Business Information Systems utilizing the Future Internet

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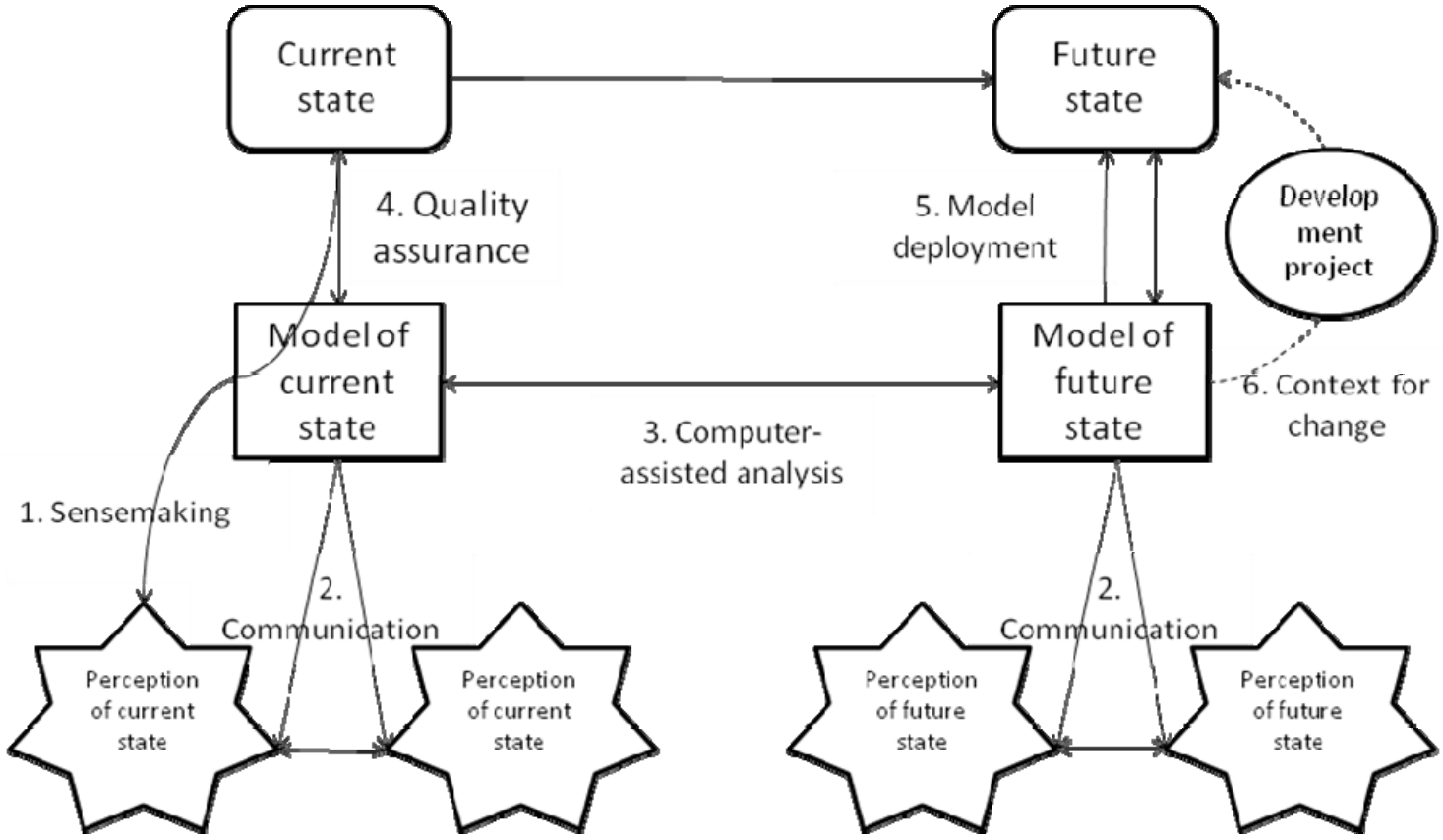
Overview of presentation

- Background
  - On me
  - On modeling
  - On overall trends in business and society
  - On the Future Internet
- Trends and challenges for business information systems
  - Examples
  - Role of modeling
- Conclusion

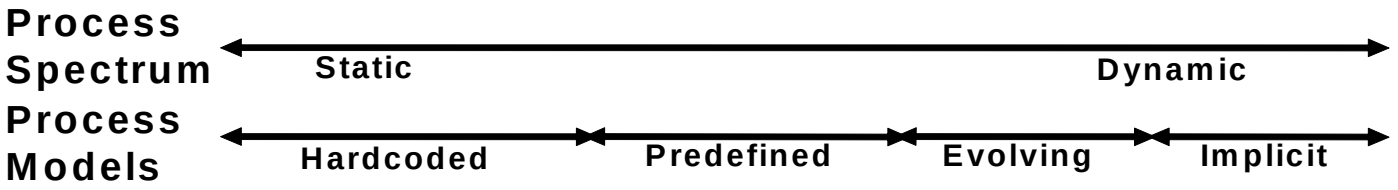
Short background on me

- Master and PhD in Information Systems (1991, 1995), modeling techniques, quality of modeling in particular
- Employed 9 years in Andersen Consulting (Accenture)
- 2000-2005 SINTEF ICT (Oslo)
- Professor at IDI, NTNU, Trondheim, Norway 1.August 2005.
- Leader of Strategic Area ICT at NTNU, coordinate cross-disciplinary ICT research at the university (health informatics, eGovernment etc)
- Leader of IFIP WG 8.1 on Design and Evaluation of Information Systems (EMMSAD, POEM, BPMDS ME…)

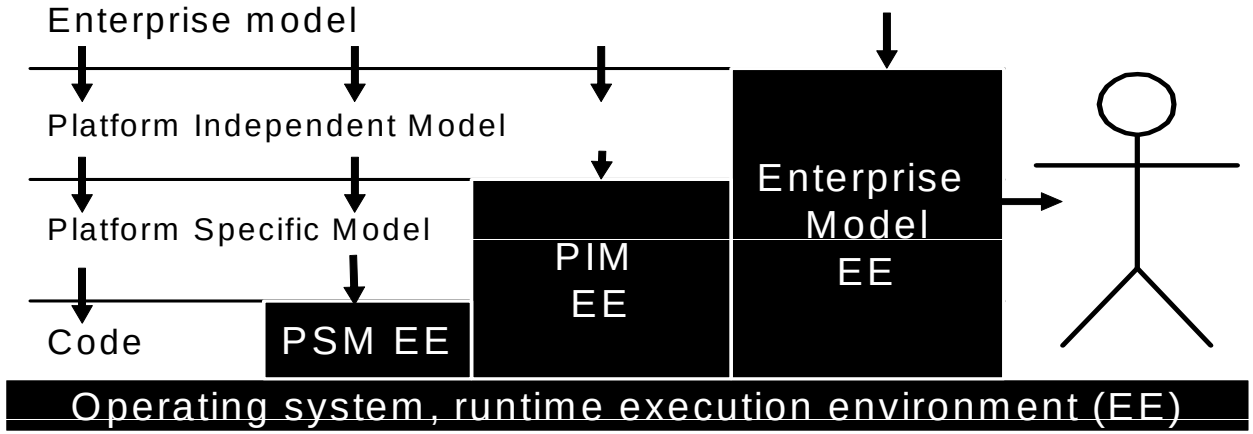
Usage of modeling and models



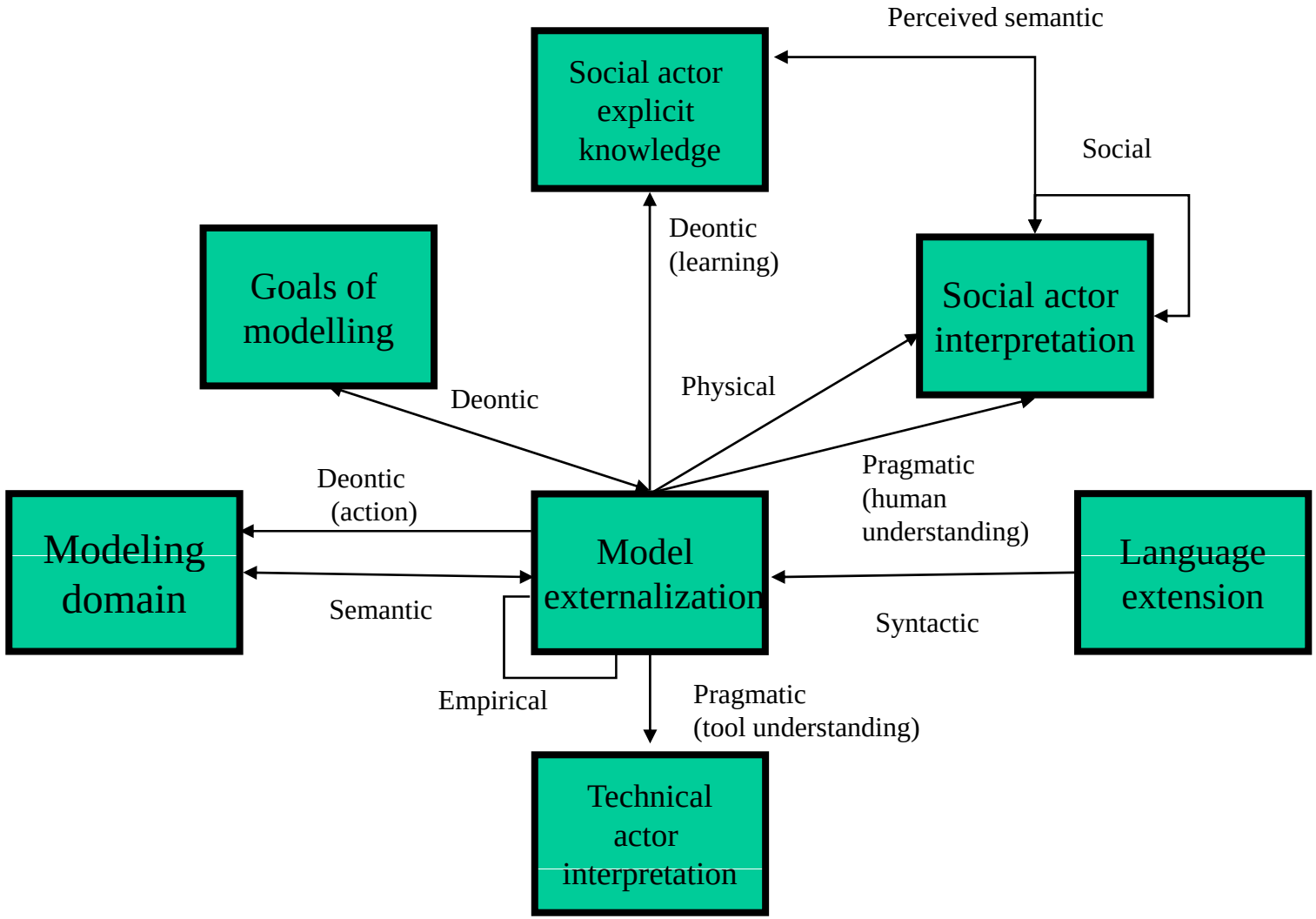
Different execution environment for different process models



Model-driven solutions:



Quality of Models - SEQUAL



Societal and political trends

- Globalization
- Towards sustainability
- Demographics
- Geo-politics
- Individualization

-> How we perform business needs to change

-> The way we develop and evolve business information systems need to change

Business trends (from FINES – Future Internet Enterprise Systems)

- The disappearing boundaries of the Enterprise.
- The larger role for SMEs.
- The WhatYou*Sense*IsWhatYouGet (WYSIWYG) Enterprise
- A Knowledge Commons for Enterprises
- Enterprises spanning the real and the virtual world

