Virtual Buildings from Theory to Practice

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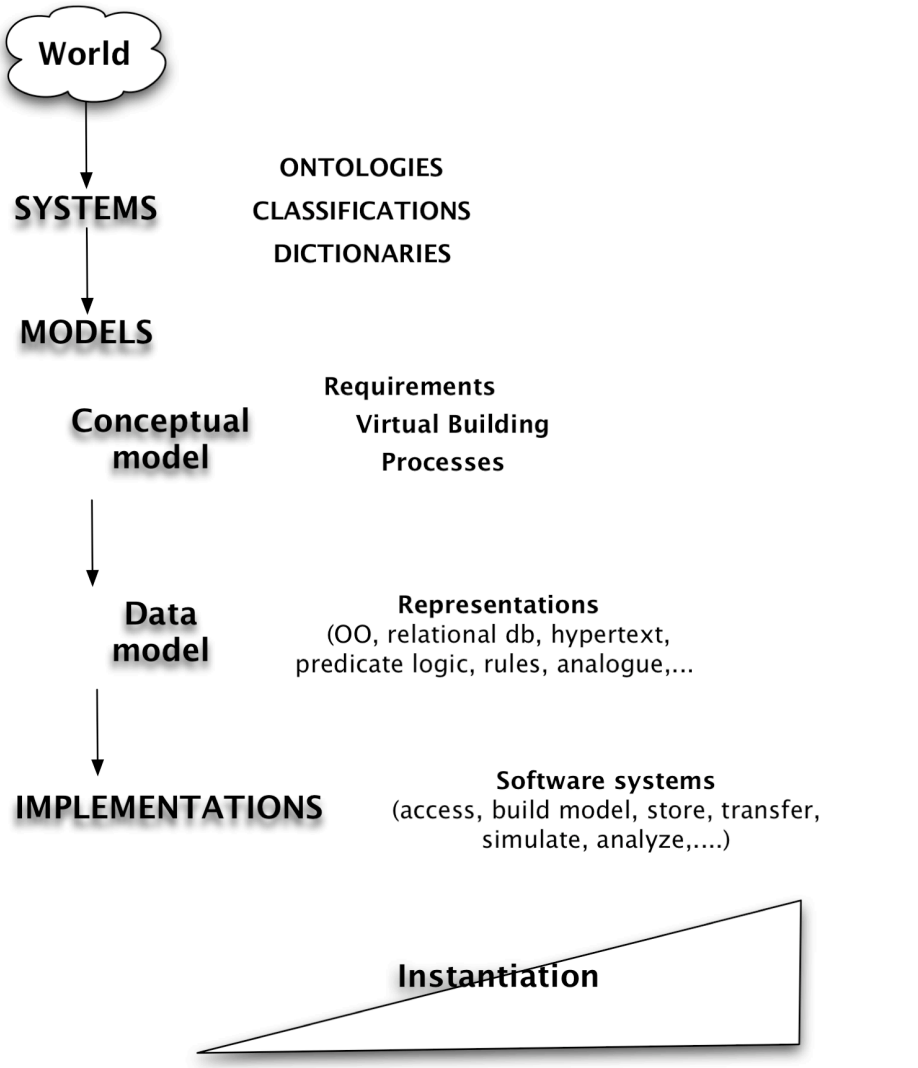
THE PROBLEM DOMAIN

Trade-off between using highly formalized building models and more loosely coupled building systems models and descriptions from the perspective of Virtual Buildings models.

