



UiO : **University of Oslo**

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Business processes and IT Architecture

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Learning outcome

- Understand why IT executives are concerned with *business processes* and *IT architecture*
- Be aware of different perspectives on IT architecture and IT architecture work
- Understand the
 - essence of enterprise architecture
 - principles of process modeling

Agenda

- Introduction
- Business processes
- IT Architecture
 - What is «IT architecture»?
 - Enterprise architecture
 - IT architecture in practice
- Summary

Introduction

Planned lectures (subject to change)

	Date	Time	Topic
	Fri. 19. Jan	12:15–14:00	Introduction of course and seminar
	Fri. 26. Jan	12:15–14:00	Strategy, governing documents and other structural frames: what does it mean, and what is the importance of IT?
	Fri. 2. Feb	12:15–14:00	Tools and frameworks 1: Introduction + projects
	Fri. 9. Feb	12:15–14:00	Tools and frameworks 2: concept selection and alternative analysis with a business case
	Fri. 16. Feb	12:15–14:00	Tools and frameworks 3: Business processes and IT architecture
	Fri. 1. Mar	12:15–14:00	Tools and frameworks 4: IT Governance & platforms.
	Fri. 19. Apr	12:15–14:00	Agile organizations

Strategy and strategic context

Management tools and frameworks

Date	Time	Topic	What is it really about?
Fri. 26. Jan	12:15–14:00	Strategy, governing documents and other structural frames: what does it mean, and what is the importance of IT?	The really big decisions in an organization: what should we improve the forthcoming years? Important discussion before choosing strategy: what are we really working together for – and who are we competing with?
Fri. 2. Feb	12:15–14:00	Tools and frameworks 1: Introduction + projects	After deciding improvements, one needs to make some kind of sub-organization to coordinate the improvements. One typical sub-organization is a project. There are several frameworks to manage projects.
Fri. 9. Feb	12:15–14:00	Tools and frameworks 2: concept selection and alternative analysis with a business case	Both while working explicitly on strategy and in the daily operation of an organization, important prioritization decisions must be made. There are established approaches for this as well – here we discuss some of them.
Fri. 16. Feb	12:15–14:00	Tools and frameworks 3: Business processes and IT architecture	So far, we have discussed tools to make important decisions and organize generic improvements. However, organizations need to be able to analyze and change their IT-systems. Business process modeling and IT architecture are important topics when analyzing and changing IT-systems.
Fri. 1. Mar	12:15–14:00	Tools and frameworks 4: IT Governance & platforms.	
Fri. 15. Mar	12:15–14:00	Agile organizations	

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Tools and frameworks 3: Business processes and IT architecture

So far, we have discussed tools to make important decisions and organize generic improvements. However, organizations needs to be able to analyze and change their IT-systems. Business process modeling and IT architecture are important topics when analyzing and changing IT-systems.

Why are IT executives concerned with *business processes* and *IT architecture*?

Business processes

All organizations have *business processes* (often simply called «processes»). These processes can be defined at different levels and have very different purposes.

Some examples:

- Shut down remote office
- Hire new employee
- Establish new server
- Register new customer club membership

IT architecture

The organization of components and systems within an organization's IT infrastructure is often called *architecture*. An important aspect of architecture is integrations between components and systems.

Examples of architectural questions is:

- What is a good way to break our new case management system into components?
- If we need the home address of our customers, should we store them in our own database, or always look them up in the national contact registry?

There is a link between business processes and IT architecture: architectural decisions must consider whether they affect important business processes.

Business processes

What is a business process?

In our context:

A business process is the combination of a set of activities within an enterprise with a structure describing their logical order and dependence whose objective is to produce a desired result.

Aguilar-Savén, Ruth Sara. "Business process modelling: Review and framework." *International Journal of production economics* 90.2 (2004): 129-149.

Business processes can be described at different levels of detail depending on the abstraction put into analysing the organisation, which depends in turn on the purpose of the analysis

Pragmatic approaches are mostly concerned with capturing and understanding processes, while rigorous paradigms are typically used for analysis of the process

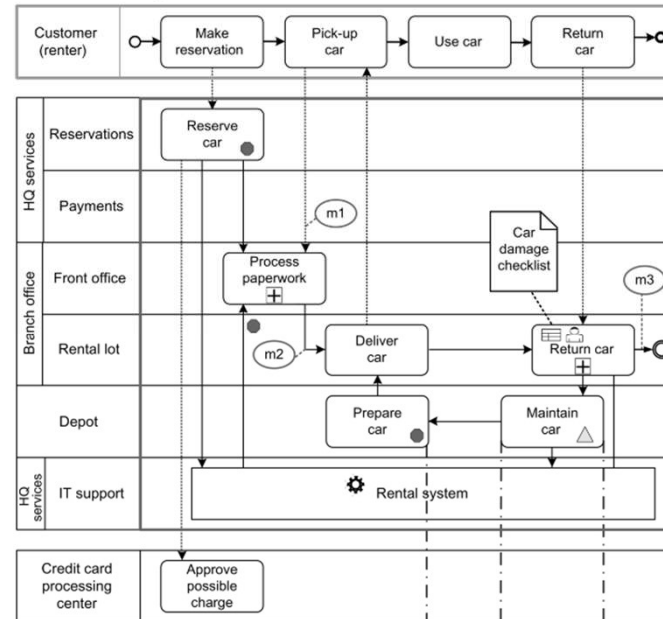
Aguilar-Savén, Ruth Sara. "Business process modelling: Review and framework." *International Journal of production economics* 90.2 (2004): 129-149.

