



Software Engineering

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KØBENHAVNS UNIVERSITET



Course goals

- Learn fundamentals of model-based software engineering & maintenance
 - The Software Engineering Project
 - Object-oriented Modelling, Analysis & Design
 - Requirements Elicitation
 - Relating models and code
 - Testing, Maintenance, Change & Evolution
 - Apply the knowledge on a real case – a Case Management System

Software Engineering: A working definition

- Software engineering is a collection of techniques, methodologies and tools that help with the production of
 - A high quality software system developed with a given budget and before a given deadline while changes occurs
 - High quality: Addresses the problem satisfactory

Software-engineering

Many stakeholders

Customer User Government

Vendors General public

Different wishes, focus and requirements

Many technologies

SOA RPA ACM Blockchain

Access control BPM AI Anonymisation

ESDH Cloud Firewall

Different strengths/weaknesses and usages

Many development processes

Waterfall

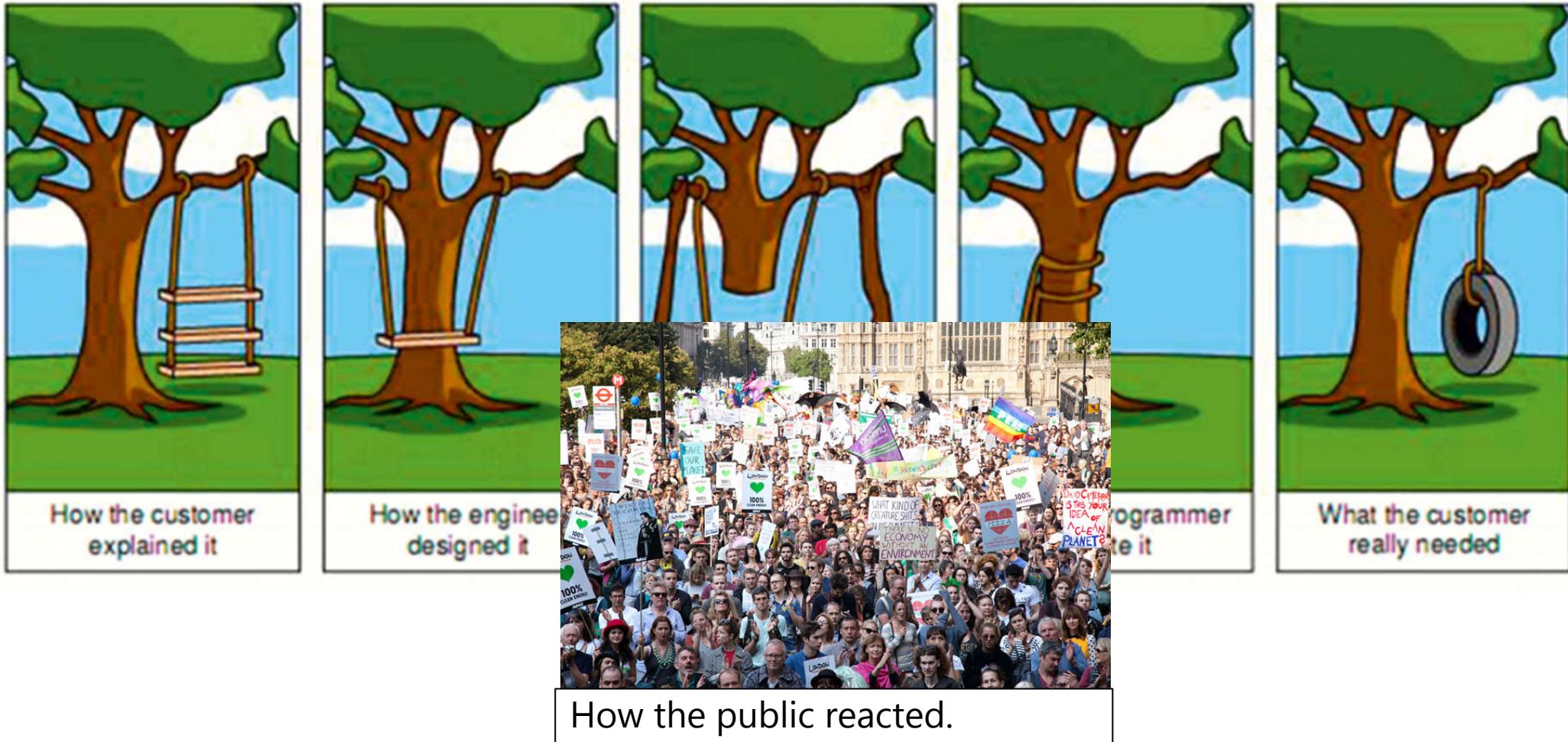
Agile

Same activities (almost), different priority and management

Stakeholders

- Customer organisation
 - Hvem har efterspurgt projektet?
 - Hvem har taget initiativ til projektet?
 - Hvem kan påvirke projektets (politiske) rammevilkår?
 - Hvem skal acceptere projektets løsning?
 - Hvem skal inddrages undervejs i projektet?
 - Hvem har interesse i de forandringer, som projektet medfører?
 - Hvem vil have modstand mod projektet?
 - Hvem skal ændre adfærd på baggrund af projektet?
- Vendor
- Users
- General public
- Government

