AALBORG UNIVERSITY

Building Informatics

Produkt og Procesmodeller (PPM) i byggeriet.
Product and Process models in Construction.

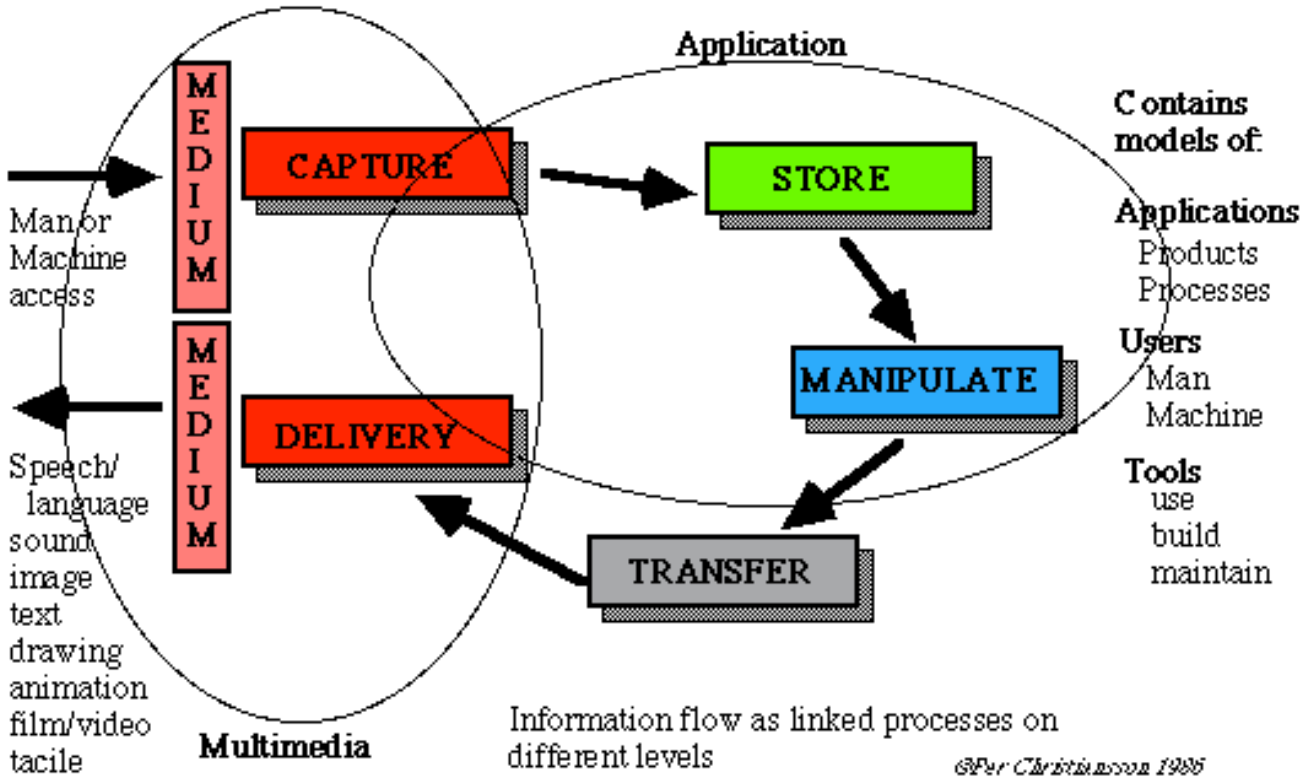
1 Perspective

Cand. Scient. Bygningsinformatik.
Semester 1, 2010.

CONTENT

- What is ICT?
- Computing paradigms
- Modelling history
- Long term development oscillations
- Future ICT. Development trends.
- From the BIM handbook

