- Internet –of –Things potential, Modelling, Architecture and standards

Östen Frånberg,

Keynote at MODPROD2017 workshop on model-based product development

Tuesday 7 February 13.40-14.20
Linköping University

Experience

28 years IT- industry

- Ericsson several positions as IT-manager. 7 years as Technical Director
- Swedish IoT-specialist and consultant on national Swedish IoT-strategy.

10 years in the academia and research

- *Project leader,* Royal Swedish Academy of Engineering Sciences
- Develop National agenda IoT, Luleå University of Technology
- Director Dep. Of Information Technology, Programme Office Internet of Things Uppsala Universit
- Editor for the ISO/IEC JCT1 IoT-standard

The outline of my presentation

1. Experience of modelling
2. From agenda to paradigm shift and economic value
3. Standardization
4. Two examples of sector architecture
5. Ecosystem and modelling

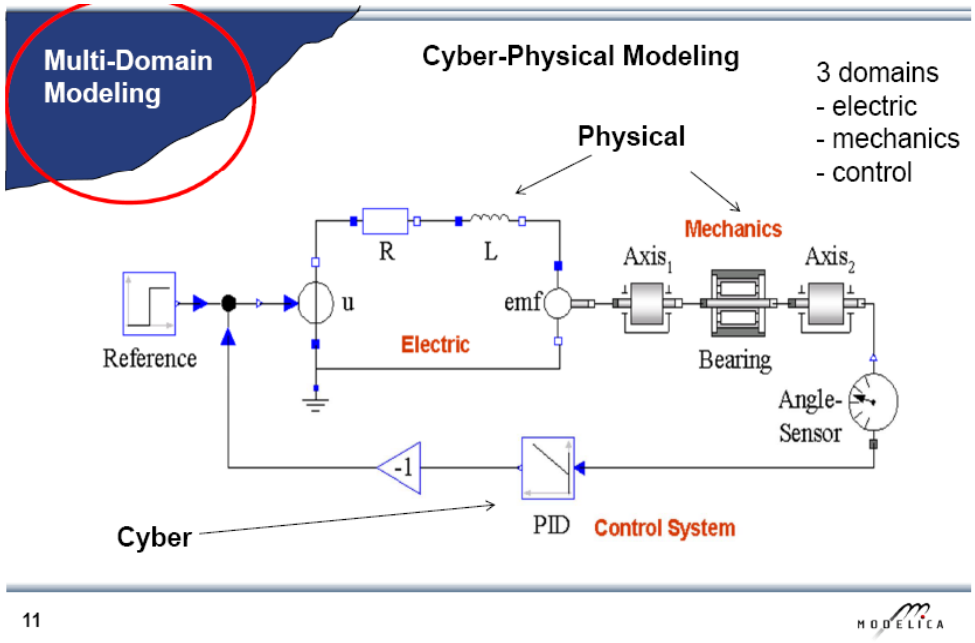
Way I am at the on the MODPROD workshop

My first contact with OpenModelica were 4 years ago when we created the National Agenda for IoT. We recognized modelling development as a method for high quality and rapid development of IoT systems

I want to learn more on MODPROD's potential as method to modelling the Operation and simulate the dynamic use

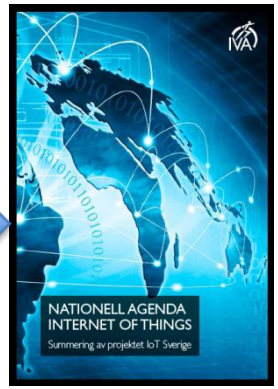
Also modelling the IoT system, simulate and creation running code

1Akonsult is part of SIP-IoT and SIP Smart Build



From Agenda to Strategic Innovation Program

REGERINGSKANSLIET



2012 2013 2014 2015 2025

70 agendas 10 partners 10 partners 18 partners, 42 actors

WASP FoU Autonoma system

Strategic Innovations Programs, "SIP"

1. Innovair (flygteknik)
2. Grafen
3. Smartare elektroniksystem
4. Internet of things
5. BioInnovation
6. SWElife (life science)
7. Gruv och metallutvinning
8. Lättvikt
9. Processindustriell IT och automation
10. Produktion2030
11. Metalliska material
12. INFRASweden2030, Kungliga tekniska högskolan.
13. Automated Transport Systems, Lindholmen Science Park AB.
14. RE:Source – resurs och avfallshantering, SP Sveriges Tekniska Forskningsinstitut AB.
15. Smart Built Environment, IQ Samhällsbyggnad AB.
16. SIO Medtech4Health, Kungliga tekniska högskolan.

Government agencies and private investments about 1.200 Msek / year 50/50%

Examples of IoT applications

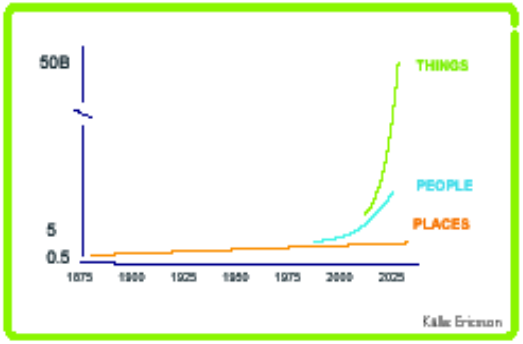
International studies report the effects of rationalization of 1.5 to 2 % in industry.

The rationalization effect is approx.70 billion SEK/ year =6.5 bn$

http://www.ltu.se/centres/cdt/IoT-Agenda-1.142290

Why is this happening now?