Future internet

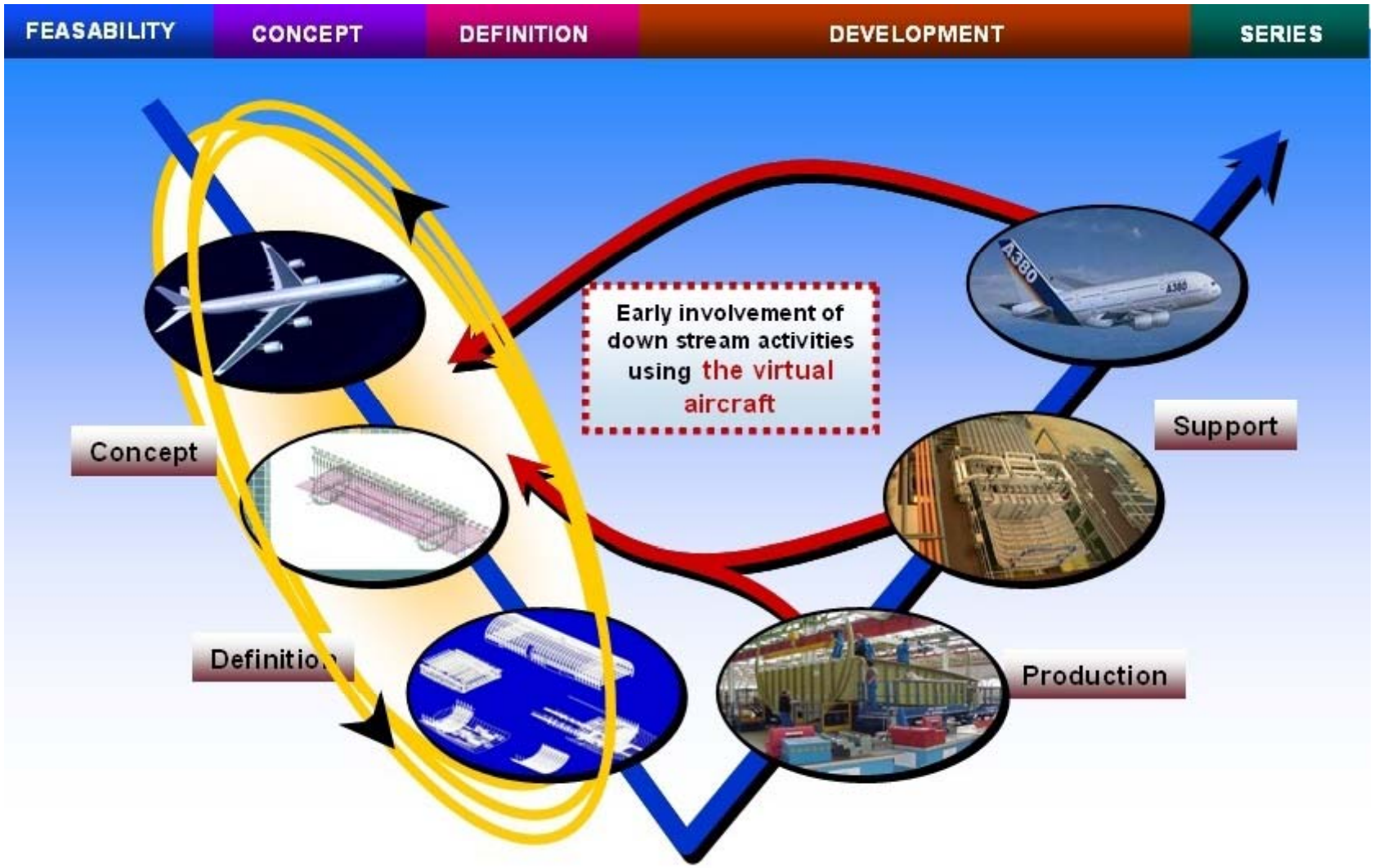
- Description from 7FP ICT program : *The **Future Internet,** both **evolutions** of the current and **completely new** network and service infrastructures, are key developments. In the shorter term, breakthroughs are expected from the integration of (IP-based) networking and service development tools into open platforms for the **development of innovative internet-empowered applications**. In the longer term, breakthroughs like all-optical networks combined with **advances in wireless communication, sensor networks, computing, autonomic network/service management capabilities, trust and security** are expected to yield totally new network architectures and systems.*

- Focus (in Norway) on development according to
  - Mobile internet
  - Social networks
  - Internet of Things

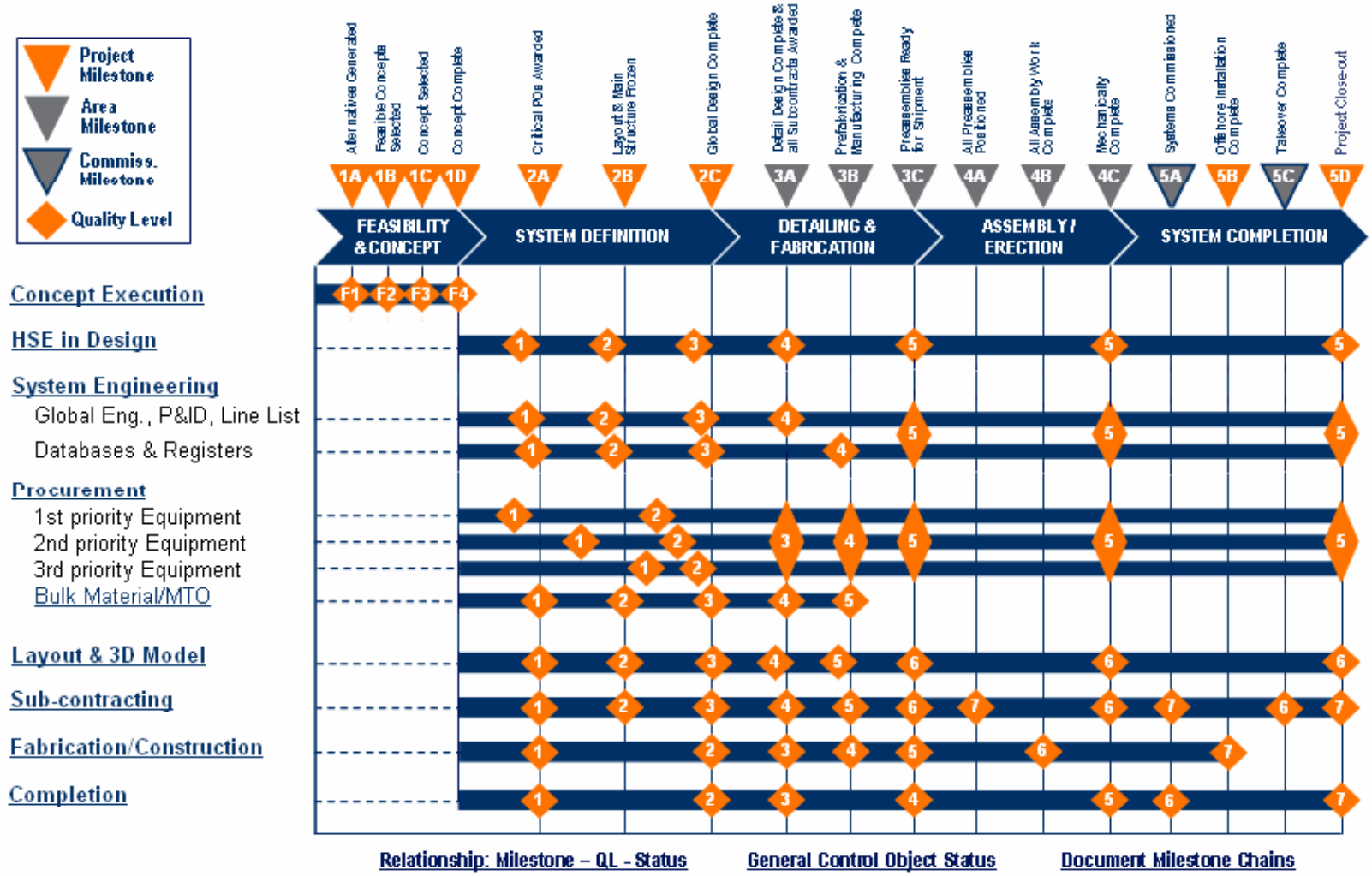
Overall technological trends

- The support of end-to-end design and engineering process (including full life-cycle support of products)
- Integration across organizations and nations
- Information systems being provided by ecosystems of providers rather than individual providers
- Event-oriented systems utilizing the internet of things

End-to-end engineering process – example
Virtual Aircraft for Early Involvement of Downstream Activities