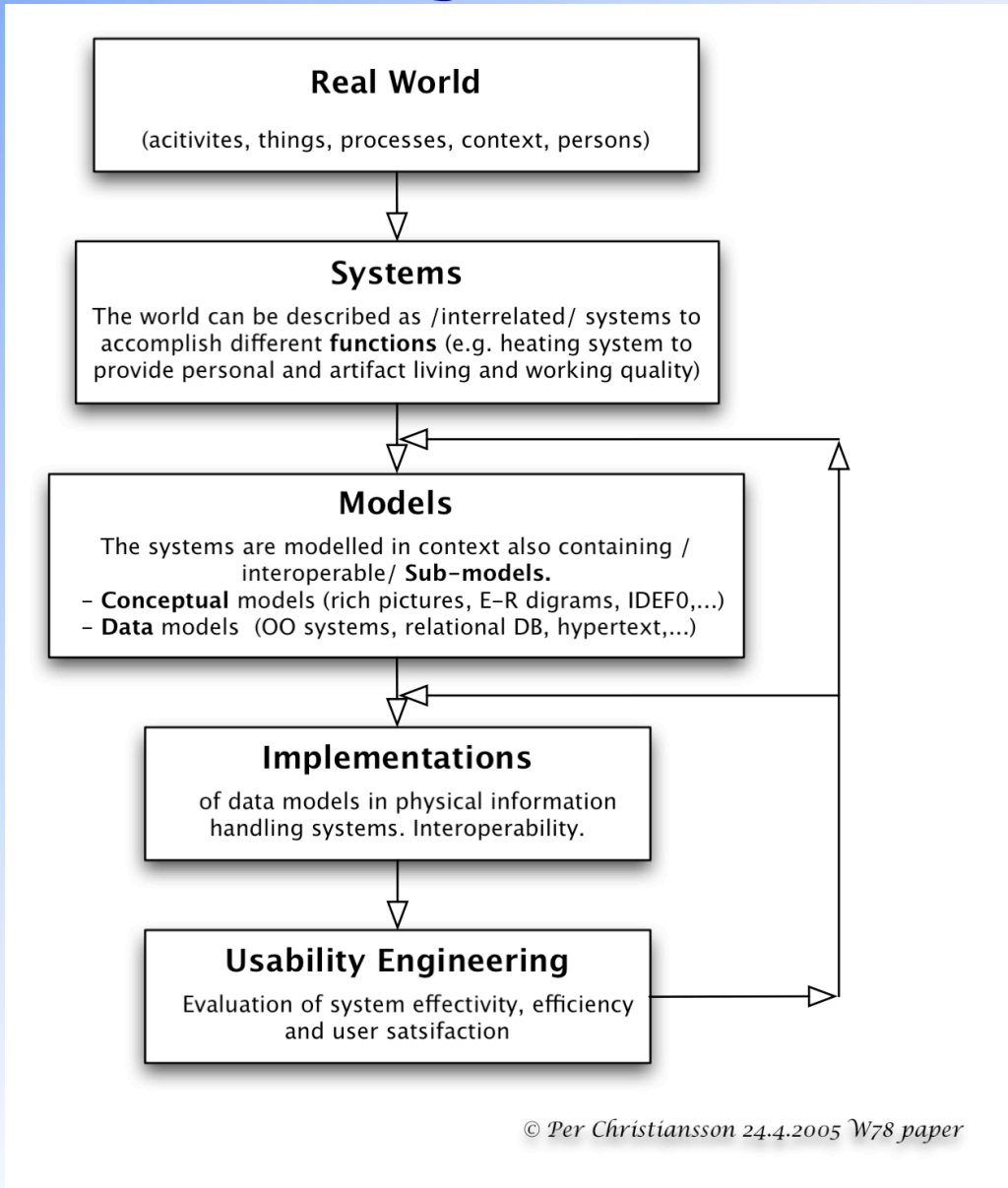
MODELS AND MODEL ACCESS

WORLD - SYSTEM - MODEL 1/4



