

# IKT i Projektering og udførelse.

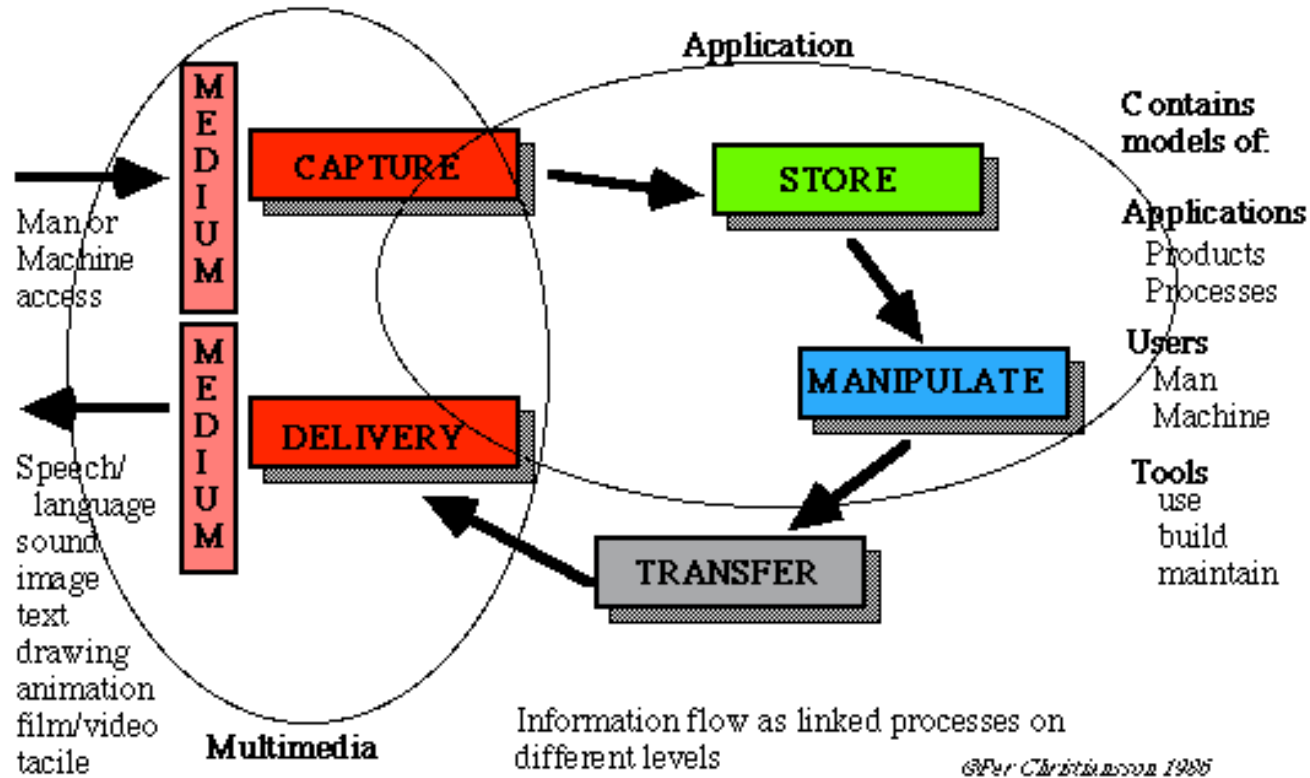
ICT Fundamentals in Construction.

Cand. Scient. Bygningsinformatik og Byggeledelse.  
Semester 1, 2010.

## CONTENT

- What is ICT?
- The building process and ICT
- Driving forces
- ICT support examples
- Implementing support systems
- Building informatics domains