50B

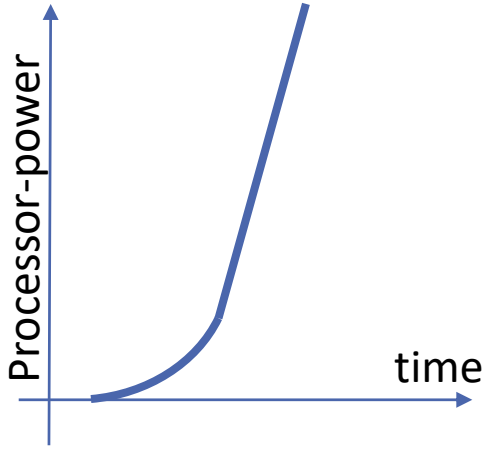


50B connected devices
World Wide 2023

Smarter

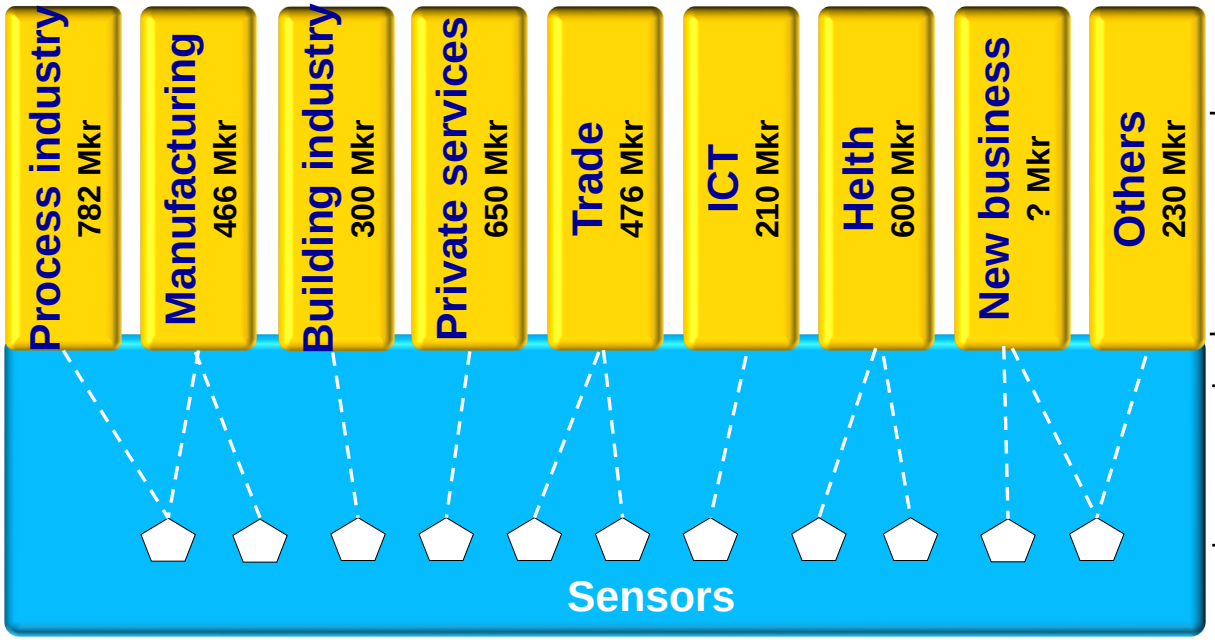
- iPhone 6S
- 1.85 GHz
- 2 GB Ram

Efficiency/Prices



Moors Law, processor-
Power increases with the
double approx. 18-24 month

Sweden's Turnover and GDP

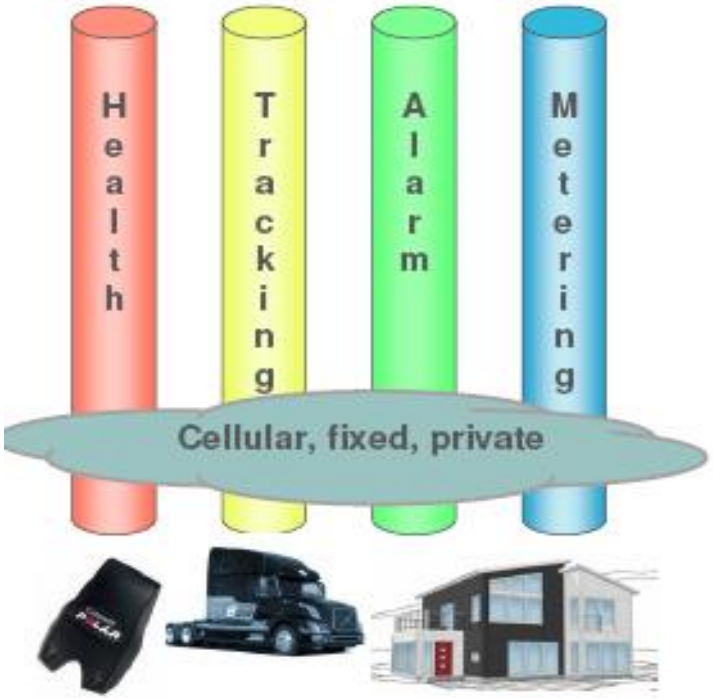


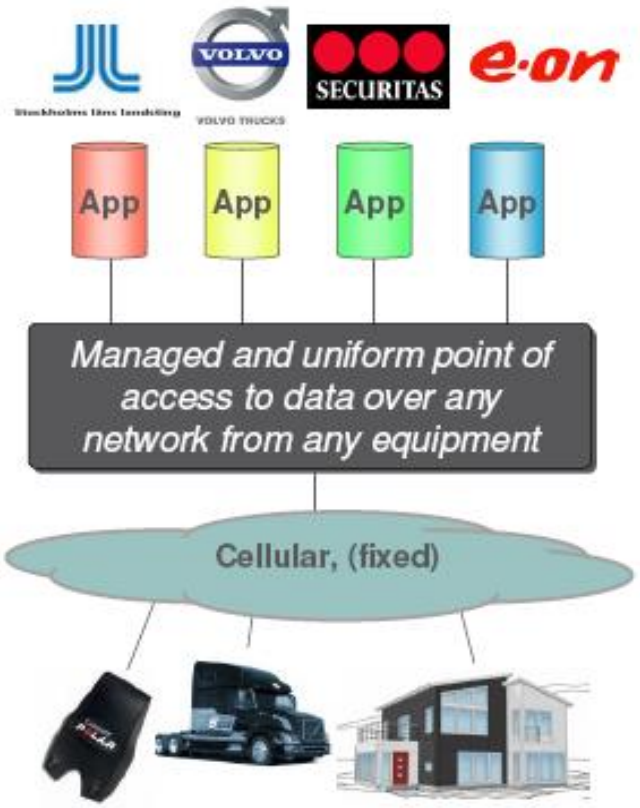
Swedish GDP
4000 Bsek (440bn$),

- Service access
- Common IoT –services
- Service infrastructure
- Content Specific
- Sensors & Actuator

Paradigm shift in Technology and Systems

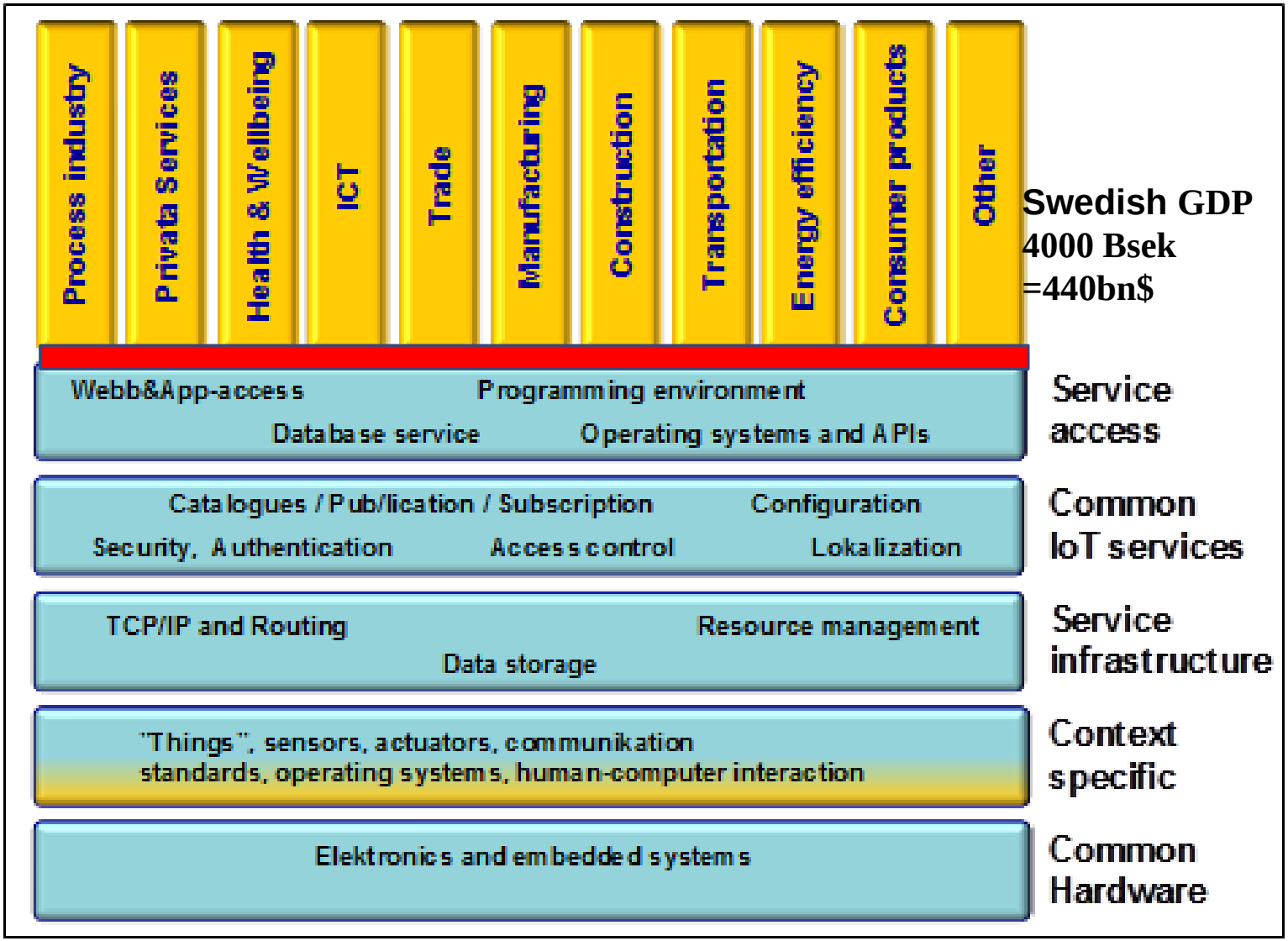
To increase our efficiency in IoT technology, we need to cooperate.
Today many systems are developed vertically. Increased cooperation and collaboration in the common parts will increase the competitiveness and profitability