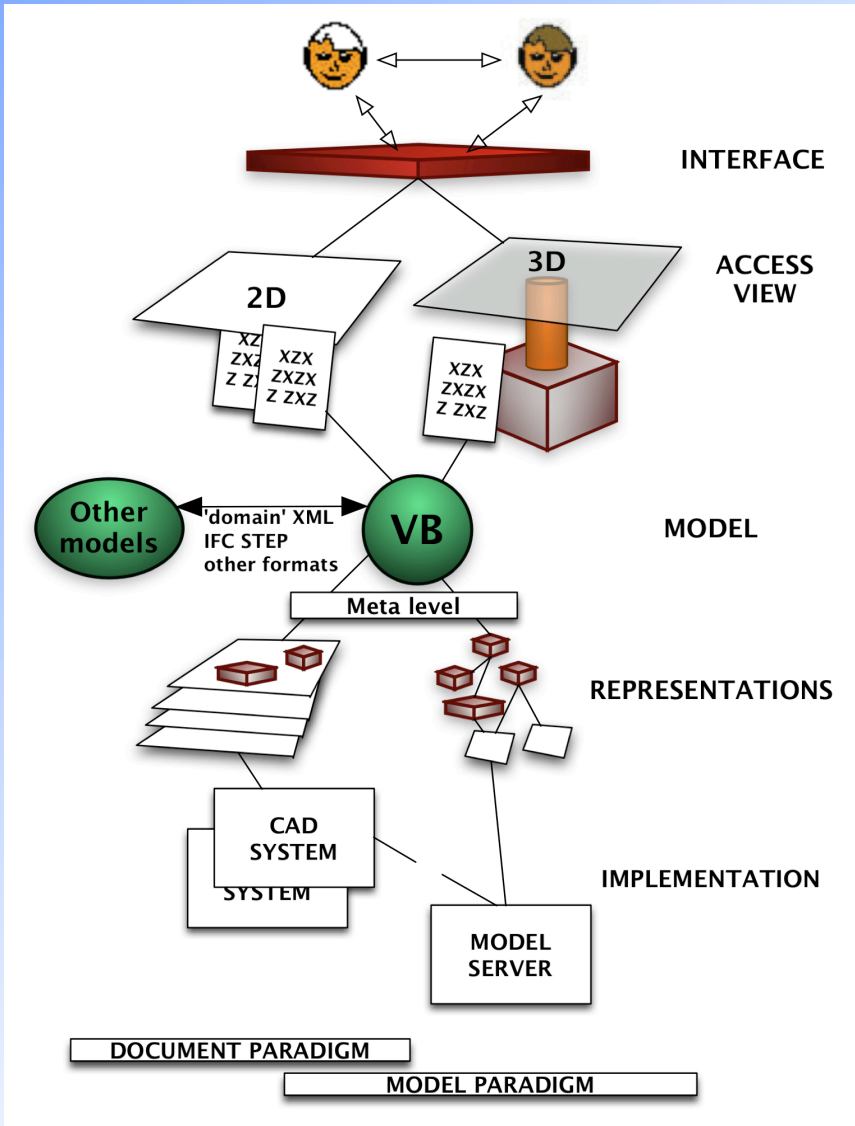
From the world to data models implemented in software systems.