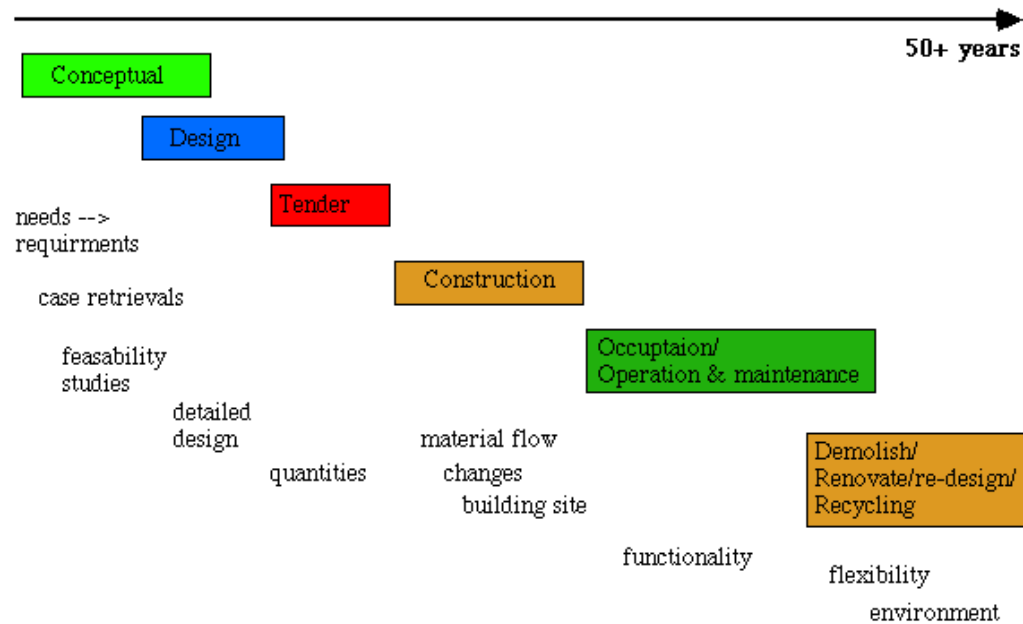
# What is ICT



## Information and Communication Technology - ICT

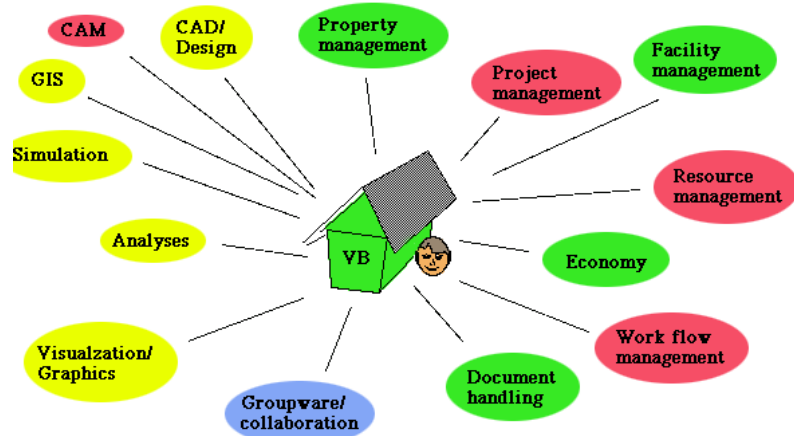
# The Building Process

## Traditional Life Cycle of the Building Process





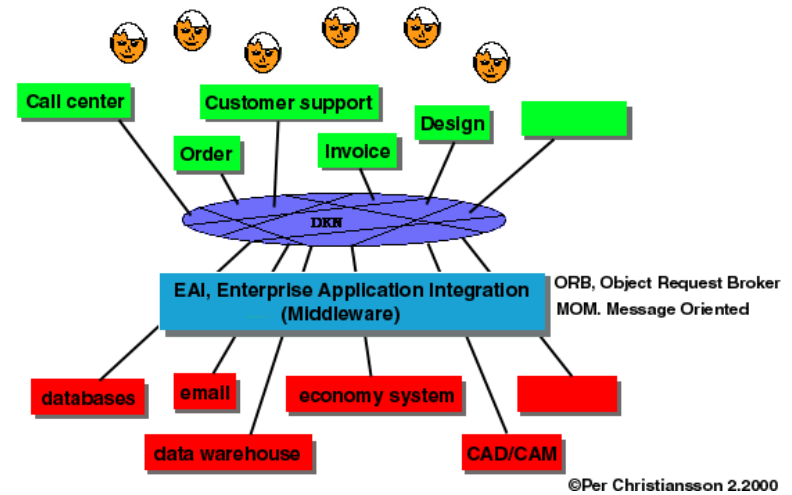
# 'BIM' Building Information Modelling .....



Building Process IT-support Systems

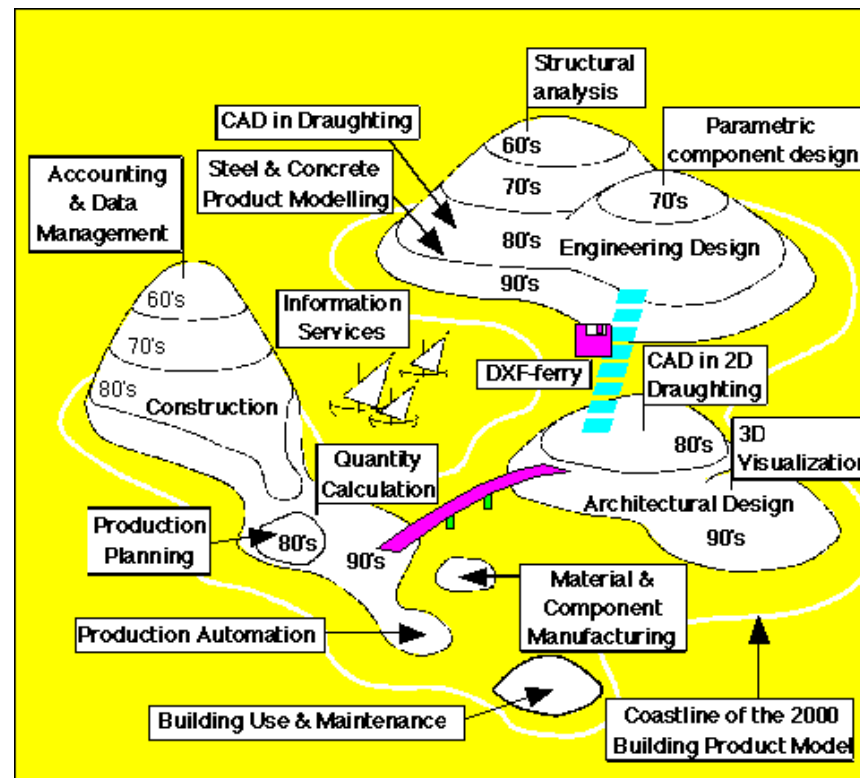
*©Per Christiansson 11.1999*

**Building Information Modeling (BIM)** is the process of generating and managing building data during its life cycle (Eastman et.al.)



ERP (Enterprise Resource Planning) .....

# Interoperability

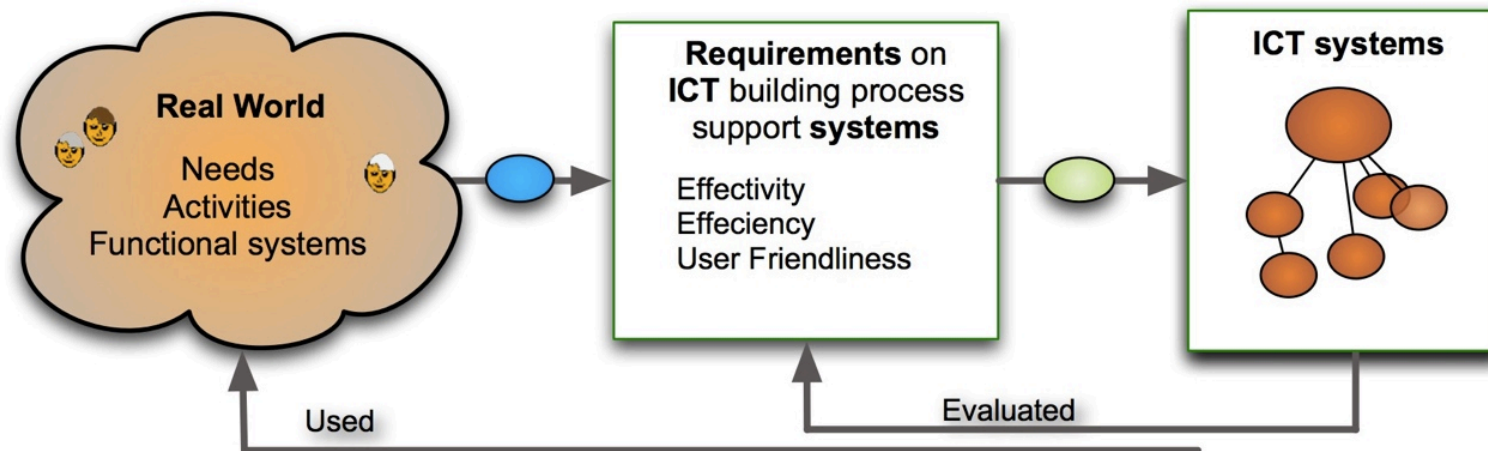


Islands of automation within the Building process (after Matti Hannus and Pär Sill'en, VTT, Finland)