Aker Project Execution Model



Model-driven approach for collecting and distributing existing information

Workplaces for roles

Update of data in core systems

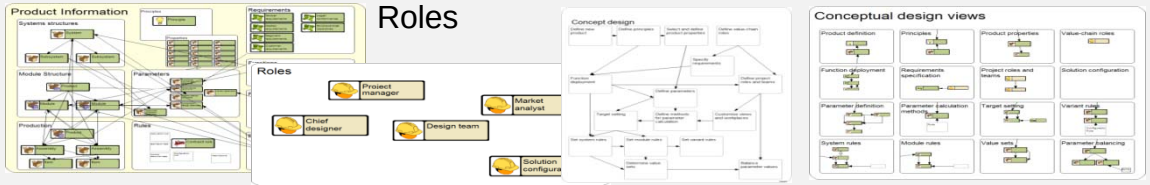
Active Knowledge Architecture

Technologies

Organization Roles

Processes, Tasks

Systems, Views



Project management

Systems engineering

3D Layout

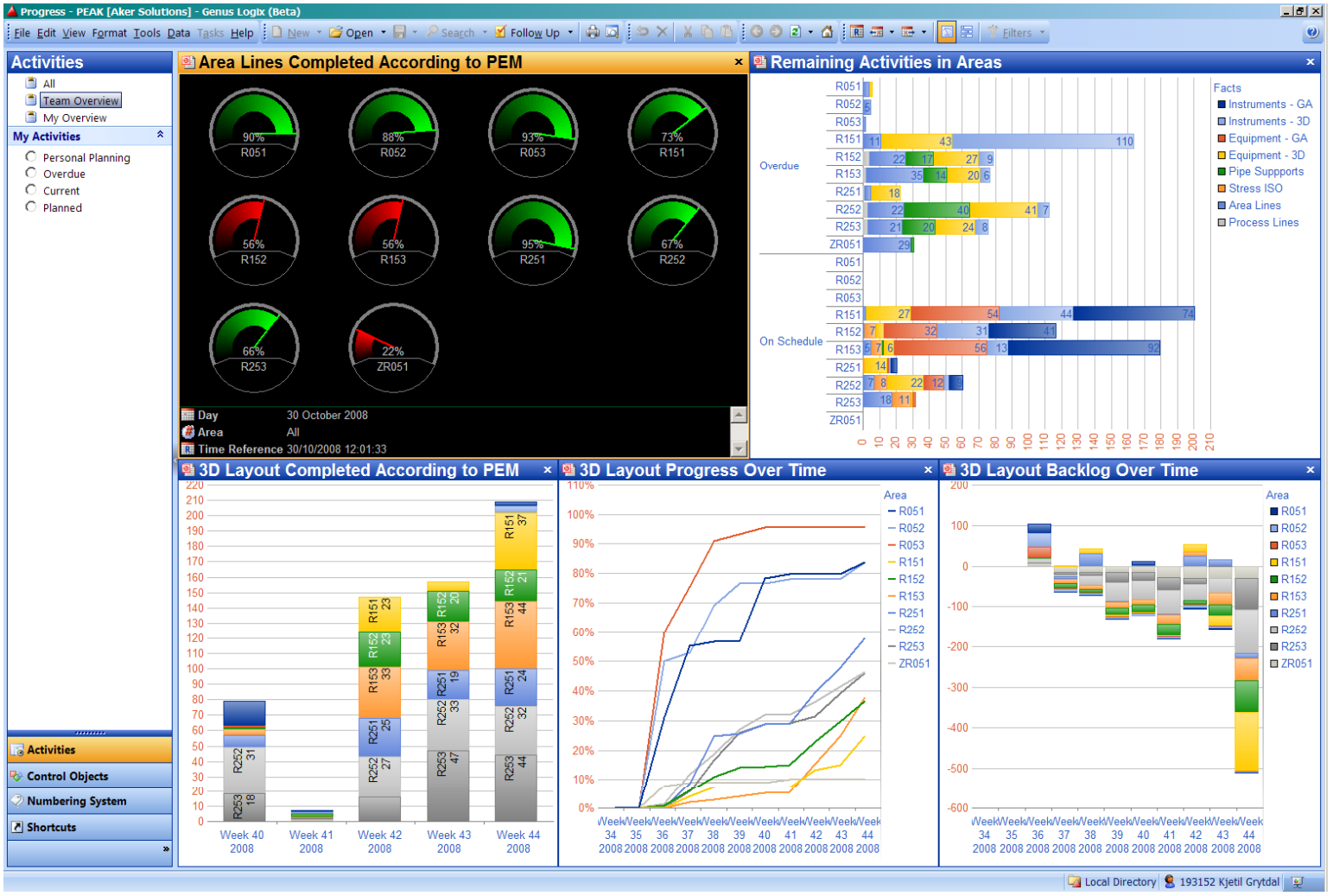
Document management

Etc.