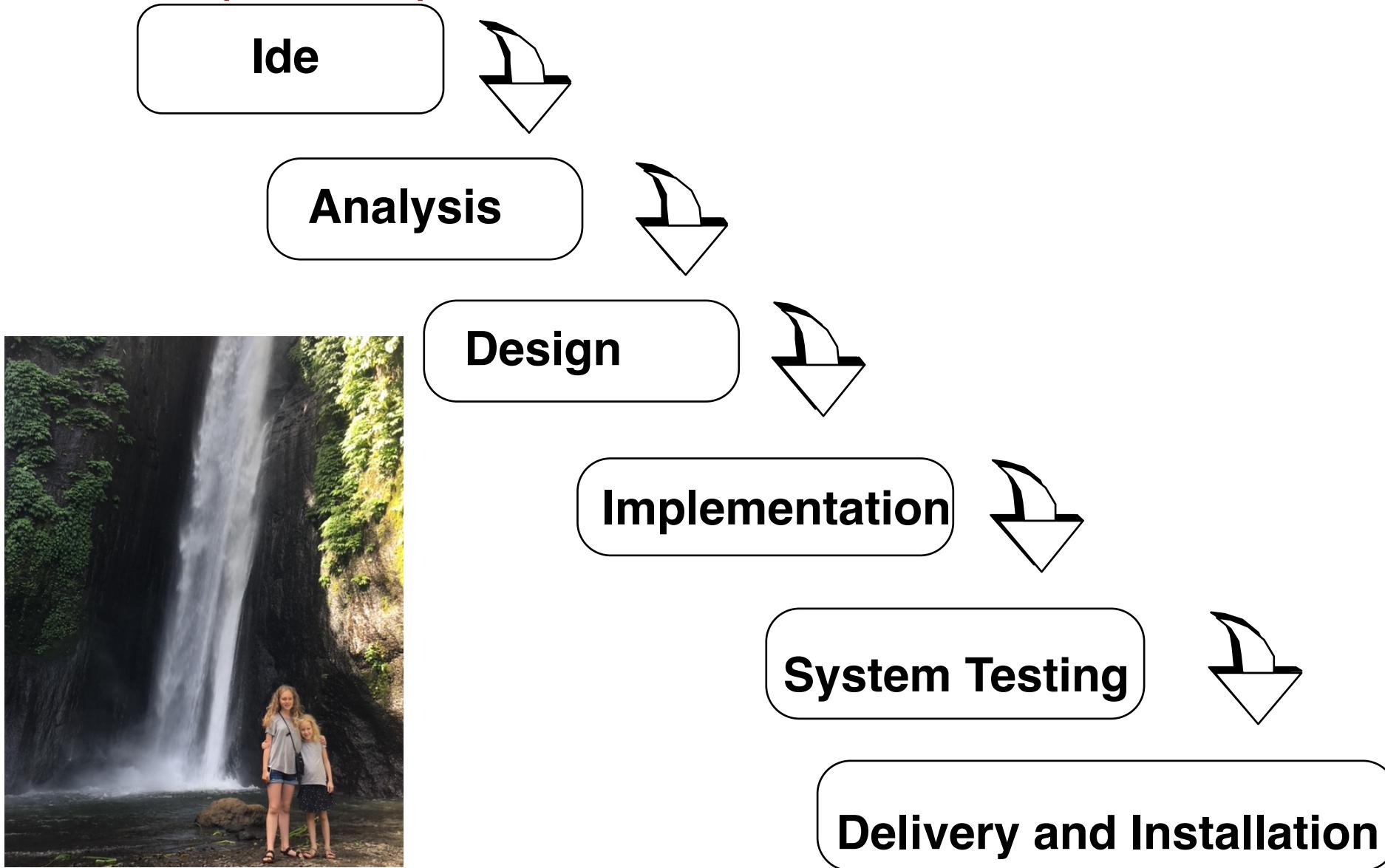
Lack of common understanding



Two types of requirements

- Functional requirements
 - What problem is solved?
Ineffective workflows. As-is proces-descriptions with flow timing
Compliance problems. Descriptions of violations
 - How should it be solved?
New it-supported/automated processes. To-be descriptions. Use-cases. Citizen/user-journey
- Non-functional/qualitative requirements
 - How good will we solved the problem?
Effektivitet, Lovmedholdelighed, Sikkerhed, Tilgængelighed, Brugbarhed, Vedligeholdbarhed
 - Have to be measurable!