World - system - model 2/4



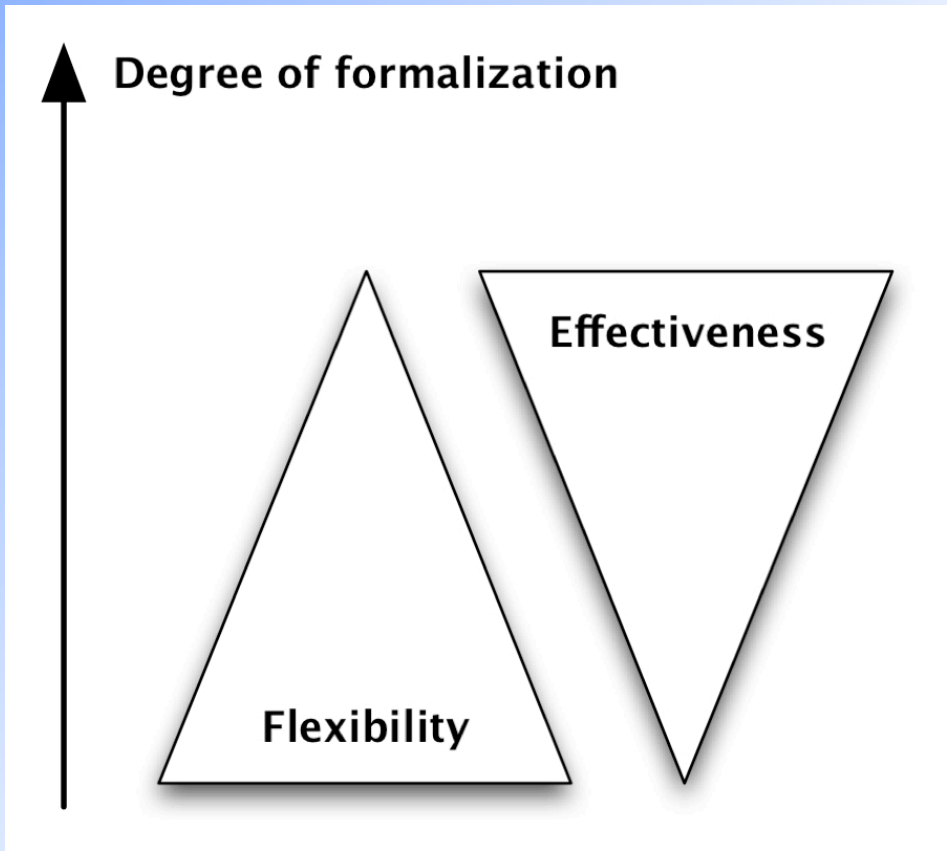
The real world is modeled and accessed from a User Environment, UE, to facilitate experience capture, design, construction, use and re-design of buildings.

World - system - model 3/4



The Virtual Building, VB, model is accessed through more or less detailed representations. The VB sub-models may be partly overlapping and also contain redundant information.