Among the formal approaches, BPMN (see example to the right) is the most common

Overview of a BPMN Diagram Used for Business Process Analysis and Redesign

In business process modeling for redesign, we usually begin with a diagram of process as it currently is—the As-Is process—and then generate one or more To-Be redesigns to explore possibilities.

The customer process



Management structure

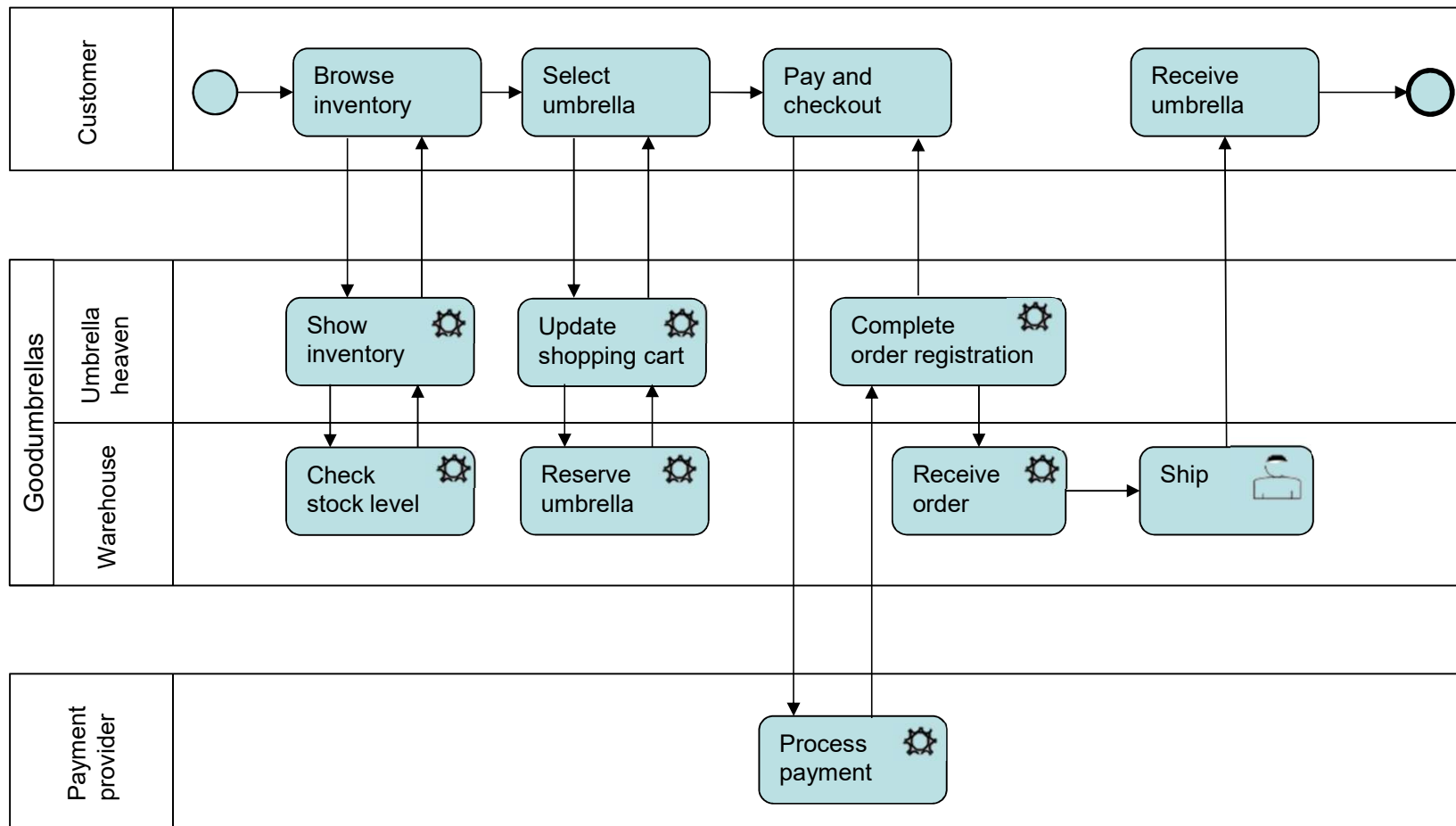
The labels for the swimlanes should reflect the management structure of the organization that owns the process. At various levels of decomposition, the boxes may represent divisions, departments, managers or supervisors. Horizontal labels can show reporting relationships.