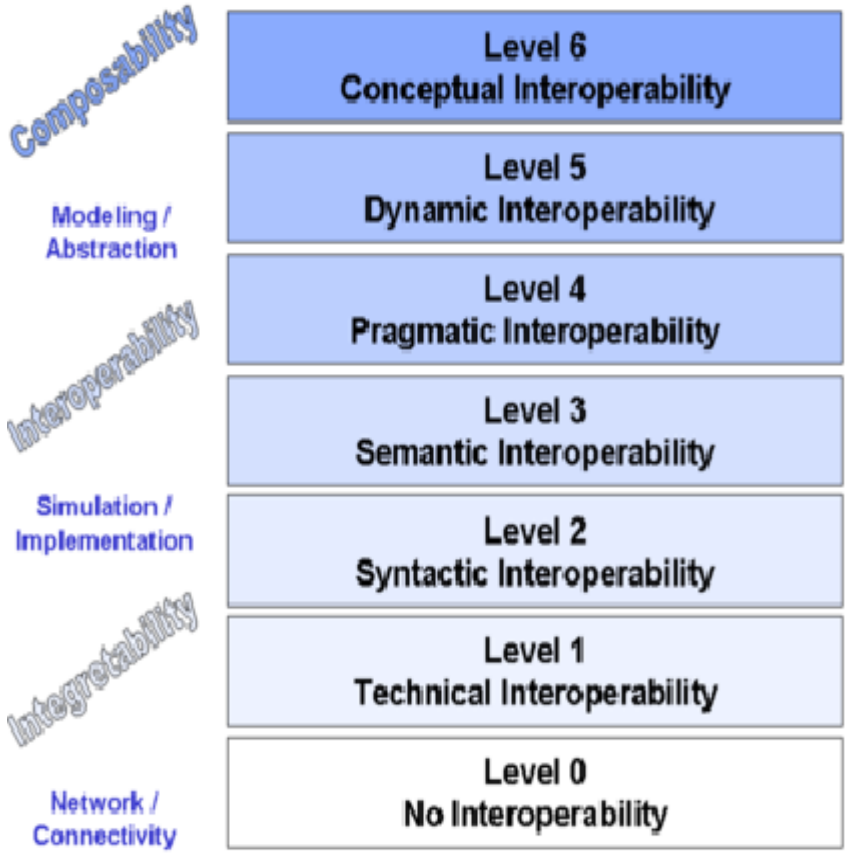
Architecture for IoT systems and applications