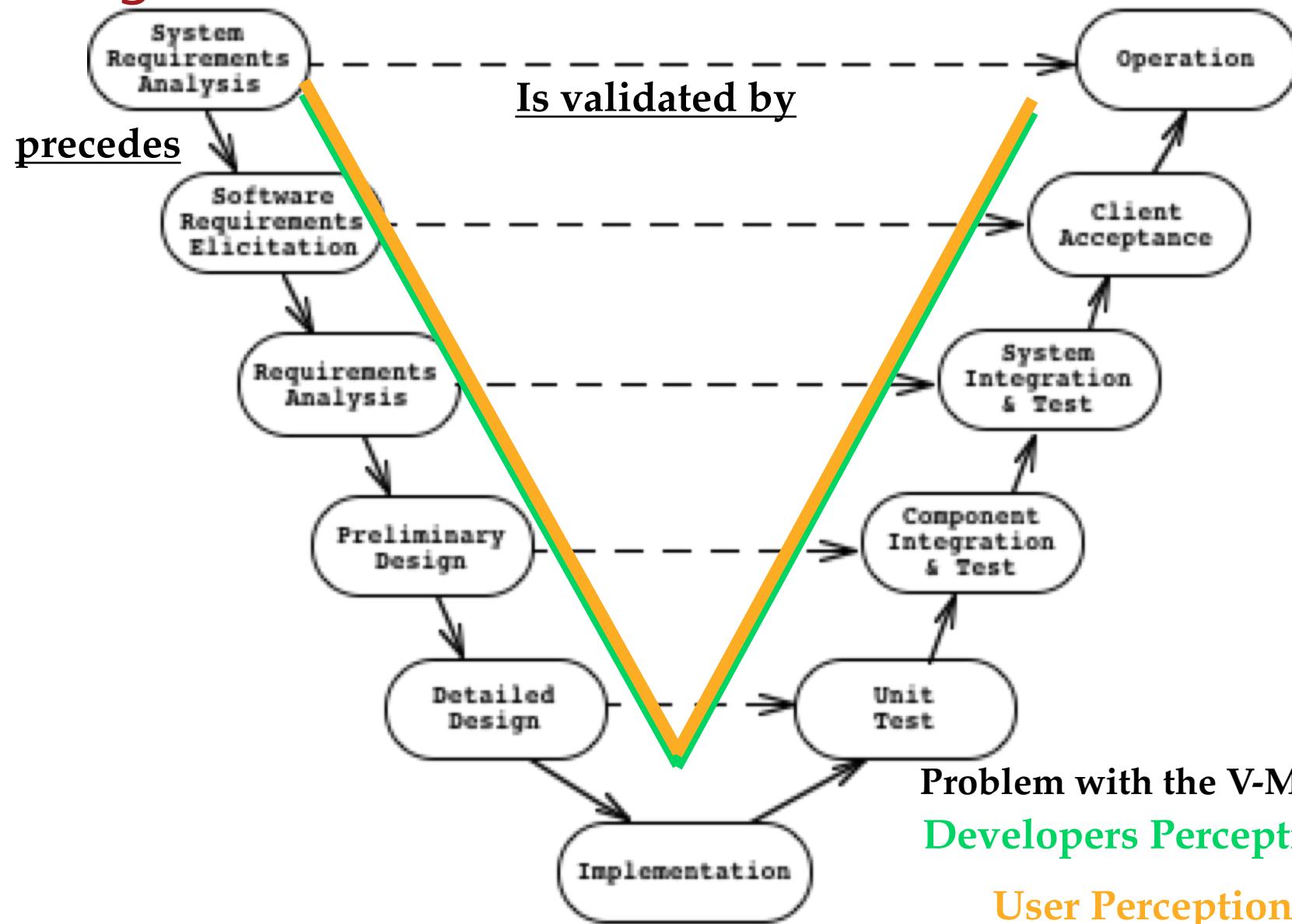
Development processes- waterfall



Properties of Waterfall-based Models

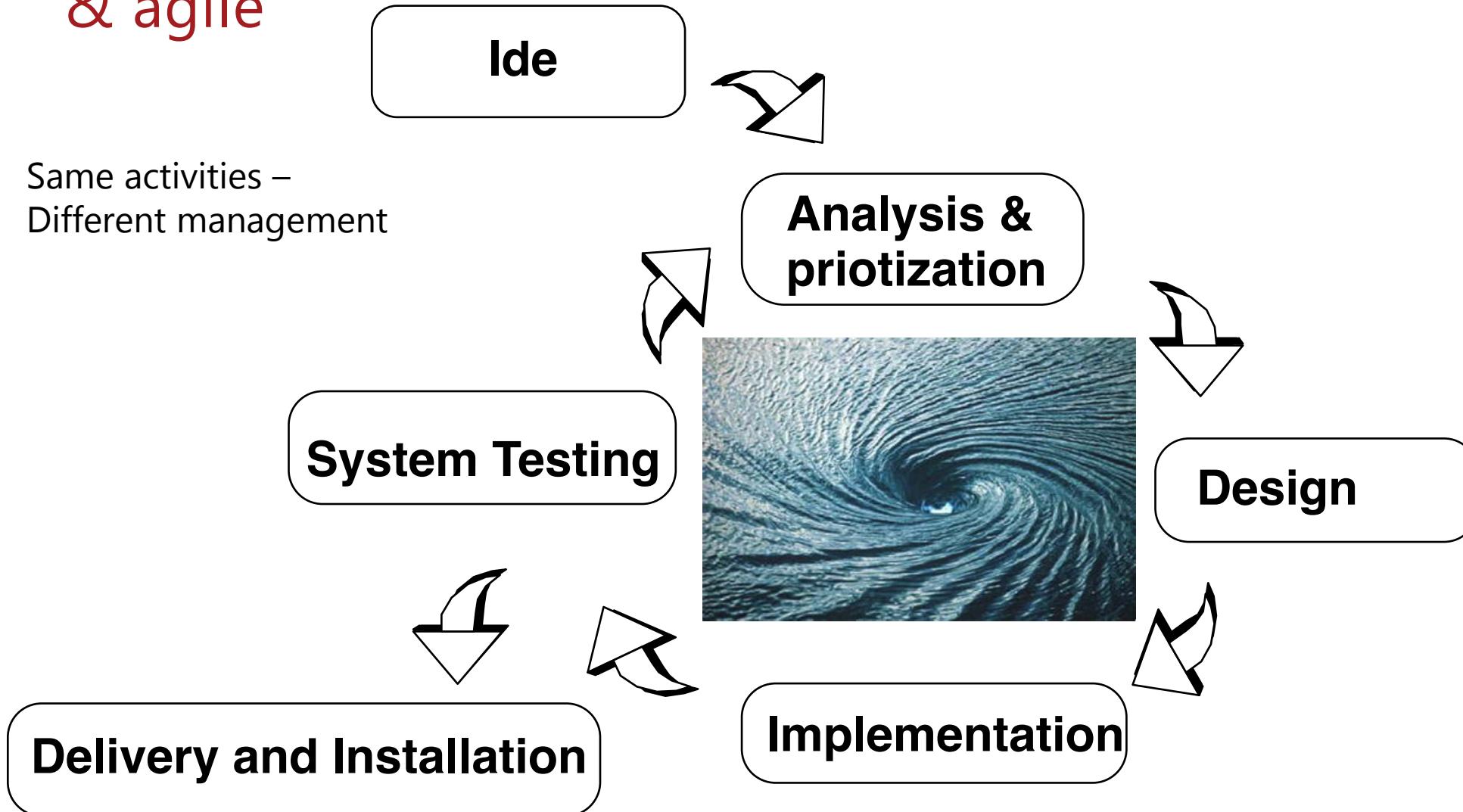
- Managers love waterfall models
 - Nice milestones
 - No need to look back (linear system)
 - Always one activity at a time
 - Easy to check progress during development: "The system is 90% coded", "We have done 20% of our tests"
- However, software development is non-linear
 - While a design is being developed, problems with requirements are identified
 - While a program is being implemented, design and requirement problems are found
 - While a program is tested, coding errors, design errors and requirement errors are found.