Time between the completion of one activity and the start of the next
 Ave. time activity takes
 Subprocess/activity times can be shown at the bottom of the BPMN diagram by inserted dashed lines

Harmon, Paul. *Business process change: a business process management guide for managers and process professionals*. Morgan Kaufmann, 2019.

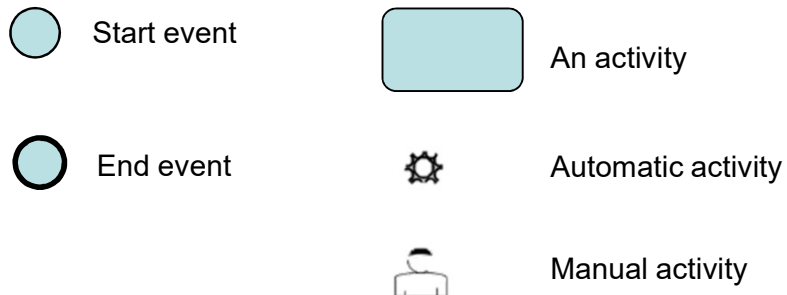
(tilgjengelig via O'Reilly learning)

Umbrella Heaven ordering process

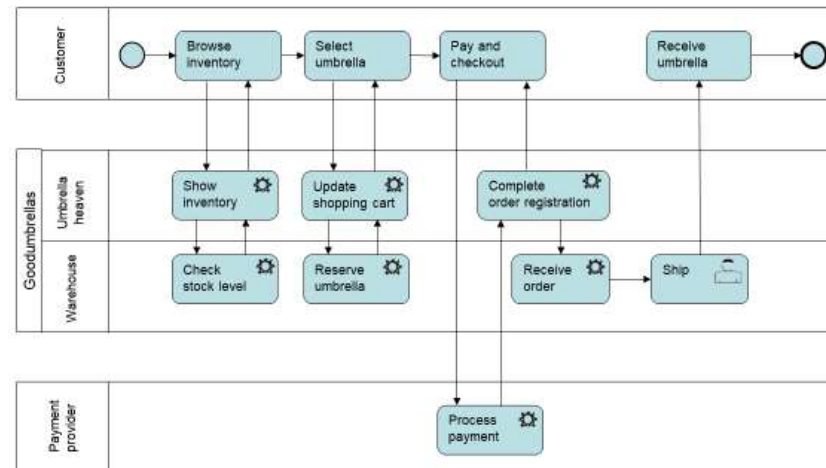


Excercise: How could the return process appear?

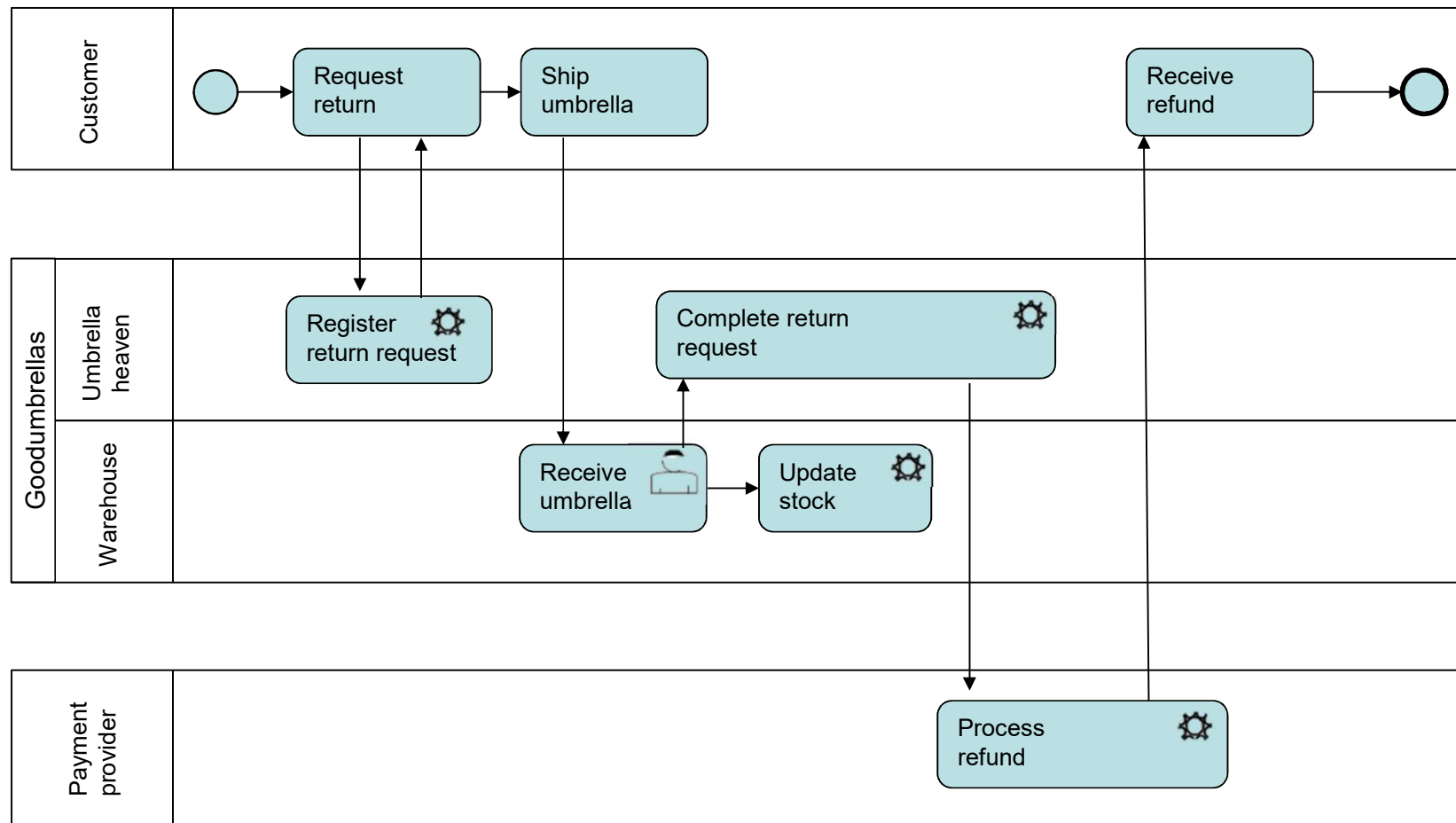
- Assume all returns are eligible for refund
- Assume returns are manually received at warehouse