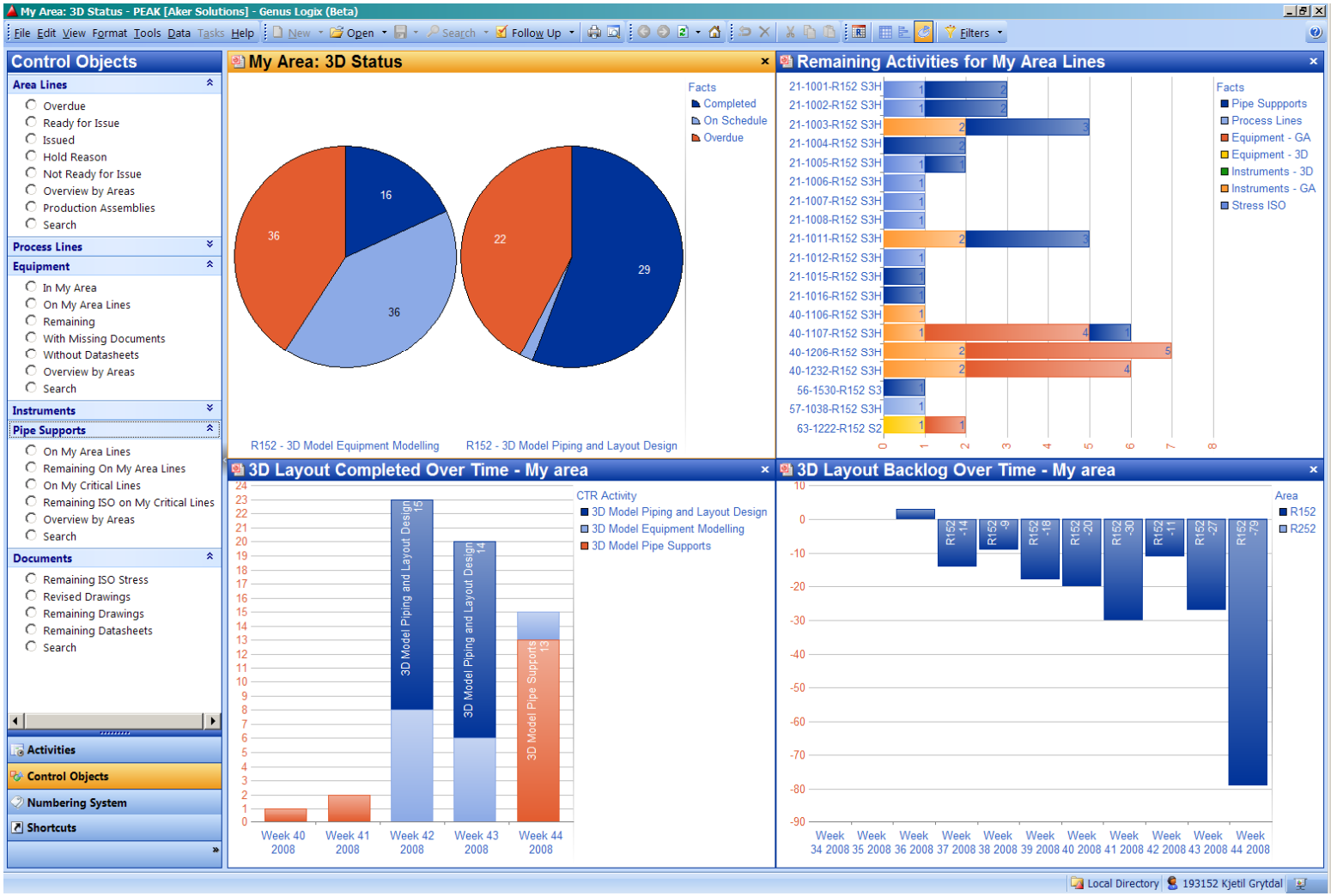
Engineering Numbering System

Project Execution Model

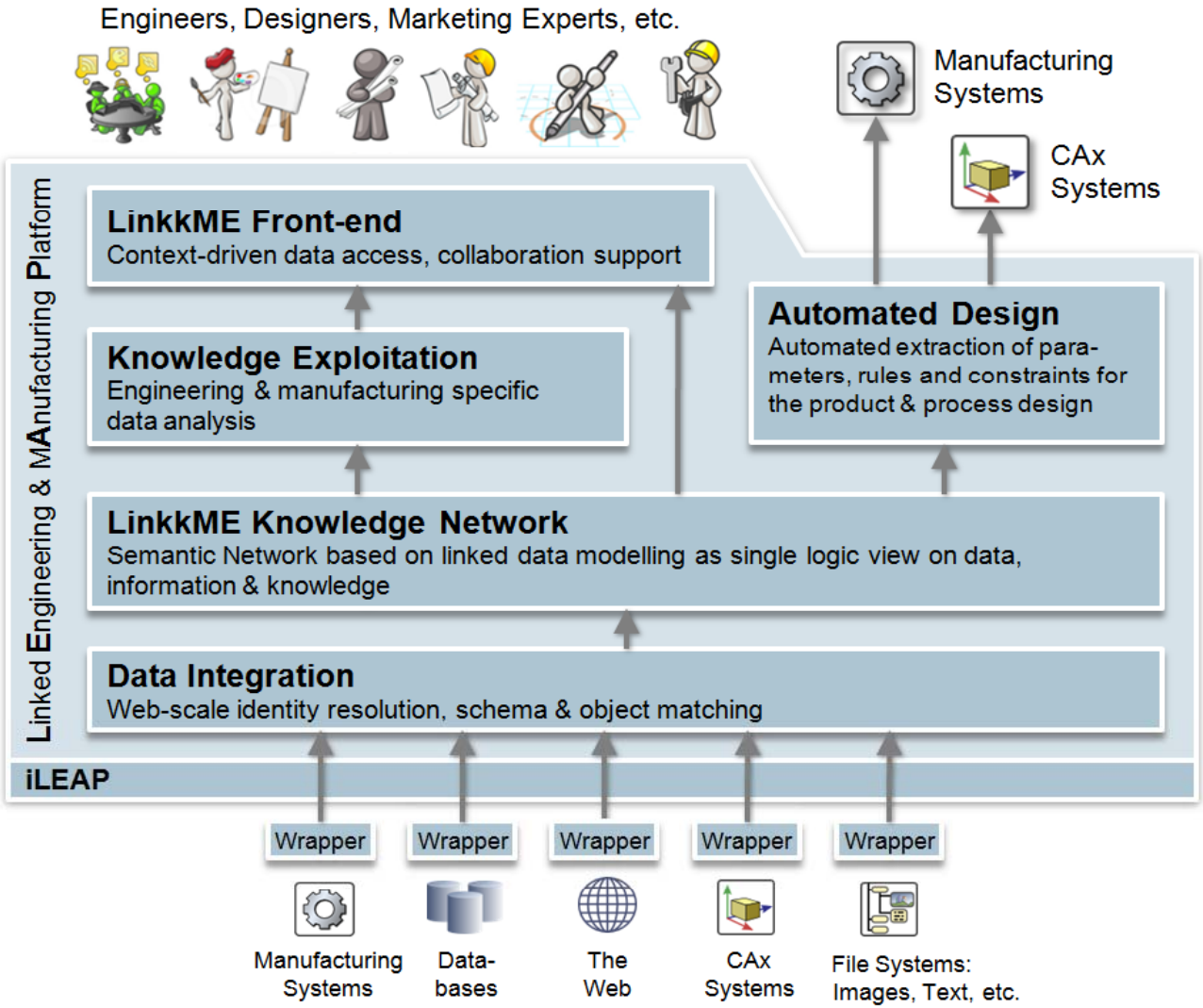
Model-generated workplaces



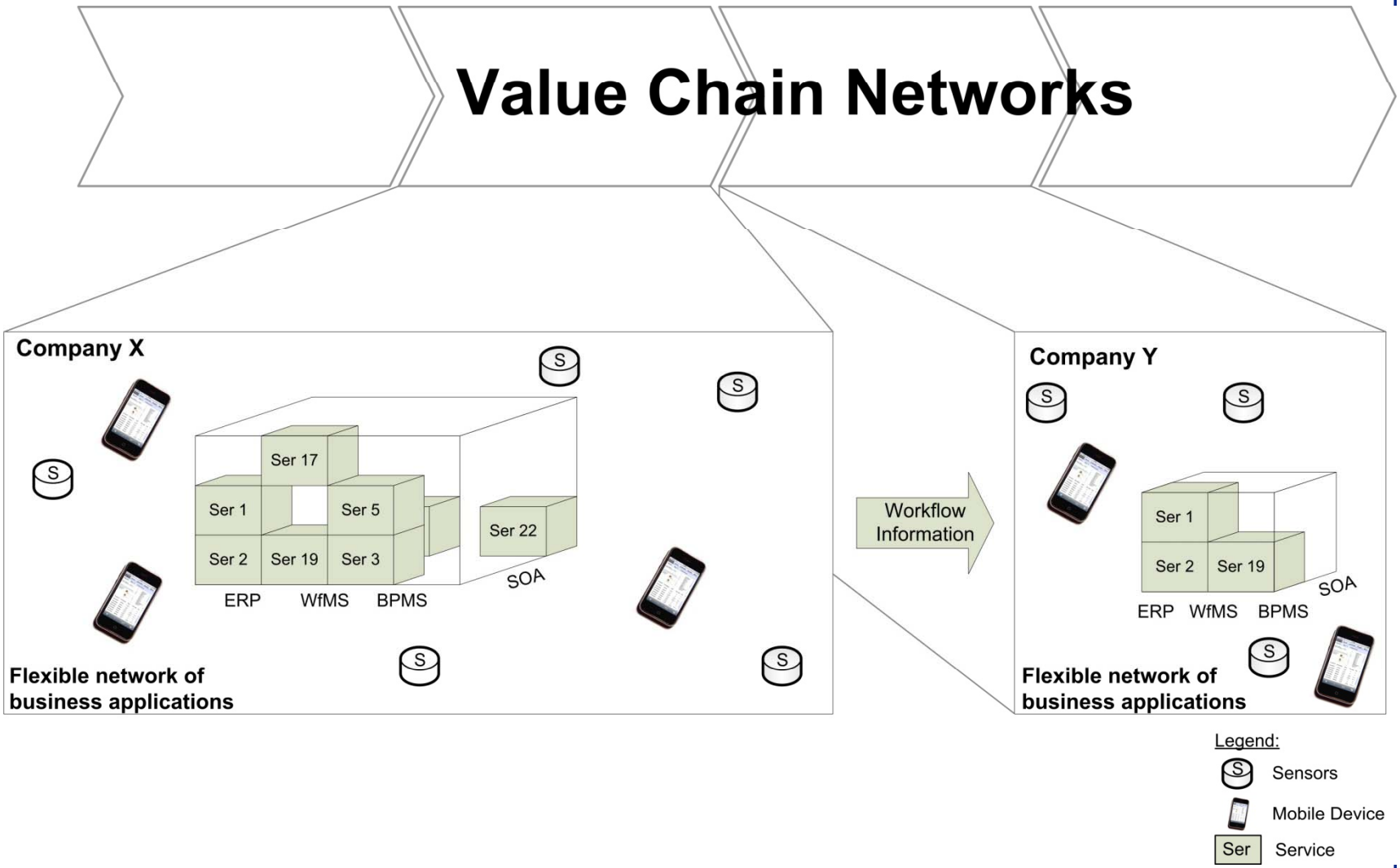
Workplace for Piping Engineer



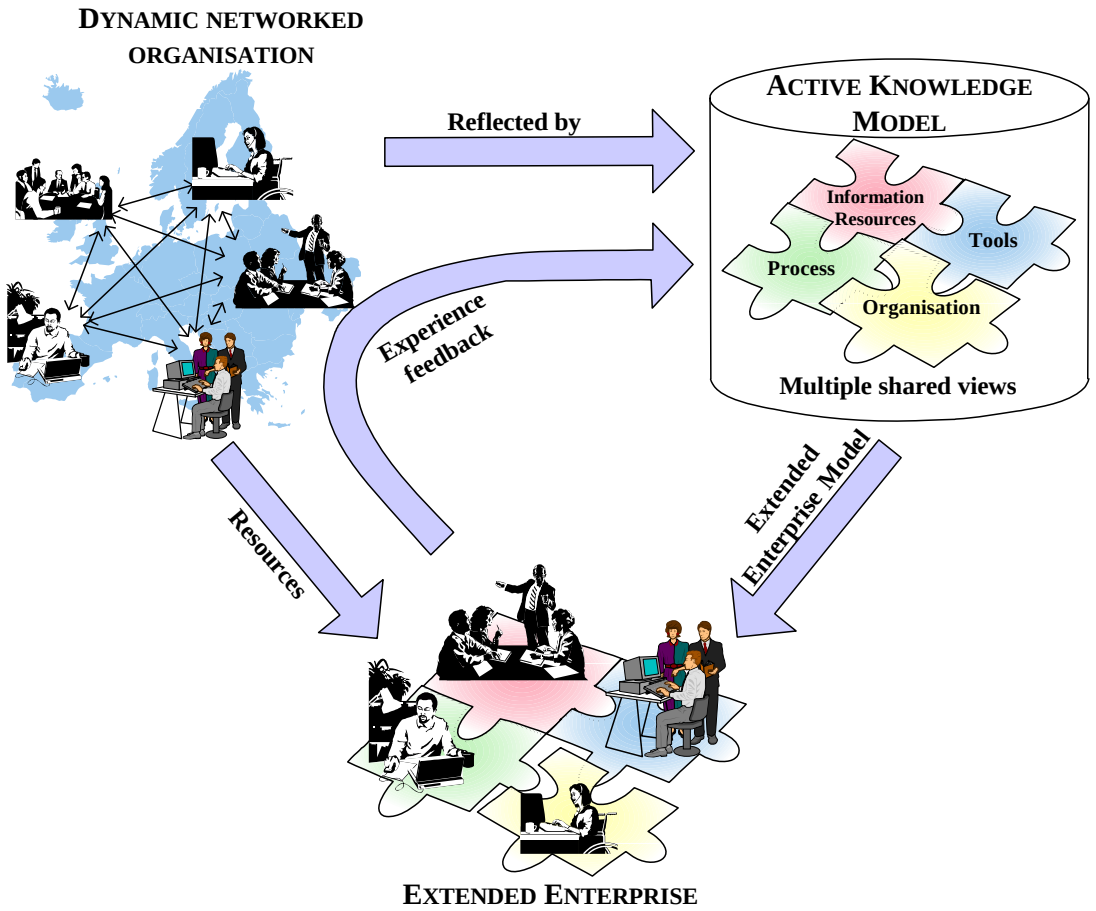
EU project starting next week (SAP, NTNU + 10 more partners)



From one to several organizations

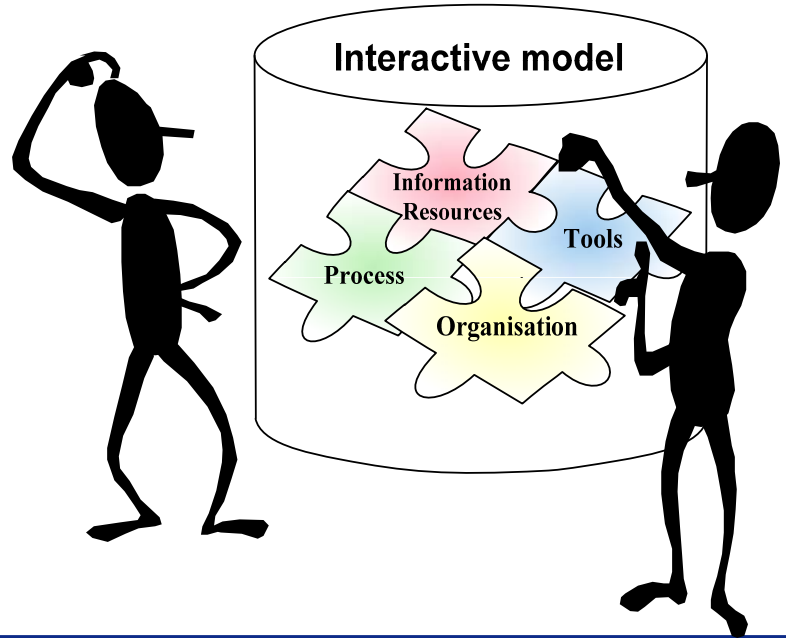


Interactive models to support loosly couple processes in extended enterprises



Interactive (active) models

- Visual (graphical) models of enterprise aspects (goals, tasks, roles, organizations, persons, information, systems...)
- Available for normal users to be viewed, traversed, analyzed, simulated, executed, and adapted
- Changes to the models influence the information systems supporting (part of) the enterprise



International organizations supporting other international organizations

- Case: Veritas certification
- Company providing similar service (certification) in many countries,
- A need to support international clients in the same way everywhere
- Attempted to streamline the process across countries
- Needed to relate to different cultures and national constraints
- -> Harmonized rather than standardized process

From EU Ministral declaration on eGovernment (November 2009)

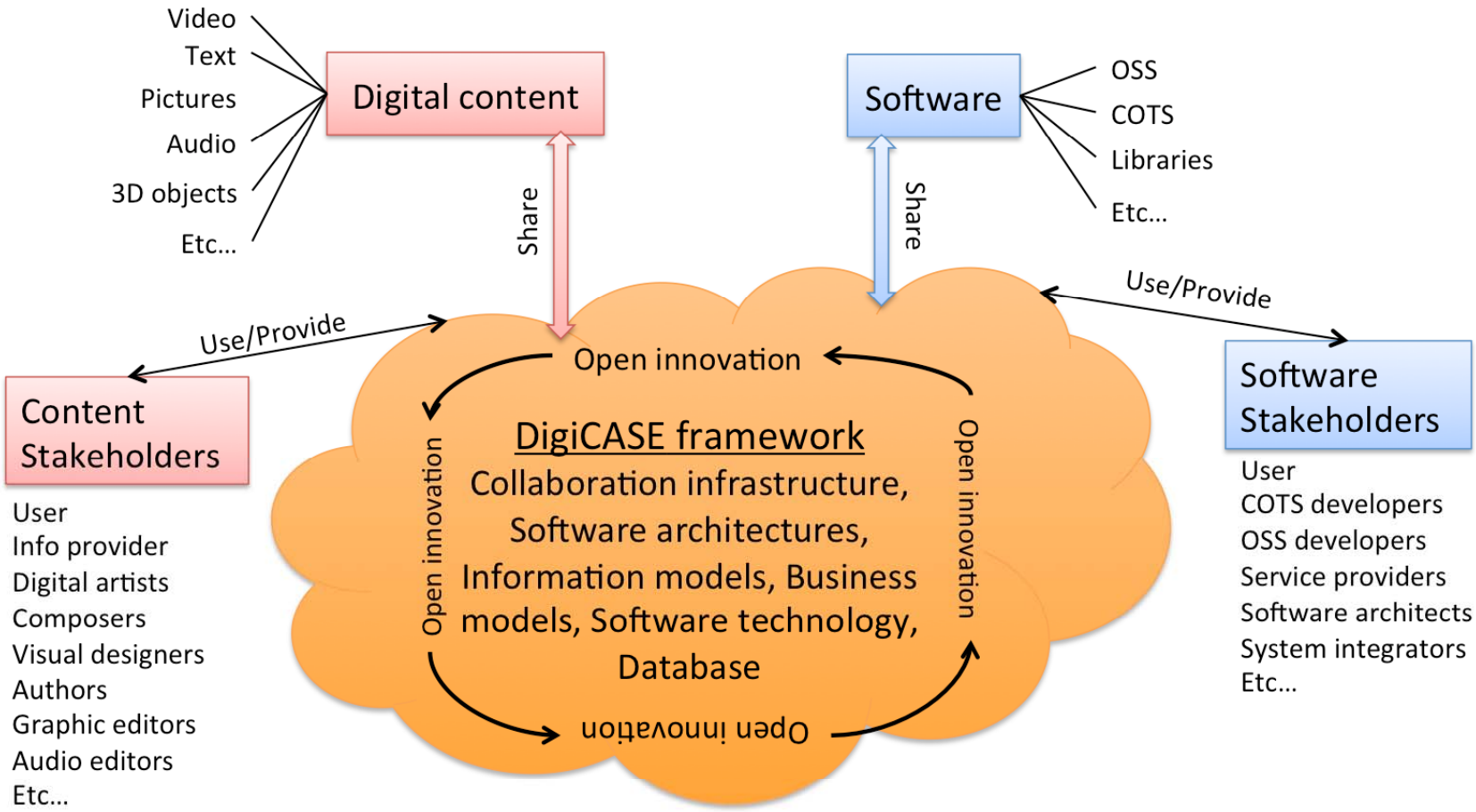
- *Mobility in the Single Market is reinforced by seamless eGovernment services for the setting up and running of a business and for studying, working, residing and retiring anywhere in the European Union*

- -> but relates to different legislations, cultures etc.