What is ICT



Information and Communication Technology - ICT

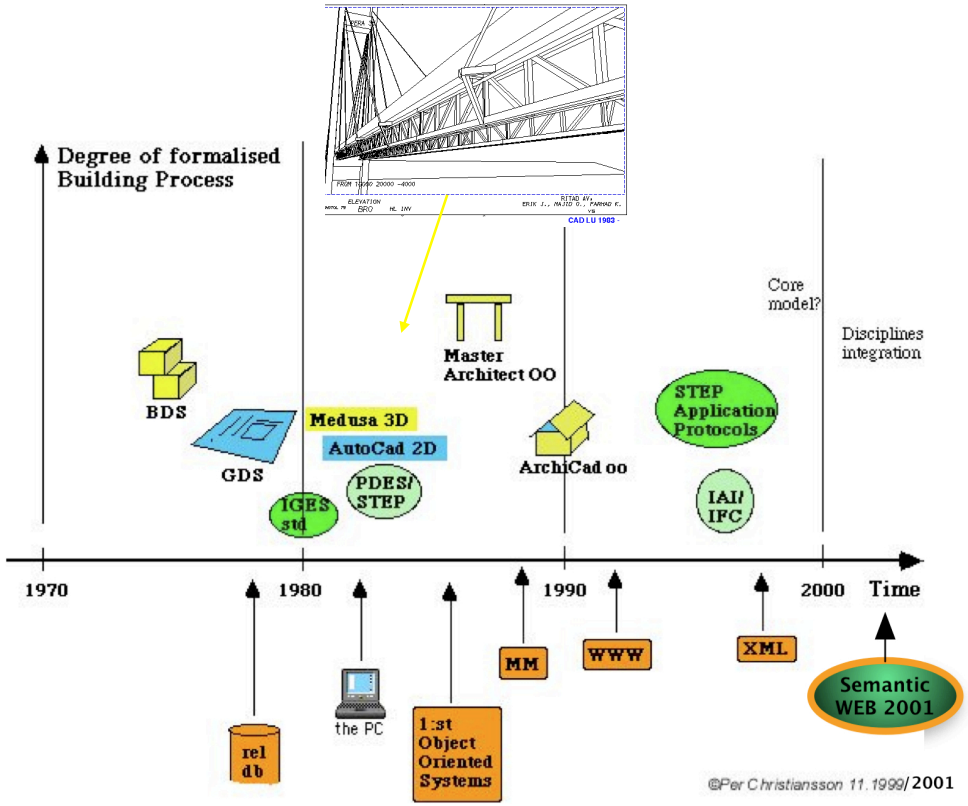
Computing Paradigms

	BATCH	TIME-SHARING	DESKTOP	NETWORK
Decade	1960s	1970s	1980s	1990s
Technology	Medium-scale integration	Large-scale integration	Very large scale	Ultra Large Scale
Location	Computer room	Terminal room	Desktop	Mobile
Users	Experts	Specialists	Individuals	Groups
User Status	Subservience	Dependence	Independence	Freedom
Data	Alpha-numeric	Text, vector	Fonts, Graphs	Script, voice
Objective	Calculate	Access	Present	Communicate
User Activity	Punch & try (submit)	Remember & type (interact)	See & point (drive)	Ask & tell (delegate)
Operation	Process	Edit	Layout	Orchestrate
Interconnect	Peripherals	Terminals	Desktops	Palmtops
Applictions	Custom	Standard	Generic	Components
Languages	COBOL, Fortran	PL/I, Basic	Pascal, C	Object oriented

Pervasive?
Ubiquitous?

The four computing paradigms (Scientific American, September 1990).