# From Needs to ICT systems

## Needs, requirements, ICT systems

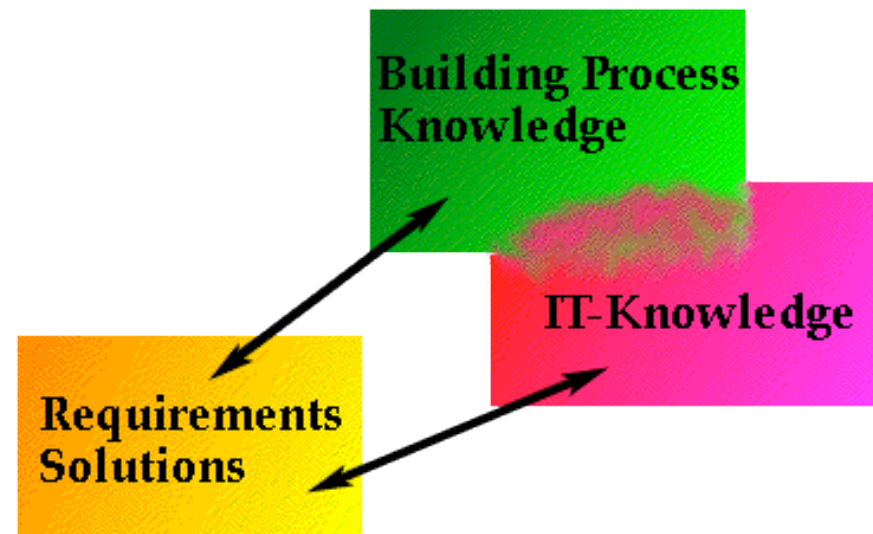


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User needs and requirements on ICT support systems are expressed during early conceptual system design and followed by more detailed data modelling and ICT systems implementation.

ICT systems are evaluated during development and use.

## Competences needs



Builders must know some basic IT to be able to formulate requirements on and participate in the design and implementation of tomorrow's building process ICT-tools. The IT community cannot (should not) by themselves build tomorrow's AEC tools.

## Future ICT

- Wireless networks with fiber based backbone
- Portable units (computers, service/communication units)
- Peer-to-peer to societies. Communities of interest. Social software. Family servers
- XML tagged communication standards
- Personal storage of information/knowledge within physical reach (virtual containers)
- All information ('good' and 'bad') accessible through dynamic logical containers (QA)
- Dynamic creation of information containers
- Many flat panel/mobile communication units in homes and workplaces.
- Virtual spaces for communication and learning
- Augmented reality applications
- Personal global positioning units
- Manifold of parallel personalised market and service places
- Embedded intelligence (installation components etc.) with Internet connectivity
- .....



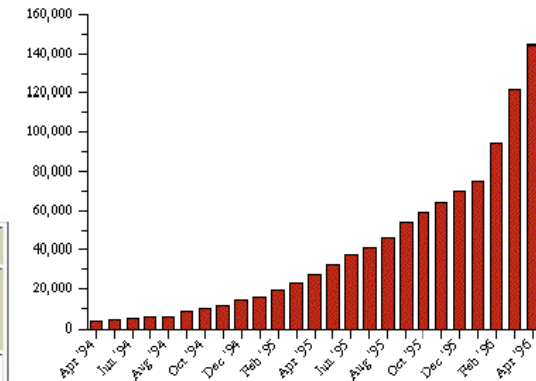
# Internet usage

## INTERNET USAGE STATISTICS The Internet Big Picture World Internet Users and Population Stats from <http://www.internetworldstats.com/stats.htm>

WORLD INTERNET USAGE AND POPULATION STATISTICS						
World Regions	Population (2008 Est.)	Internet Users Dec/31, 2000	Internet Usage, Latest Data	% Population (Penetration)	Usage % of World	Usage Growth 2000-2008
<a href="#">Africa</a>	955,206,348	4,514,400	51,065,630	5.3 %	3.5 %	1,031.2 %
<a href="#">Asia</a>	3,776,181,949	114,304,000	578,538,257	15.3 %	39.5 %	406.1 %
<a href="#">Europe</a>	800,401,065	105,096,093	384,633,765	48.1 %	26.3 %	266.0 %
<a href="#">Middle East</a>	197,090,443	3,284,800	41,939,200	21.3 %	2.9 %	1,176.8 %
<a href="#">North America</a>	337,167,248	108,096,800	248,241,969	73.6 %	17.0 %	129.6 %
<a href="#">Latin America/Caribbean</a>	576,091,673	18,068,919	139,009,209	24.1 %	9.5 %	669.3 %
<a href="#">Oceania / Australia</a>	33,981,562	7,620,480	20,204,331	59.5 %	1.4 %	165.1 %
<b>WORLD TOTAL</b>	<b>6,676,120,288</b>	<b>360,985,492</b>	<b>1,463,632,361</b>	<b>21.9 %</b>	<b>100.0 %</b>	<b>305.5 %</b>

NOTES: (1) Internet Usage and World Population Statistics are for June 30, 2008. (2) CLICK on each world region name for detailed regional usage information. (3) Demographic (Population) numbers are based on data from the [US Census Bureau](#). (4) Internet usage information comes from data published by Nielsen//NetRatings, by the [International Telecommunications Union](#), by local NIC, and other reliable sources. (5) For definitions, disclaimer, and navigation help, please refer to the [Site Surfing Guide](#), now in ten languages. (6) Information in this site may be cited, giving the due credit to [www.internetworldstats.com](http://www.internetworldstats.com). Copyright © 2001 - 2008, Miniwatts Marketing Group. All rights reserved worldwide.

Number of HTTP Servers



The Internet is one of the main contributors to transforming the world. Globalization, the global village, world wide services, Internet of things....

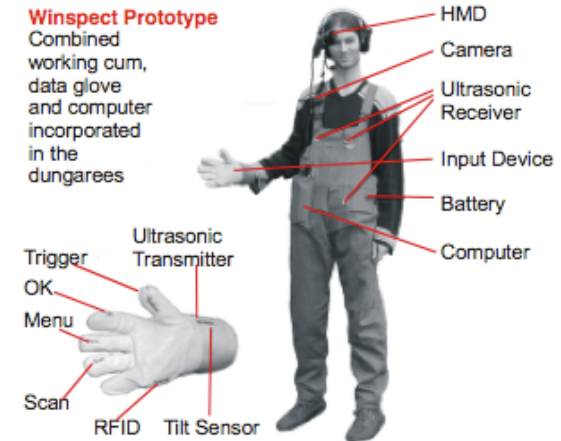
## ICT at the Construction Site



VuMan 1991, CMU



Digital Hardhat, UIUC, 1996



[wearLab] Bremen

Ontologies

Wireless

Peer-to-Peer

Virtual Spaces

Augmented Reality

RFID

GPS

Grid Services

We are in an intense period of development where we can do **creative design of future user environments.**

