model for application services of the SOA

Service orientation: Business services and application services

Business services

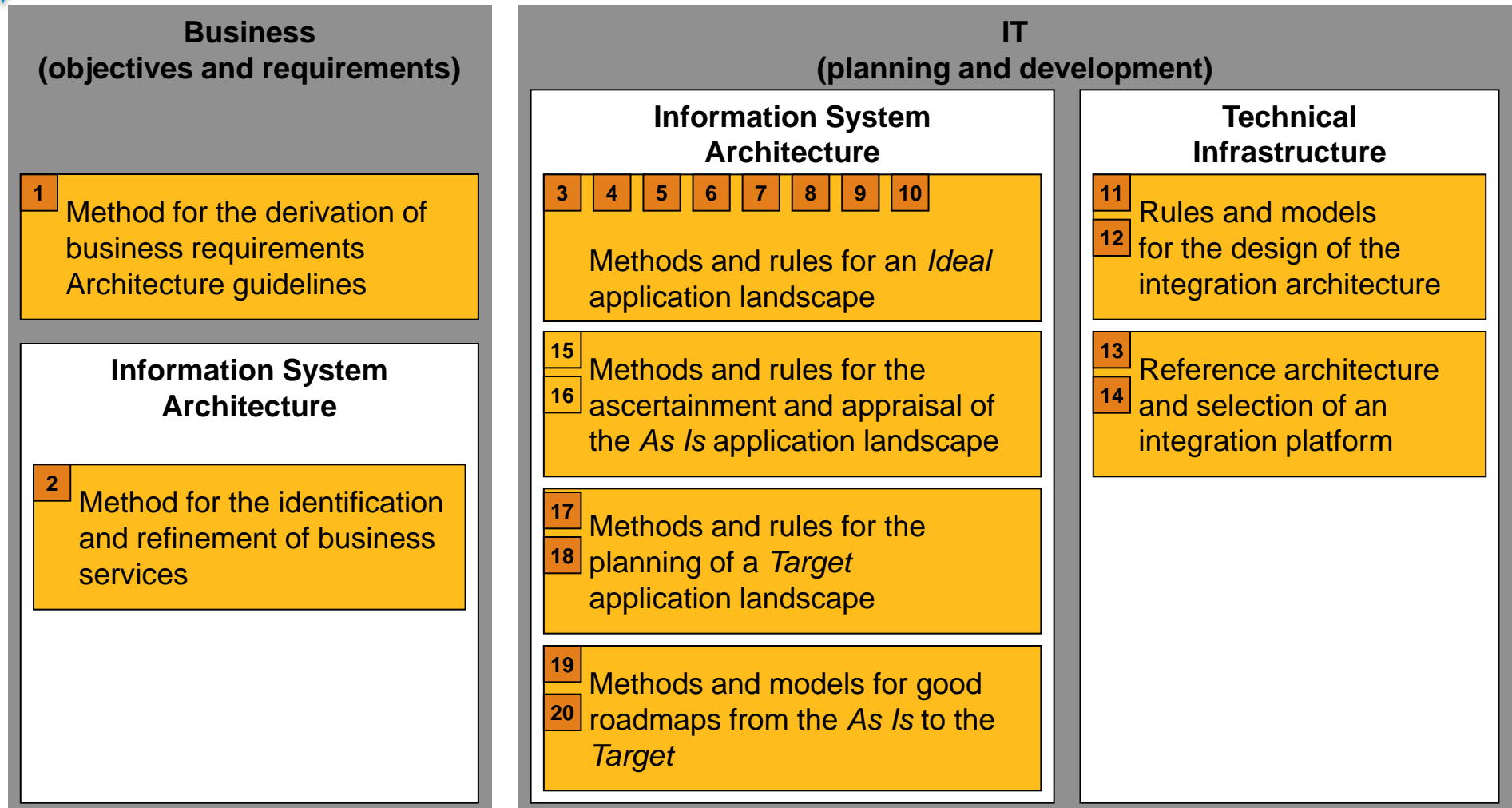
- represent functionality that has a direct business significance (e.g. transfer of money for banks)
- are used in a uniquely defined way (e.g. with money transfer form OR via online banking (but not on demand))
- result in clearly defined reactions and effects (e.g. acknowledgement, debiting of one account and crediting of the other)
- are within the context of contractual obligations and usage (e.g. to balance an overdrawn account or to credit the target account after a short time)
- are offered outwards at the boundaries of the organization (e.g. in a bank branch or also by a main bank or an appropriate department internal to the bank)

Application services of the SOA

- are based on the ideal conceptions of the business services
- represent business services where IT support is sensible
- are offered by components of the application landscape

Quasar Enterprise provides proven method modules for this service-oriented development

Motivation: Overview of the Quasar Enterprise modules



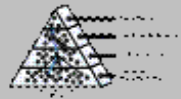
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- Enterprise architecture management in a nutshell
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- Quasar Enterprise – ideal application landscape
- Quasar Enterprise – managed evolution

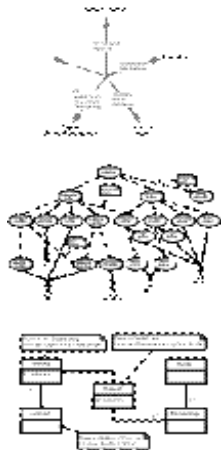
The development of corporate architectures is based on the business and on the ideal

Step 1: Understanding the business

Business

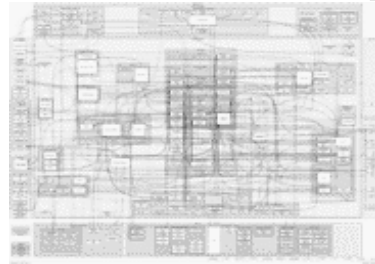


Business architecture



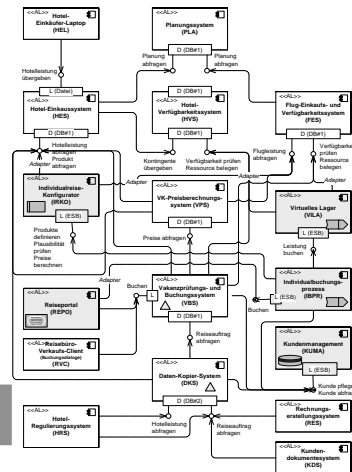
Step 3: Ascertaining and appraising the actual situation

As Is



From As Is
to Target

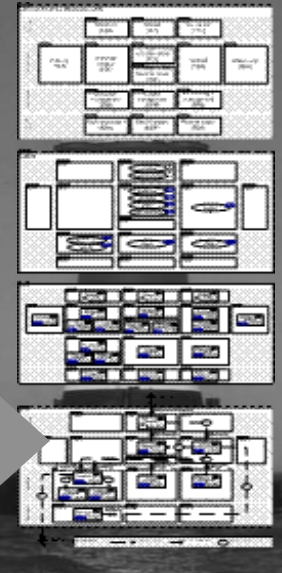
Target



Based on

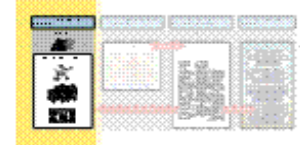
Step 2: Creating the ideal

Ideal



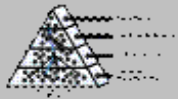
Based on

The architect must first understand the business for the service-oriented design of an application landscape



Step 1: Understanding the business

Business



Business architecture



The architect derives the architecture guidelines from the business objectives and requirements.

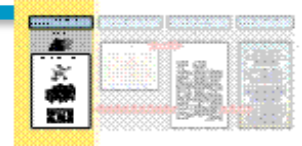
The IT architect identifies and appraises the relevant business dimensions.

The architect identifies and refines the business services as the basis for a genuine SOA ...

... and determines the associated business objects

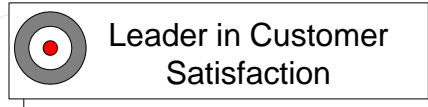
Business objectives and architecture guidelines – why does a company do what it does?

The business architecture



Identify business objectives:

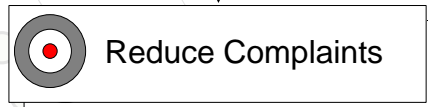
Identify business objectives in the business strategy.



Ascertain to which decision rules a company is to trade

Derive business requirements:

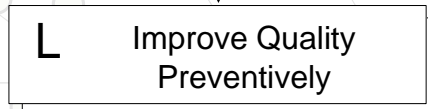
Identify derived objectives.



Ascertain how a company needs to modify the actual situation to achieve the (business) objectives.

Derive architecture guidelines:

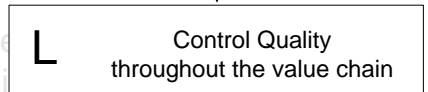
Derive architecture guidelines and agree with the business.



Define objectives and limiting framework conditions for the future business architecture.

Detail Architecture Guidelines:

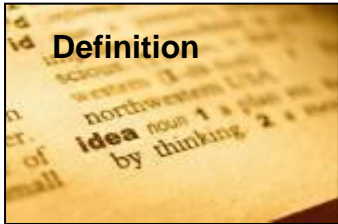
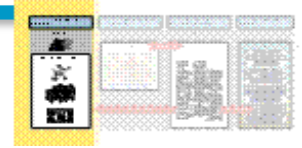
Detail agreed guidelines.



Define specific activities for the design of the business architecture.

Business dimensions – What are the customers, products, etc. of a company?

The business architecture



Business dimensions structure the business by specifying the distinctive features of a business (the *Business Principles*). Its characteristics to be regarded as relevant reflect the business objectives of the company.

Examples of business dimensions:

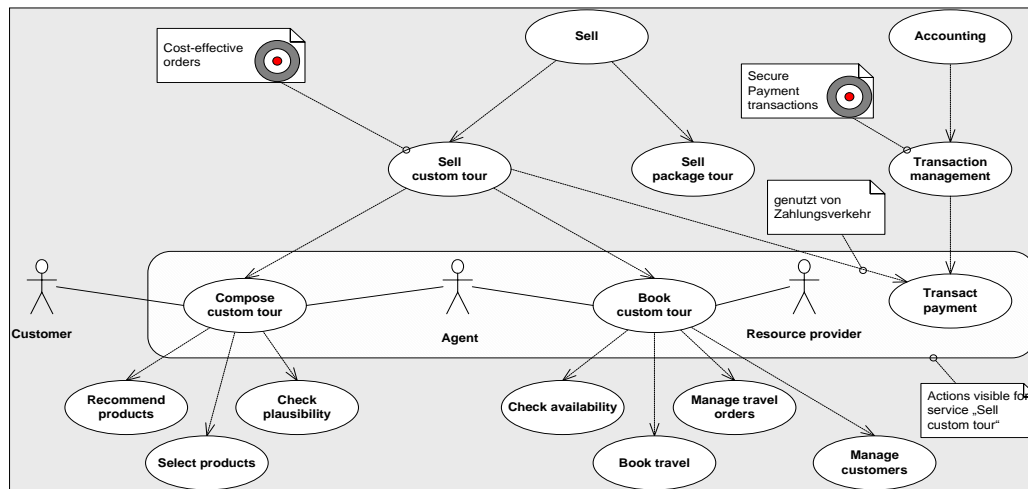
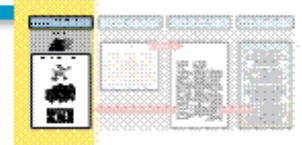
- **Customers/brands:** Which different customer segments does a company address with different brands
 - Travel industry: Cheap brands and premium brands
 - IT service provider: Differentiation projects, hybrid projects and efficiency projects.
- **Products:** Which (main) product categories does a company offer
 - Travel industry: Package tours and individual tours
 - IT service provider: System creation, system integration and consultancy.
- **Customer channels:** Via which channels does a company address its customers and via which channels does a company sell its products
 - Travel industry: Travel agents, Internet and call centres
 - IT service provider: New customer business and follow-up business
- **Part of the value-add chain:** What does the company produce itself and what does it buy in:
 - Travel industry: Own airline and hotels for the sale of holidays
 - IT service provider: Integration of software systems using own products.

Business services as the basis for a genuine SOA and associated business objects.