Modelling history

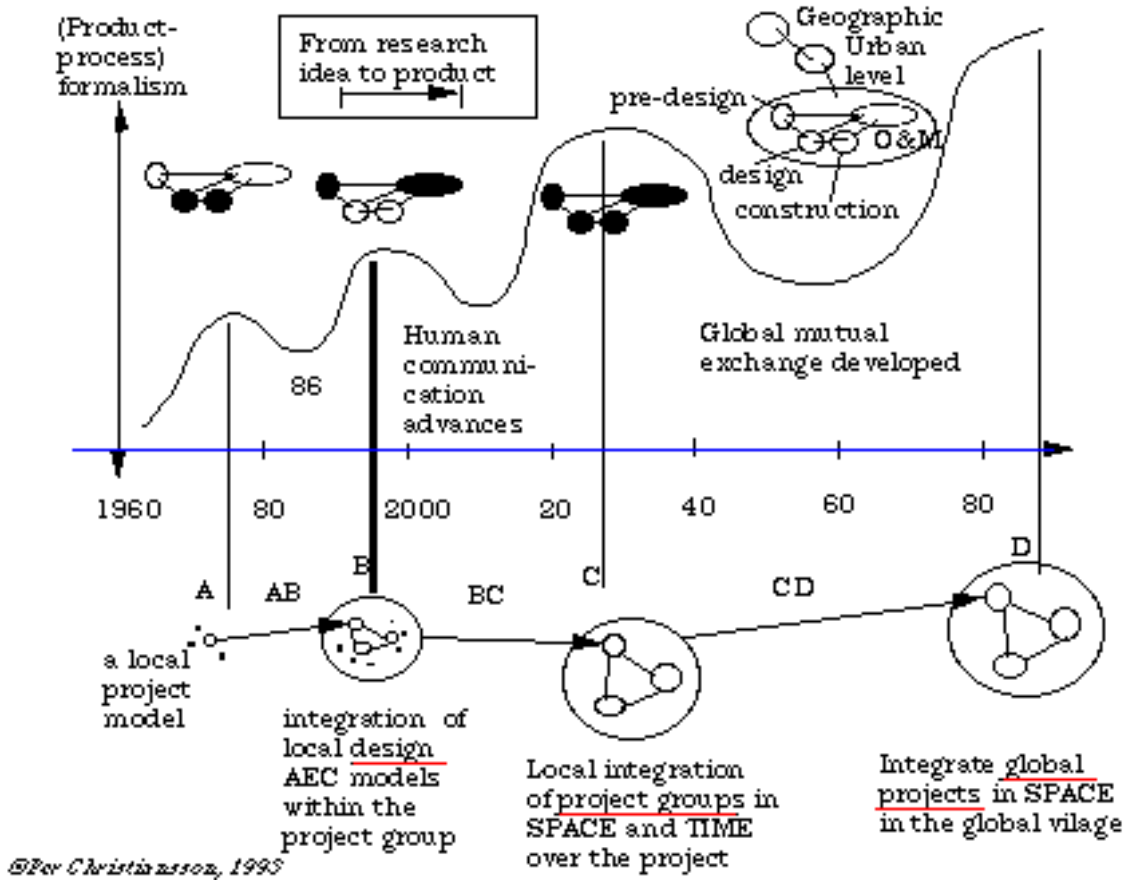


Building Process models development have during the latest decades had periodic focus on achieving a highly formalized non-redundant building product model, Virtual Building, VB.

Below are some highlights from the modeling/ICT history listed
- Ivan Sutherland creates SKETCHPAD (1960)
- Integration of building parts to a Product Model,(1970),
- Time-sharing computers (mid 1970s).
- User tools perspective. 3D modeling (1975), -IGES. Initial Graphics Exchange Specification in USA (1979)
- Cad database integration (1980). Applications spread physically in networks (1980).
- 1983. IGES/PDES. Product Data Exchange Specification/using step (USA) , ISO/STEP Stan-dard for Exchange of Product Model Data
- First practical object orientation implementation (1985). CIB W78 conference in Lund 'Conceptual modeling of buildings' (1988)
- PDES/STEP General AEC Reference Model(1988)
- Integration of mixed representations. Knowledgebases (1990). Integrated networks on services level ISDN (1990), INTERNET accelerates. Process modeling focus (1990). WWW (1990).
- IFC Release 1 (1996).
-(1993). January, 40 known http servers. October, 200 known http servers.
- (1994). May, First International WWW Confer- ence at CERN Geneva. (KBS-Media Lab, Lund University on the web in April). June, over 1500 registered http servers. 2.5 million computers on the Internet.
- XML (1998), Resource Description Framework, RDF (1998), Semantic Web (2001). See also (Christiansson, 1998 & 2003), (Lai et. al. 2003).

From Christiansson P, Carlsen M (2005) Virtual Building from Theory to Practice. *Proceedings W78 22nd Conference on Information Technology in Construction*. (Edited by R.J. Scherer, P. Katranuschkov, S.-E. Schapke). Dresden July 19-21, 2005. ISBN: 3-86005-478-3, CIB Publication No.: 304. (pp. 171- 175).

Long term development oscillations



From (Christiansson, 1993, " The K3 Program 1994- . A program for Communication, Classification and Representation of building process knowledge."), (16 pp.)

"We (researchers and developers) continue to climb the ladder or mountain of abstractions:

* Integrating building parts to a Product Model, (1970),
* User tools perspective. 3D modelling (1975),
* Cad database integration (1980). Disintegrate physically in networks (1980). Object orientation starts (1985). CIB W78 conference in Lund `Conceptual modelling of buildings' (1988)
* Integrate mixed representations. Knowledge bases (1990). Integrate networks on services level ISDN (1990), INTERNET accelerates. Process modelling (1990)
* Connectionist product/process models (2000), everywhere accessible DKN [Dynamic Knowledge Net today World Wide Web] (2000).

What next?

* Unlearn, virtual agents, pattern communication, (20XX)."