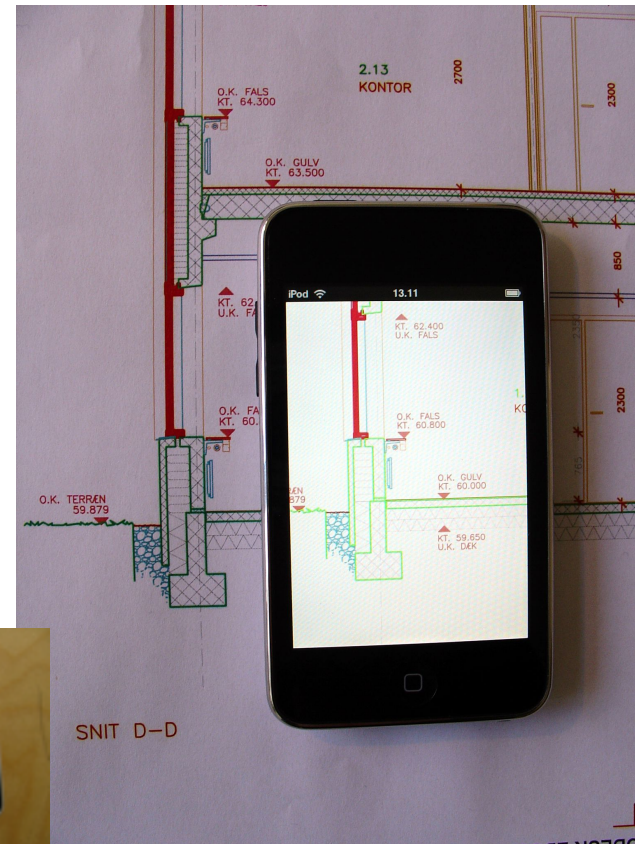
High quality **models of building products and processes** can be used in augmented reality environments to make collaboration and 4D simulations more effective, supported by underlying models and efficient data transfer.



# ICT at the Construction Site



Ericsson T68i Mobile phone equipped with barcode reader scanning a laminated barcode sheet.



Drawing (wireless transfer) from computer to iPod

# Collaboration



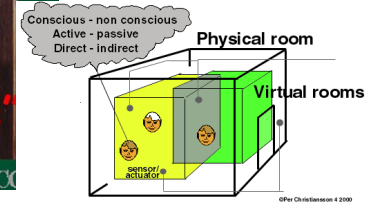
4 parts video conference, 2008



Desktop collaboration

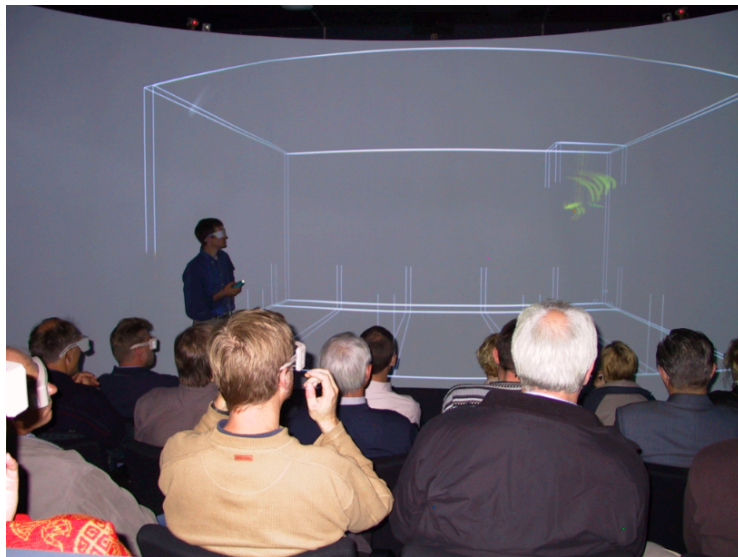


Remote lecture and application sharing between Aalborg and Lund Universities 1999





# Virtual Reality

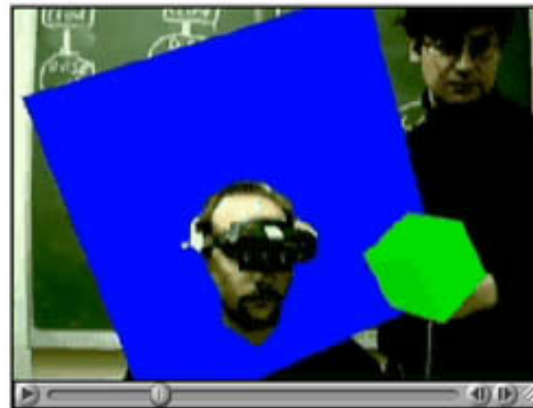
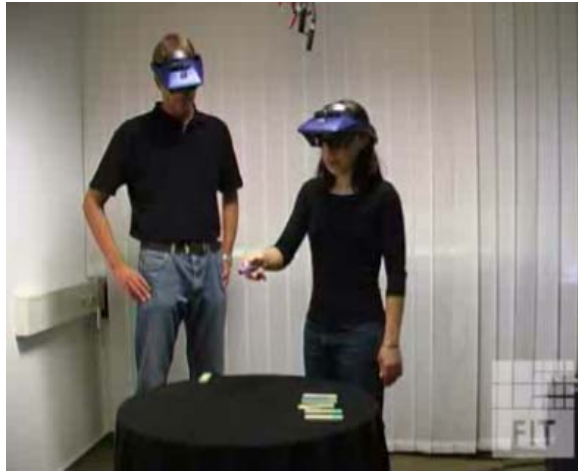