The business architecture

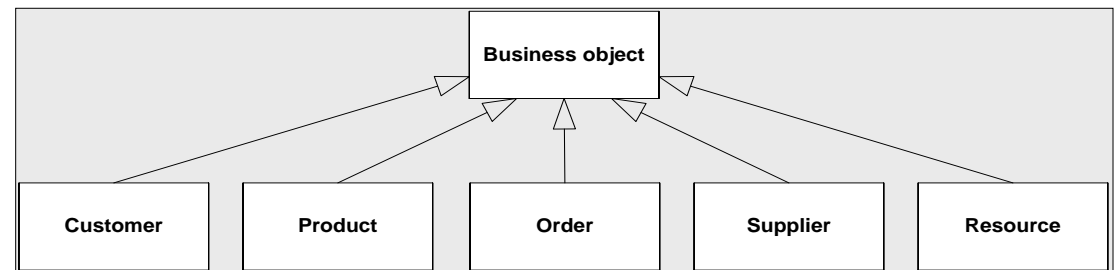
1

2



2

Identification of
Business Services



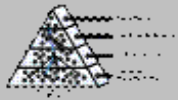
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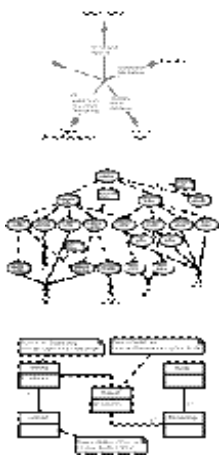
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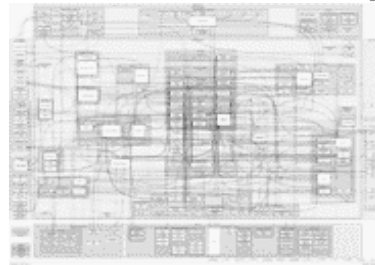


Business architecture



Step 3: Ascertaining and appraising the actual situation

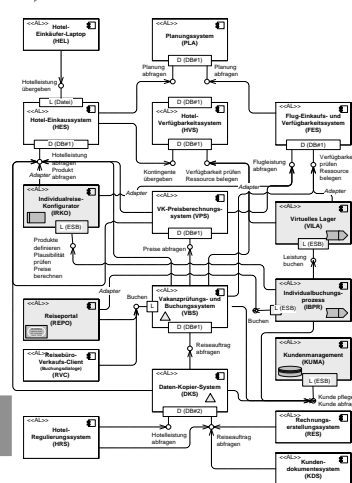
As Is



From As Is to Target

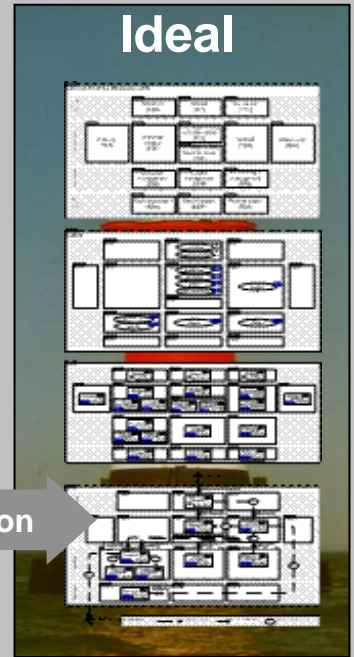
Step 4: Creating the target architecture

Target



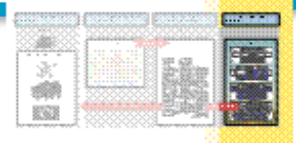
Step 2: Creating the ideal

Ideal



If architects understand the business, they begin to develop an ideal picture of the application landscape

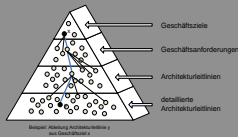
Ideal application landscape



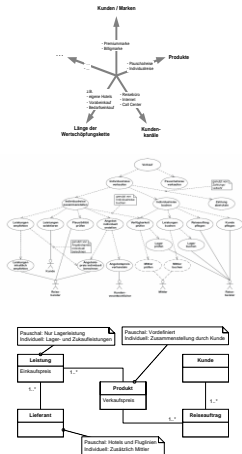
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Business



Business Architecture



IT



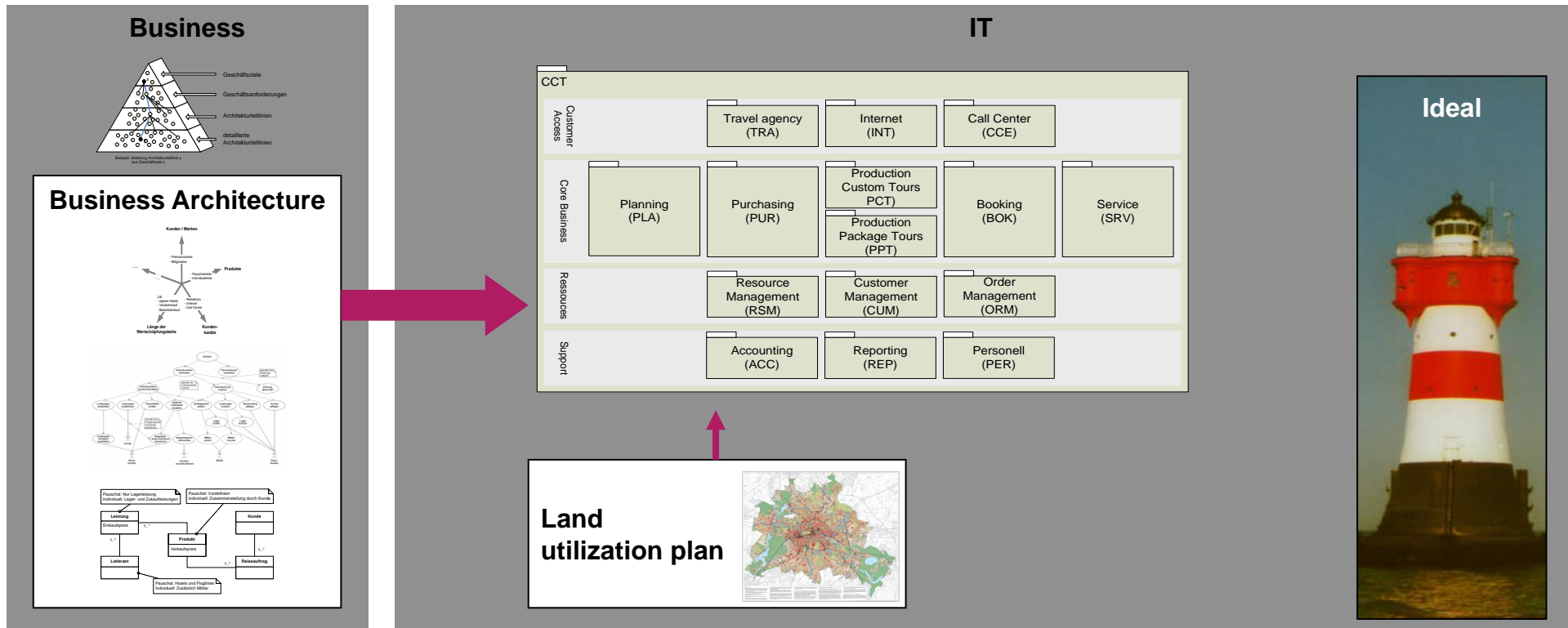
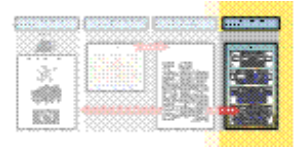
Ideal



The architect structures the application landscape in the form of domains

Ideal application landscape

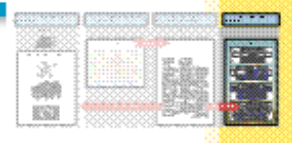
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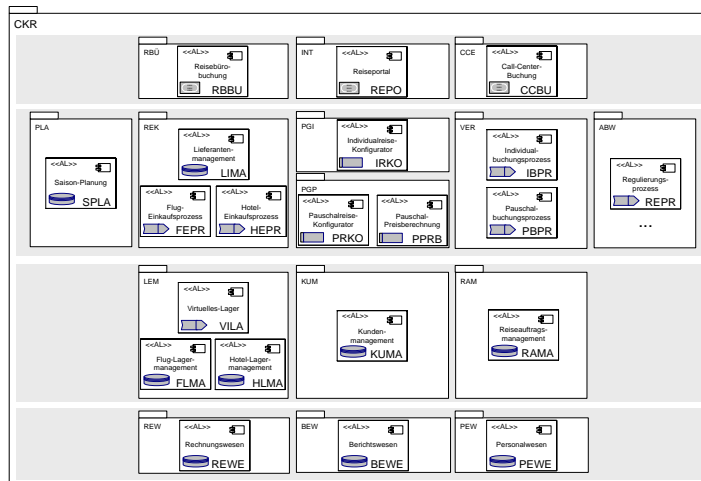
3
Finding domains

Domains form an ideal regulation framework for the components of an application landscape

Domain map – the space utilization plan



- Domains group the components of an application landscape according to functional considerations
- Domains are used for communication between specialist departments and IT, especially when the issue is responsibility
- For the architect, domains are an important tool in the planning and evolution of application landscapes
- The domain section provides the architect important criteria for the design of AL components, their interfaces and coupling
- Domains are always oriented towards the business of the company. Sales and partner management are examples.

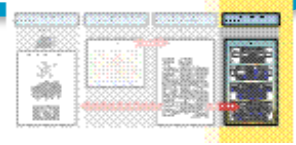


There are approximate rule-of-thumb values for the number of domains and AL components

Size of the AL	Domain Depth	Number of Domains	Number of AL Components
Small	1	<10	<30
Mid-sized	1-2	10-30	30-100
Large	2-3	30-100	100-1.000
Very large	≥ 3	>100	>1.000

Ideally, a good domain model satisfies an array of structuring criteria

Domain map – the space utilization plan



- 1 Minimality**

There are few domains on the uppermost level. These are divided further into subdomains where required.
- 2 Similar processing**

From a functional viewpoint, a delineated tasks block is defined by the domains in which shared rules and procedures exist
- 3 Loose coupling**

The number of dependencies between domains is minimal
- 4 Process orientation**

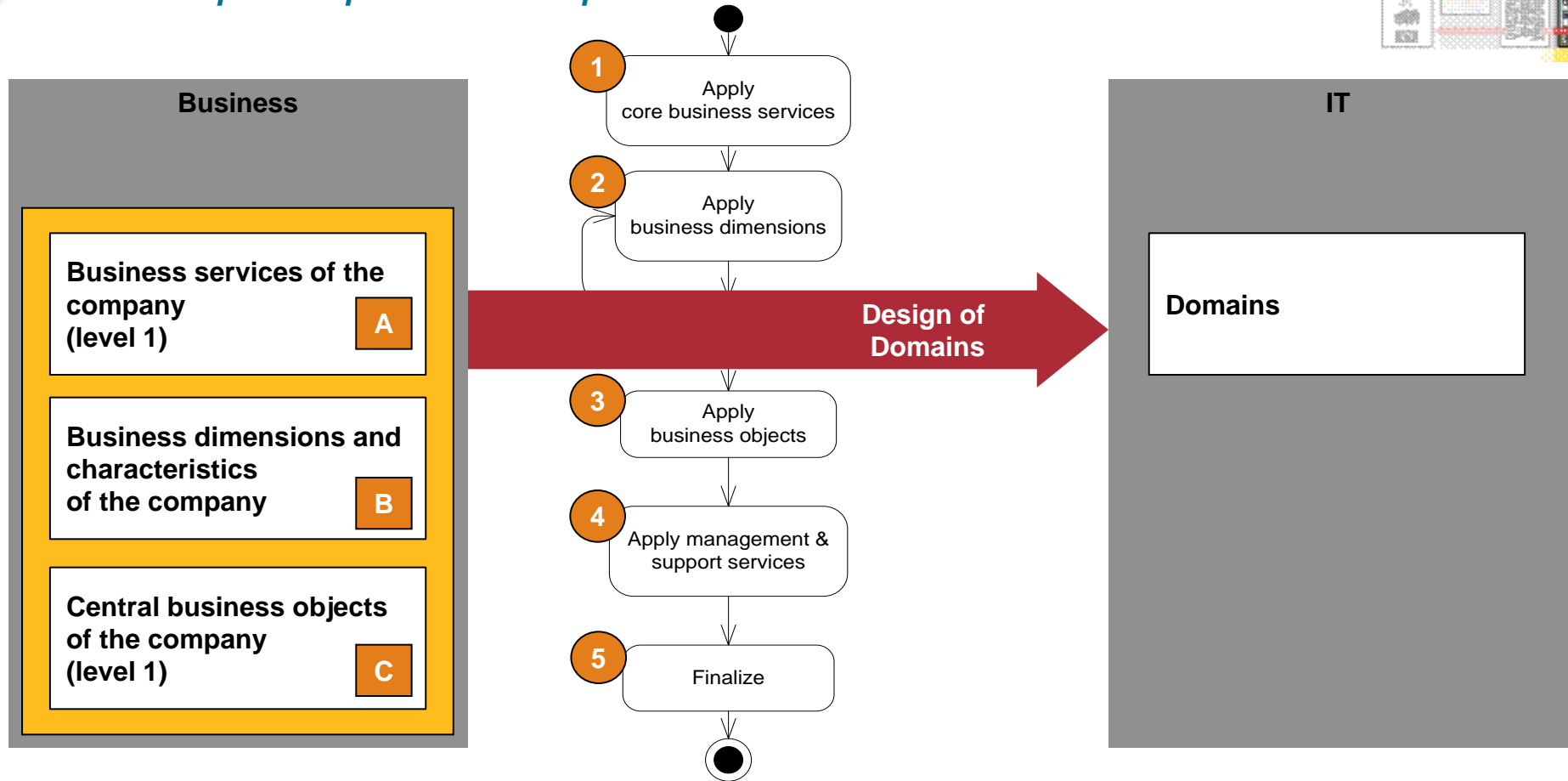
Business processes do not switch back and forth between domains whilst running
- 5 Stability**

Domains are, up to a point, stable compared to variation/enhancement of business processes
- 6 Usage profile**

The domain offers more than just one service, or the service is used by more than one domain

Method of designing application landscape domains

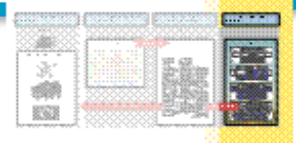
Domain map – the space utilization plan



The following slides describe the method in simplified form for CKR.