Activity Diagram of the V Model

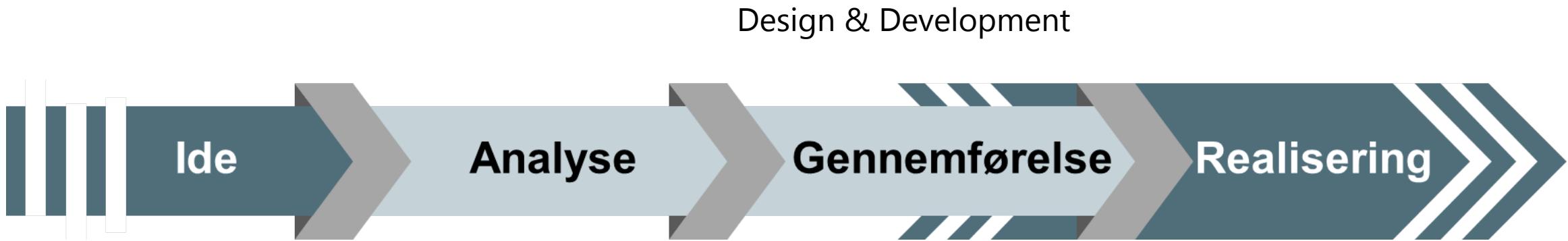


Development processes – Incremental & agile

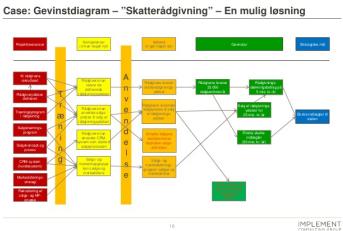
Same activities –
Different management



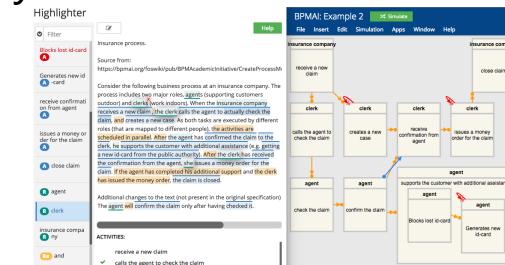
IT-project phases – “statens it-projektmodel” in Denmark



Problem, budget and Business case



Project establishment & Analysis



<https://digst.dk/media/18234/vejledning-til-brug-af-business-case-i-staten.pdf>

<https://digst.dk/styring/projektstyring/statens-it-projektmodel/>

Realisation of business case..

17/2017

STATSREVISORERNE
RIGSREVISIONEN

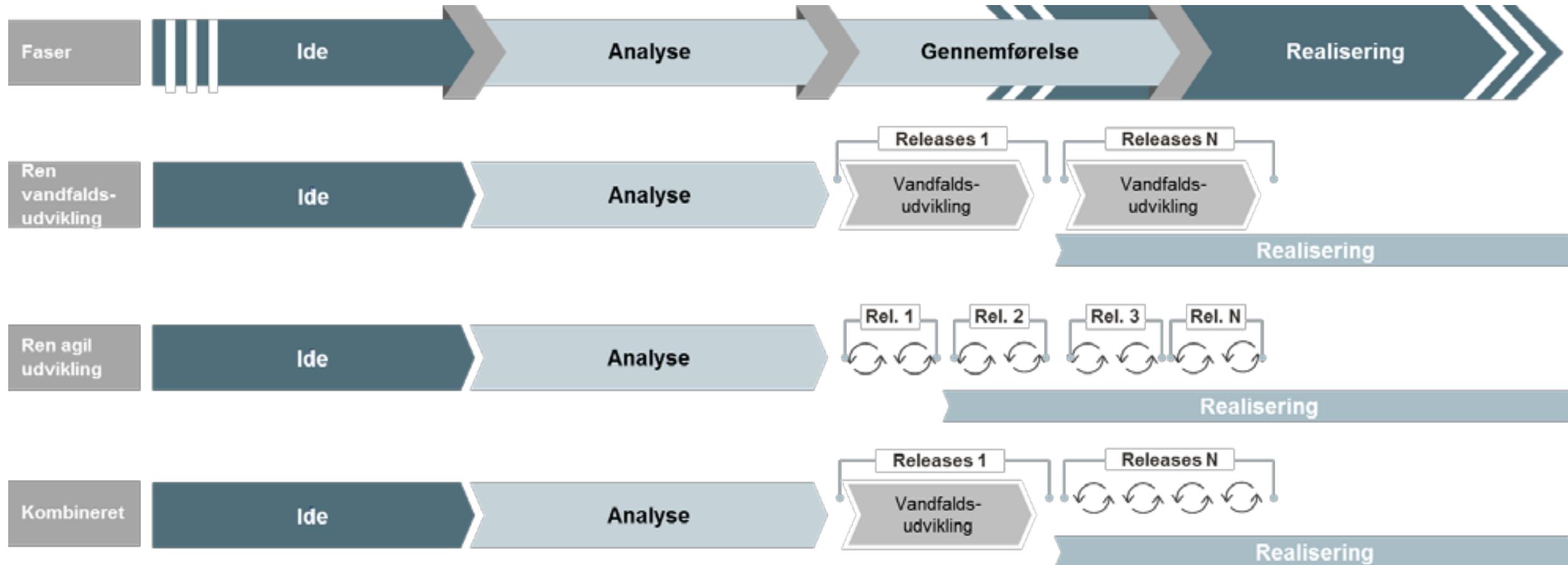


Statsrevisorerne bemærker, at faldet i hospitalernes aktivitet har været væsentligt over det forventede, og at de forudsatte gevinster ved Sundhedsplatformen endnu ikke har kunnet realiseres.