Panorama



CAVE

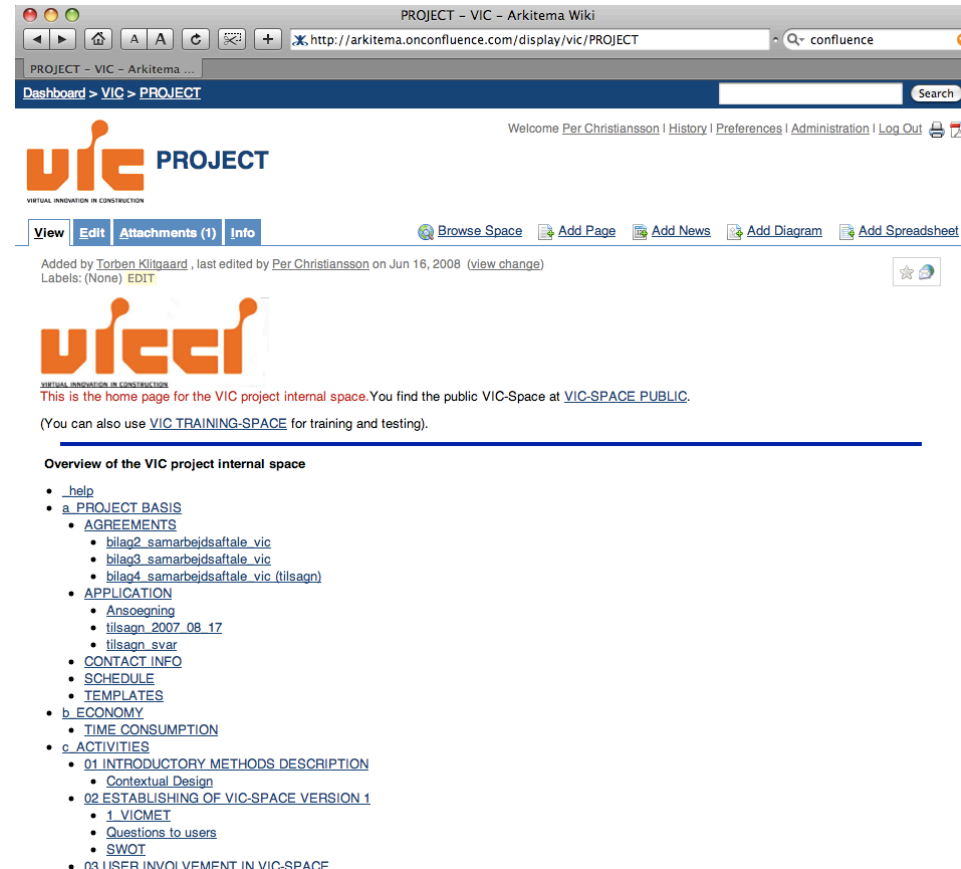
# Augmented Reality



# 'Project webs'

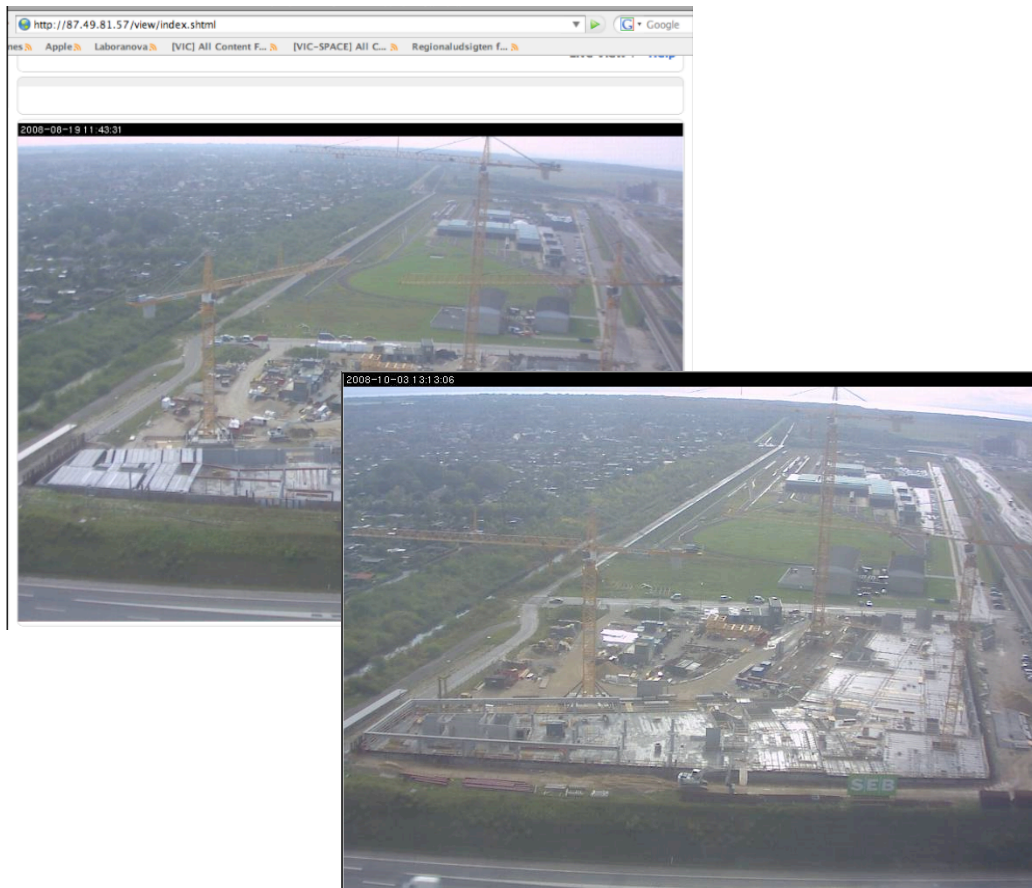


Enterprise Wiki example



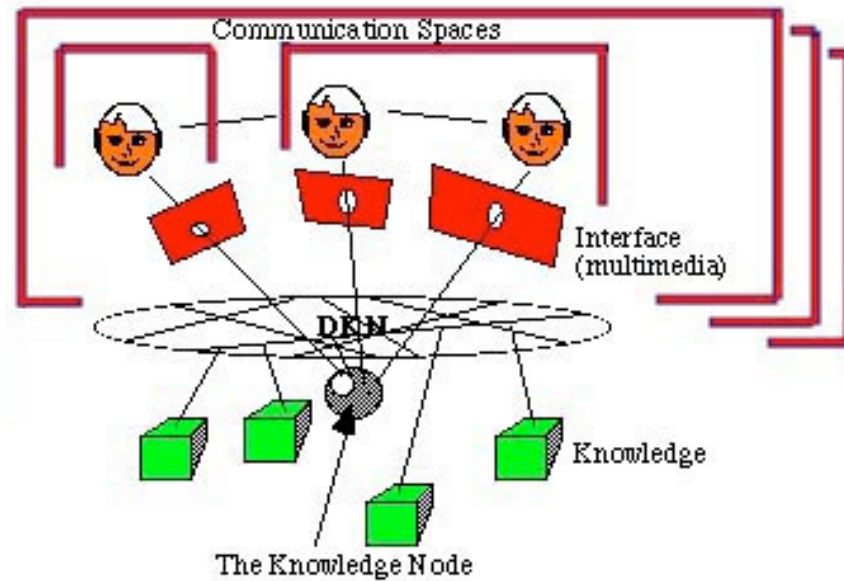


## Reality access



Rambøll new headquarters at Ørestad

## Users - models - networks



- Access and Augmentation of Digital Knowledge
- Communication Support
- Shared Workspaces

@Per Christiansson 1996, 2001

Due to introduction of ICT we must define some basic parameters to describe the collaboration in existing and not yet defined environments