Umbrella Heaven ordering process



Example: How would the return process appear?



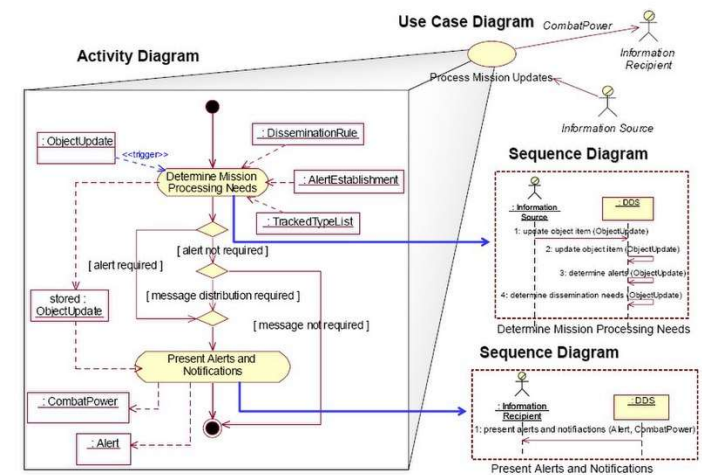
IT ARCHITECTURE

What is (IT) architecture?

” As the size and complexity of software systems increase, the design and specification of overall system structure become more significant issues than the choice of algorithms and data structures of computation.

Structural issues include the organization of a system as a composition of components; global control structures; the protocols for communication, synchronization, and data access; the assignment of functionality to design elements; the composition of design elements; physical distribution; scaling and performance; dimensions of evolution; and selection among design alternatives. This is the software architecture level of design.

From Mary, Shaw, and Garlan David. "Software architecture: perspectives on an emerging discipline." Prentice-Hall (1996).



What is (IT) architecture?

No universal definition. Two important variants:

1) "The software architecture of a computing system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both."
(Carnegie Mellon University)

2) "Architecture is the set of design decisions that must be made early in the project"

(Martin Fowler and Ralph Johnson)

"System" depends entirely on the chosen perspective – can be nationwide or one single component within a deployable application

Sources:

(1) https://resources.sei.cmu.edu/asset_files/FactSheet/2010_010_001_513810.pdf

(2) <https://ieeexplore.ieee.org/document/1231144>

This distinction is essential

The descriptive alternative

"The software architecture of a computing system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both."

Here, architecture is about **understanding** and **documenting** (implicit or explicit) decisions – not making them.

Consequences for architecture work:

- Focuses on modeling, documentation and presentation
- Not really about (technology) management

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The normative alternative

"Architecture is the set of design decisions that must be made early in the project"

Here, architecture is about **decisions**.

Consequences for architecture work:

- Focus is on decision making – which involves a broad set of skills
- Largely about (technology) management

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So what does *an architect* do? And what is *good architecture*?

IT vs other engineering disciplines: forces affecting the construction



What are the forces affecting the construction?