World - system - model 4/4



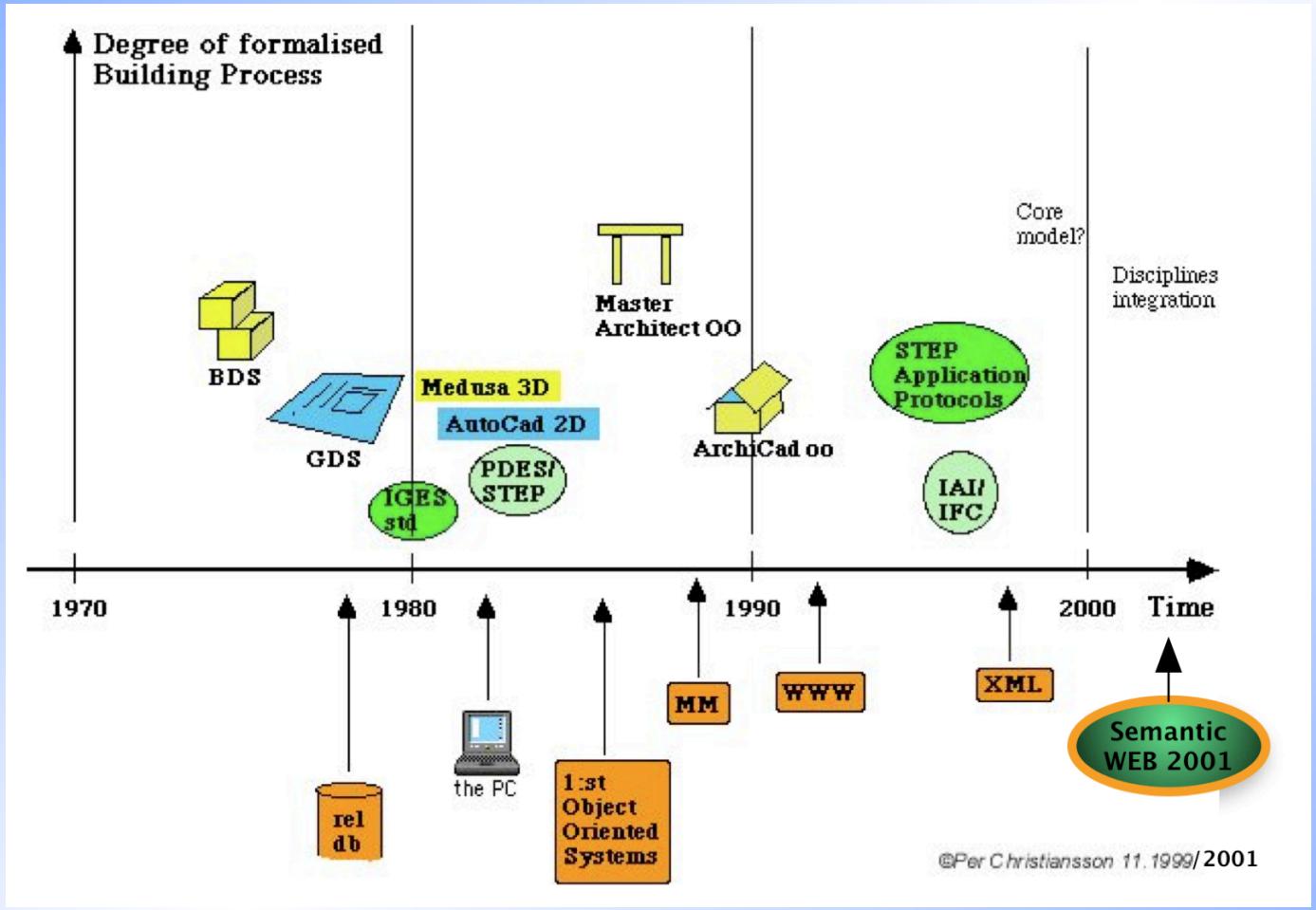
There might be a negative correlation between effectiveness and flexibility for different representations.

The *complexity* and flexibility in organization of the building process leads to large difficulties to build up *highly formalized non-redundant* models except for certain more standardized buildings and process organization

The favorable degree of optimum formalization of the building process will be different dependent on which actors view it applied.

BUILDING MODELLING HISTORY

Building Process Oscillations



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

The Danish Digital Construction Program, DDB

DDB 1/2

In 2002 the Danish national 'Digital Construction - a development program for the whole construction sector' in Danish *'Det Digitale Byggeri', DDB*, was started.

See also http://www.detdigitalebyggeri.dk.

As a result the public clients will *2007* state a set of ICT *requirements* that the enterprises of the construction sector must meet if they wish to tender for public construction projects.

An Advisory Board advises the National Agency for Enterprise and Construction. *EBST*, on the overall direction and progress of the development project. EBST also forms secretariat for the project, http://www.naec.dk/

DDB 2/2

Four projects were launched in 2003 within client requirements formulation

(1) *Digital tender*
(2) *3D models*
(3) *Digital handover* (Digital aflevering), DACaPo
(4) *Projectweb*
together with a project on
(5) *Foundation for Digital Construction* (classification and standardization issues).

In 2005 the final project was launched namely
(6) *Best Practice* - or in Danish 'Bedst i Byggeriet'

http://www.detdigitalebyggeri.dk/english/0/10

DIGITAL HANDOVER THE DACaPo PROJECT

DACaPo 1/2

DACaPo project partners

- **COWI** (http://www.cowi.dk/ - engineers, project leader),
- **Pihl** (http://www.pihl-as.dk/ - building contractor),
- **Denmark Radio** (http://www.dr.dk/ - facility manager),
- **Aalborg University** (http://it.bt.aau.dk).

First version on a specification on requirements for digital handover published in December 2003.

See also DACaPo workshop2 documentation at http://www.detdigitalebyggeri.dk/dacapo_ws2/0/10.