# Virtual Buildings

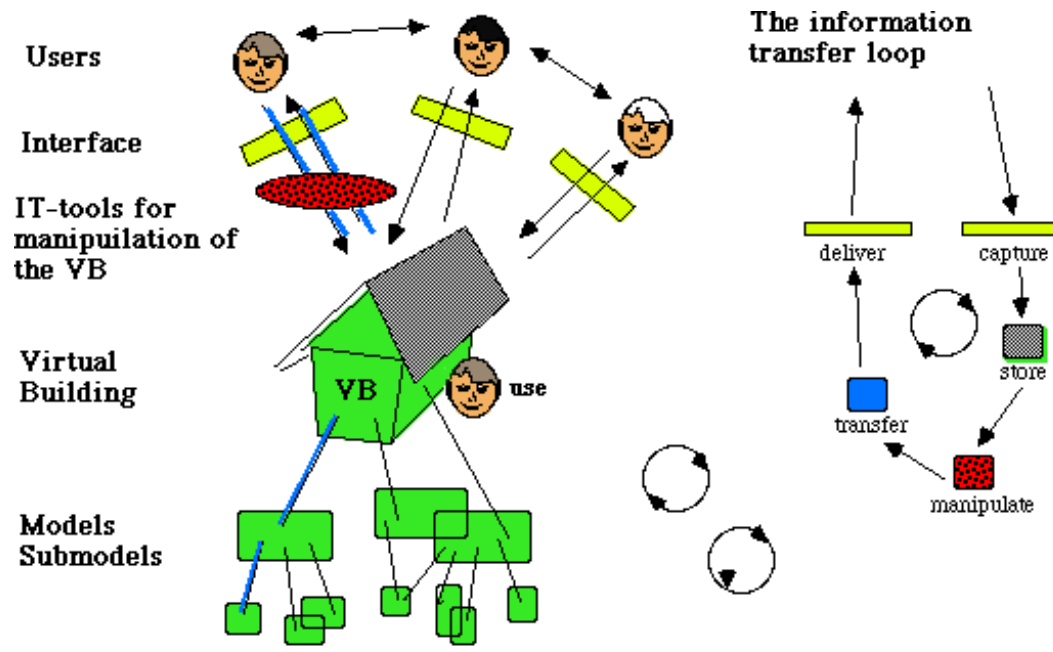


Arkitema and Rambøll headquarters





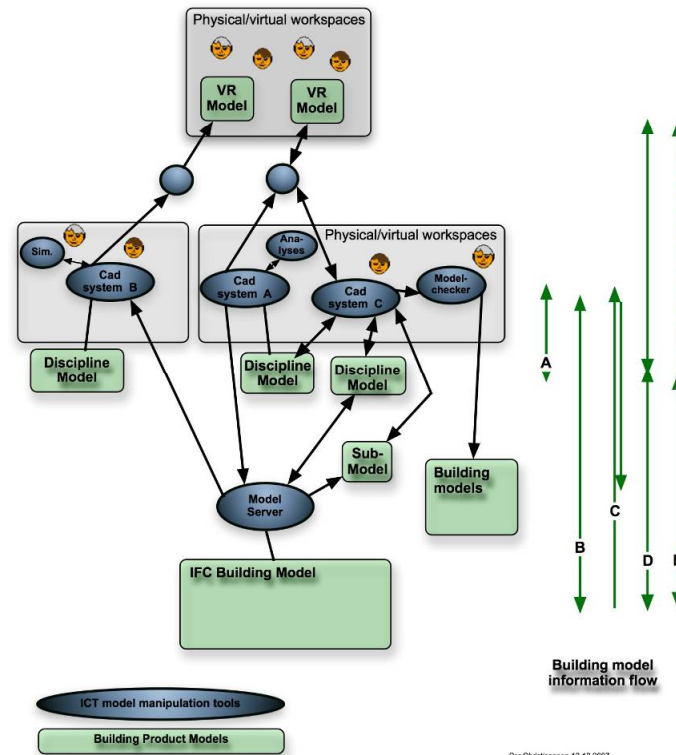
# The Virtual Building and the ICT loop



©Per Christensen, 2 1999

# Models of Buildings

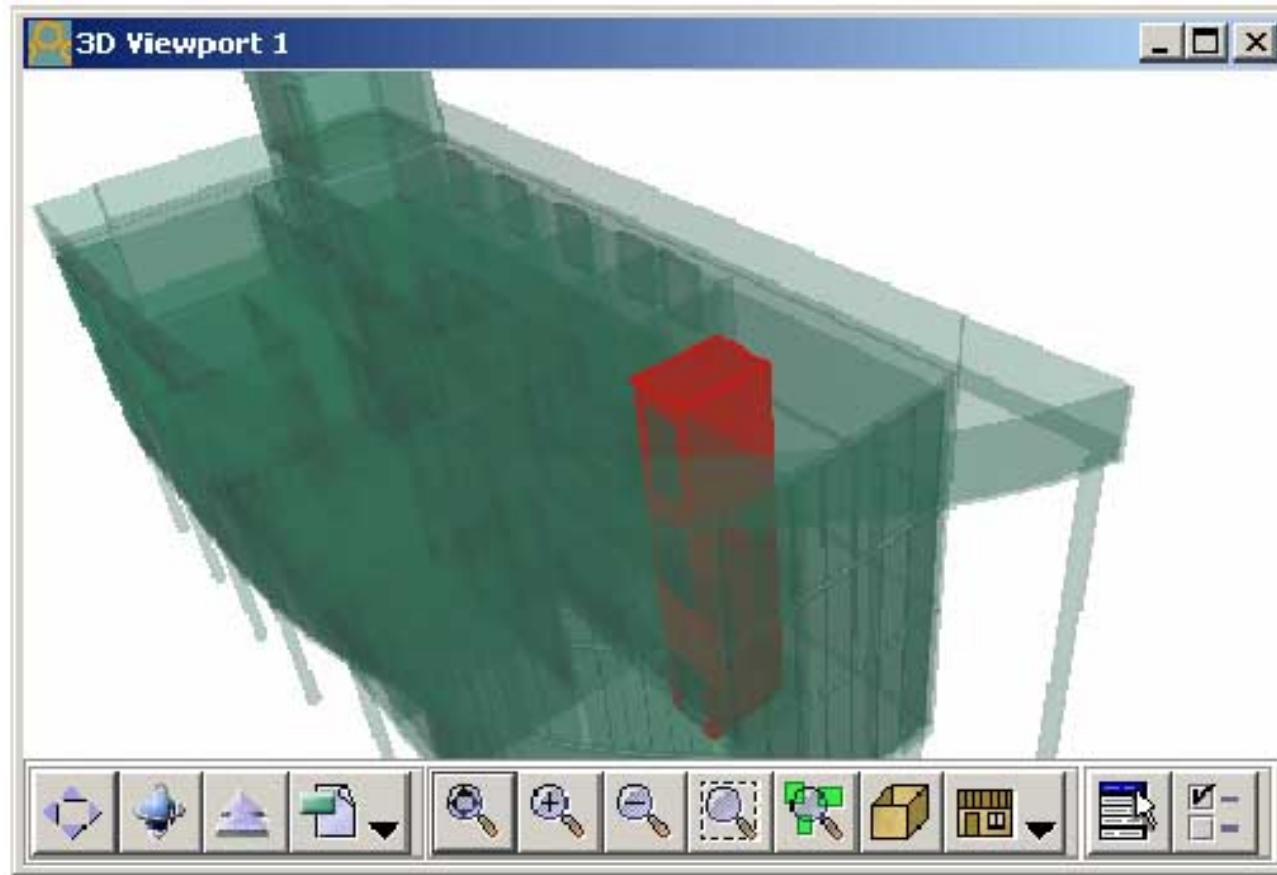
## Design and Model Storage Supports



Per Christianson 12.12.2007

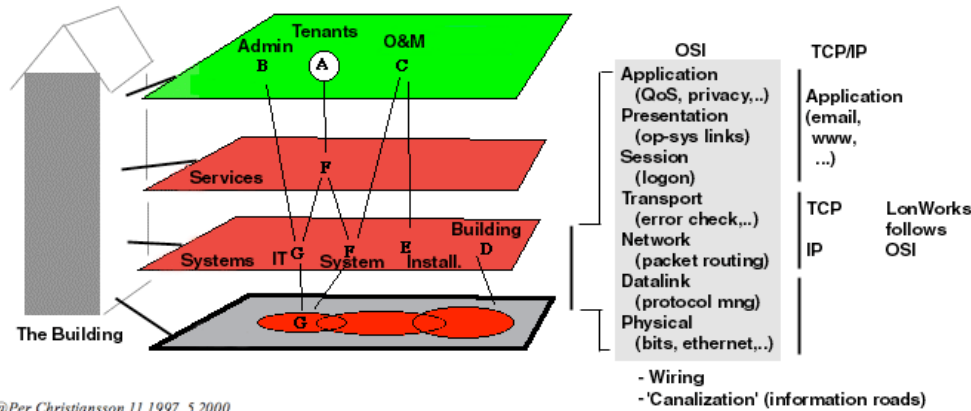
Building product models can today be stored shared and distributed and used in more or less mixed reality environments.

## Model checker



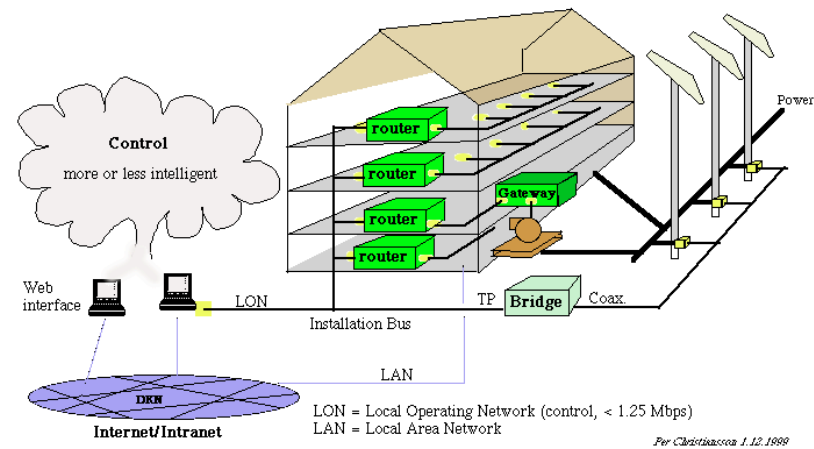
Solibri Model checker example