Statsrevisorerne fremhæver, at Region Hovedstaden tog Sundhedsplatformen i brug:

- Selv om systemet var ufærdigt og behæftet med fejl og mangler.
- Uden tilstrækkelige tests.
- Uden tilstrækkelig uddannelse af brugerne.
- Med mangelfuld planlægning af iBrugtagningen.

Waterfall, Agile, Combi



Steering/Management documents

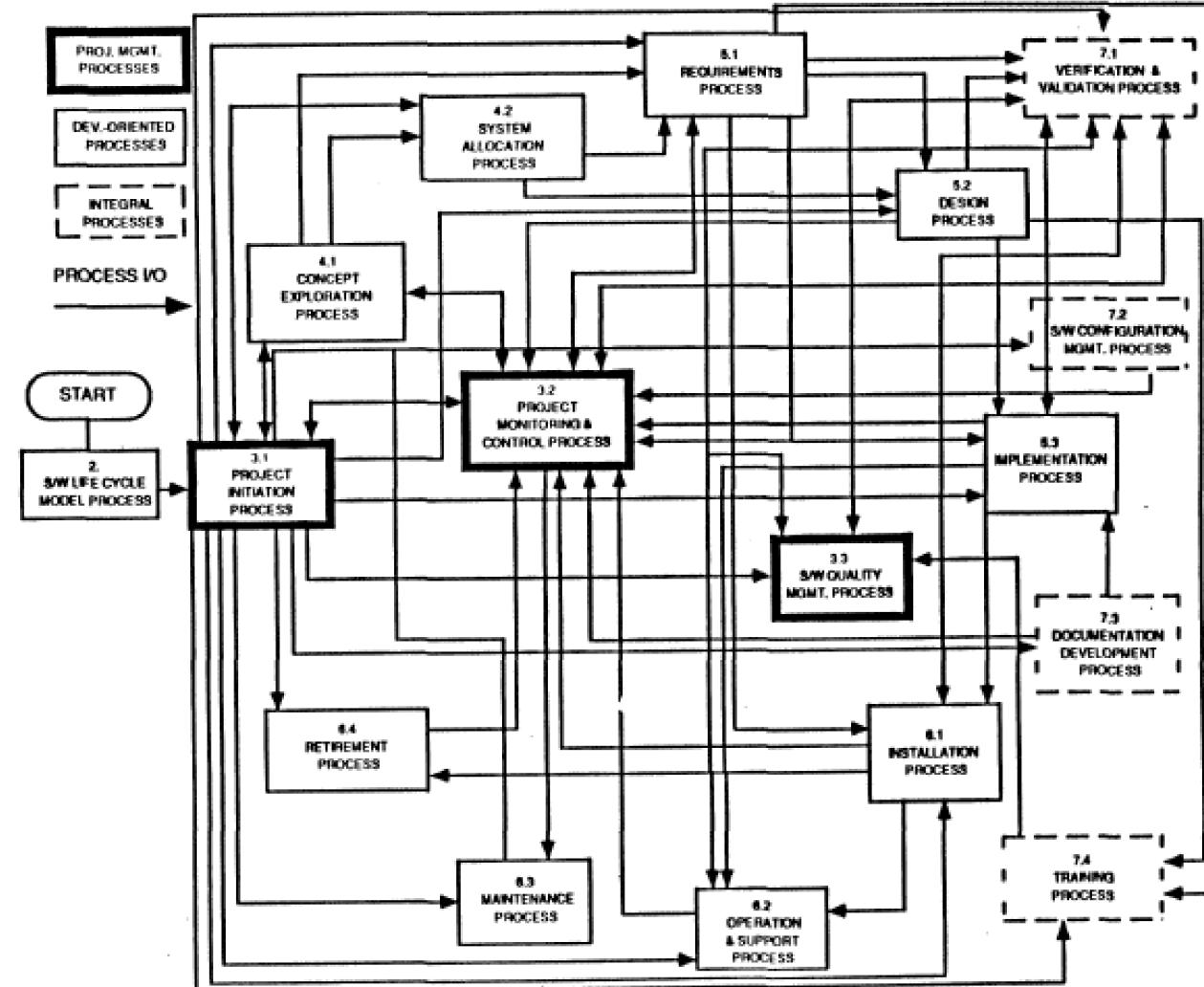
- Project foundation (incl. Plan for analysis phase)
- Risk checklist
- Risk log
- Steering group agreement
- Business case

5 principles in "Statens IT-projektmodel"

- Use mature technologies
 - unless specific perspectives in using new technologies
- Reuse existing solutions as much as possible (viable)
- Only carry through projects with clearly described costs and benefits
- Minimize scope and complexity with focus on business goals
- Common methods and qualified resources