Input from the business strategy: Core and supporting business services on level 1

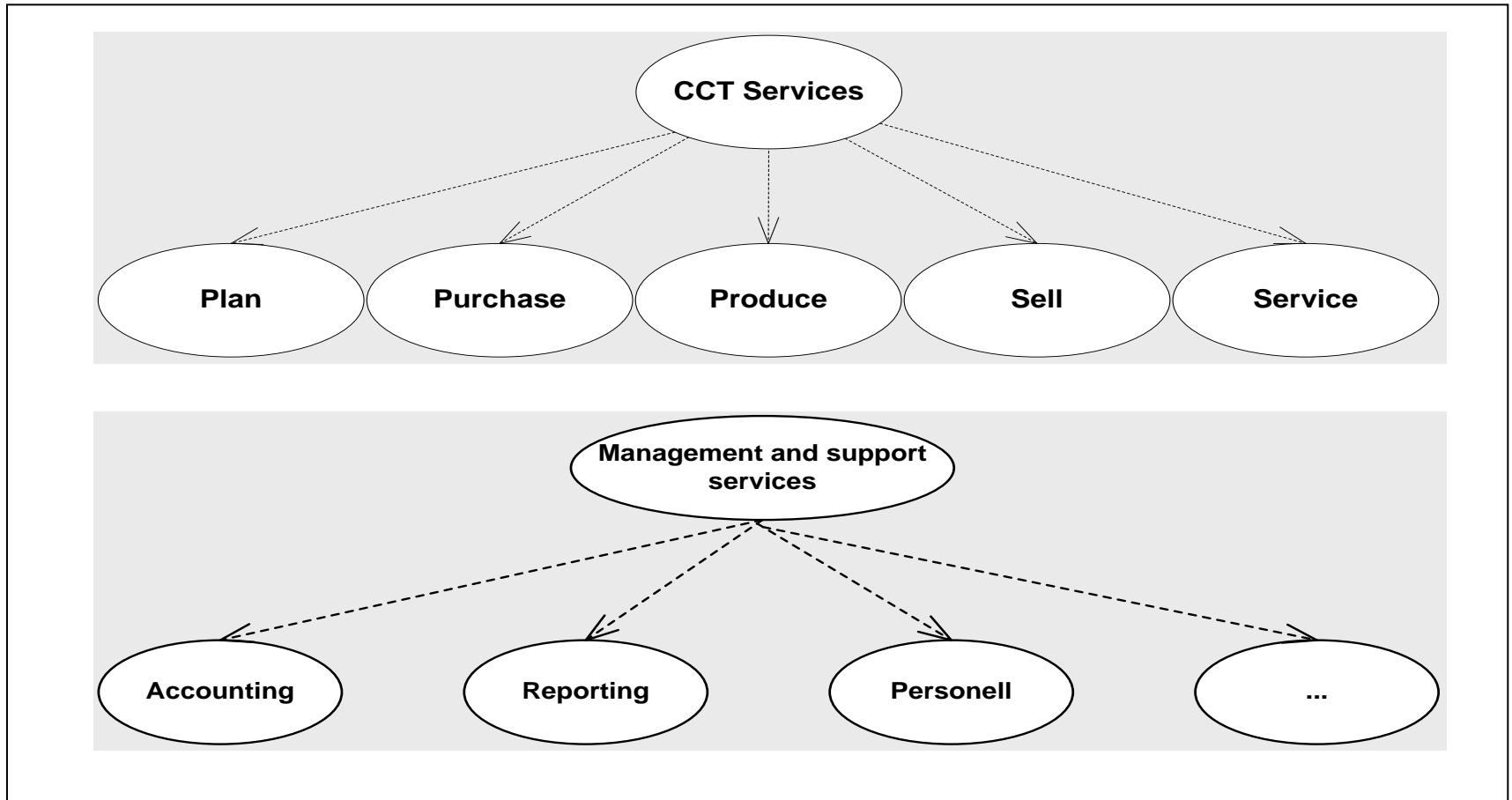
Domain map – the space utilization plan



A

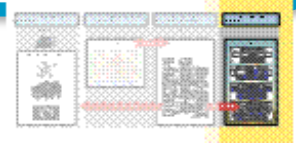
B

C



Input from the business strategy: business dimensions

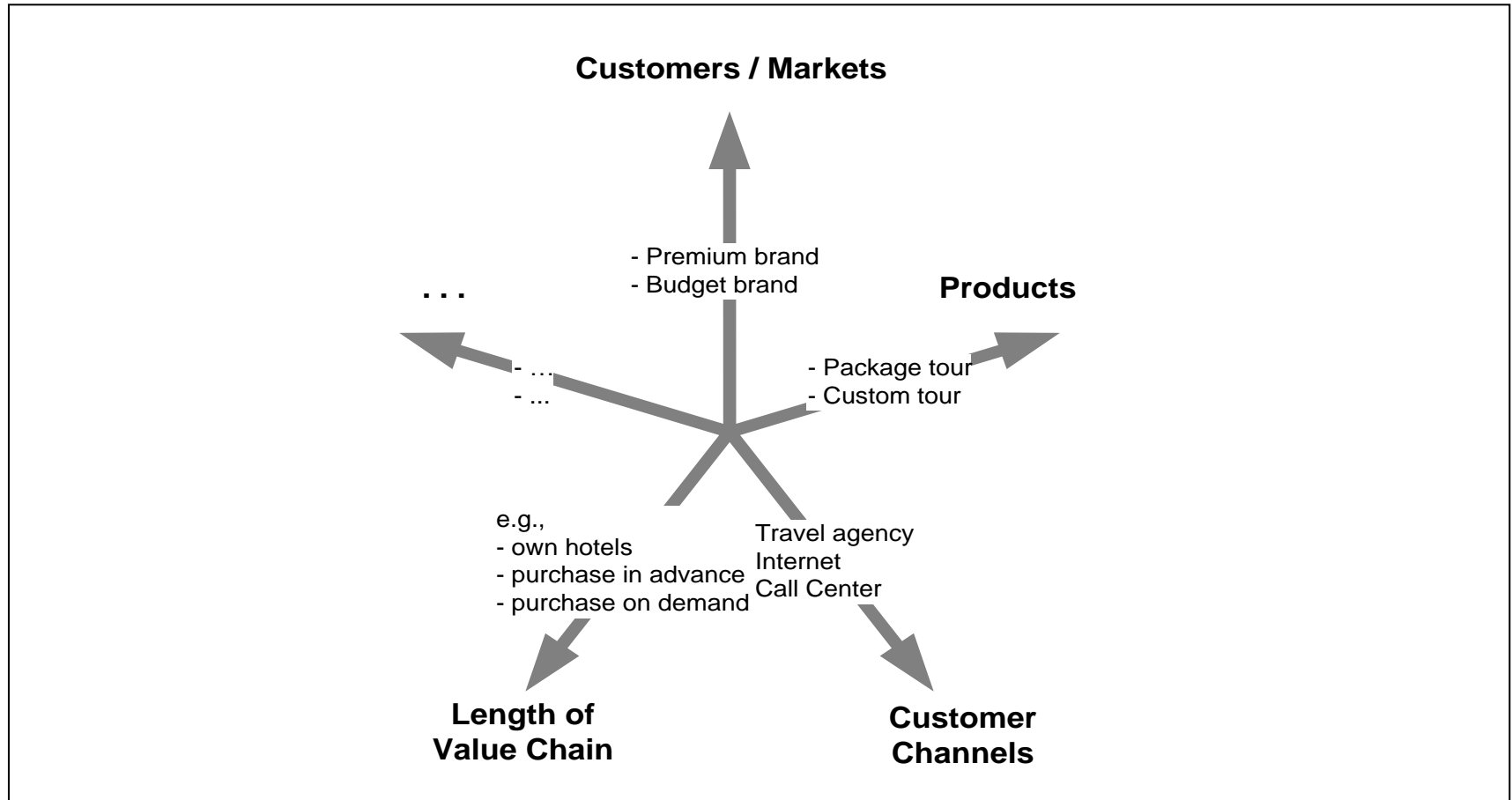
Domain map – the space utilization plan



A

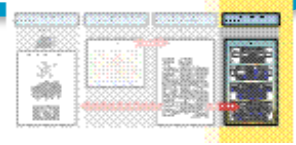
B

C



Input from the business strategy: core business objects

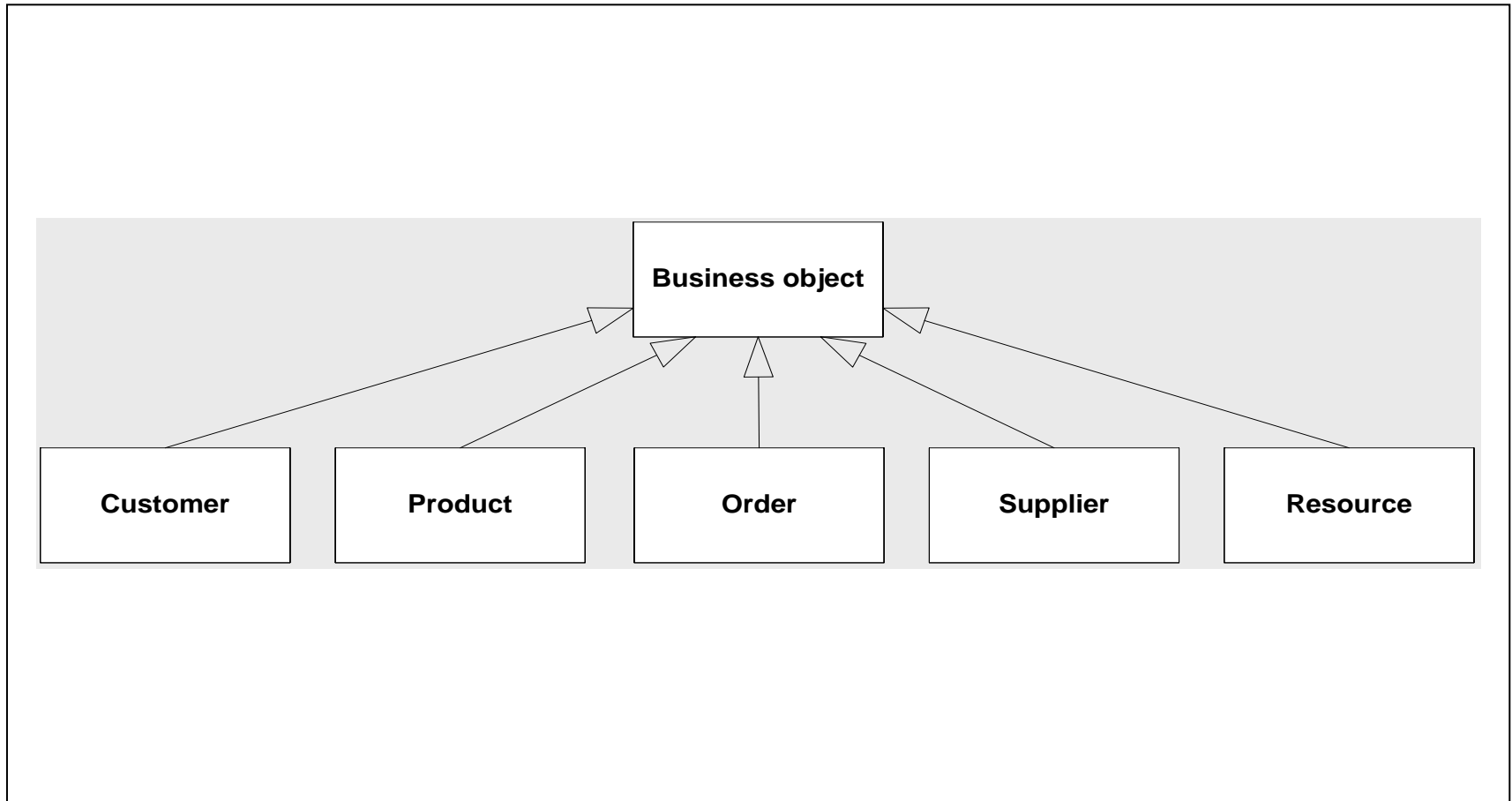
Domain map – the space utilization plan



A

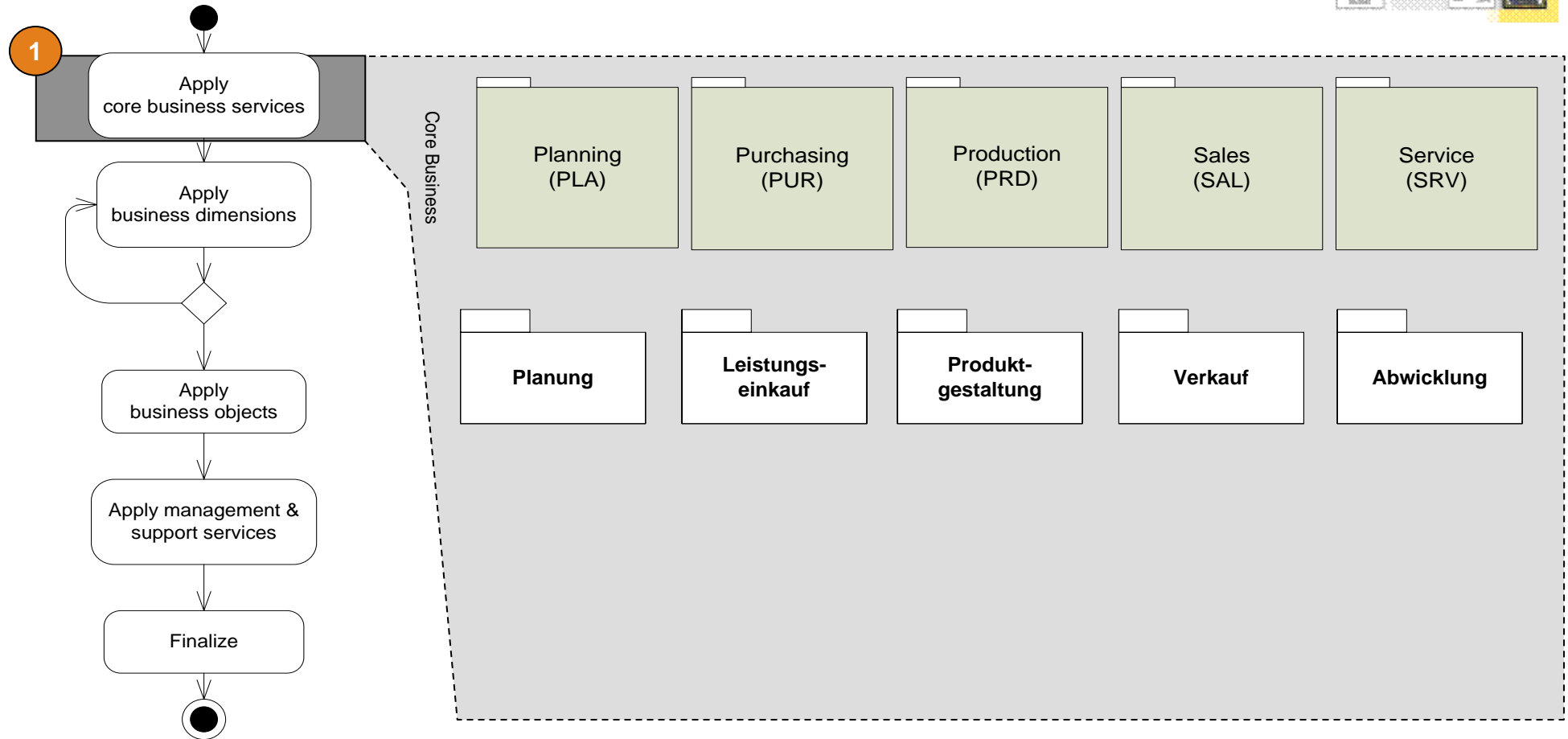
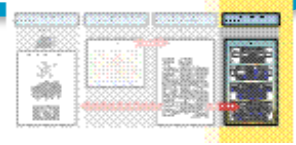
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C