# Intelligent buildings



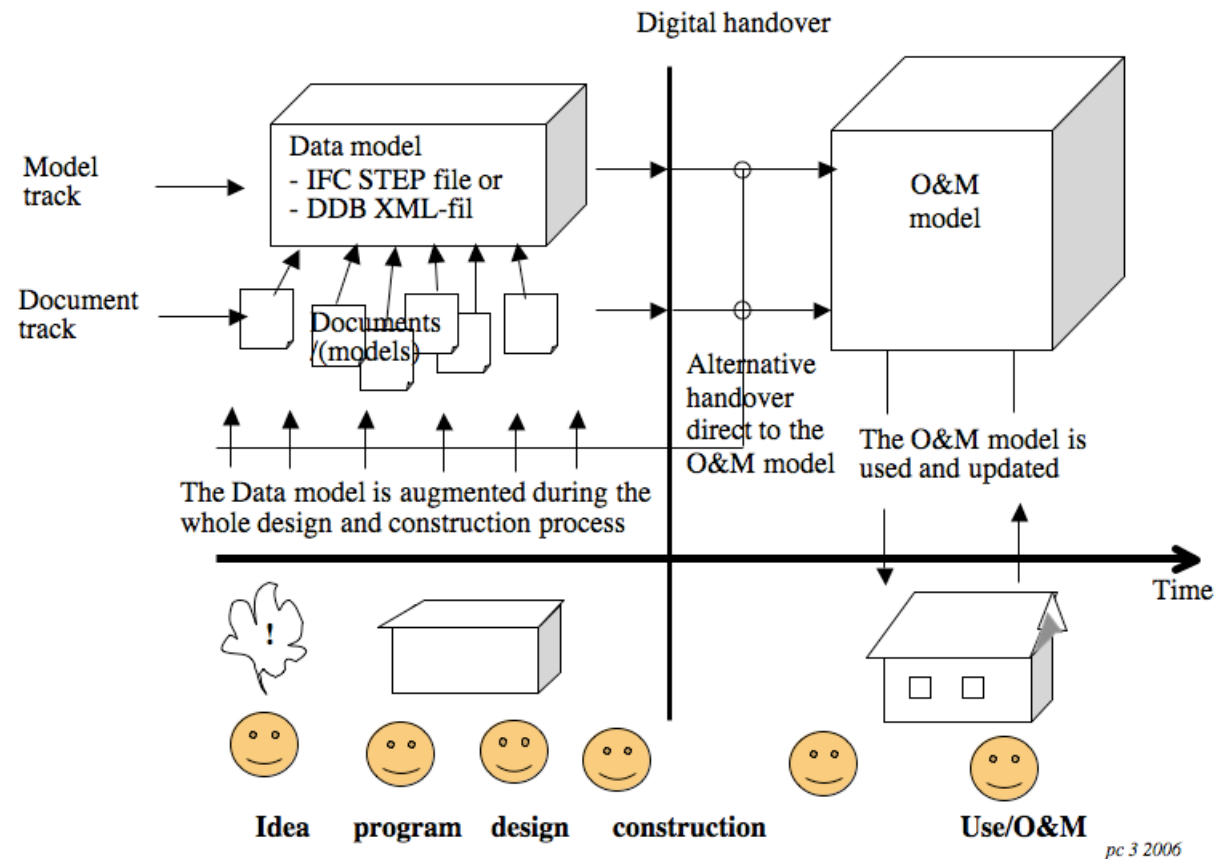
@Per Christiansson 11 1997, 5 2000

Intelligent buildings are buildings that through their physical design and IT installations are responsive, flexible and adaptive to changing needs from its users and the organisations that inhabit the building during it's life time. The building will supply services for its inhabitants, its administration and operation & maintenance. The intelligent building will accomplish transparent 'intelligent' behaviour, have state memory, support human and installation systems communication, and be equipped with sensors and actuators.