IT vs other engineering disciplines: forces affecting a bridge



The forces affecting a bridge are:

- Wind
- Weight
- Temperature
- Water
- Erosion
- Corrosion
- Space constraints
- Human cognitive capabilities
- Human behavior
- Human aesthetical preferences

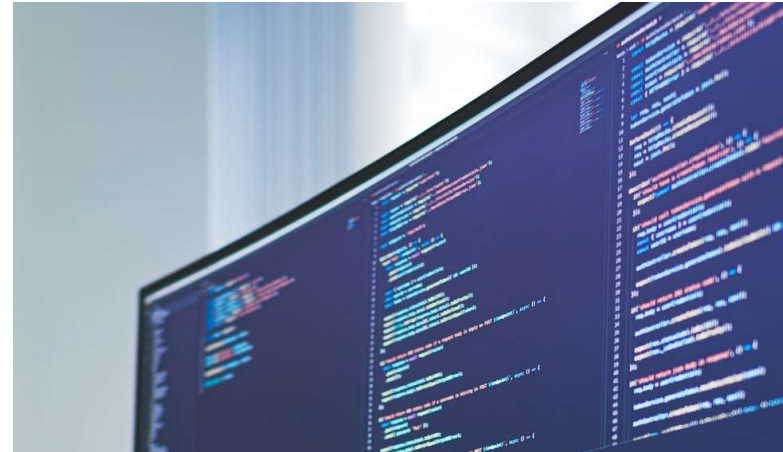
IT vs other engineering disciplines: «forces» affecting an IT system



The forces affecting computer software are

- Wind
- Weight
- Temperature
- Water
- Erosion
- Corrosion
- Network speed and capacity
- CPU and memory speed and capacity
- Human cognitive capabilities
- Human behavior
- Human aesthetical preferences

IT vs other engineering disciplines: the difference is significant



The "engineering" of software engineering is very different from other engineering disciplines. The forces affecting computer systems are dominated by human cognitive capability, human behavior and human aesthetical preferences.

IT quality is dominated by human judgment. What rules can we apply to judge system quality?



This again means that quality in software engineering – and in software architecture - is mainly given by human judgment. So what is **good** architecture?

Good IT architecture is a multi-disciplinary exercise.

The question «who understands the users, and who will be responsible for wrong architecture choices from the user's perspective?» is an important one.

Another important question is «who understands the technical possibilities (**in our organization**), and is responsible for the consequences of wrong architecture choices?

And finally: «who has the funding?»

Architecture taxonomy (according to TOGAF)

- **Business Architecture** defines the business strategy, governance, organization, and key business processes
- The **Data Architecture** describes the structure of an organization's logical and physical data assets and data management resources
- The **Application Architecture** provides a blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes of the organization
- The **Technology Architecture** describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services; this includes IT infrastructure, middleware, networks, communications, processing, standards, etc.

Enterprise Architecture

Enterprise architecture

Operational effectiveness

Perform similar activities better than rivals perform them.

"Best practice"

Examples of similar activities: quality assurance, project management, HR

- Porter, M.E. (1996)
"What is Strategy",
[Harvard Business Review](#) 1996

A standardized business process is performed the same way, no matter where and by whom it is executed. For example, McDonald's is well known for its standardization of operational processes around the globe. Similarly, when CEMEX grew internationally, leaders defined a set of processes, ranging from procurement and finance to logistics and HR, called the "CEMEX Way." Every country organization adopted this enterprise-wide standard way of working.

Ross, Jeanne W.; Beath, Cynthia M.; Mocker, Martin. Designed for Digital (Management on the Cutting Edge) (p. 209). MIT Press. Kindle Edition.

For most organizations, a set of well-defined and standardized processes is necessary to achieve operational effectiveness – also to maximize the utilization of information technology

Enterprise Architecture

"The purpose of enterprise architecture is to optimize across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy"

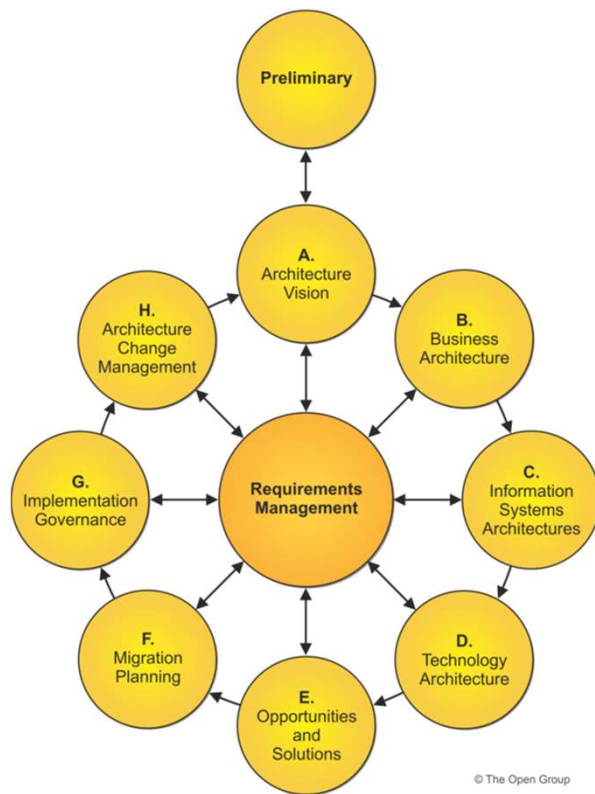
Harrison, Rachel. *TOGAF 9 Foundation Study Guide*. Van Haren, 2013.