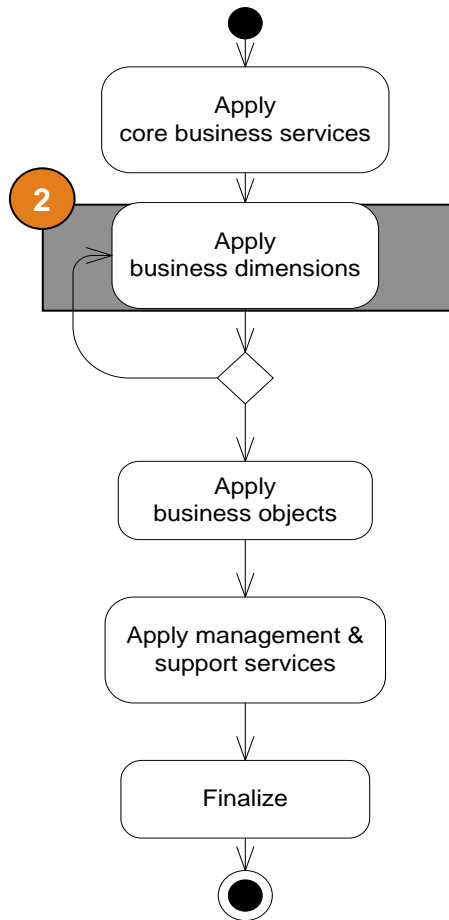
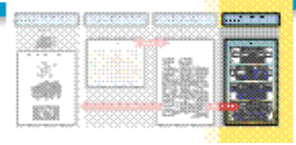
Step 1: Core business services become domain candidates

Domain map – the space utilization plan



Step 2: Domain candidates can be divided up along a business dimension

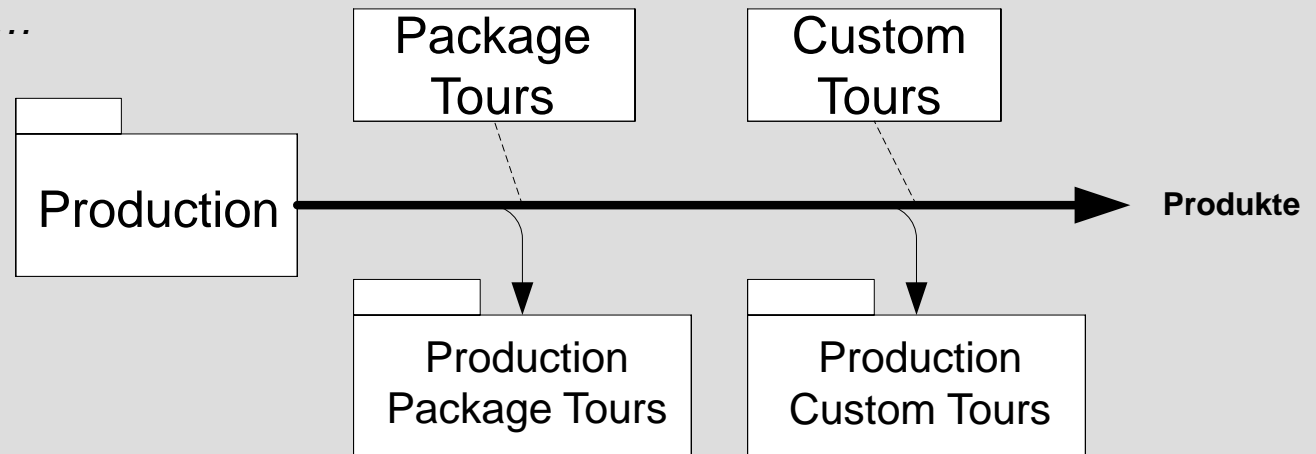
Domain map – the space utilization plan



Package tours differ significantly from individual tours:

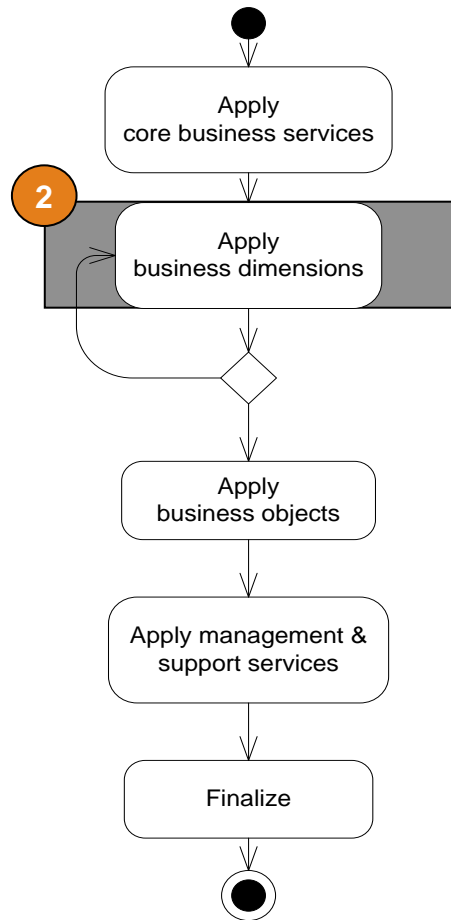
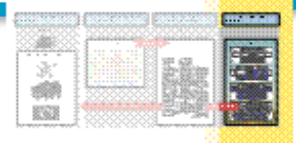
- *Package tours are fully priced, individual tours are not.*
- *Package tours are subject to fixed time periods (7 days, 14 days), individual tours are not.*

• ...