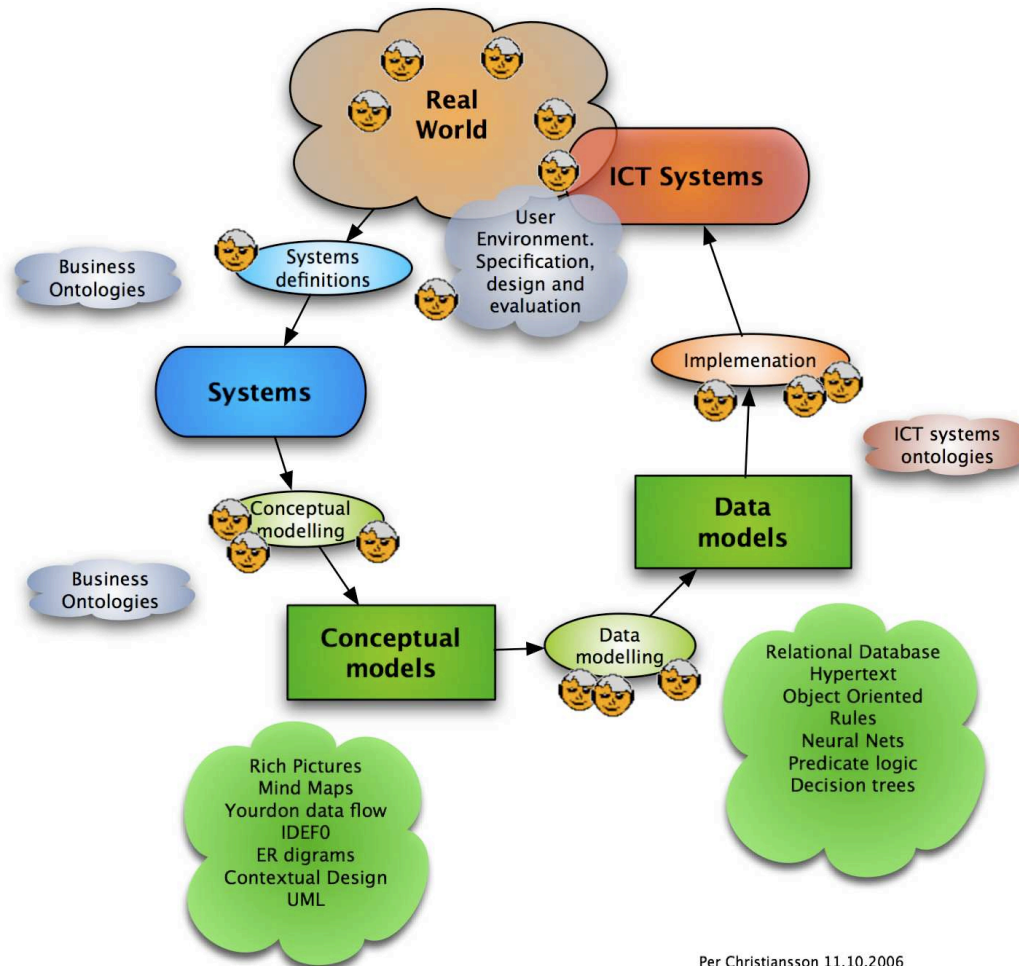
Per Christiansson 1.12.1999

# Hand over of Building Models



The newly released, January 2007, Danish digital construction requirements lets public clients put requirements on the content of the digital models of the building handed over to the client after finalised construction. (DDB, 2006)

# Implementing ICT support systems



In the *real world* we identify activities, things, processes, context, and persons.

The real world can be described as (interrelated) *systems* (no de-facto structure is available today) to accomplish different *functions* e.g. a comfort system to provide personal living and working quality, personal transport system, load carrying building system, escape system, and communication systems (collaboration, knowledge transfer, mediation, virtual meeting).

Per Christiansson 11.10.2006



# Building Informatics

## User Environment (UE) design

User needs capture  
Requirements specs  
Contextual design  
Usability/evaluation

## Knowledge Management (KM)

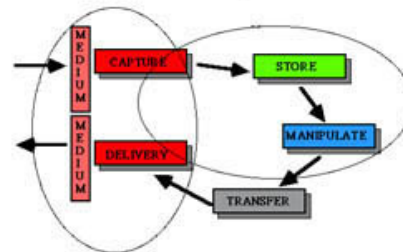
Intranet/extranet specifications  
ICT and change strategy  
Knowledge and experiences discovery, capture, storage and transfer  
Information QA

## Intelligent Buildings (IB)

IB design  
Services and systems  
Networks  
Facility management  
Intelligent city

## Computer Supported Collaborative Working (CSCW)

Virtual workspaces  
Sync/async communication  
Distributed collaboration  
Storytelling



## Building simulations

Building systems simulations  
Building systems integration

## Virtual Buildings (VB)

CAD  
Product and process models and modelling  
Classification  
Conceptual modelling  
3D geometric modelling

## Human Computer Interaction/Multimedia (HCI/MM)

HCI design  
Multimodal interfaces  
MM formats  
Computer graphics  
Virtual Reality

## Knowledge Representations (KR)

Relational databases  
Object Oriented  
Logic  
HyperText  
XML  
Semantic Web

Building informatics related areas.

END

<http://it.civil.aau.dk>



## Intelligent Building definition

In 2000 the author made the following *definition*:

"Intelligent buildings are buildings that through their physical design and IT installations are responsive, flexible and adaptive to changing needs from its users and the organisations that inhabit the building during its life time. The building will supply services for its inhabitants, its administration and operation & maintenance. The intelligent building will accomplish transparent 'intelligent' behaviour, have state memory, support human and installation systems communication, and be equipped with sensors and actuators."

Some important characteristics

- be *flexible* and *responsive* to different usage and environmental contexts
- be able to *change state* (with long and short term memory)
- contain tenant, O&M, and administration *service systems*
- support *human communication*
- accomplish *'intelligent' behaviour* and *transparent intelligence*
- *Integrate* different IB systems to form complex systems