Transport 2%



Interoperability

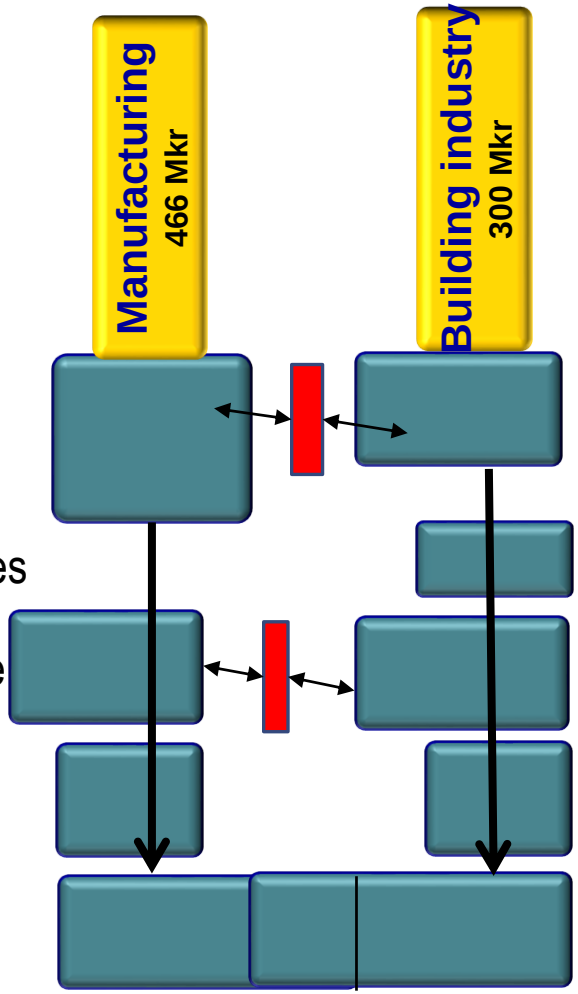
Interoperability Levels



Source; Conceptual interoperability - Wikipedia

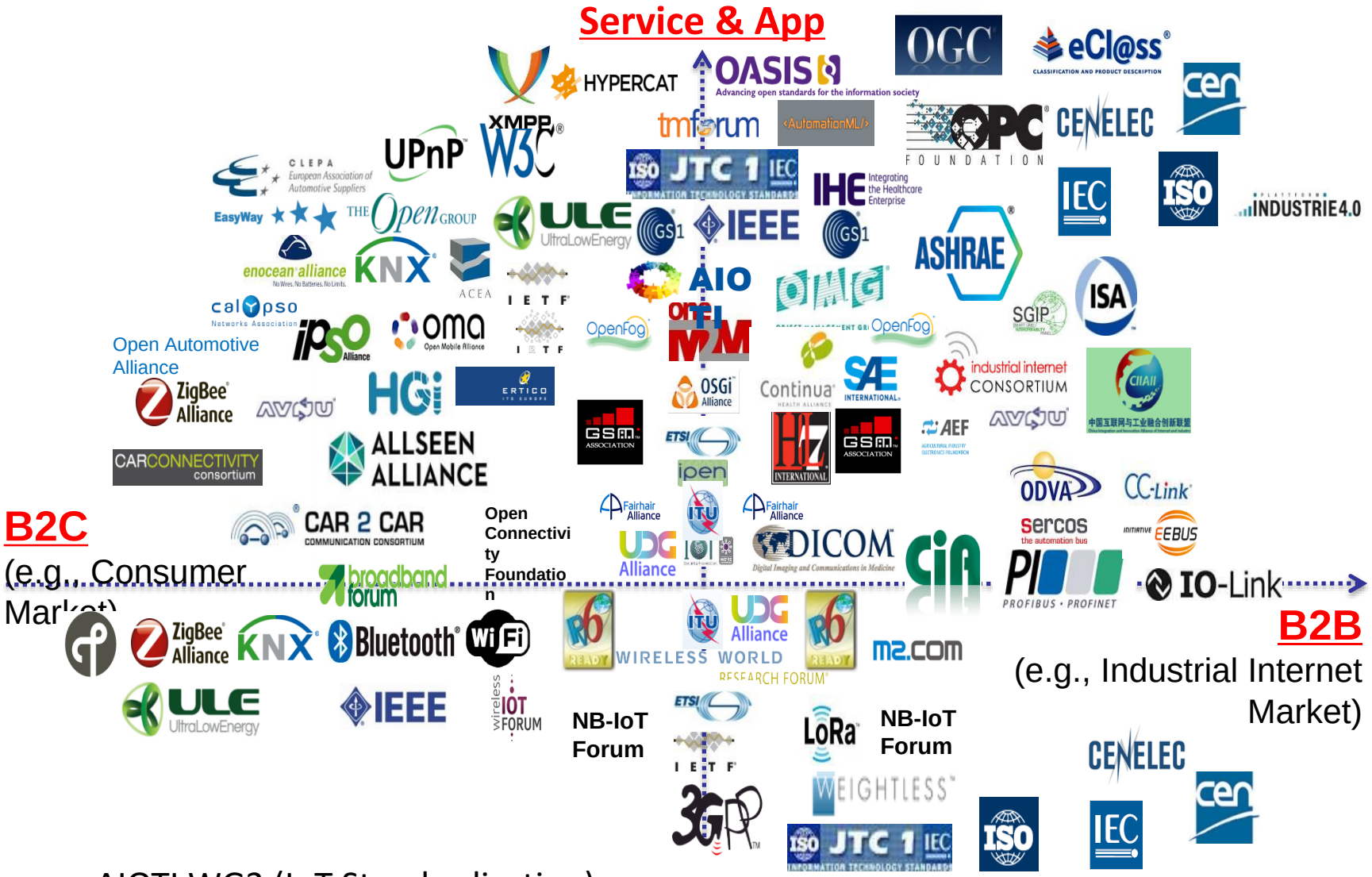
Interoperability Implementations

- Service access
- Common. IoT–services
- Service infrastructure
- Content Specific
- Sensors & Actuator



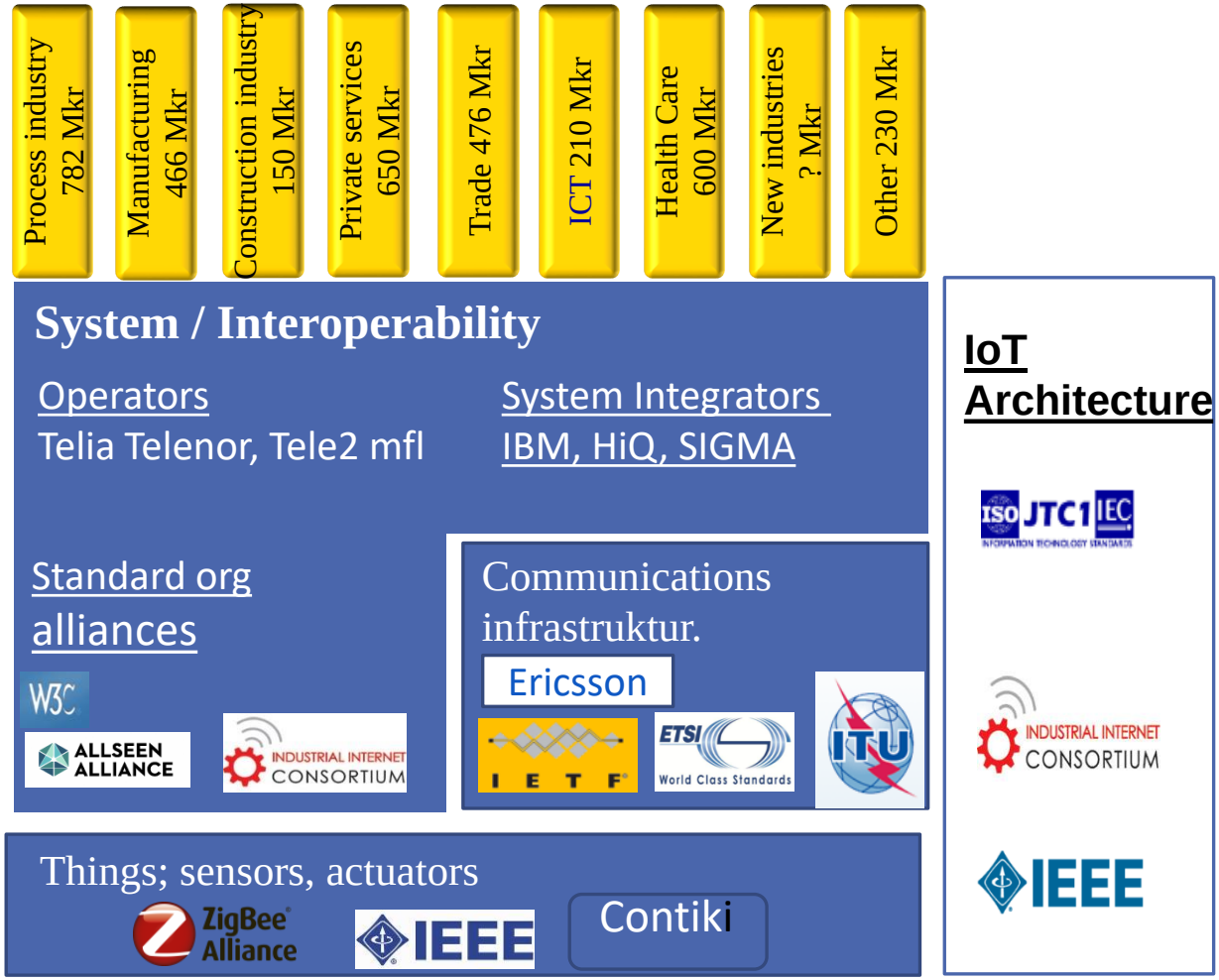
How IoT Standards Work?