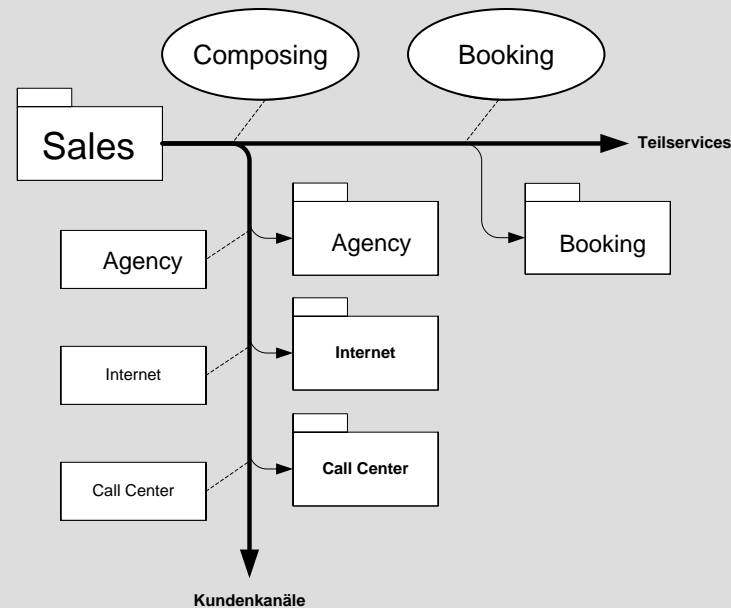


Step 2: Domain candidates can also be split over several dimensions

Domain map – the space utilization plan

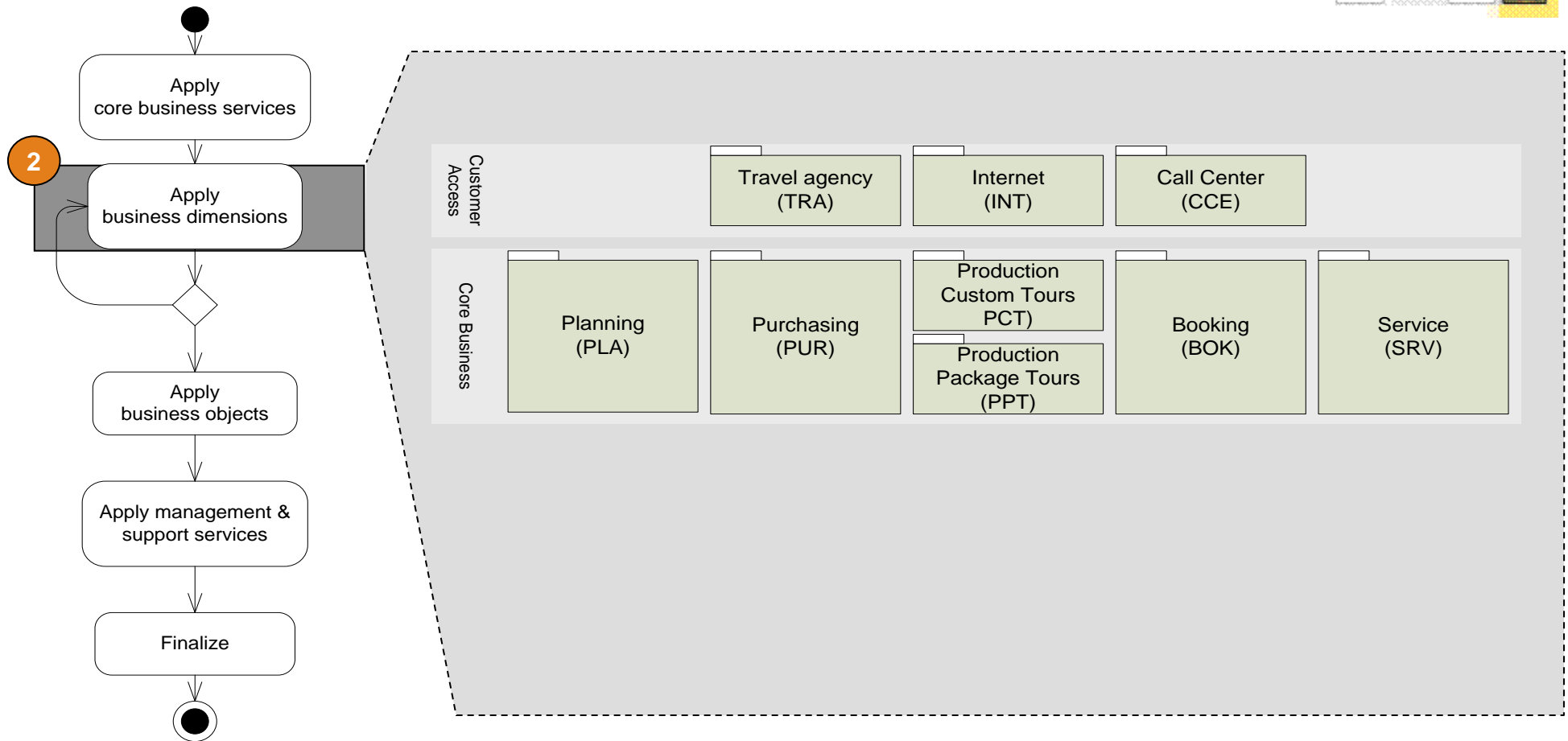
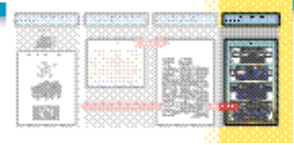


- The sale as a whole is comprised of the "put together itinerary" and "book trip" activities.
- The putting together of the itinerary is customer channel-specific. Selling in the travel agents is fundamentally different to Internet selling.



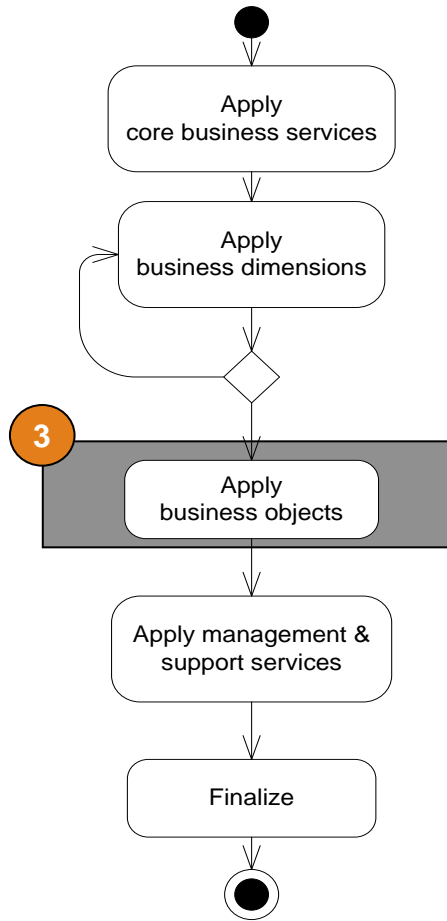
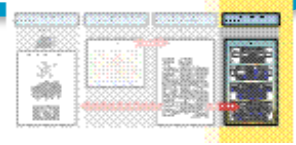
Step 2: Domains after refinement along the business dimensions

Domain map – the space utilization plan



Step 3: Top-level business objects used beyond domains become own domain candidates

Domain map – the space utilization plan

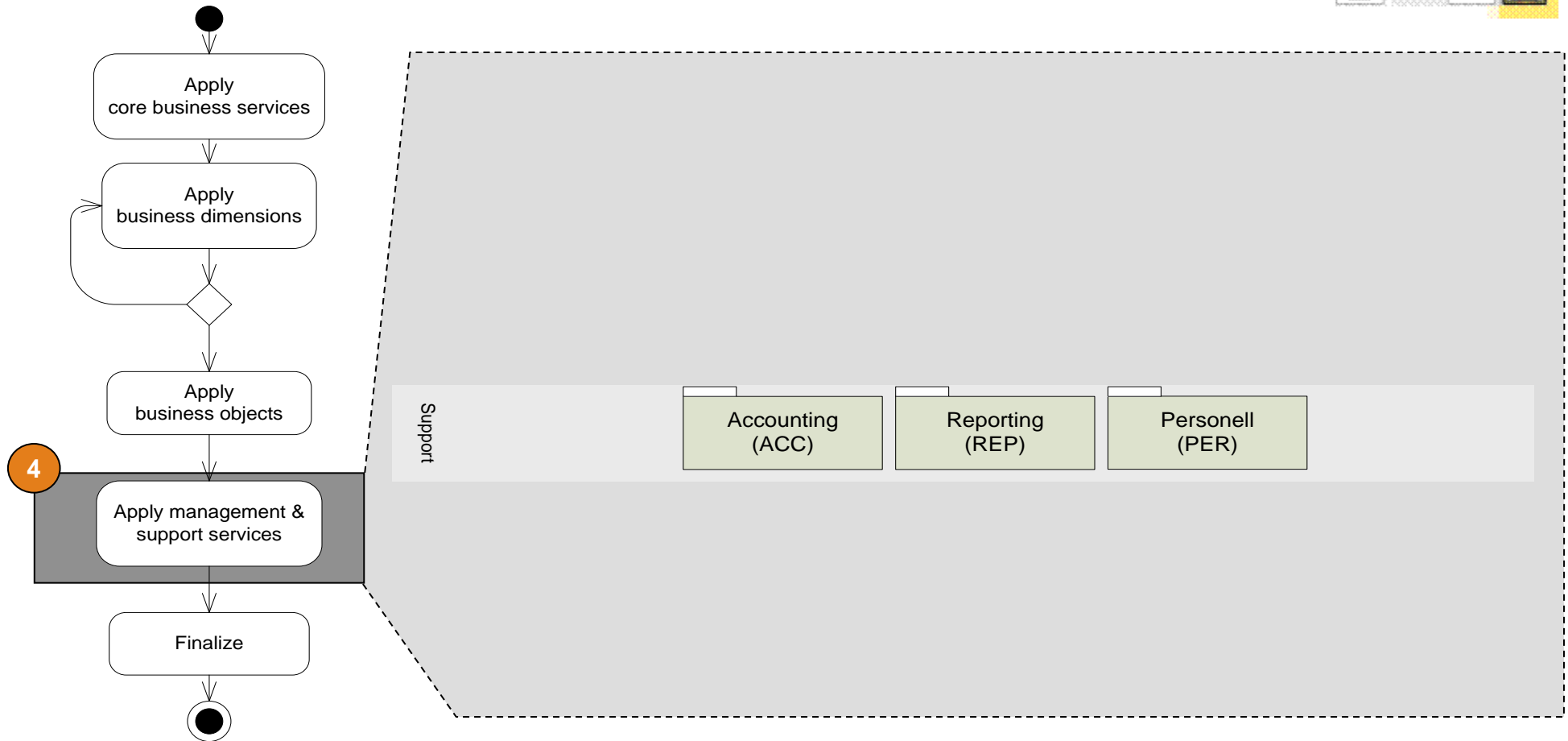
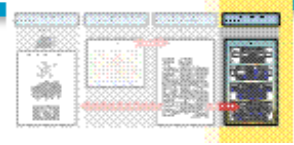


Business object	Written in
Customer	Travel agent applications, Internet portals, call centres, booking ✓
Product	Product design
Travel order	Booking, transaction ✓
Supplier	Purchasing
Service/Resource	Service purchasing, sales ✓



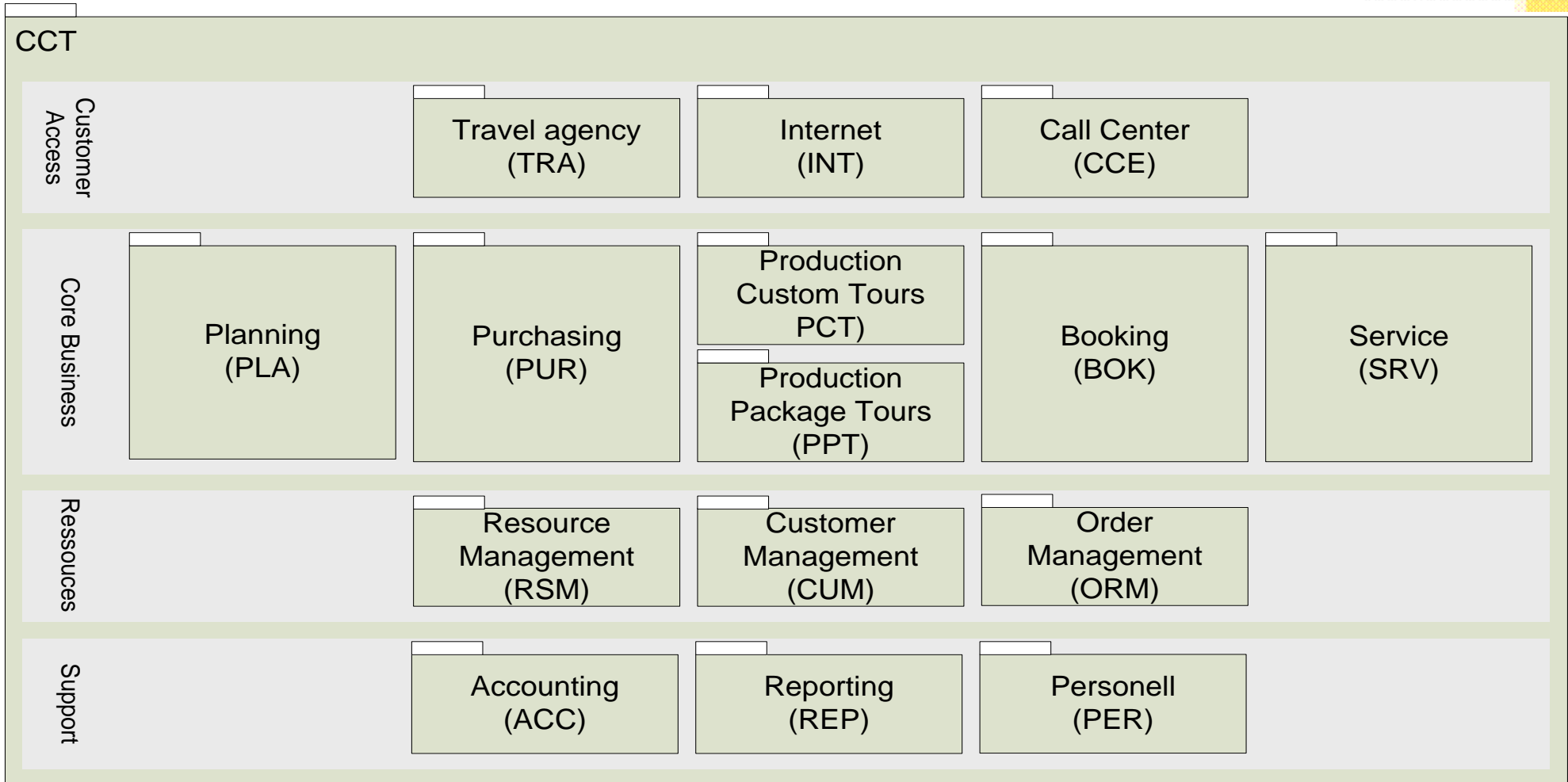
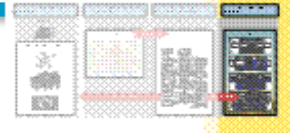
Step 4: Management and support processes become domain candidates