"In the years since [John Zachman](#) originated the field of Enterprise Architecture (EA) in his [seminal 1987 article for IBM Systems Journal](#), EA has achieved a surprisingly paltry level of success.

Yes, Enterprise Architects have used various frameworks and other tools to document how their organization operates, often with meticulous detail. But to what end? The cost savings and responsiveness benefits that EA has purported to deliver have been few and far between. Stories of stalled or misdirected EA initiatives vastly outnumber bona fide examples of EA efforts leading to measurable business value."

<https://forbes.com/sites/jasonbloomberg/2014/07/11/is-enterprise-architecture-completely-broken/?sh=2b181b633710>

TOGAF: The Architecture Development Method (ADM)



Excerpt from step C "Information Systems Architecture"

Develop a Target Description for the Application Architecture, to the extent necessary to support the Architecture Vision, Target Business Architecture, and Target Data Architecture.

The scope and level of detail to be defined will depend on the relevance of the application elements to attaining the Target Architecture Vision, and on whether architectural descriptions exist. To the extent possible, identify the relevant Application Architecture building blocks, drawing on the Architecture Repository





"What if we take on step back and proceed with a modular solution?"

Why is enterprise architecture hard?

Hylving, Lena, and Bendik Bygstad. "Nuanced responses to Enterprise architecture management: Loyalty, voice, and exit." *Journal of Management Information Systems* 36.1 (2019): 14-36.

[Check for updates](#)

Nuanced Responses to Enterprise Architecture Management: Loyalty, Voice, and Exit

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BENDIK BYGSTAD (bendikby@ifi.uio.no) is a professor at the University of Oslo, Norway. A sociologist, his main research interests are IT-based service innovation and the relationship between information systems and organizational change. He has published in such journals as *MIS Quarterly*, *Information Systems Journal*, *Journal of Information Technology*, and *International Journal of Project Management*.

ABSTRACT: Enterprise Architecture Management (EAM) aims to deal with the complexities of information technology (IT) solutions and to achieve more organizational agility. EAM is a holistic approach to IT architecture, but the results of the approach have been variable. An under-researched aspect of EAM is how different organizational units respond to the call for a holistic approach. In this study, we investigate how different stakeholders in a large governmental agency connected to three on-going projects and their response to EAM initiatives. With a qualitative approach, we identify three options of response to EAM initiatives: (1) active compliance with the EAM strategy, (2) loyal but passive response, and (3) rebel solutions. We argue for the need of a more nuanced repertoire of actions for dealing with EAM and show how these responses are useful for understanding and managing successful EAM.

KEY WORDS AND PHRASES: Enterprise Architecture Management, IT architecture, organizational agility.

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/mmis.

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ISSN 0742-1222 (print) / ISSN 1557-928X (online)
DOI: <https://doi.org/10.1080/07421222.2018.1550549>

- EAM has been hailed as a holistic and feasible approach for organizations with complex and fragmented IT portfolios
- It has also been proposed as a means to increase organizational agility and emphasis on organizational aspects has been highlighted
- However (...), many EAM initiatives have been disappointments; they are not necessarily outright failures, but they seem to go on forever, without concrete results

(Hylving and Bygstad, 2019)



Enterprise Architecture Challenges

Enterprise Architecture should *"optimize across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy"*
(TOGAF)

EAM initiatives are usually run in a top-down manner; a central team of enterprise architects run the process of developing and implementing the architecture, in co-operation with business managers and IT specialists

...

One core issue is: organizations are not "architected". They grow and change organically as they adapt to outer and inner pressures and changes.

(Hylving and Bygstad, 2019)

Architecture in practice: examples



Example 1: Development

Thale is an application architect working in the IT department of her employer, Goodumbrellas Inc. She is currently engaged in a project working to integrate the logistics system of Goodumbrellas with their customer database, to allow customers to track their orders through a web interface. This is expected both to increase customer satisfaction and reduce the number of support requests.

Thales role is to assist the hired developers with technical questions, and ensure the quality of their work. The developers are friendly and energetic, but they understand way to little of Goodumbrellas complex logistics system to work independently. She also helps designing REST-based service interfaces according to the current standards of Goodumbrellas.