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
- ……

Development trends 1/2

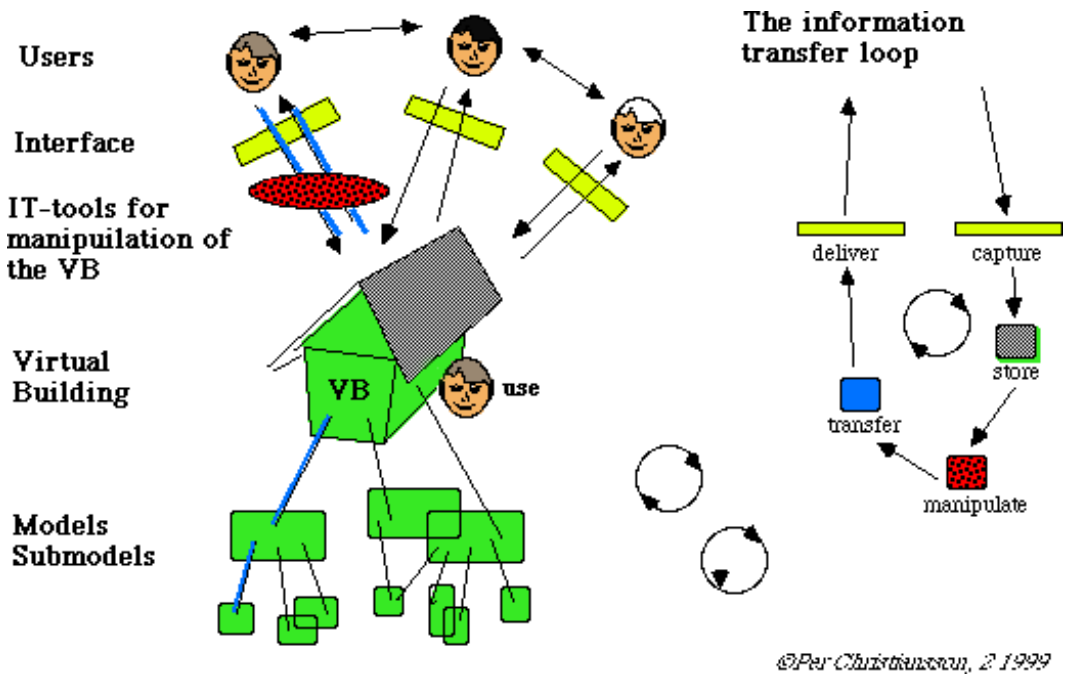
From (Christiansson, et.al, 2009)
What important development trends can we observe today?

- Local businesses is becoming global local-like businesses i.e. with greater needs for harmonization of cultural values on all levels.
- Lack of formal Business models. We have today business models very much based on locally optimizing value chains, see also Figure 5.
- Innovation in construction is a challenge (fax and mobile phones were real hitters).
- Virtual Organizations will be more often brought into play implying organisations sharing common resources during a project.
- Moore's law will be valid for at least another 20 years (memory, speed, ubiquitous computing).
- Extended development and use of meta-data marked www-accessible information (e.g. semantic web based solutions). See also (Lai, 2006).
- Internet based services on business application and technical service levels are developed, see also (Christiansson, 1993) "The so called Dynamic Knowledge Nets, DKN, are defined and used to explain changes for the next generation of computerized communication and knowledge handling systems"

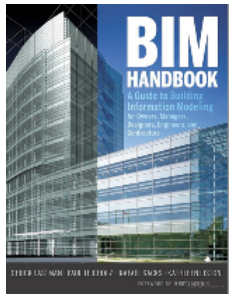
Development trends 2/2

- Clients get instruments to formulate better requirements on buildings.
- We are introducing, also in practice, the time dimension (4D) in Virtual Building models, see e.g. (Fischer & Kam, 2002).
- Virtual building (VB) models access and exchange is getting more standardized through use of the IFC standard, http://www.iai-international.org/.
- Efforts are under way to create International Framework for Dictionaries (and Ontologies) (IFD), http://dev.ifd-library.org/
- Information Delivery Manual (IDM) supporting information exchange for business processes in the building and construction industry. http://www.iai.no/idm/, http://idm.buildingsmart.no/confluence/display/IDM/Home
- Intelligent products and buildings with embedded sensors and actuators are again in focus.
- Energy optimization and ecological and sustainable building is gaining importance.
- We should be in a continuing reflective development process aiming at moving goals.

The Virtual Building and the ICT loop



From the BIM handbook



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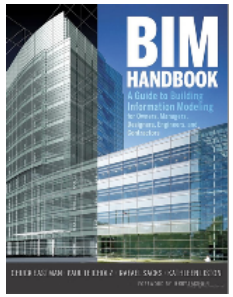


p.13

"For the purpose of this book, we define BIM as a modeling technology and associated set of processes to produce, communicate, and analyze *building models*."

p.14

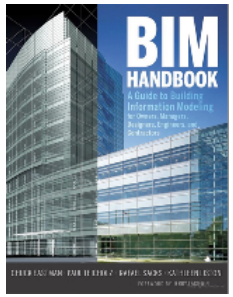
"The concept of parametric objects is central to understanding BIM and its differentiation from traditional 2D objects.

p.15-

1.5 What is not BIM techniology

- Models that contain 3D data only and no attributes.
- Models with no support of behavior (do not uitilize parametric intelligence)
- Models that are composed of multiple 2D CAD reference files that must be combined to define he building
- Models that allow changes to dimension in one view that are not automatically reflected in other views.