Domain map – the space utilization plan



Step 5: Final naming and sensible configuration of domains

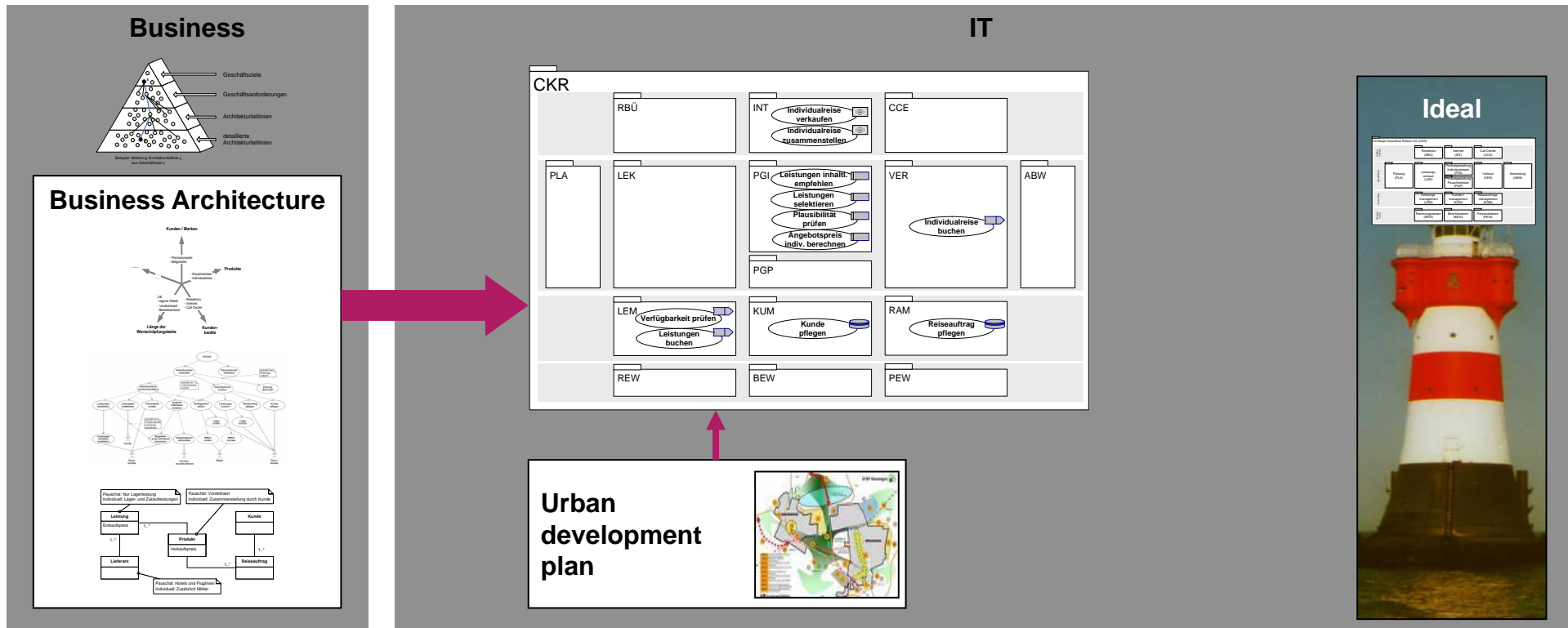
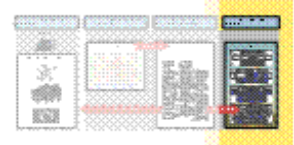
Domain map – the space utilization plan



The architect identifies application services and assigns them to domains

Ideal application landscape

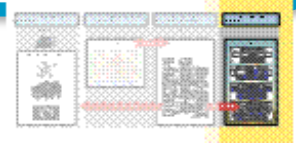
1 2 3 4



4 Identification of Application Services

Application services and service actions

Application services – the urban development plan



Definition

Application services

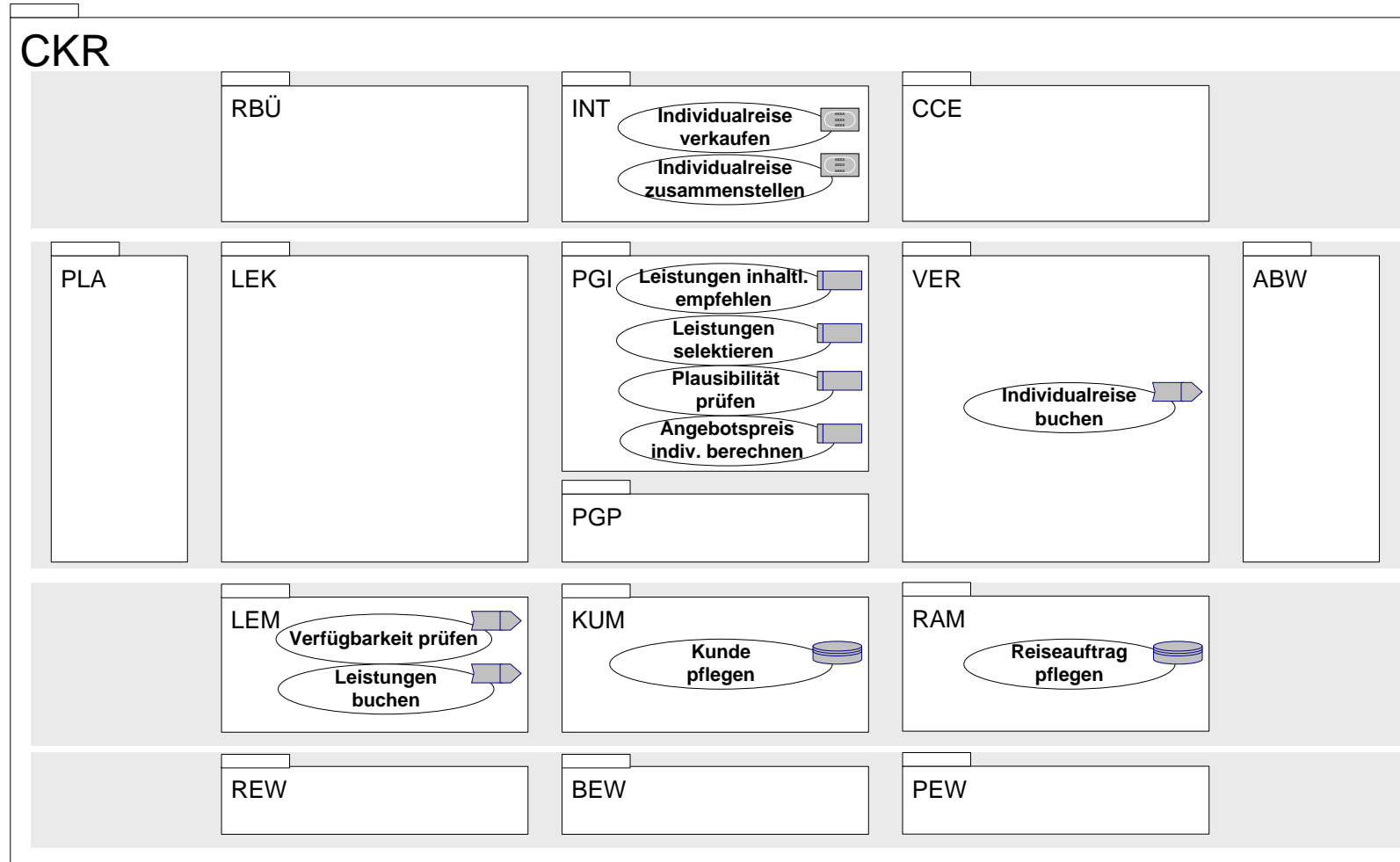
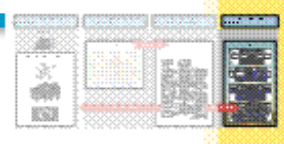
- An application service defines an information technology service rendered by a service provider for a service requester.
- The service provider is an application landscape or part thereof.
- The service requester can be a group of persons or part of a possibly different application landscape.
- Every application service is based on a contract. This specifies incoming and outgoing information. It defines the actions to be run as part of the service and their ordering if relevant for the service requester. It also specifies all relevant framework conditions.

Service actions

- Actions are the steps when running an application service that are relevant to the service requester.

Integration of application services into domains

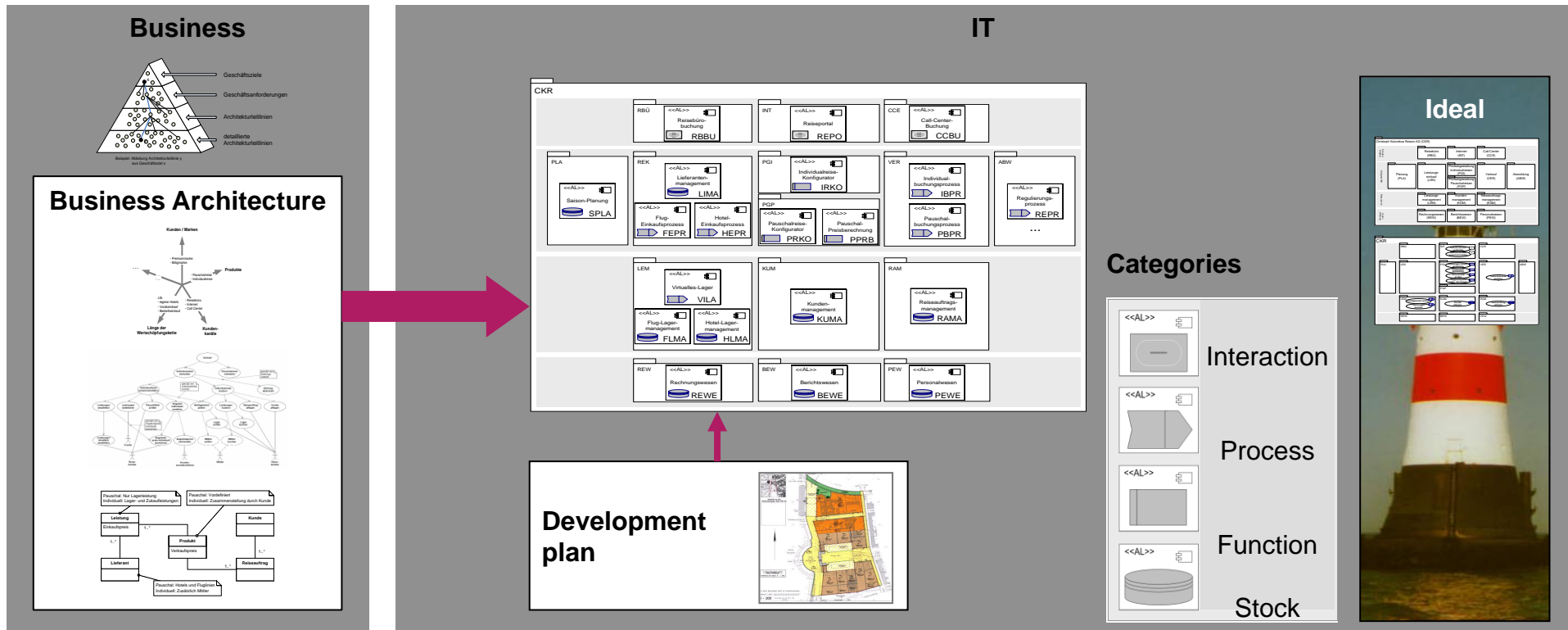
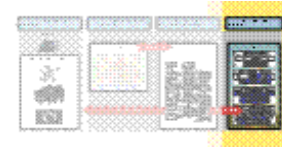
Application services – the urban development plan