Systems being provided by ecosystems of prosumers rather than individual providers

- Information systems to a lesser degree developed in-house
- Increasing use of packaged systems
- Increasing levels of outsourcing of development, maintenance, operations, and user support
- From primarily internal users to a mix of internal and external users
- Consumers of software services and content turns to prosumers
- Open source solutions are increasingly more used
- Need to understand the added value of a more open business model

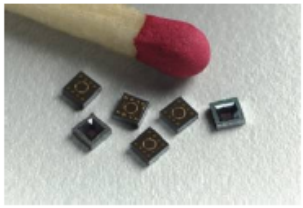
Digital content and software ecosystems



Enter the Internet of things (IoT)

Trends

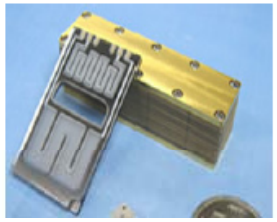
- 10 000 M microprocessors produced every year
- Short range communications cost towards zero
- Significant improvements in energy usage
- Macro, micro and touch positioning
- Most processors will be on net in the future

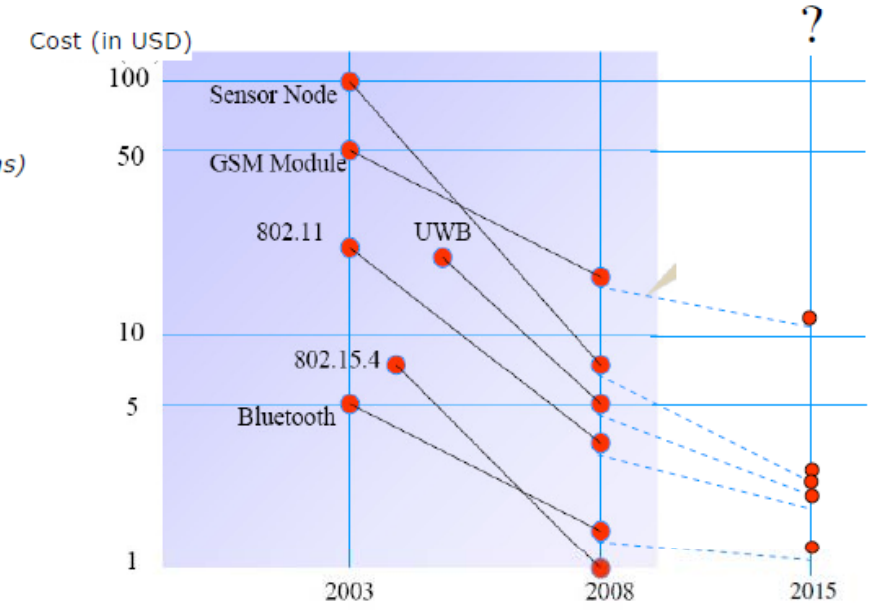


Tiny MEMS (Micro ElectroMechanic Systems) exist as temperature sensors, gyroscopes, microphones etc

Small low cost modems 30x36x4.8Xmm

Microenergy sources





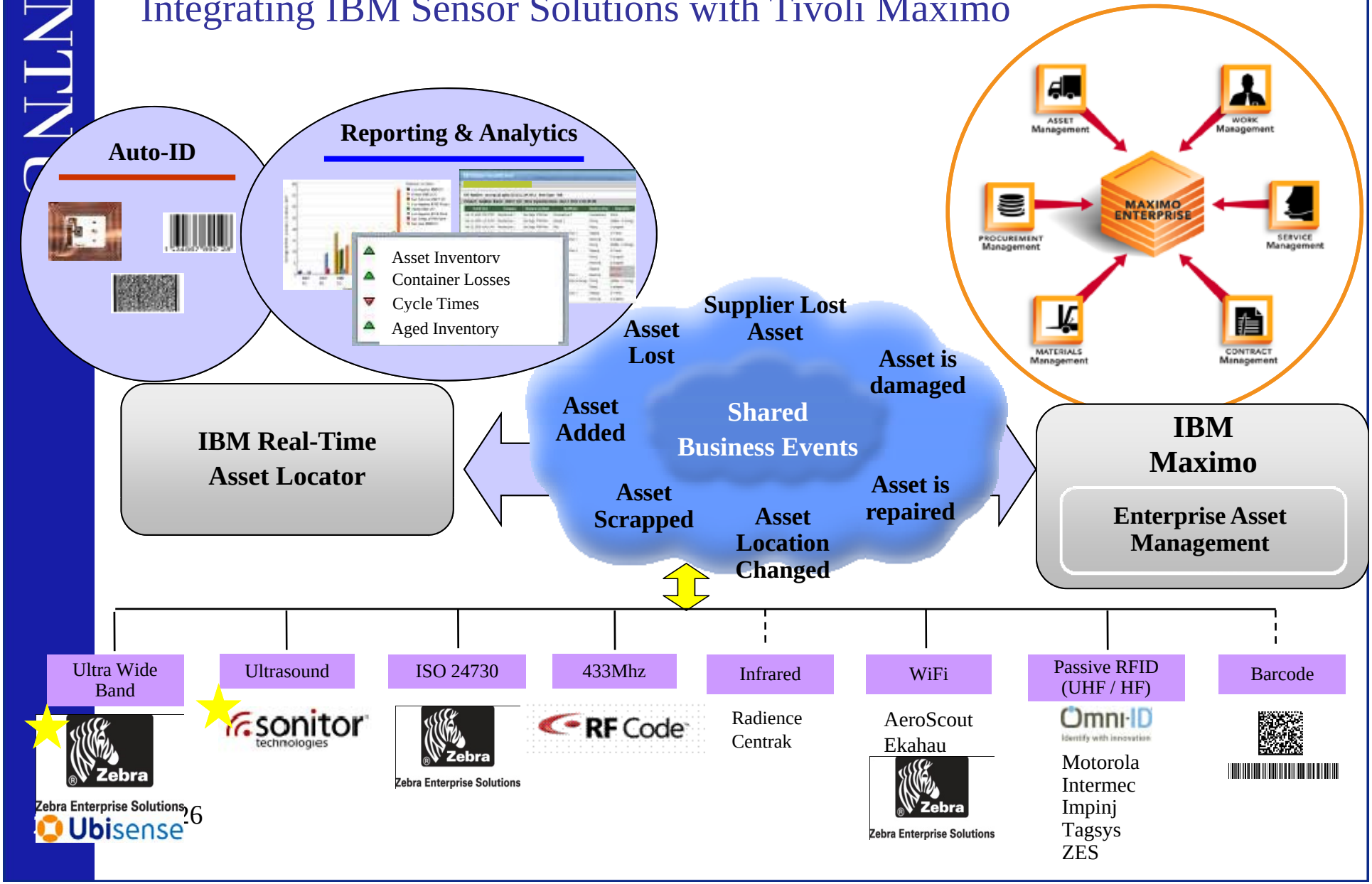
Business applications following EDA – Event-driven architecture

- Report current events as they happens
- Pushes notification on events
- Consumer system respond immediately on event
- One-way communication
- Notifications free of commands

- Event-driven and minimally coupled

End-to-End Solution Stack

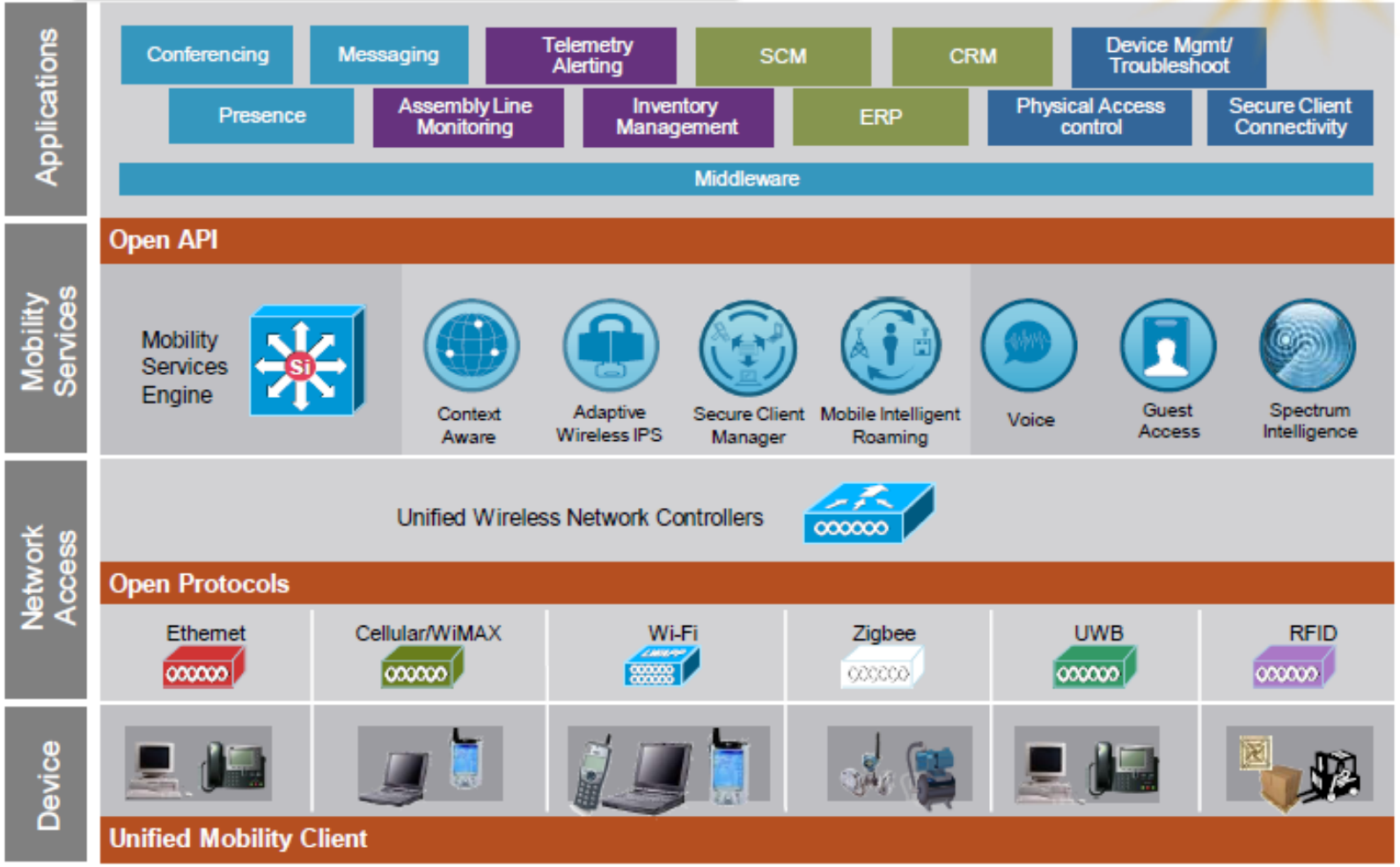
Integrating IBM Sensor Solutions with Tivoli Maximo