From the BIM handbook



Some benefits mentioned

p.16-

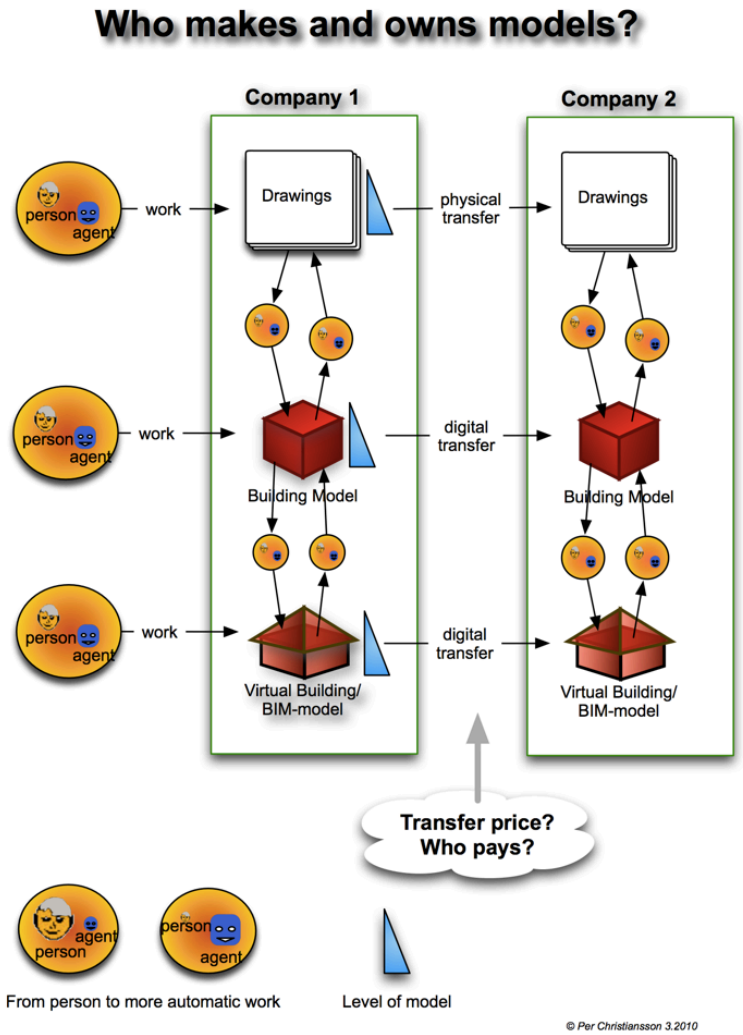
- Early cost analyses on approximate (or macro) building model.

- Early and more accurate visualization of design.
- Generate accurate and consistent 2D drawings at any stage of design.
- Earlier collaboration of multiple design disciplines.

- Synchronize design and construction planning.
- Discover design errors before construction.
- Use design model as basis for fabricated components

- Better manage and operate facilities

Who owns the model?