IoT SDOs and Alliances Landscape



Source: AIOTI WG3 (IoT Standardisation) – Release 2.6

Examples operators active in the IoT ecosystem



The idea from the description technology AIOTI

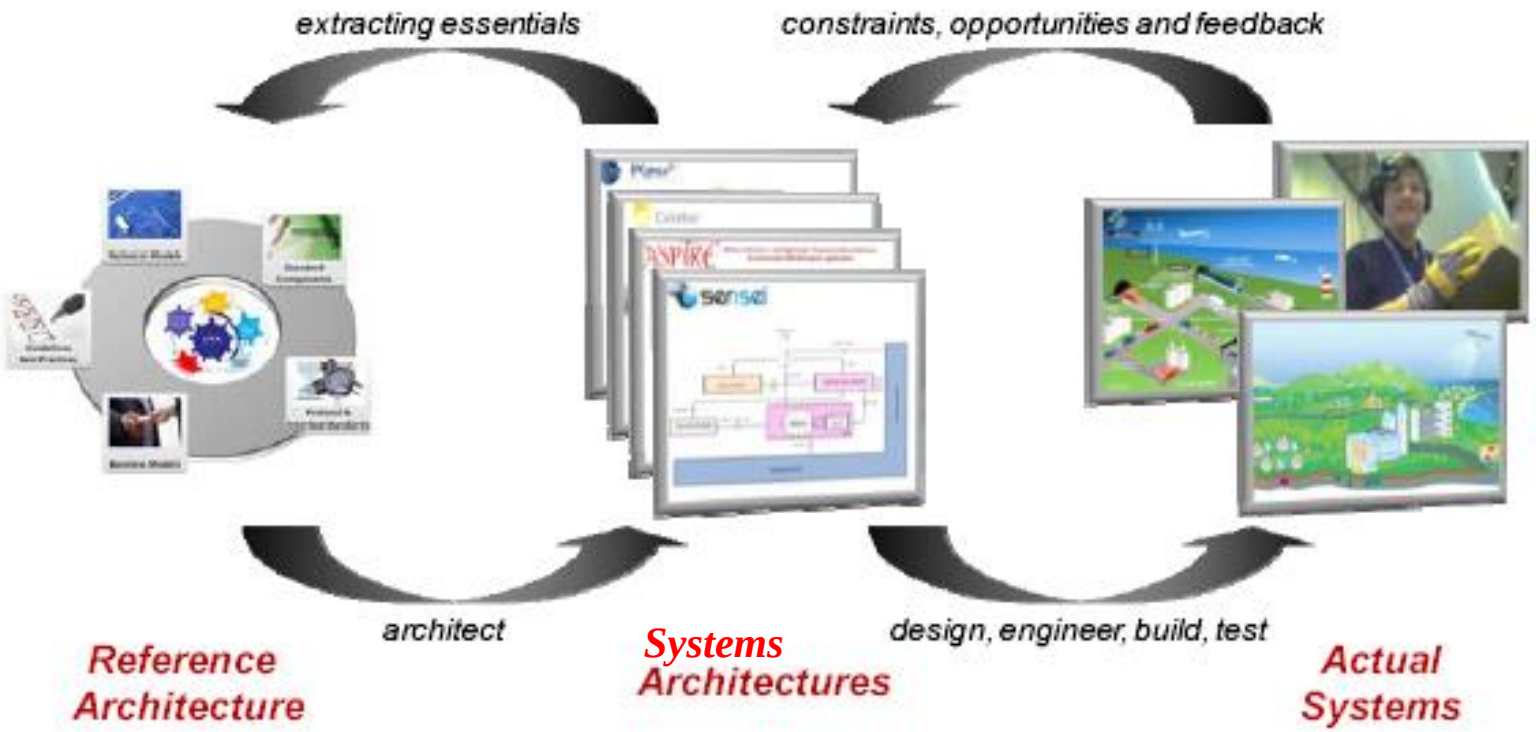
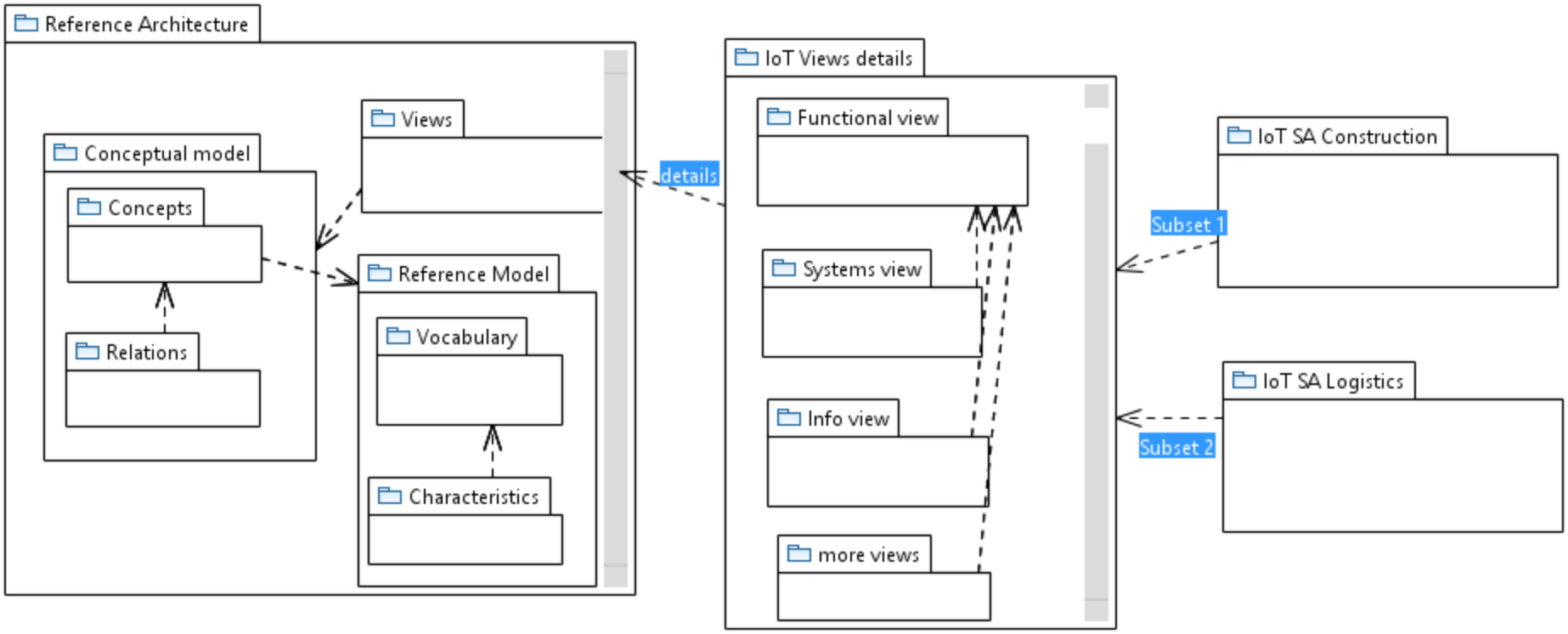


Figure 2: Relationship between a reference architecture, architectures, and actual systems (adapted from Mueller [Mueller, 2008])

Reference & systems – Architectures and views



The picture describe an UML-diagram of the principles of Reference architecture Referense model, views & Systems – Architectures ‘ for Construction and Logistics’

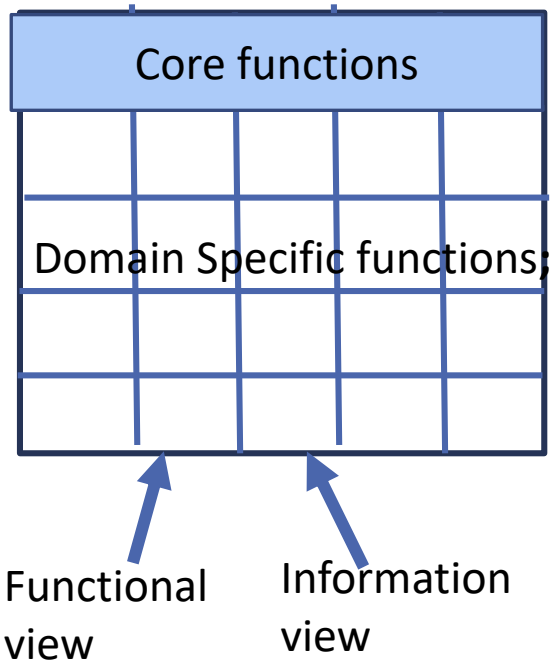
The content of the Reference Architecture

Conceptual Model; a uml description with most important concepts (~40) and their relations

Vocabulary; approx. 50 terms and definitions that is the common language

Functions:

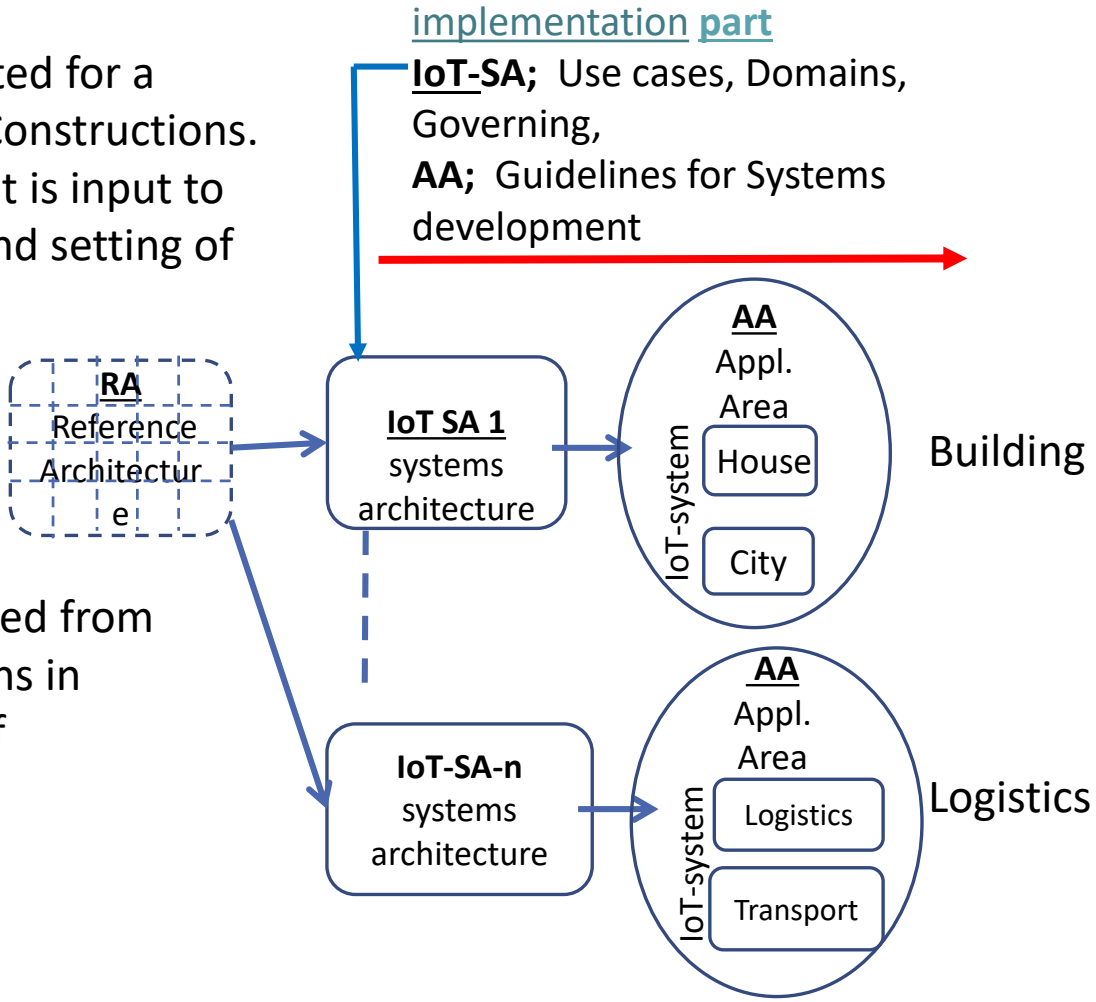
- **Core functions** 6+ that always exists in an IoT-system, ie Security, Catalogue, addressing mapping etc
- **Domain Specific functions;** User , Operation & Management, Application Service, Resource Interchange, Sensing &Controlling, Physical Entity.



Development of Systems architectures

An Systems Architecture (SA)is created for a special branch (industry group) Ie. Constructions. Use cases and technical requirement is input to the selection of specific functions and setting of parameters for the actual SA

Actual IoT applications are developed from the SA, and will have many functions in common . This increase the level of Interoperability



Smart Built goals from 2015 –> 2025

- **Social Construction sector:**
- Annual investments> 300bsek
- Over 500,000 employees
- Over 20,000 companies, many SMEs, 290 municipalities
- From early planning to finished projects > 8 years
- Housing and services - 40% of Sweden's total energy

SIP - Smart Built

40% reduction in environmental impact of new construction and renovation

33% reduction in time from design to finished projects

33% reduction in construction costs. Renewed business logic, new value chains and business Models

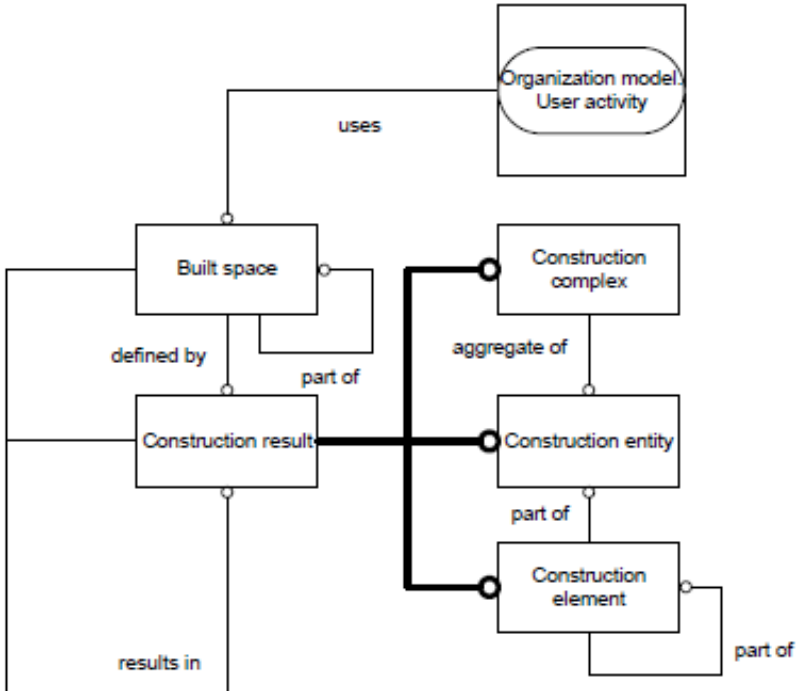
Enable new business logic in the built environment sector

Building information models (BIMs)

Traditional building design reduction and maintains was largely reliant upon two-dimensional technical drawings (plans, elevations, sections,

Building Information Modelling (BIM) is a digital representation of infrastructures, building and all necessary detailed objects.
It covers: Investigation, Project, Production, operation & maintenance, and demolition

It is supported by ISO 12006.



The figure shoes Part of definitions, classes and relations ISO 12006, in Express G format

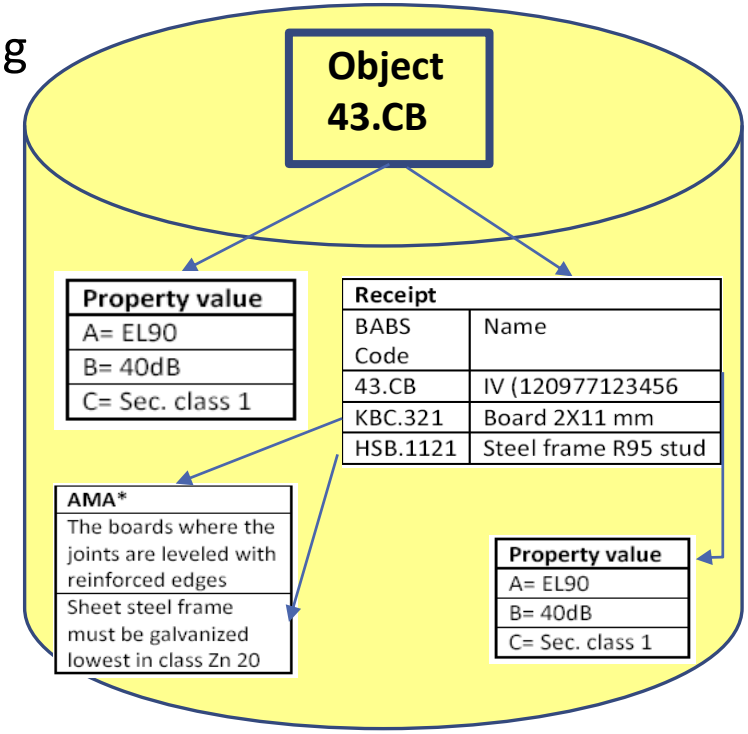
Building information modelling (**BIM**) is a process involving the generation and management of digital representations of physical and functional characteristics of places.
Building information models (**BIMs**) are files which can be extracted, exchanged or networked to support decision-making regarding a building or other built asset.