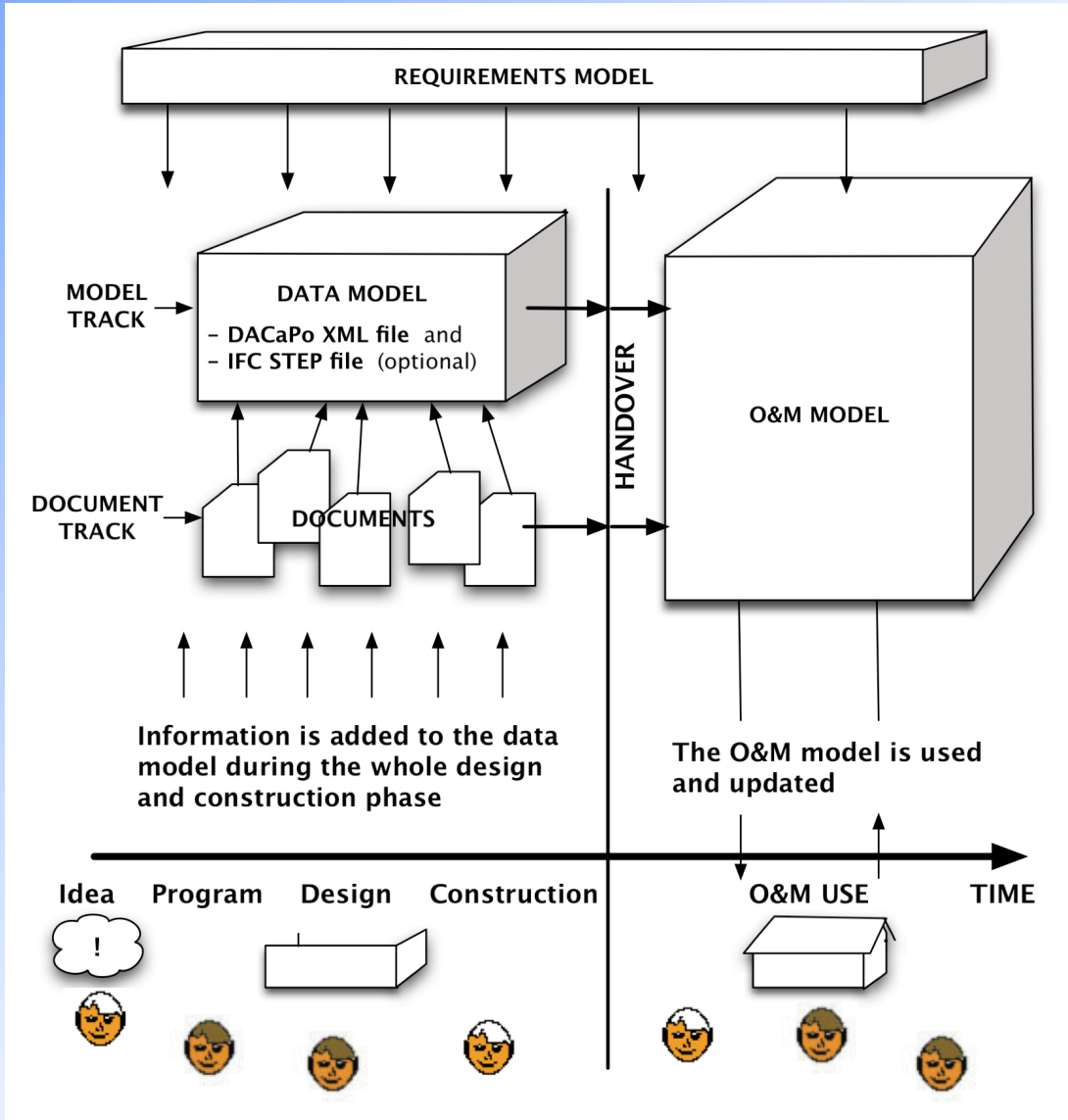
DEFINITIONS

ONTOLOGY
- the branch of metaphysics dealing with the nature of being
- An explicit formal specification of how to represent the objects, concepts, and other entities that are assumed to exist in some area of interest and the relationships that hold among them.