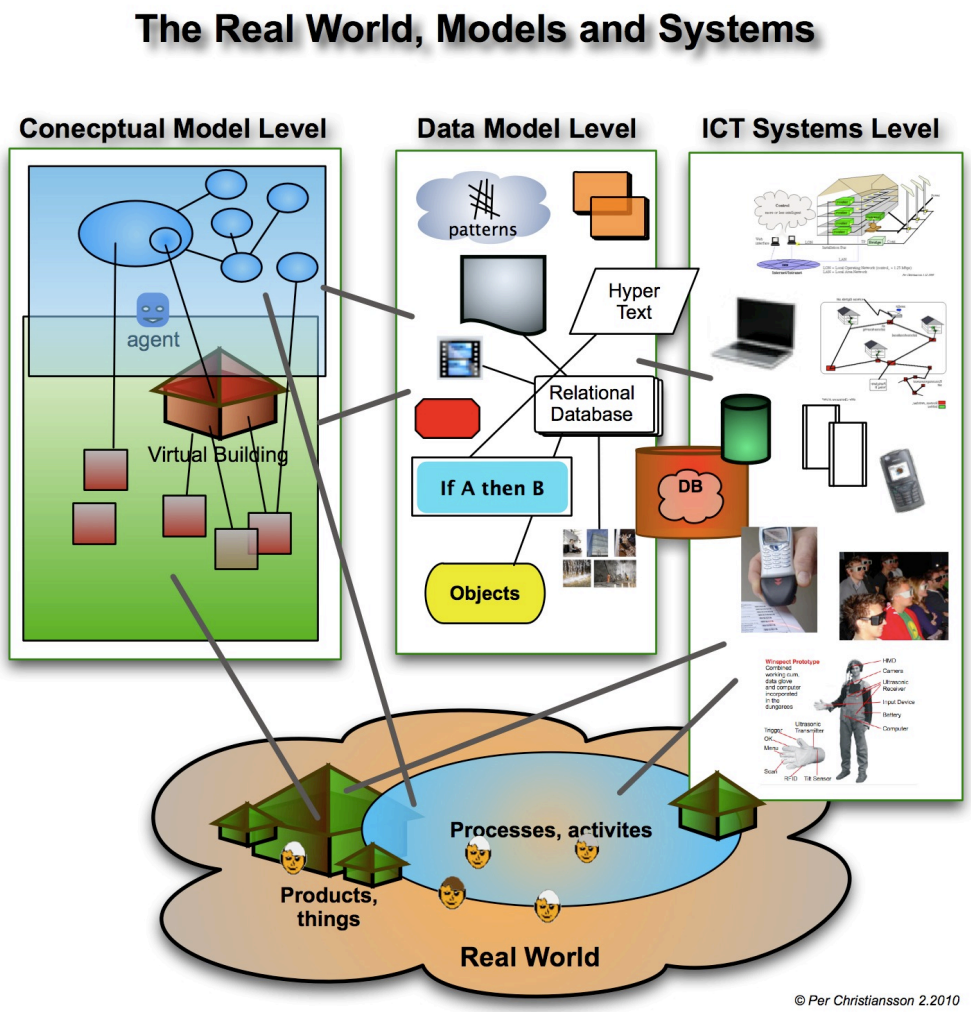


It is easier to transpor more detailed model knowledge if the model is stored as a digital building model (BM) or a Virtual Building/BIM-model than on paper as a drawing.

END

http://it.civil.aau.dk

Models of the real world

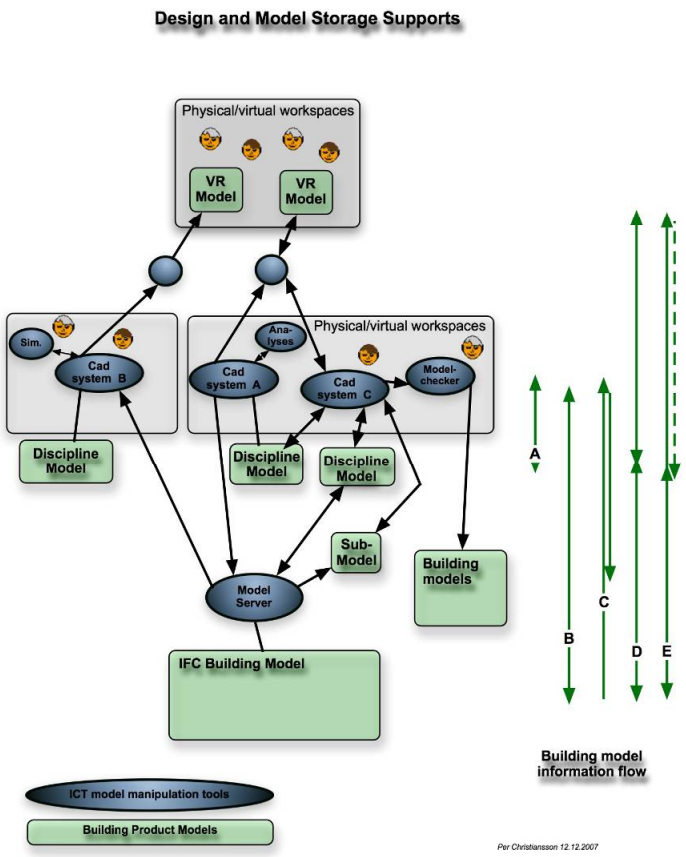


The HOLISTIC view

The holistic view.We use different kinds of *ICT support* in the building process and the built environment.