Usage of BIM

Countries in the world are using BIM and tailored it to their needs.
UK has decided to use BIM from 2016 http://www.bimtaskgroup.org/
The Nordic countries has participated in ISO standard 12006-2:2015

Sweden has based their BIM modelling on structures, vocabulary, using current industry practices, *BABS, AMA, and more

Projects are now running to defined: classes, characteristics, hierarchies of objects, and objects substructures



Example of Common data format

*BABS, is a common structure for information in the construction sector. (Byggandets Samordning AB)
AMA = General Materials and Job Description (Allmän Material och Arbetsbeskrivning)

Structures of architectures

Three facets

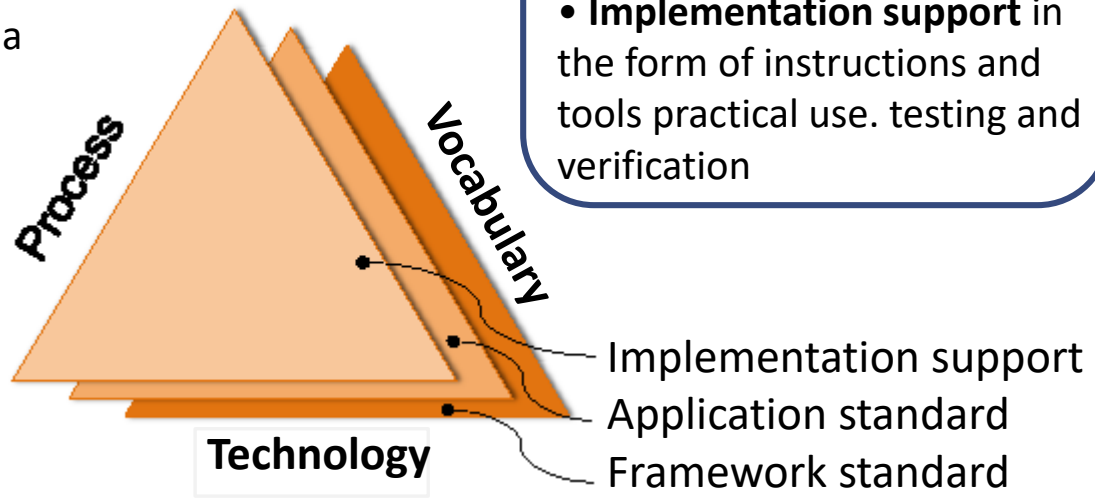
standardization of information:

- **Vocabulary** that makes information common and that it can be understood by all parties and interpreted by system.
- **Process** is the way to common use information and exchange it a quality, secure and on efficient manner.
- **Technology** make IT systems, communicate and work together.

Three layers

that complement each other workable standard:

- **Framework standards**, often international
- **Application Standards,** national or international.
- **Implementation support** in the form of instructions and tools practical use. testing and verification

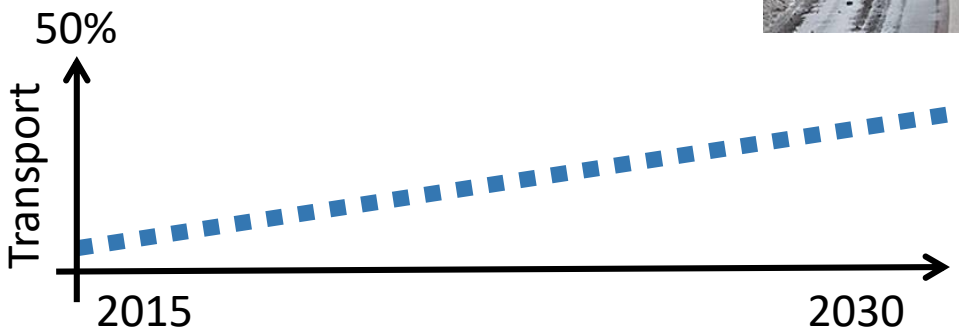


Source; Kurt Löwnertz, SWECO

Logistics is the industry's bloodstream

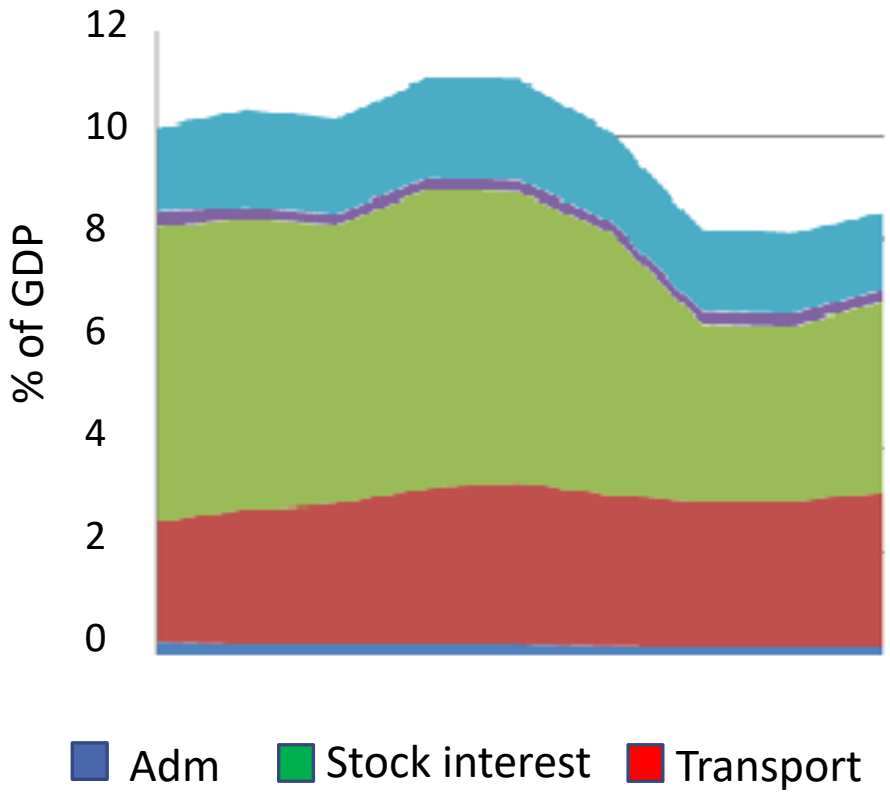
Value of goods transported is about 2800 billion SEK (10^9) per year
Cost of transportation is about 135 billion SEK per year
That value is 20 times greater than the cost of transport?
- Safety, quality, insurance, liability

One of the world's most advanced transportation manufacturer’s, expertise and new technology can create smart transport and products



Logistics costs

Total logistics costs distributed different types *



Logistics Costs share of GDP **

USA¹	10,2	8,7
USA	10,5	9,3
Sverige²	10,2	10,1
Storbritannien	10,1	11,3
Japan	11,4	11,4
Frankrike	12,0	11,6
Holland	11,9	11,9
Canada	12,1	11,9
Belgien	11,4	12,1
Italien	12,0	12,2
Grekland	12,6	13,0
Portugal	12,9	13,4
Spanien	14,7	14,1
Irland	14,0	14,9
Tyskland	13,1	16,7
Indien	15,4	17,4
Kina	16,9	17,9