DICTIONARY
- a book that lists the words of a language in alphabetic order and gives their meaning, or that gives equivalent words in different language.

CLASSIFICATION
- The action or process of classifying something according to shared qualities or characteristics

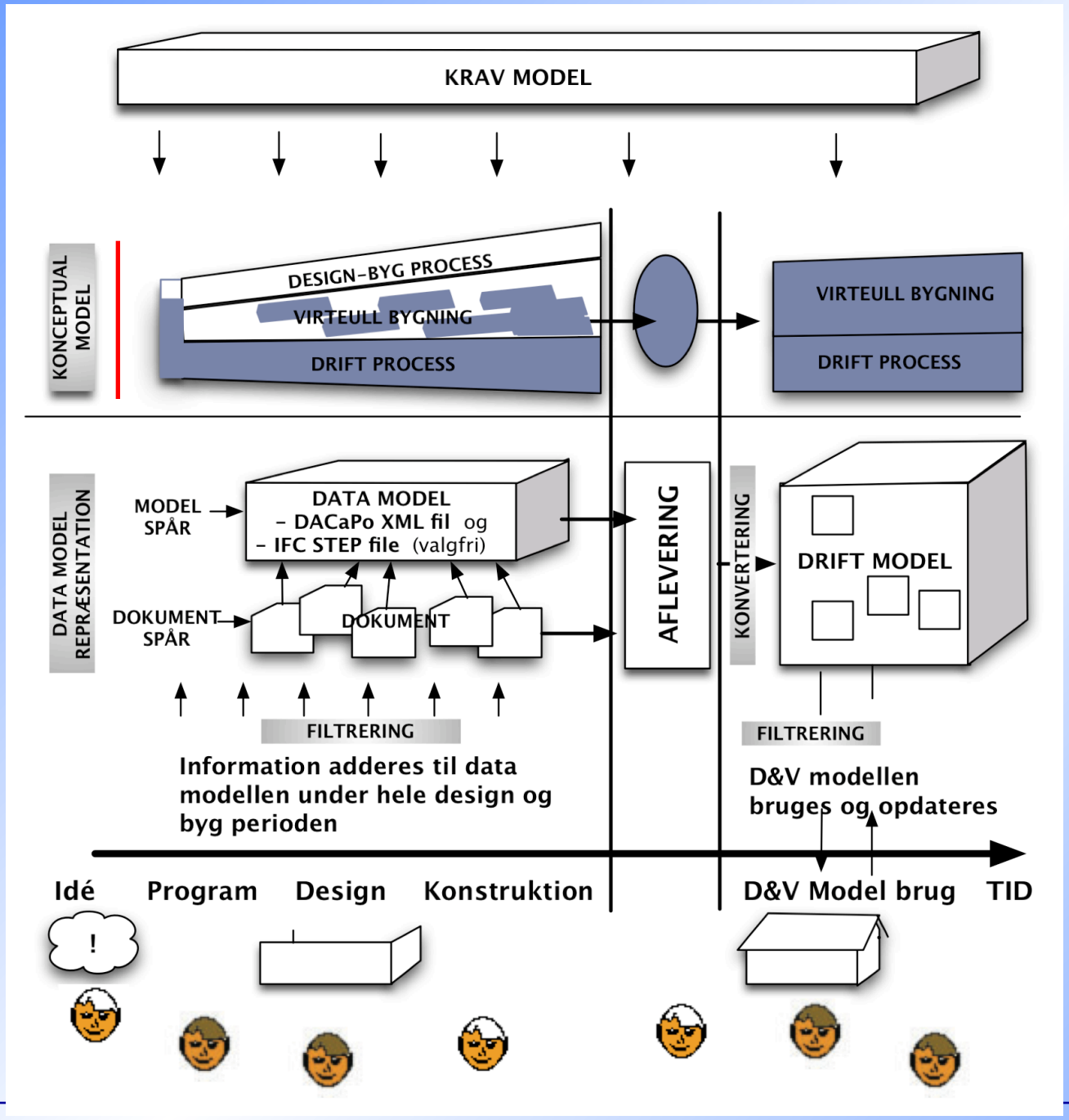
DIGITAL HANDOVER MODEL



PC 3.6.2005

Document Classes
Site
Building
O&M
Economy

The first version of the Danish requirements for digital handover in 2005 is presently tried out at the Slots- og Ejendomsstyrelsen, Palaces and Property Agency, Ministry of Finance, http://www.ses.dk/.



Document Classes