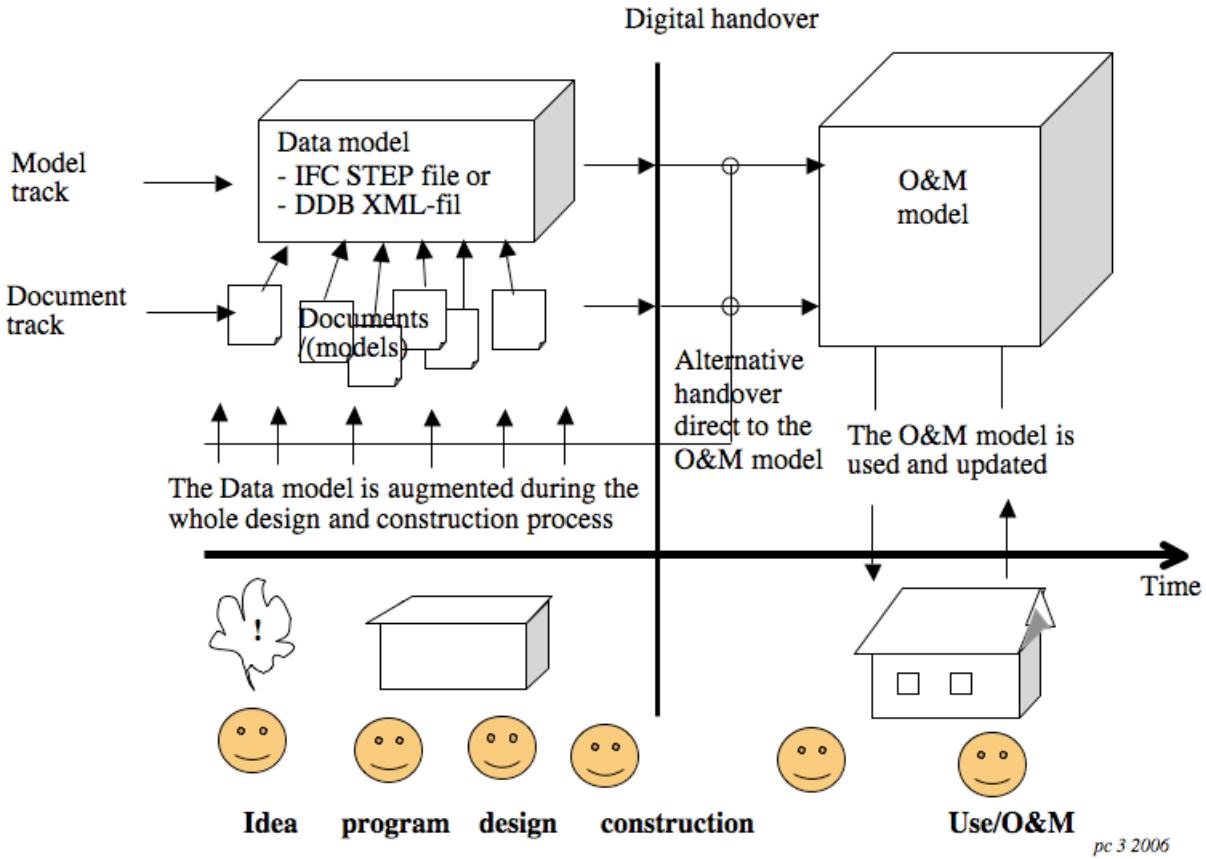
The ICT systems support different functionalities in the building process and built environment.

Models of Buildings



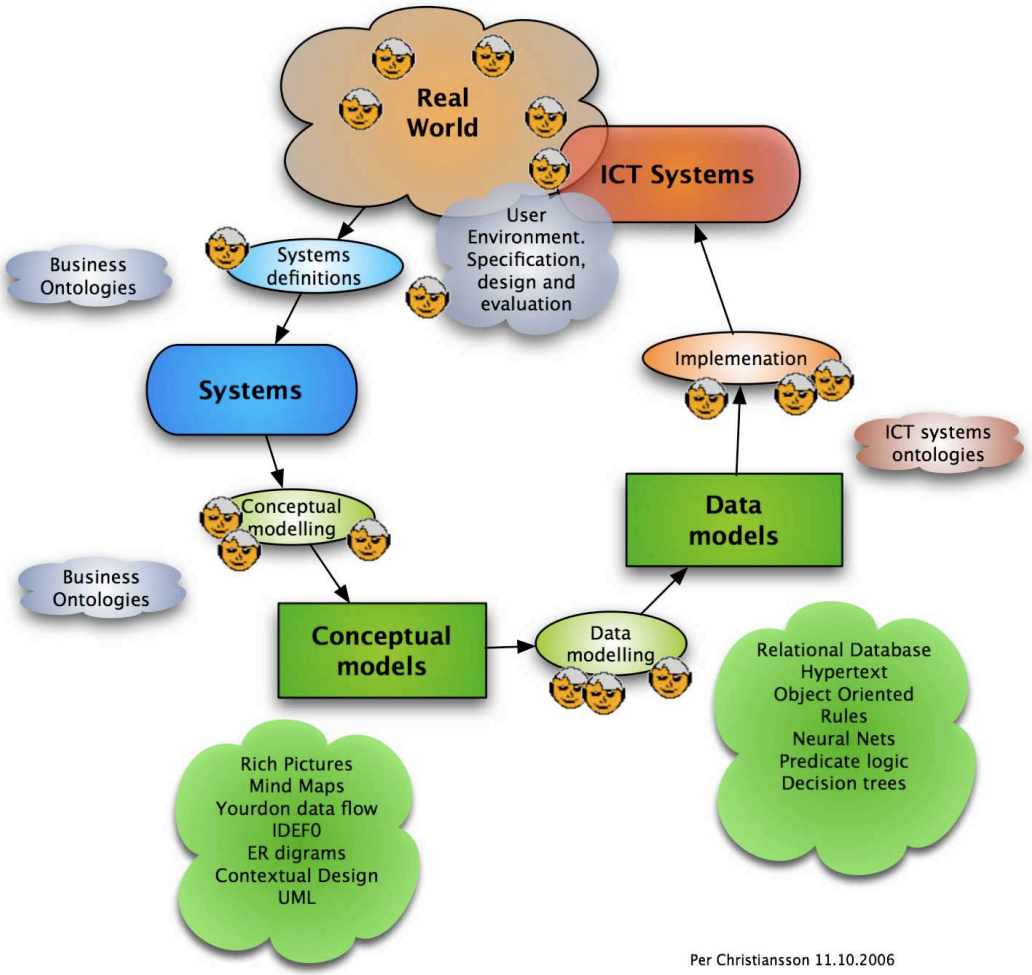
Building product models can today be stored shared and distributed and used in more or less mixed reality environments.