In the next step, the architect plans the development of domains with components

Ideal application landscape

1 2 3 4 5 6 7



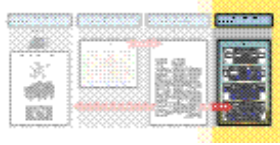
5 Method: Design of components

6 Rules: Design of components

7 Ref. architecture: Categorized application landscape

AL components

Components in the AL – the development plan



Definition

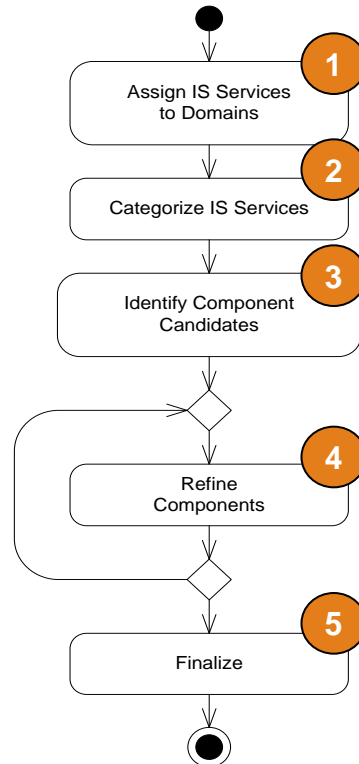
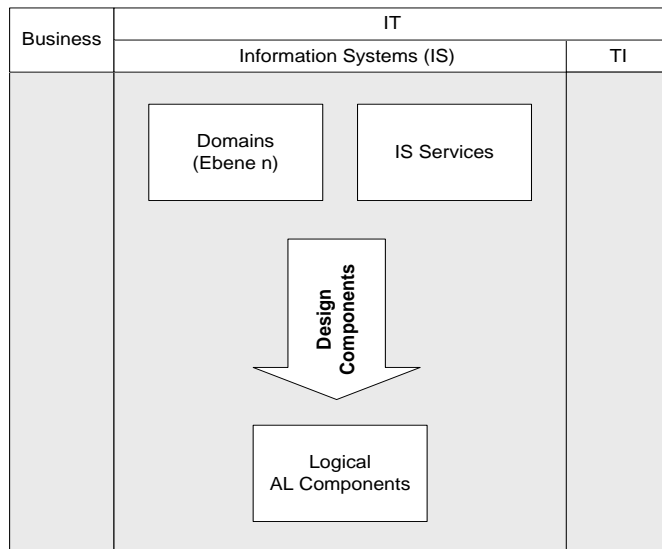
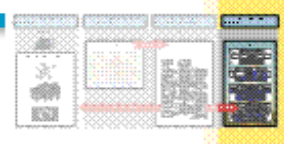
Application landscape component

An application landscape component (AL component) is an enclosed unit within an application landscape with the following properties:

1. It implements application services of a company
2. It is comprehensive
3. It has explicit and well-defined interfaces for functions it offers
4. It has explicit and well-defined interfaces for functions it uses
5. It can be coupled with other AL components

Method for designing components

Components in the AL – the development plan



Application services are assigned to domains.

Application services are grouped according to categories Stock, Function, Process and Interaction

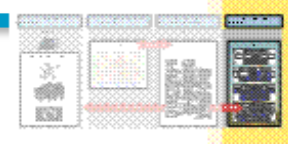
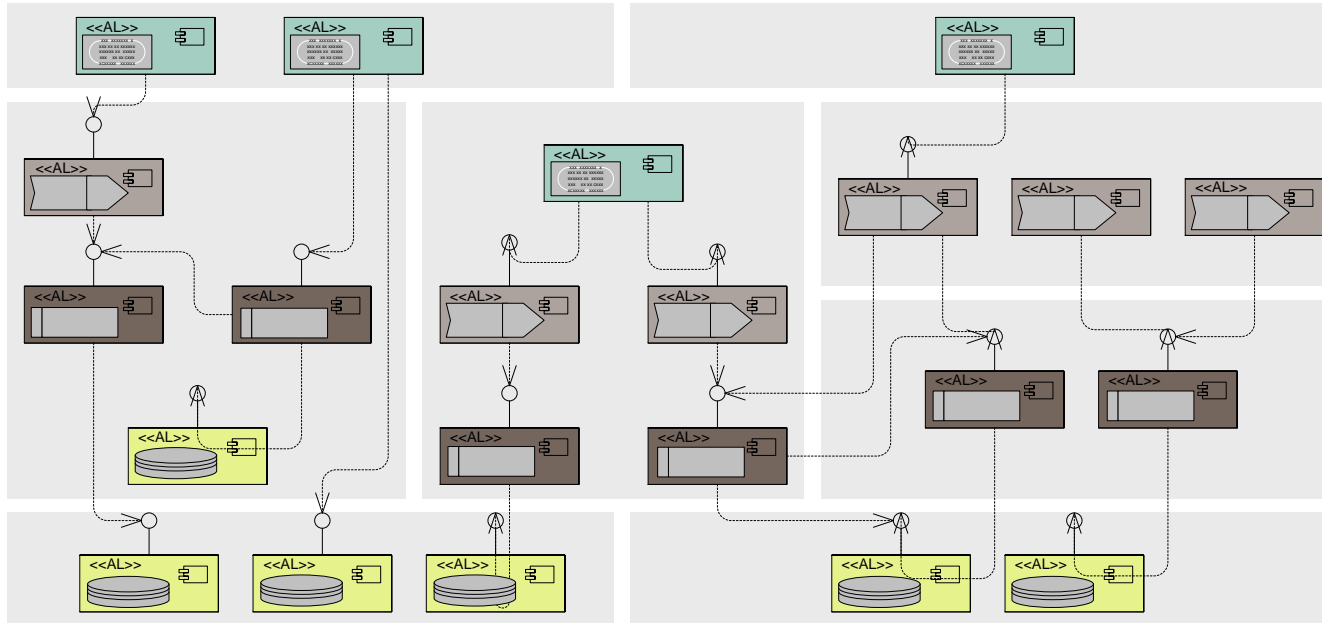
One component candidate each is created for the application services of a domain and of a category.

The component candidates are refined in accordance with the rules for the component design.

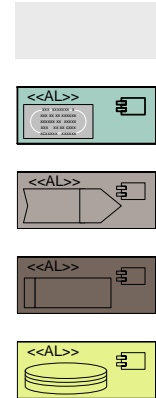
The physical components of the actual application landscape are used to check the component candidates for completeness and are adapted where necessary. They are then given names that are understood and accepted by those involved. They form the final components.

Reference architecture for application landscapes

Components in the AL – the development plan



Interaction
Process
Function
Stock

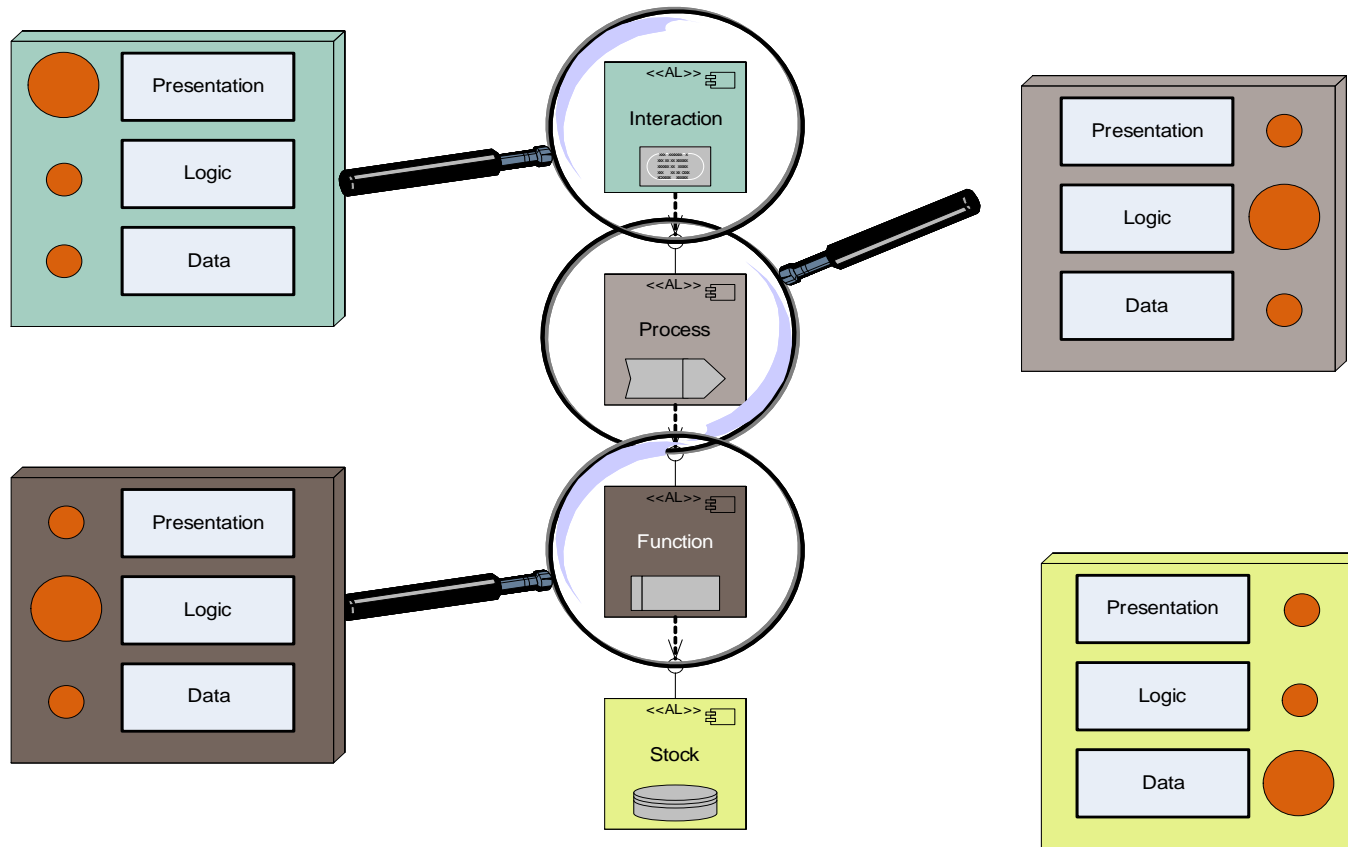
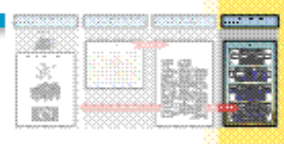


- AL components are assigned uniquely to domains
- The components are assigned uniquely to a category
- The component dependencies follow a layering in the sense that clear-cut call names apply in line with categories
Interaction → Process → Function → Stock

The separation of the process logic of function and stock components is one of the most important architectural measures in designing application landscapes.

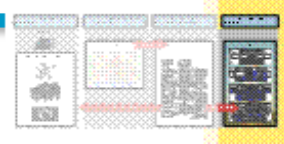
Categories are not layers!

Components in the AL – the development plan



Rules for the design of components

Components in the AL – the development plan



Components

Components and domains

Components should be uniquely assigned to a domain

Functional components

Components should be formed according to functional criteria.

Category-free components

All operations of a component should be of precisely one category (Stock, Function, Process, Interaction).

Coupling in accordance with categories

AL components of different categories should only have couplings in accordance with the reference architecture of the categorized application landscape.

No cyclic couplings

The couplings between components should form an aligned acyclic graph.