Dealing with Complexity

- Abstraction & Models
- Decomposition
- Hierarchy

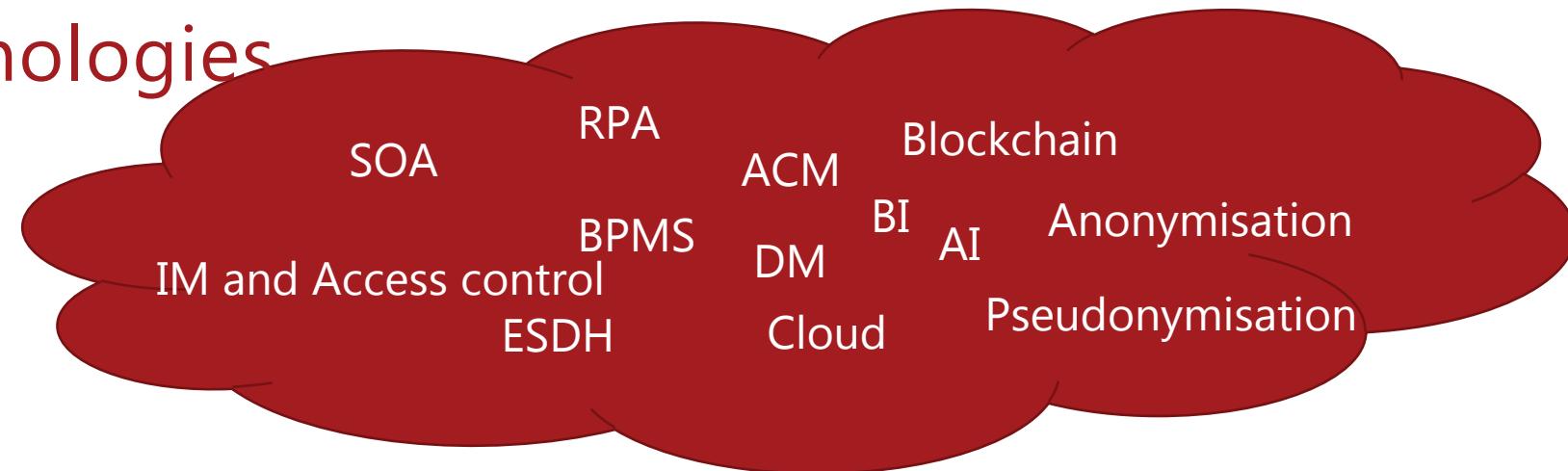


Models to describe Software Systems

- **Object model:** What is the structure of the system?
- **Functional model:** What are the functions of the system?
- **Dynamic model:** How does the system react to external events?

- **System Model:** Object model + functional model + dynamic model

Software technologies



ESDH (Elektronisk Sags & Dokument Håndtering)

IM (Identity Management) and access control

SOA (Service Oriented Architecture)

Cloud

RPA (Robotic Process Automation)

BPMS (Business Process Management Systems)

DM (Decision Modelling)

Pseudonymisation

ACM (Adaptive Case Management)

BI (Business Intelligence)

AI (Kunstig Intelligens)

Anonymisation

Blockchain

SOA – Service Oriented Architecture

- SOA: Services available via API (Application Programming Interface)
- Supports principle of matureness and reuse of existing systems
- Requires governance, agreement on interfaces and types of values, overview of use of personal/sensitive data, monitoring of errors



COMPUTERWORLD CIO PREMIUM JOB & KARRIERE EKSPERTI

FORSIDE DIGITALISERING FORRETNINGSSOFTWARE TOP 100 TELE & MOBIL PC'ER & HARDV



It-fejl mellem Sundhedsplatformen og det Fælles Medicinkort udløste hundredvis af fejlfyldte ordinationer

På en enkel dag fik mere end 1.000 patienter udskrevet medicin med forkerte udløbsdatoer