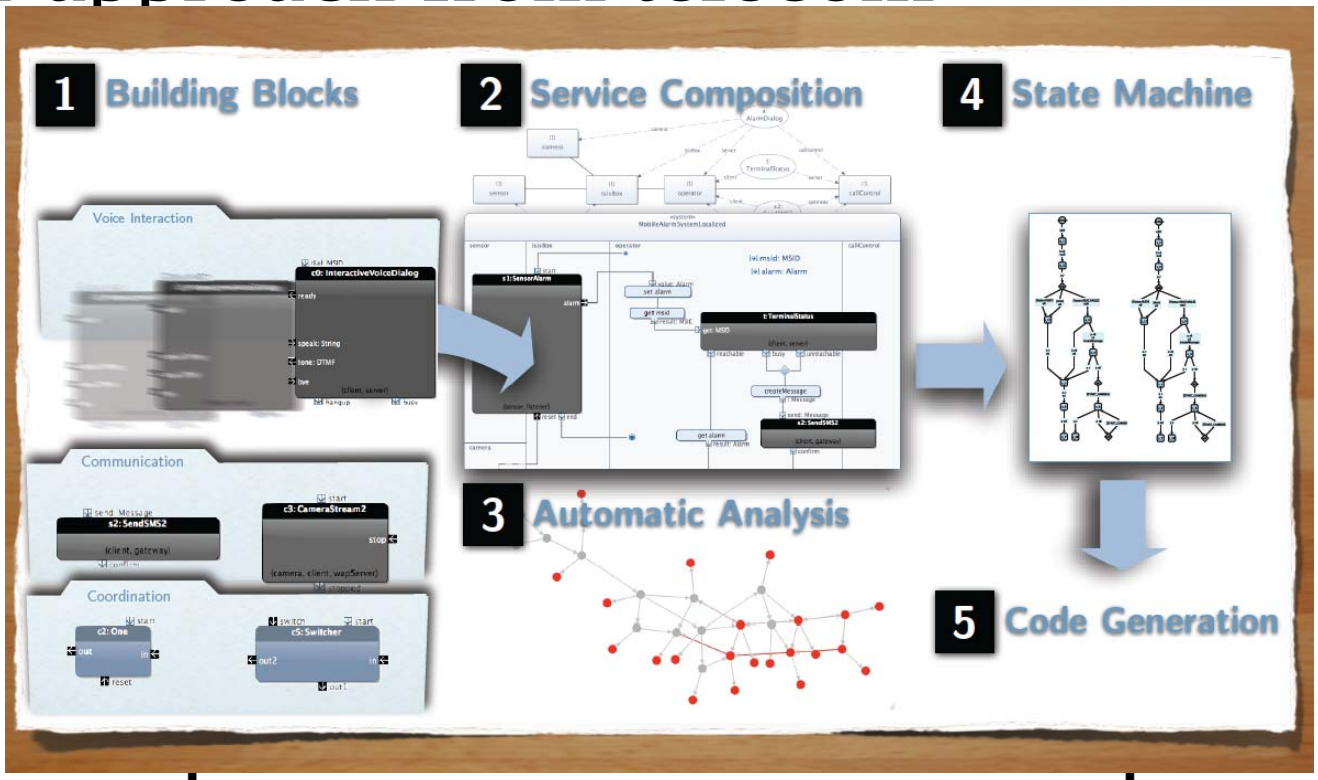
Cisco Mobility Services Engine

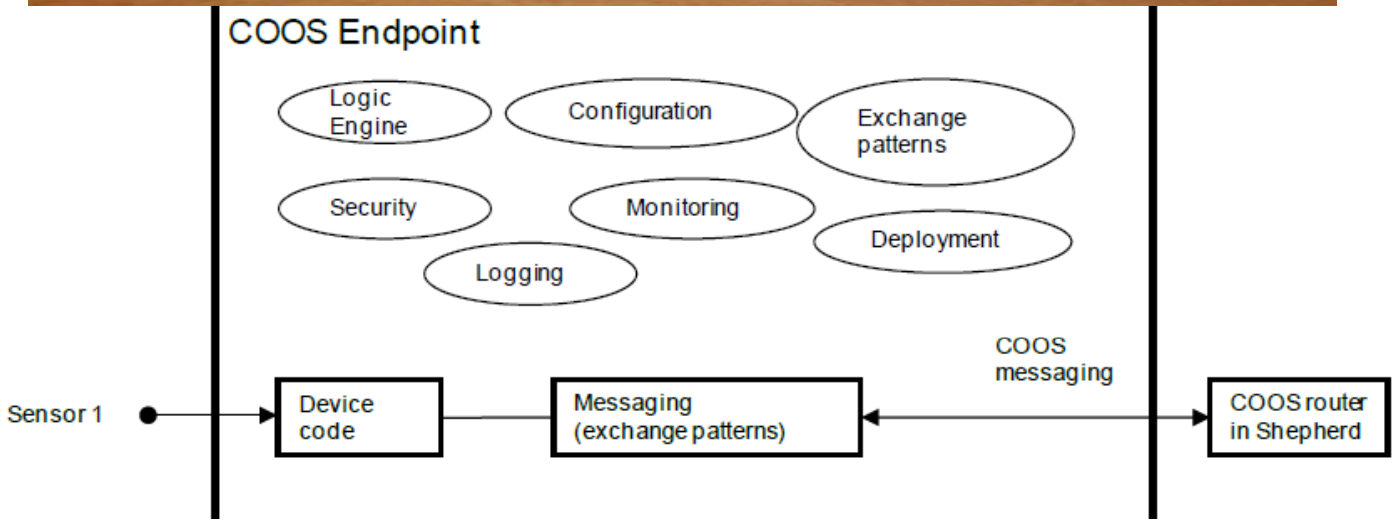
Unifying the Mobility Network

New!



Similar approach from telecom





Summary on trends and challenges

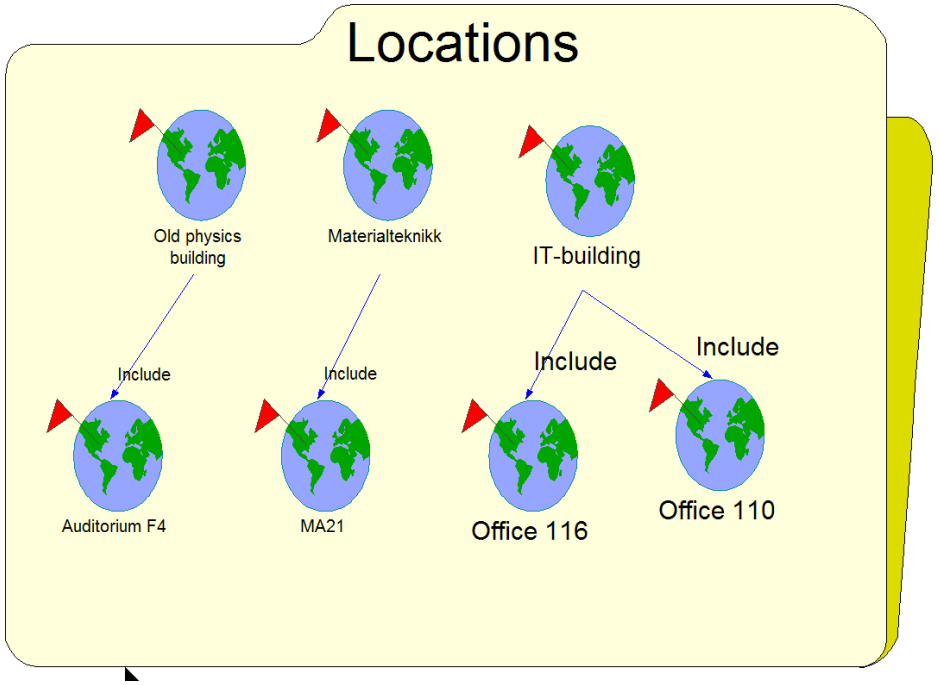
- business processes are potentially *increasingly interconnected* within and across organizational boundaries
- the *number of processes* an organization has to cope with *is rapidly increasing*
- An increasung number of types of stakeholders is involved
- modern technology is generating large streams of *event data* representing the *states* of different *processes*
- different devices are used to access the business information systems in different situations necessitating a *flexible multi-channel support*
- Additional concepts (e.g. *location*) needs to be represented

Motivation for modeling location

- ’Where’ is increasingly relevant
  - Supply Chain Management/Logistics
  - Virtual organization
  - Eco-systems of providers
  - Mobile applications and information systems
- And it is possible to utilize ’where’ to a larger degree (also real time) to know where users, equipment and goods should be, are or where at a certain time

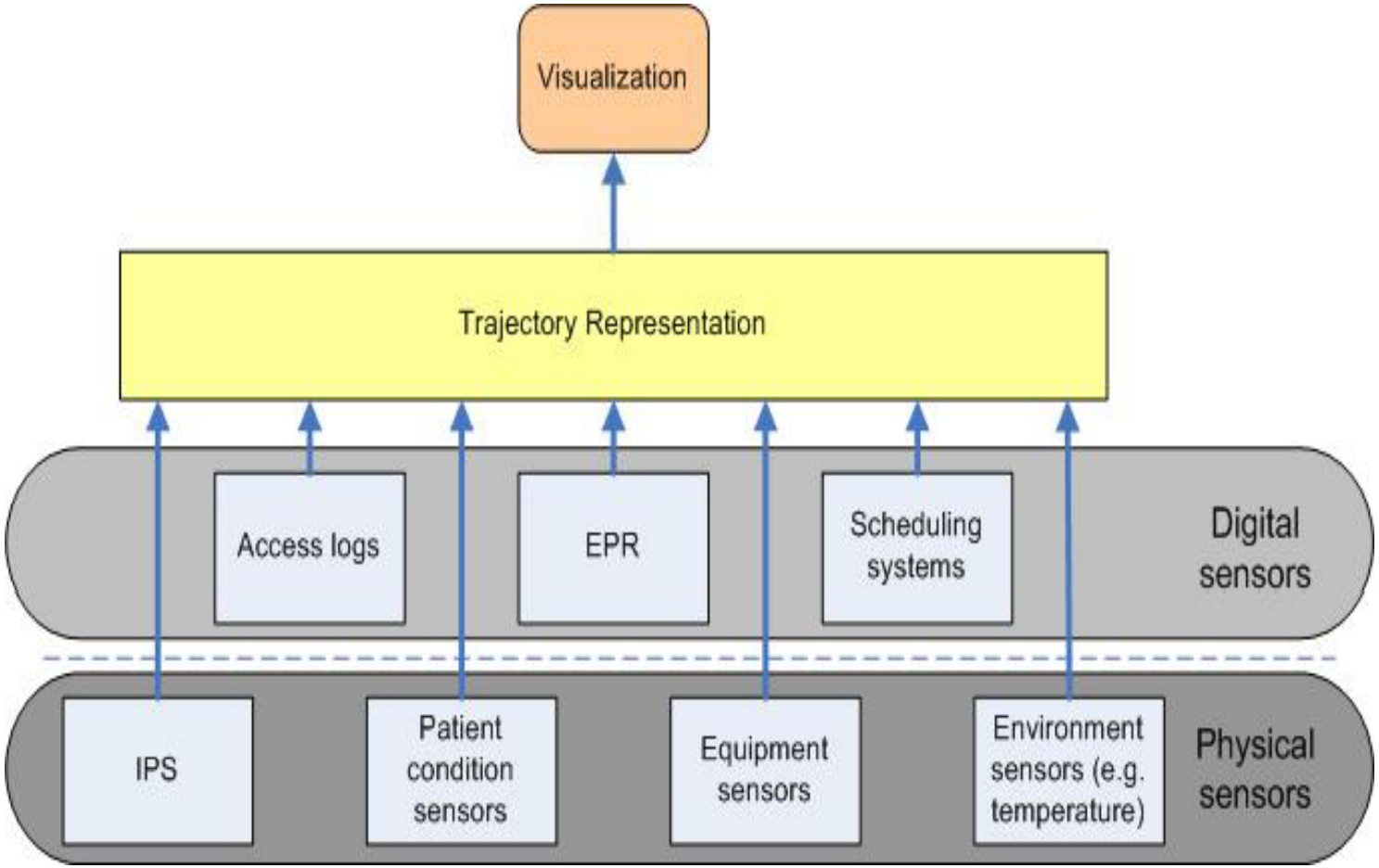
Representation of location

- Maps of different types
- Topological diagrams
- Conceptual representation of place and space in enterprise modeling