Tight cohesion, low coupling

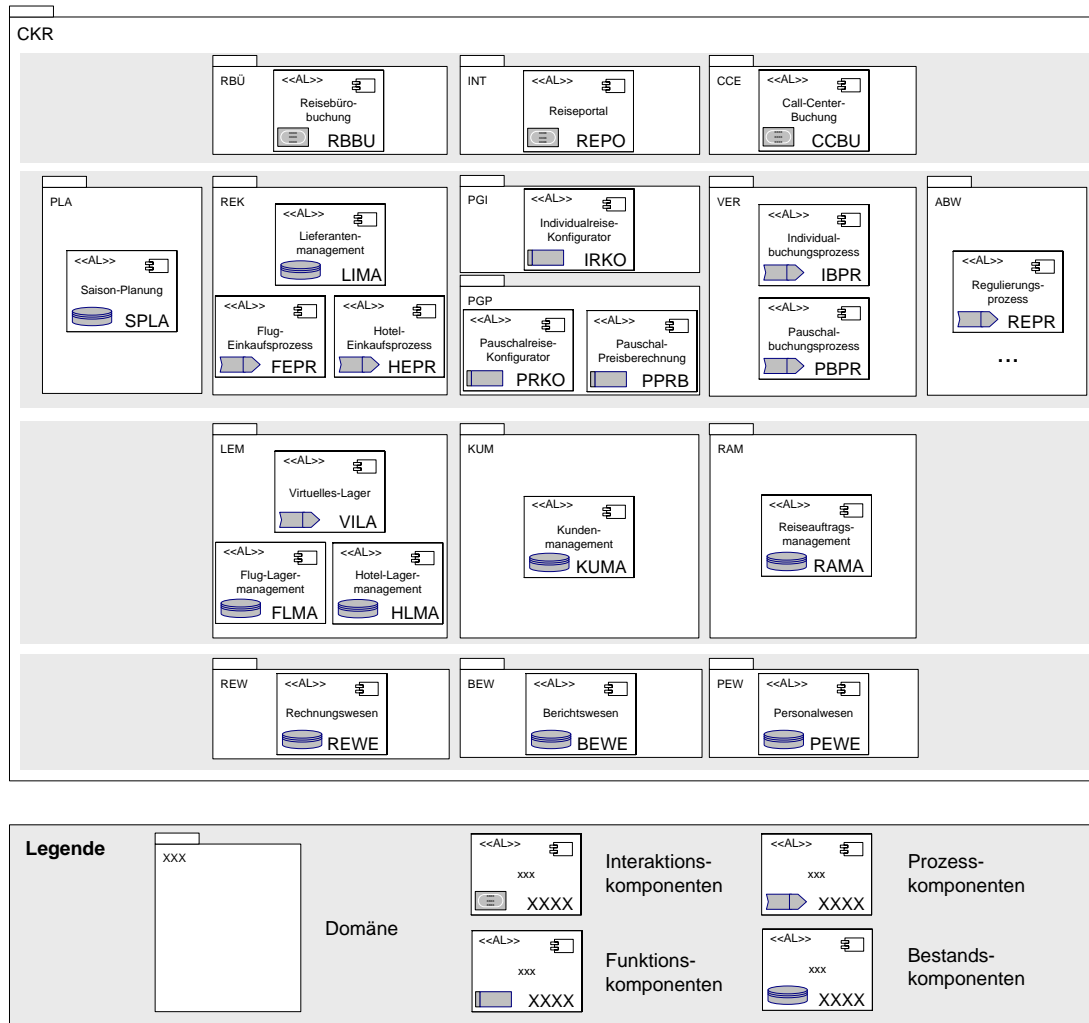
Components should be designed such that they have tight cohesion internally and have a low degree of coupling with each other.

Data sovereignty

Stock components should have data sovereignty over the business objects.

Development of domains with components

Components in the AL – the development plan

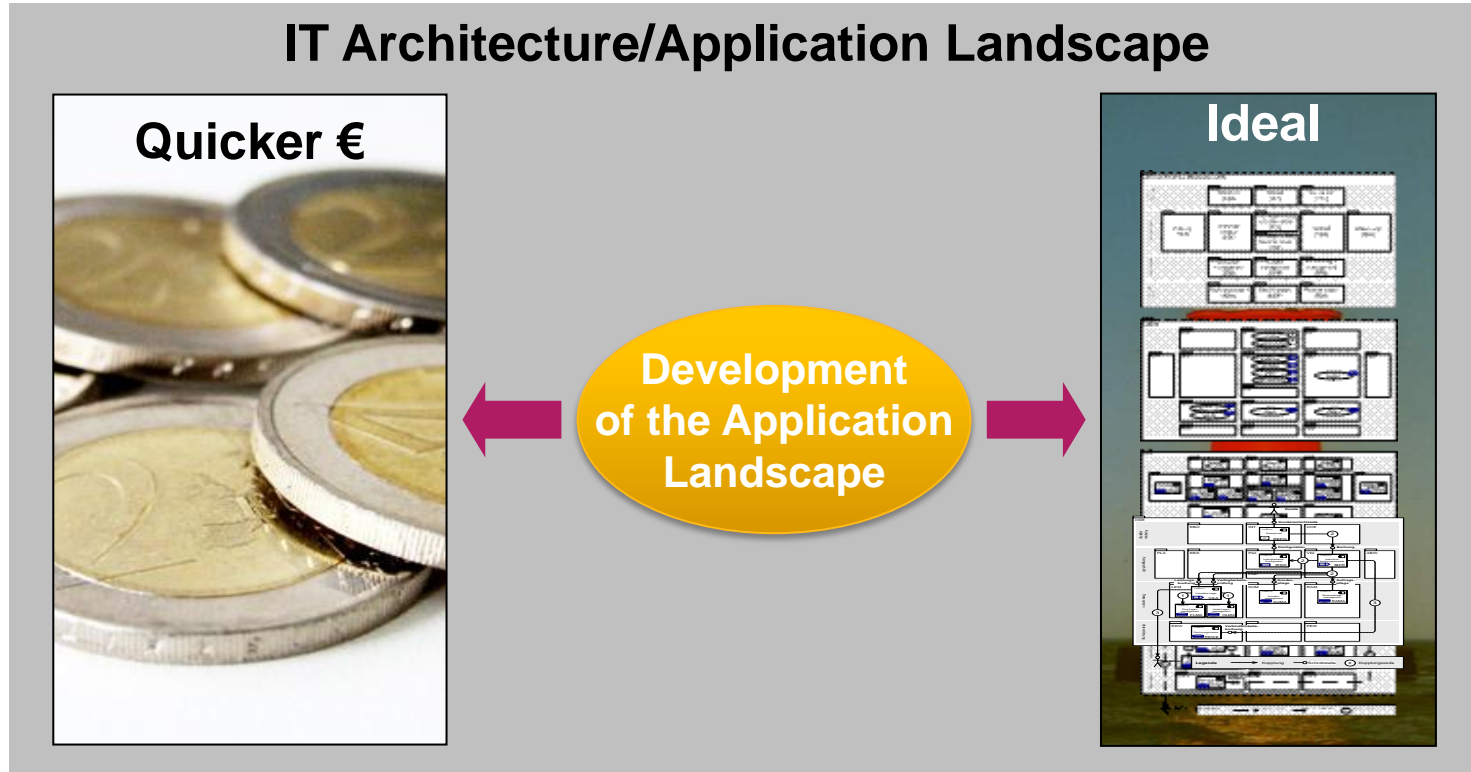


Agenda

- Enterprise Architecture - overview
- Enterprise architecture management in a nutshell
- Quasar Enterprise – business architecture
- Quasar Enterprise – ideal application landscape
- **Quasar Enterprise – managed evolution**

Business and ideal represent two poles - the application landscape must satisfy both as best as possible

Overview of the drivers in the design of an AL

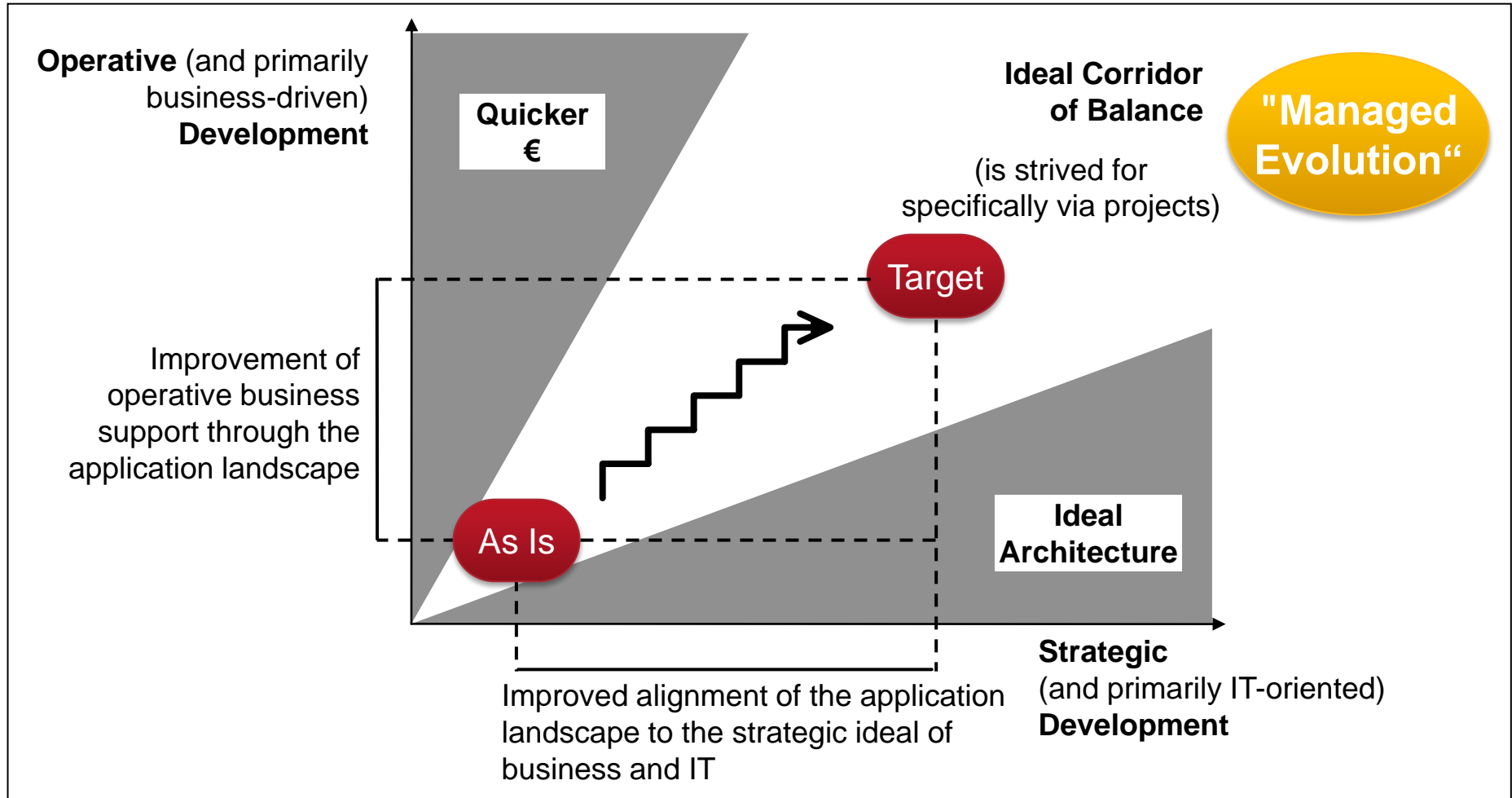


Assessment of the actual application landscape in regard to the operative (and primarily business-driven) objectives and requirements.

Assessment of the actual application landscape in regard to the strategic (and primarily IT-driven) objectives in the form of the ideal and the platform strategy – quantitatively and qualitatively.

The architect plans the development of the application landscape as a balance between these two requirements

Overview of the drivers in the design of an AL



References on Enterprise Architecture Management



People matter, results count.

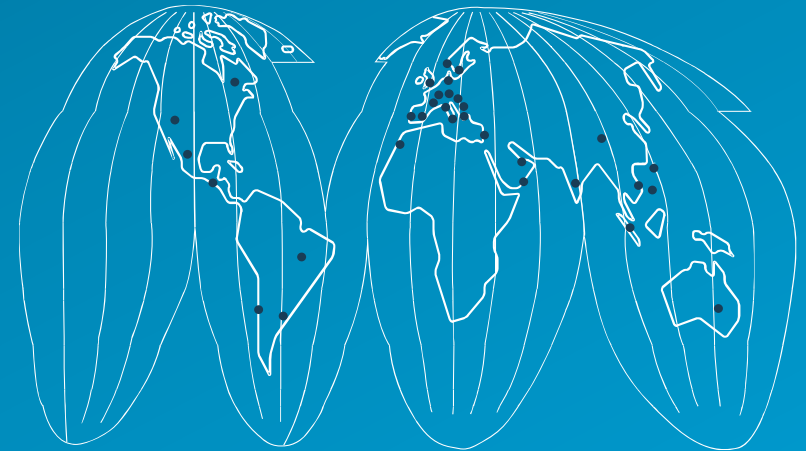


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