Thale will work on...

Systems design

Problem solving

Professional guidance

Security

Documentation





Example 2: Standardization

Finn is an enterprise architect at Goodumbrellas Inc. After being harshly criticised in the executive meeting, the IT director has initiated a programme (i.e. a set of projects) named "Economies of scale". The goal is to reduce complexity and consolidate the plethora of small, independent applications into a set of shared, standardized and integrated systems.

To ensure correct implementation, all exceptions from the standards must be validated by an Architecture Governance Board led by Finn. The number of applications for exceptions is unexpectedly high, and the waiting time for a decision soon exceeds 8 weeks.



Example 2: Standardization

Luke is the new project manager of www.umbrella-heaven.com They plan to – finally - launch the first complete version to the public in 6 weeks.

The only important feature missing is an integration between the web site and the logistics system. Luke has found a local provider developing the necessary integration with a custom, Java-based component to integrate with the logistics system. The problem is that the "Economies of scale" program has decided that all internal systems should communicate through the enterprise service bus. The necessary integrations require specific certifications on the designated service bus product, and all available personell are booked for the next three months. Luke is offered the option of applying for an exception, where waiting times are only eight weeks...



Luke's response

Finn will work on...

Conflict resolution

Difficult dilemmas

Politics

Systems design



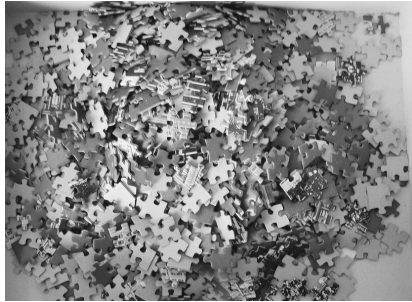


Example 3: Big decisions

After the launch of Umbrella Heaven, Goodumbrella establishes two divisions: Business Customers and Personal Customers. The Business division targets physical retailers, while the Personal division is responsible for direct sales through www.umbrella-heaven.com.

The core systems of the Business Customers division is the CRM (Customer Relational Management) system, which is used also for order management, and the billing system to ensure invoices are processed correctly. The CRM system is working well, while the billing system is obsolete and troublesome. Mia is responsible for choosing a new, custom billing system to replace the old.

However, the Personal Customers-division have their own billing system which also contains an order management module, and the new director of Personal Customers, Luke, is strongly advocating establishing their system as a company standard to ensure an integrated view of the order status. The challenge is: the CRM module of Business is strongly integrated with the ordering system - how to proceed?



Mia will work with...