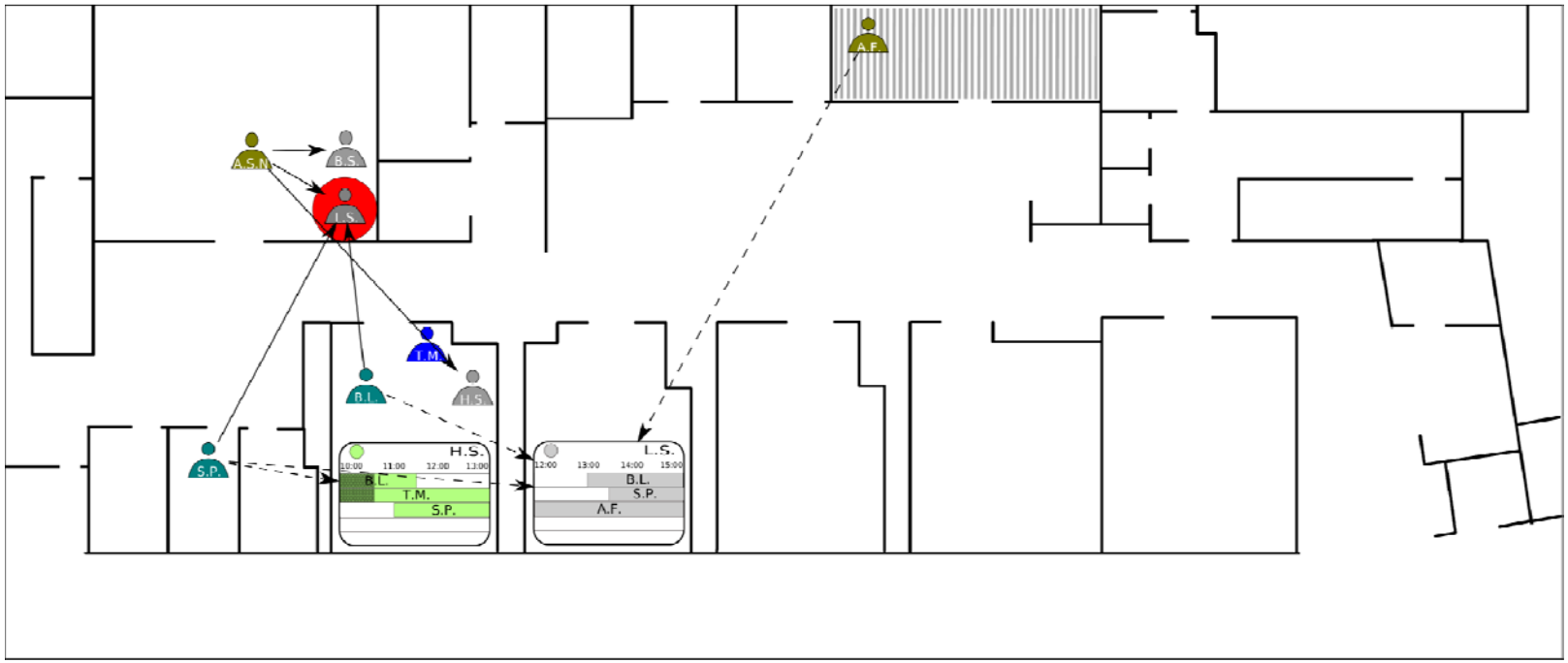


Example – representation of space

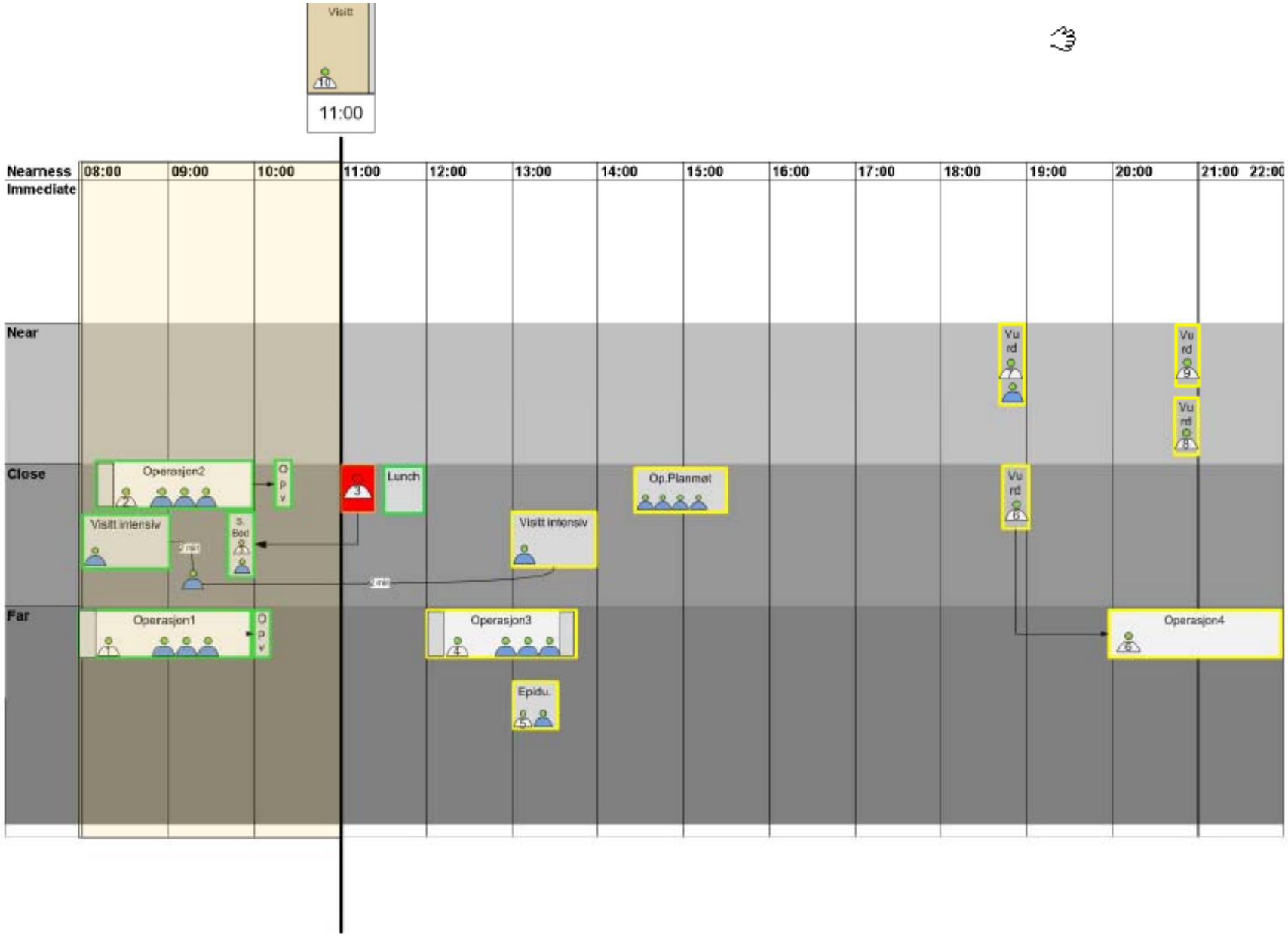
- COSTT – Co-operation Support Through Transperancy
- Case in the hospital domain
- Utilize the possibility to detect location of persons and equipment automatically real-time (RTLS- Real time Location Systems)
- Support of self-coordination of task
- Need a representation of aspects related to location, time and concepts to support continous replanning


Visualization
Trajectory Representation
Access logs
EPR
Scheduling systems
Digital sensors
IPS
Patient condition sensors
Equipment sensors
Environment sensors (e.g. temperature)
Physical sensors