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).

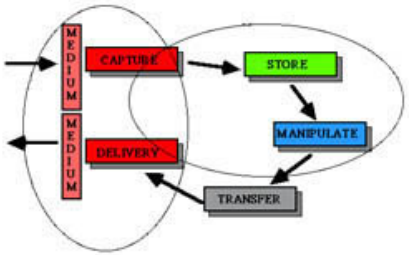
Building Informatics

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.

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 tnant, O&M, and administration *service systems*
- support *human communication*
- accomplish *'intelligent' behaviour* and *transparent intelligence*
- *Integrate* different IB systems to form complex systems

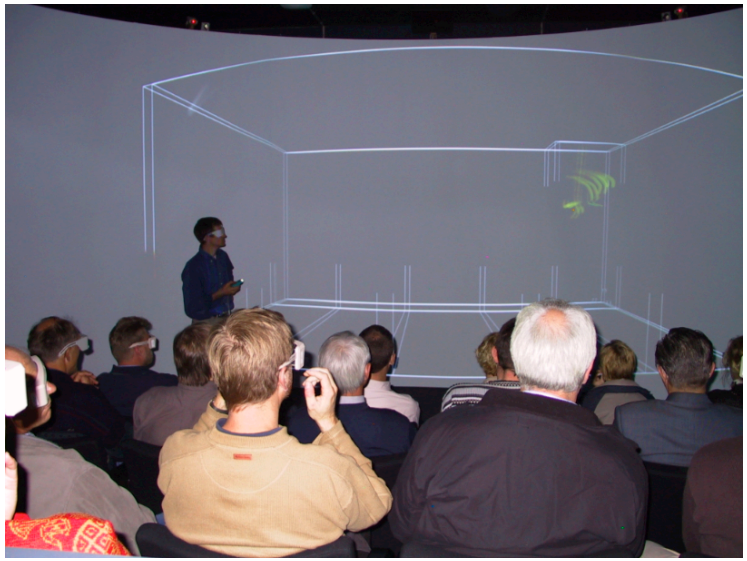
Collaboration

4 parts video conference, 2008

Desktop collaboration

Remote lecture and application sharing between Aalborg and Lund Universities 1999

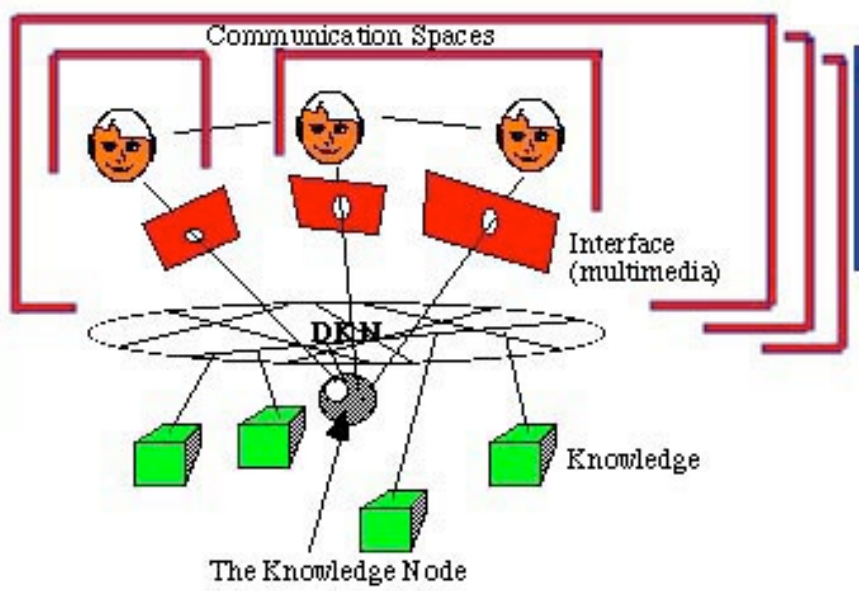
Virtual Reality



Panorama

CAVE

Users - models - networks



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