Stakeholder mapping

Technical concept
development

Risk analysis

Business case

Politics

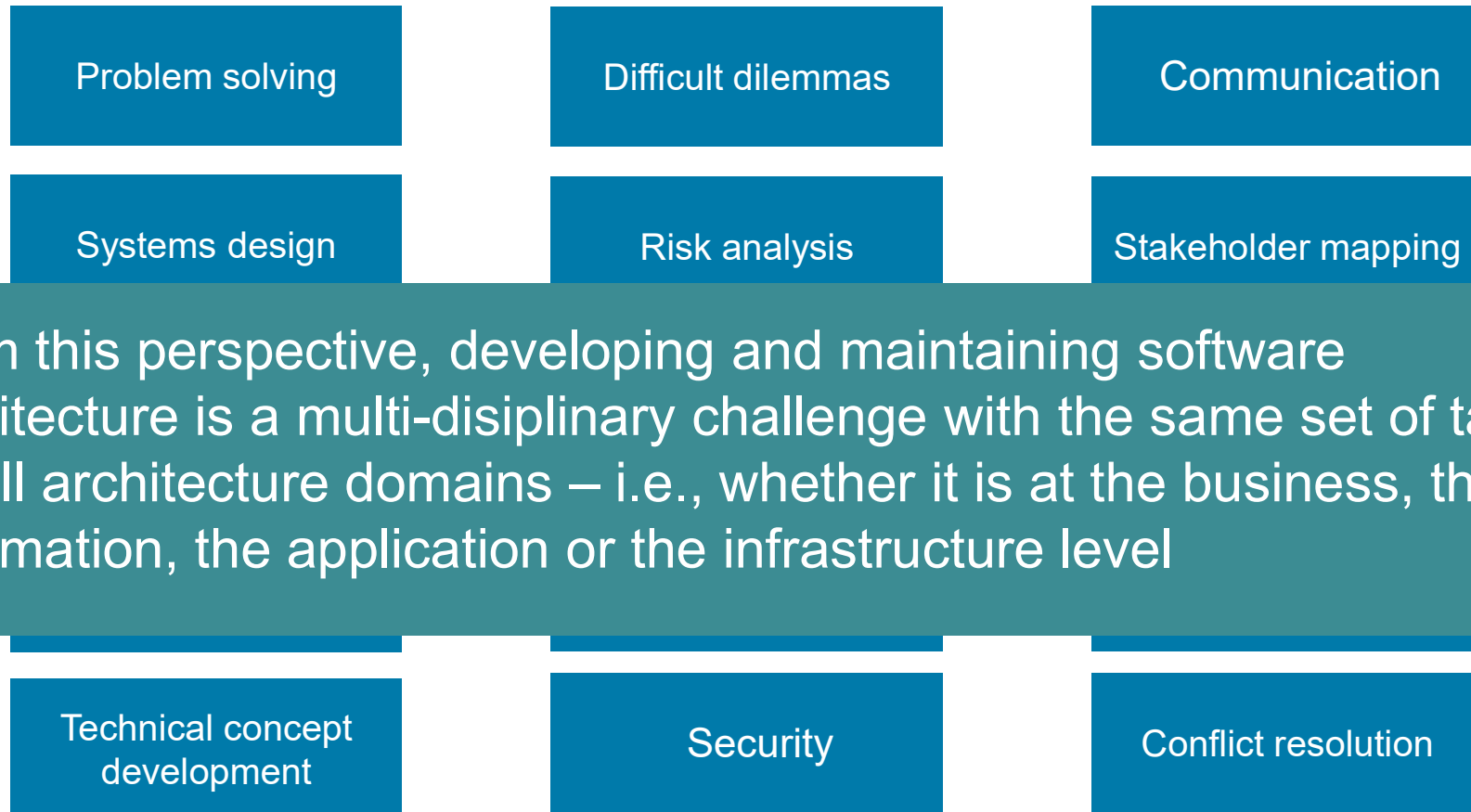
Systems design

Procurement

Communication

Test and deployment





Technical

Management

How you will meet architecture

Which **systems** or **components** do we need?

How should we structure our **knowledge**?

What should we **generalize** and what should be allowed to be **specific**?

How should our systems **communicate** - and with whom?

How should we **document** our systems?

How should we **structure** our systems to ensure maintainability and security?

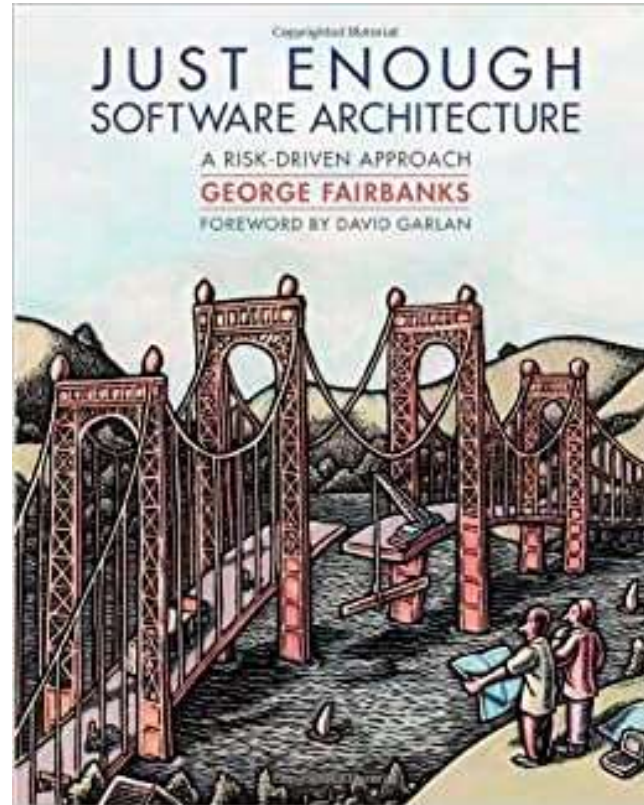
The Conceptual Model and Abstractions

- A large part of developing and maintaining IT Architecture is to find:
 - Map a part of the world to a conceptual model with the right level of generalization and abstraction
 - **Do not** aim to generalize and abstract as much as possible
 - Find the right vocabulary (terms and perspectives) to build a common understanding of business requirements
 - Align IT to the business – e.g., through "ubiquitous language" and Domain Driven Design

Note: there is a huge difference between:

- building software for "yourself" (e.g. for IT-professionals)
- entering a "greenfield" domain
- providing better tools for existing, complex domains such as healthcare or supply chain

Creating good systems is about cooperation and compromise - **listen** to users and to other stakeholders, including developers, operations and managers



Summary

Summary

- Business processes are essential to understand organizations – and to implement good IT systems
- Creating good architecture is about cooperation and compromise
- "Architecture is the set of design decisions that must be made early in the project"
- **But also:** "The software architecture of a computing system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both"
- The purpose of enterprise architecture is [often] to optimize across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment
- The benefits of Enterprise Architecture are often much harder to achieve in practice than expected
- Developing and maintaining software architecture is a multi-disciplinary challenge with the same set of tasks for all architecture domains – i.e., whether it is at the business, the information, the application or the infrastructure level