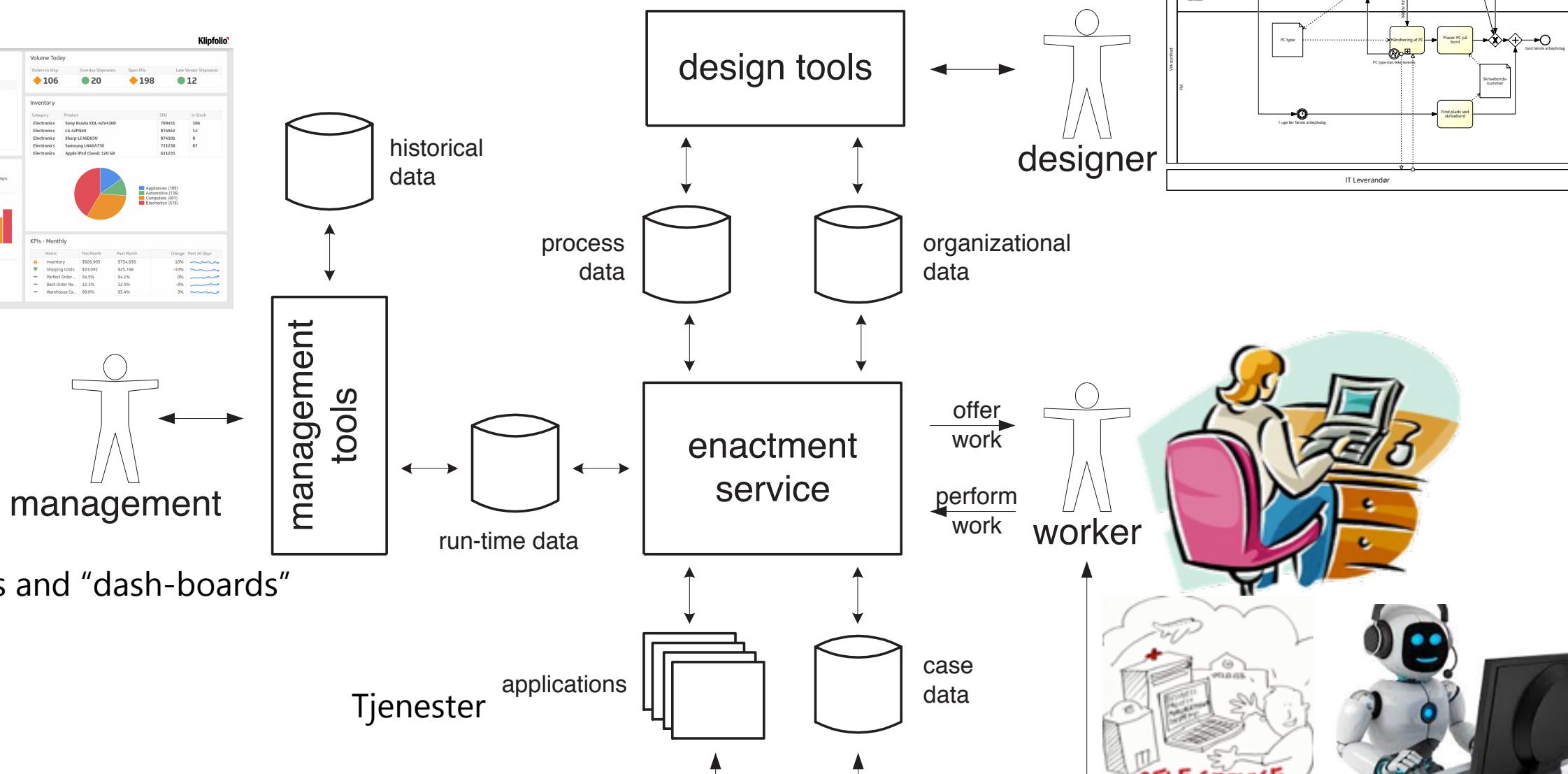
21. august 2018 kl. 14.14



NIELS DE BOISSEZON Teknologiredaktør

BPMS – Business Process Management Systems

Supports principle of matureness and reuse of existing systems



Standard BPMS usually depends on

- SOA
- Business processes described as flow diagrams (BPMN)
- Does it work?



RPA – Robotic Process Automation



Robotic process automation

Class of software “robots” that replicates the actions of a human being interacting with the user interfaces of other software systems. Enables the automation of many “back-office” workflows without requiring expensive IT integration

A FUTURE THAT WORKS:

the impact of automation
in Denmark

McKinsey&Company

THE TUBORG RESEARCH CENTRE
FOR GLOBALISATION AND FIRMS
INSTITUT FOR ØKONOMI
AARHUS UNIVERSITET
BSS

What does RPA mean?

Corporate Loan Origination

New Enter Query

Workflow Reference #

Priority Low

Application Category *

Product Code *

Description

Application Branch

Application Date

Lead Id

Enquiry ID

Default

Application Number *

User Reference *

Priority Low

Status New Application

Main Details Financials Requested Limits Collateral Credit Score Bureau Ratio Loan Component Charges Investigation Comments

External Credit Rating

1 Of 1

Request ID 1

External Agency

Score

Recommended Not Recommended

Status Not Required

Remarks

Documents | Trade In | KYC Review | Customer Dedupe | Loan Dedupe | Customer MIS | Customer Account MIS | Customer/Account Fields |

Vehicle Evaluator | Bureau Report | Loan MIS | Loan Fields

Previous Remarks

Remarks

Audit

Outcome

Exit

skriv først her

så her

vælg i menuen

og tryk exit

The screenshot illustrates a user interface for 'Corporate Loan Origination'. The main window has tabs at the top: Main, Details, Financials, Requested, Limits, Collateral, Credit Score, Bureau, Ratio, Loan, Component, Charges, Investigation, and Comments. The 'Bureau' tab is currently selected. The interface includes fields for Workflow Reference #, Priority (set to Low), Application Category, Product Code, Description, Application Branch, Application Date, Lead Id, Enquiry ID, and Default status. On the right side, there are fields for Application Number, User Reference, Priority (set to Low), and Status (set to New Application). At the bottom, there are sections for External Credit Rating (with tabs for Request ID, External Agency, and Score) and Previous Remarks (with tabs for Remarks, Audit, and Outcome). Handwritten Danish text overlays the interface: 'skriv først her' (write first here) points to the Application Category field; 'så her' (then here) points to the Priority dropdown; 'vælg i menuen' (select in the menu) points to the Bureau tab; and 'og tryk exit' (and press exit) points to the Exit button at the bottom right.

Digitaliseringspris 2019 Copenhagen Municipality



Københavns Kommune vinder Digitaliseringsprisen 2019

13.3.2019 10:45:06 CET | [Københavns Kommune Økonomiforvaltningen](#)

Del

I dag er årets digitale vindere blevet kåret på konferencen Offentlig Digitalisering 2019. Vinderen af Implementeringsprisen blev Københavns Kommune: Prisen blev givet for den fælles platform til implementering af softwareroboter

I Københavns Kommune er de digitale kolleger – softwareroboterne – og den bagvedliggende RPA-teknologi for alvor blevet en del af hverdagen. Roboterne løser for eksempel sager vedrørende aktindsigter og journalisering.

The image shows a magazine spread from 'danske kommuner' (issue 07/2017). The left page features the magazine's logo and the title 'Roboterne kommer – fremtiden er landet'. The right page contains an article with the heading 'Der kan både være økonomiske og kvalitetsmæssige gevinst at hente ved at overlade ensformige og rutineprægede opgaver til en digital kollega. Flere kommuner er i gang, og et fælleskommunalt initiativ skal sætte skub i udviklingen.' and author information 'tekst SØREN FREDERIK BREGENOV, CHEFKONSULENT I KL'S CENTER FOR DIGITALISERING OG BORGERBETJENING'.