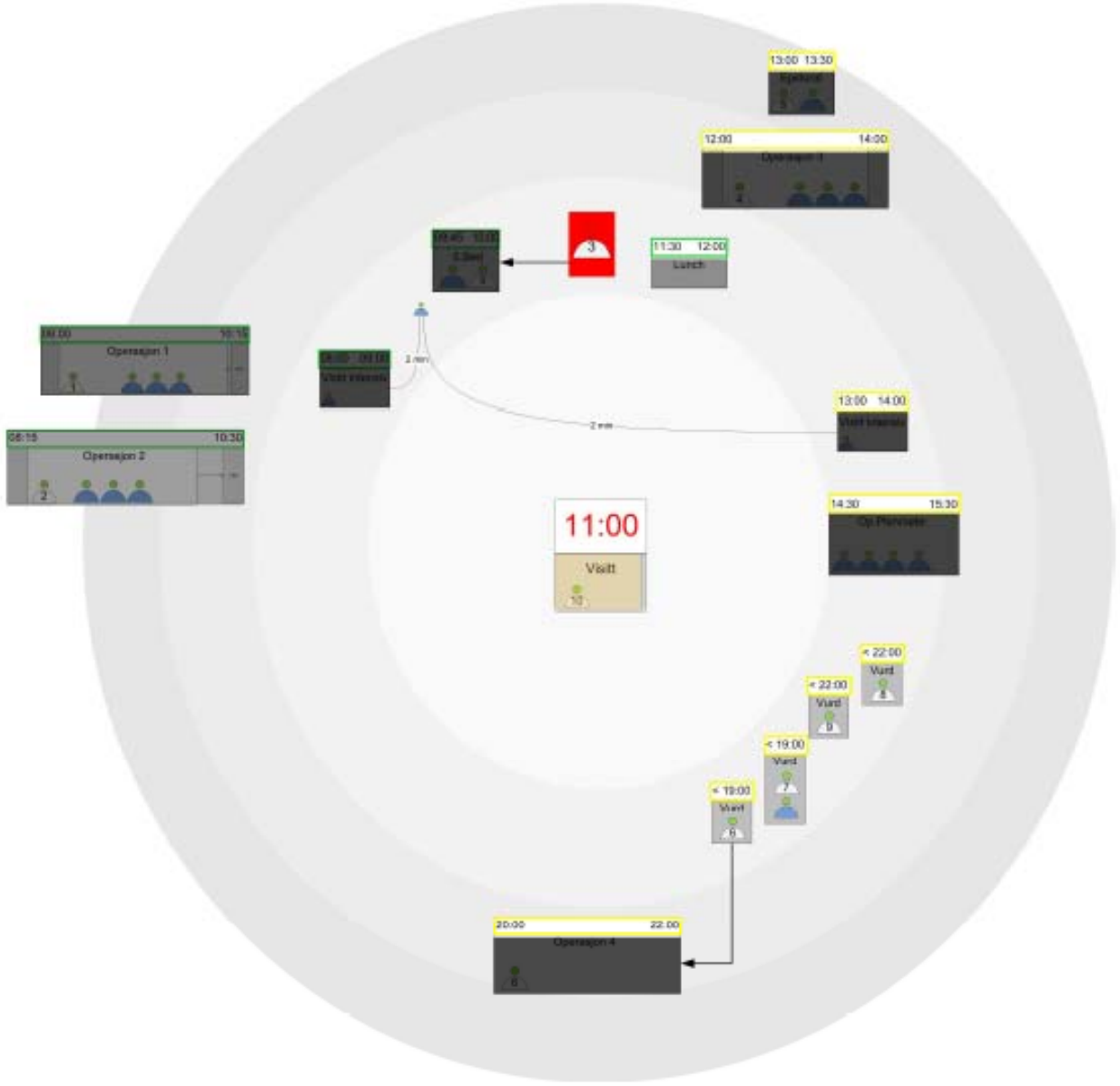
’Naive’ representation



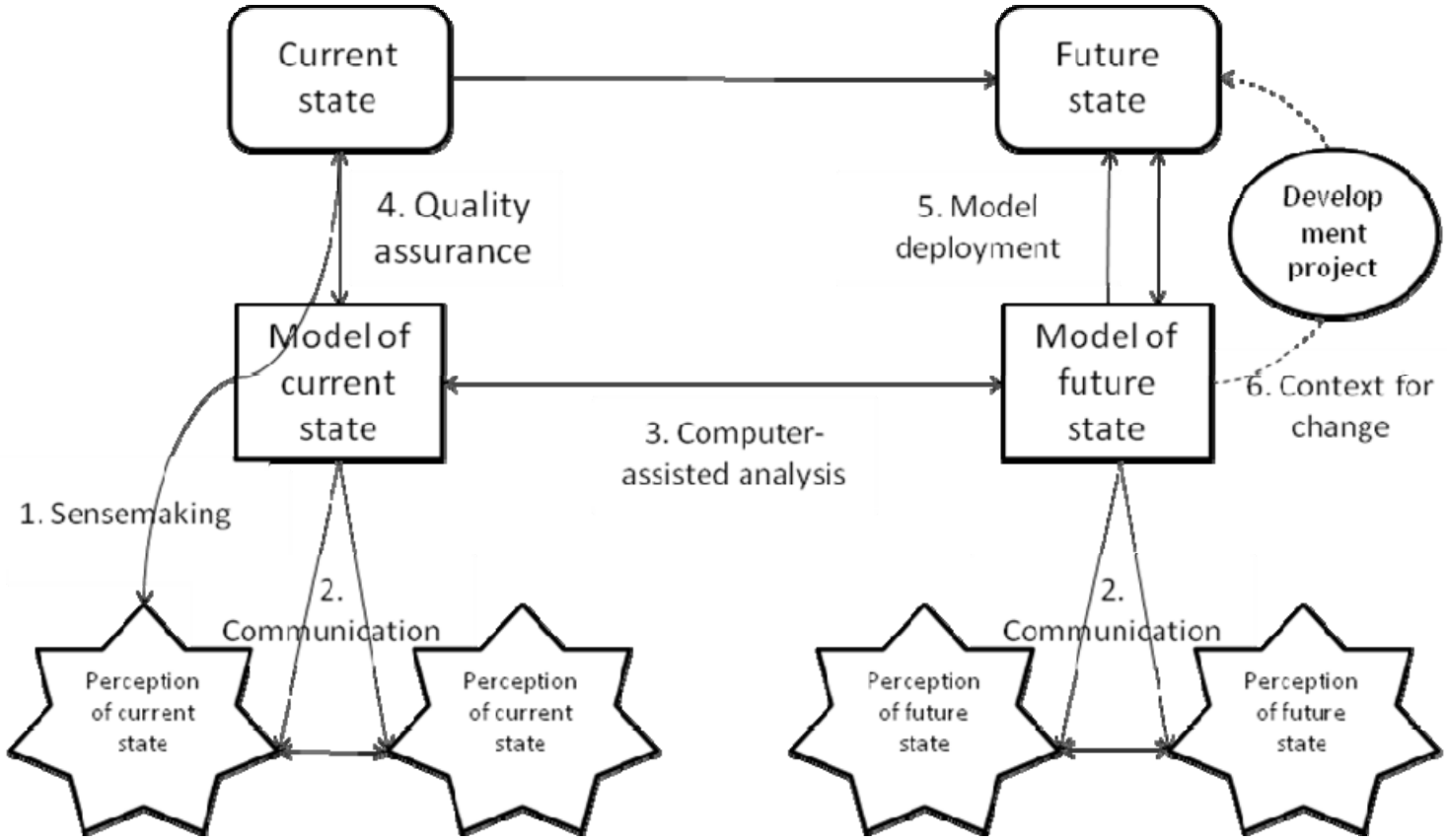
Representation with emphasis on time



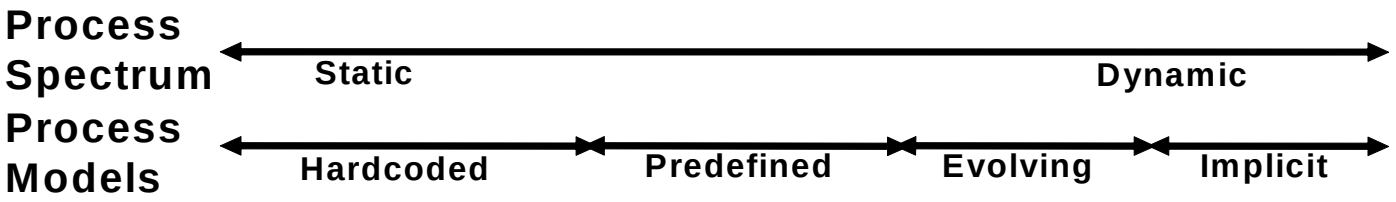
Representation with emphasis on distance



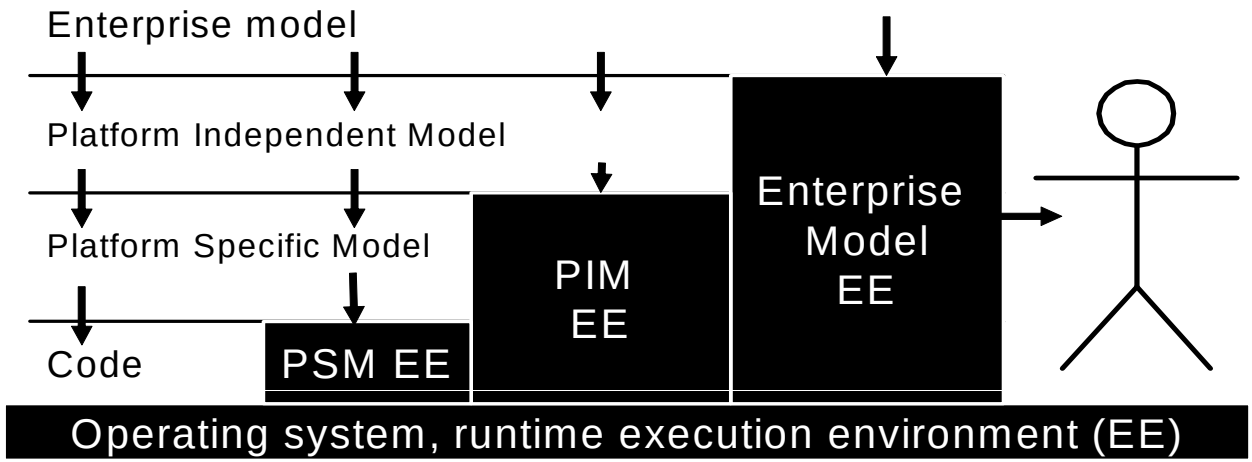
Usage of modeling and models



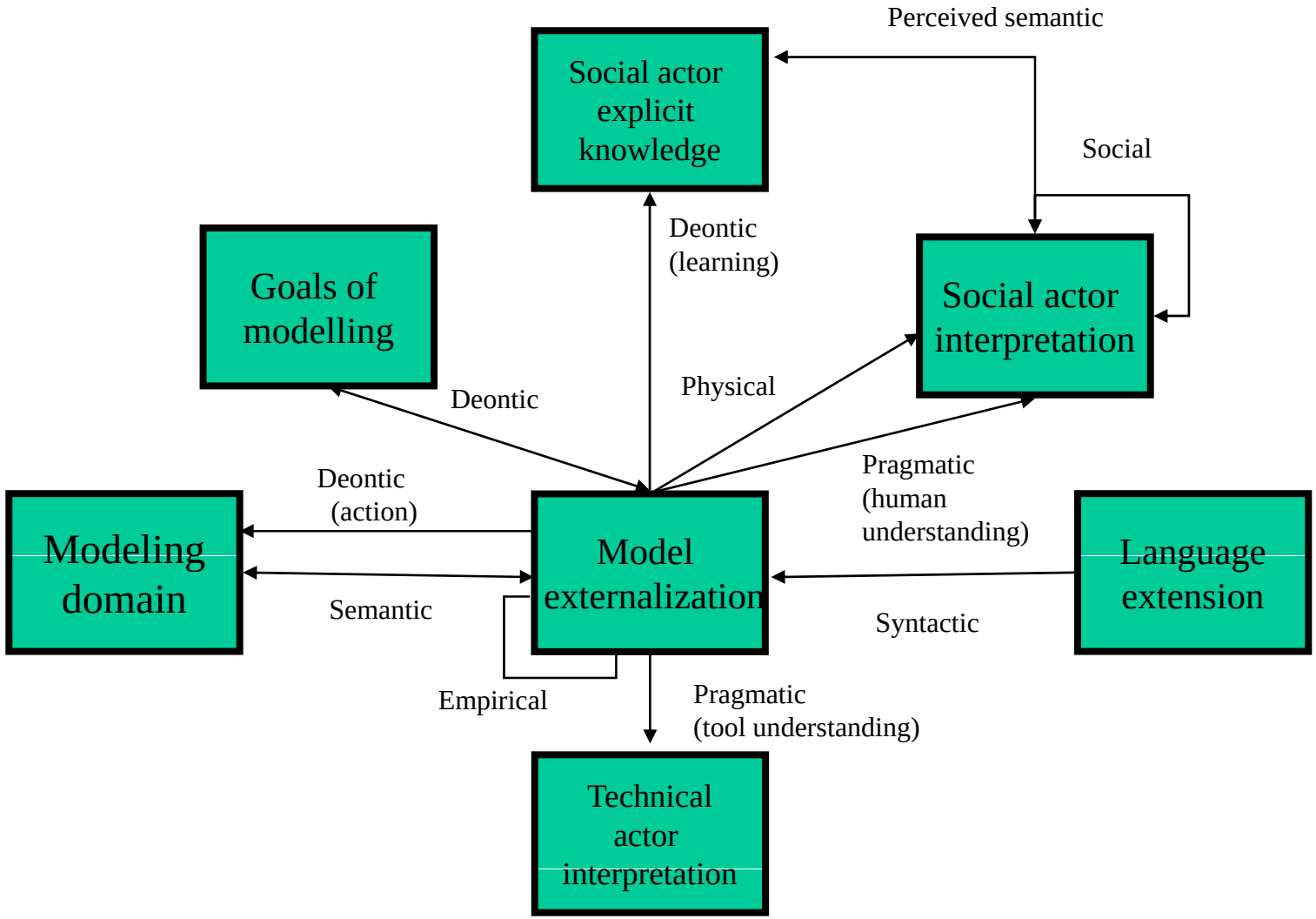
Different execution environment for different process models



Model-driven solutions:



Quality of models revisited



Summary

- The future internet gives new challenges and opportunities for business information systems
- This give new challenges and opportunities for modelling
  - Interaction and federation vs automation and global consistency
- Some of these one have tried to attack for quite some time
- But the adoption of many important solutions are slow
- Existing knowledge on modeling can be reused and adapted (but again, knowledge adoption are slow)

Questions ?

- Coming up: PoEM 2011 – Practice of Enterprise Modeling , Oslo, Norway, November 2-3, 2011
- EMMSAD 2012 and CAiSE 2012 : Gdansk , Poland June 25-29 2012 (call for papers, CAiSE November 30, EMMSAD February 2012)

- John Krogstie: Model-based Development and Evolution of Information Systems: A Quality Approach, Springer 2012

Selected references

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- Andresen, S. H., Krogstie, J., & Jelle, T. (2007a). *Lab and Research Activities at Wireless Trondheim*. Paper presented at the 4.th IEEE International Symposium on Wireless Communication Systems (ISWCS'07) See also http://research.idi.ntnu.no/trimaks
- IFIP WG8.1 https://research.idi.ntnu.no/ifip-wg81/
- EMMSAD : http://www.emmsad.org