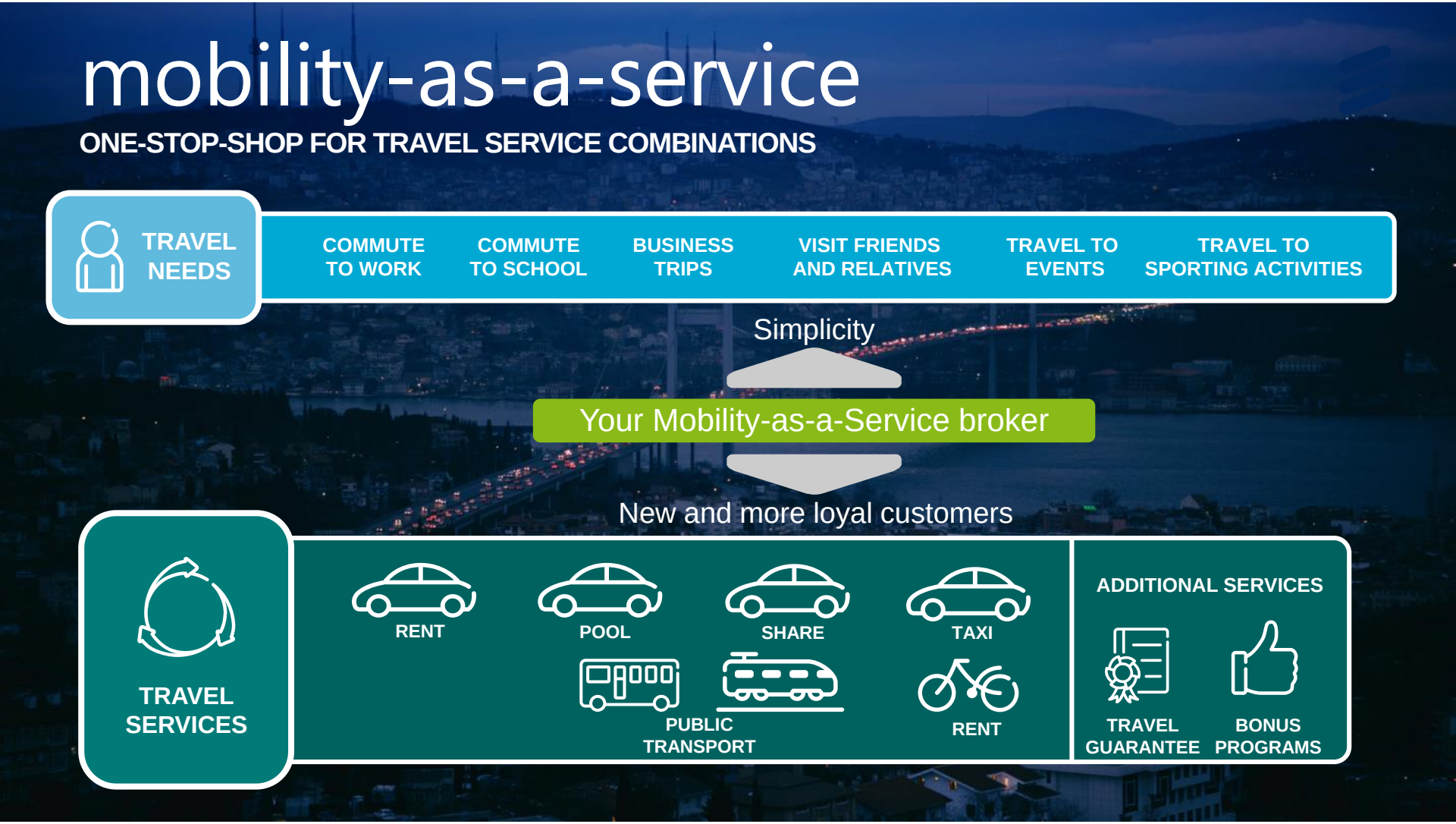
* Source Swedish macro logistics 1997-2005 ** Source: Rodrigues et alf

NEW VALUE PROPOSITITIONS

“SAVE AS YOU DRIVE”

mobility-as-a-service

ONE-STOP-SHOP FOR TRAVEL SERVICE COMBINATIONS



Plan build an industry architecture for Logistic and Transport

Base on Reference architecture Vocabulary, Conceptual, model core function, and views select and create an industry Architecture for Logistic and Transport.

This is based on use cases, platforms, methods, IoT-systems for Logistics and transport. Also studies and reports from research, operations, statistics etc

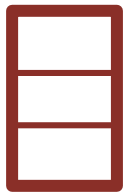
A exhibition on smart seminar on Logistics and Transport at Kistamässan in Stockholm 21-22 Sep 2016 It had 5000 participants and 30 seminaries, 60 exhibitor

The work is planed as a project to develop the industry architecture and create an ecosystem that supports this industry architecture

Collaboration across sectors

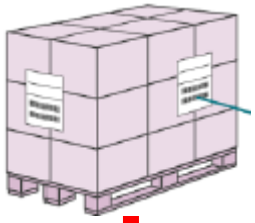
Manufacturer

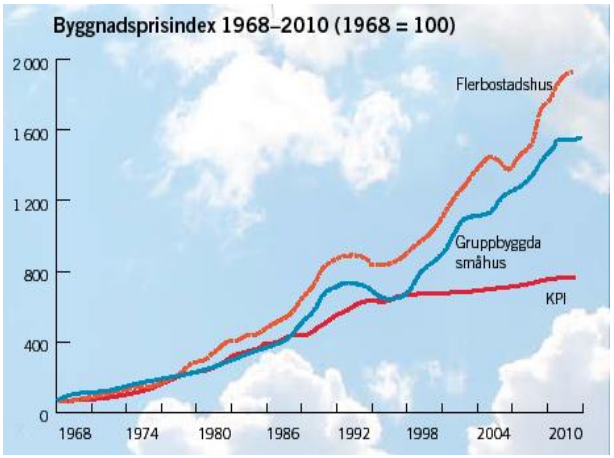
Windows
-Product code



-Product code
-Case code

-Product code
-Case code
-Pallet code



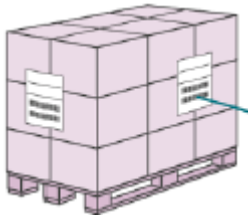


Built apartment block

Windows are installed. Then registered by IoT system

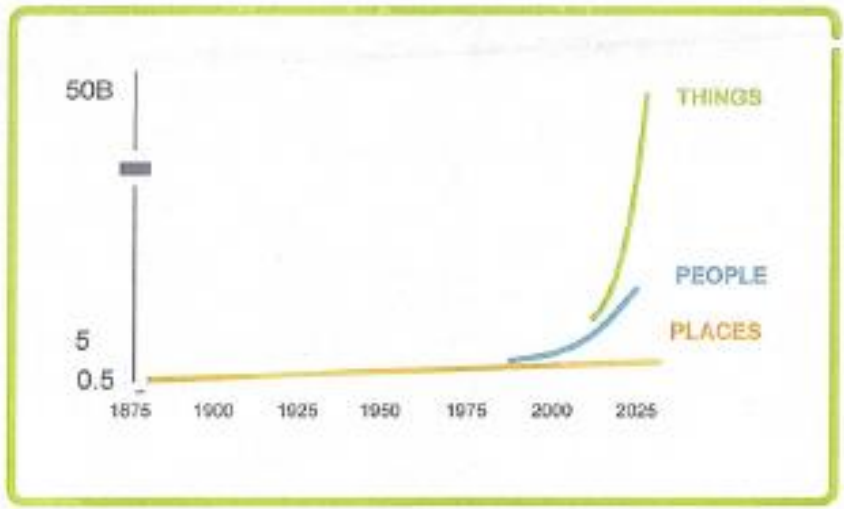
Windows arrive Just-in time at the right place.

Logistics/Transport



Ecosystem for IoT

1. **An organization** that support planning & resources in IoT for Sweden
2 **Technical framework and rules**
   - Reference architecture
   - Branch specification architecture, protocols, name spaces, etc.
3**. Enablers**
   - Software products, functions
   - Hardware Products
   - Tools, Big data, AI and G/I- models
   - Methods for model based development, simulations, deployments
4. **Provision of skills: basic, advanced** and special education
5. **R&D, state of the art and modern** innovation and business model
6. **Laws, regulations and safety.**



Thank you for listening!

More information

National Agenda for IoT in Sweden
http://www.ltu.se/centres/cdt/IoT-Agenda-1.142290

Program Office IoT Sweden http://iotsverige.se/

National Standards organization Sweden
http://www.sis.se/

http://www.internetmuseum.se/tema/internetpionjarer/

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