RPA is not always the right solution

Harvard Business Review

CHANGE MANAGEMENT

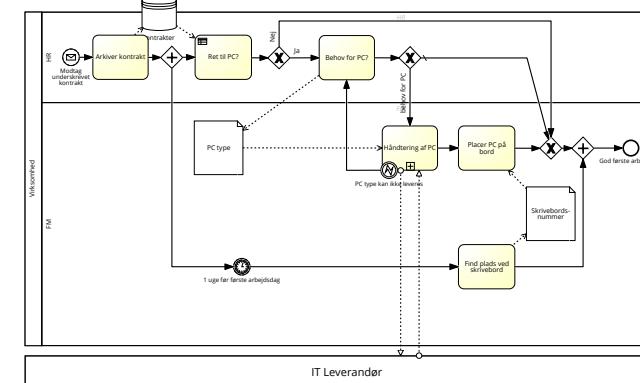
Reengineering Work: Don't Automate, Obliterate

by Michael Hammer

FROM THE JULY-AUGUST 1990 ISSUE



New dependencies



Amtrak - Reservations - Passenger Information

Security Warning

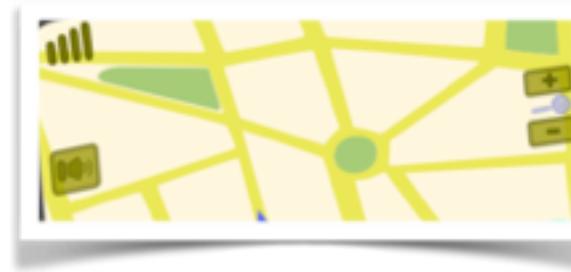
Although this page is encrypted, the information you have entered is to be sent over an unencrypted connection and could easily be read by a third party.

Are you sure you want to continue sending this information?

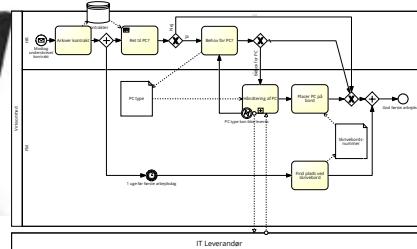
Password Login

This is a screenshot of a web browser showing a security warning. The title bar says "Amtrak - Reservations - Passenger Information". A modal dialog box is open, titled "Security Warning". The text inside the dialog says: "Although this page is encrypted, the information you have entered is to be sent over an unencrypted connection and could easily be read by a third party." Below that, another message says: "Are you sure you want to continue sending this information?". At the bottom of the dialog are two buttons: "Cancel" and "Continue". At the very bottom of the screen, there is a password field and a "Login" button with a right-pointing arrow icon.

Not everything can be automated



Highly predictable & many repetitions



Many tasks (27%) but few end-to-end workflows (<5%) can be fully automated
(McKinsey 2017)

Partly predictable and some repetitions

Unpredictable and few repetitions

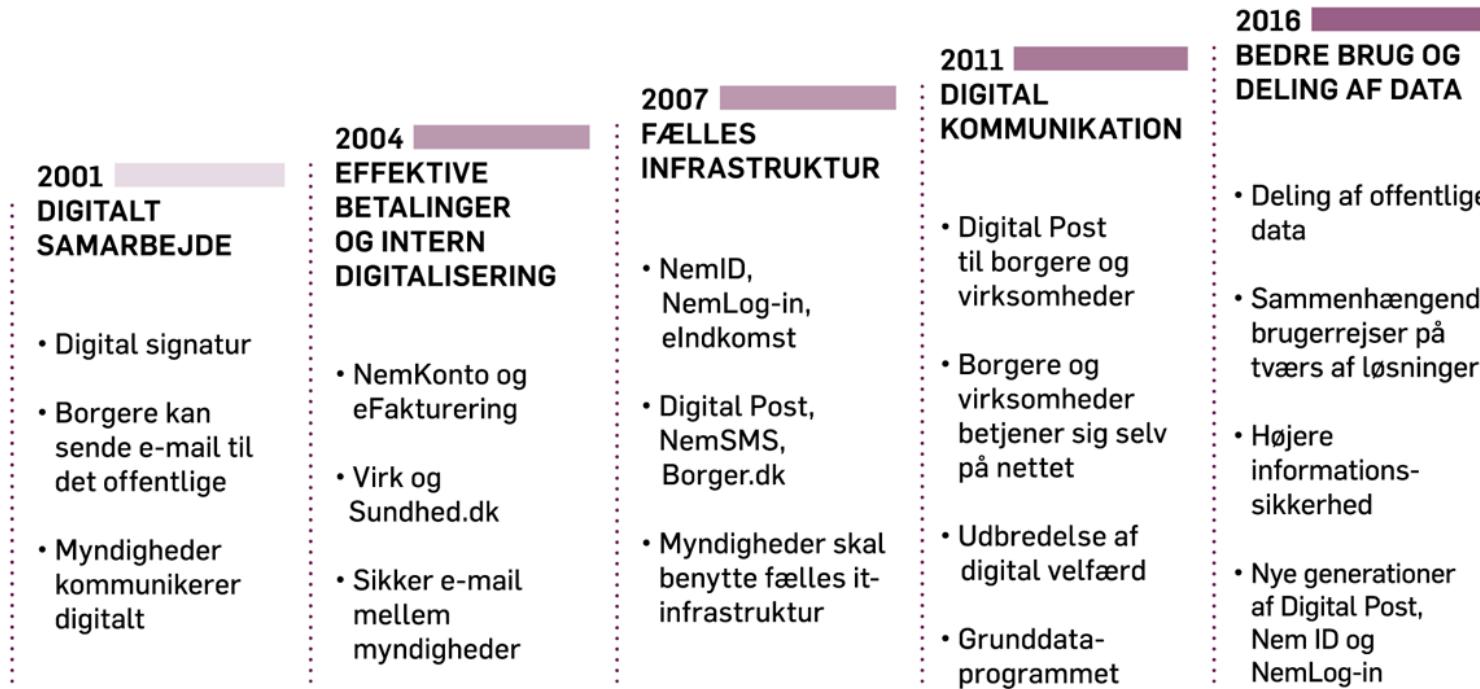
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Two decades of digitalisation strategies



United Nations (UN) 1st place in public digitalisation !