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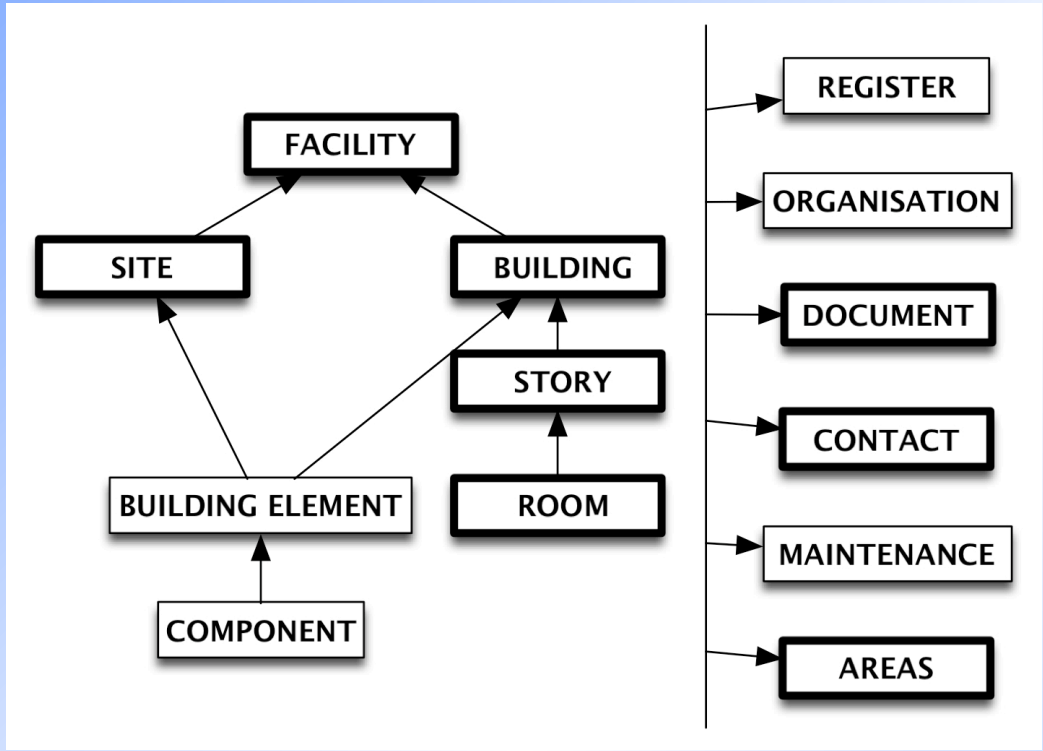
PC 3.6.2005

DACaPo Data Model



The DACaPo meta data for marking documents is based on *ISO 82045-5* (Application of metadata for construction and facility management).

DACaPo XML is also harmonized with *IFC XML* and *OIO XML* (Offentlig Information Online http://www.oio.dk)

The DACaPo XML structure is developed in close contact with the International Alliance for Interoperability, IAI, http://www.iai-international.org/index.html , to ensure harmonization with IFC.

Required (bold) and optional objects of the DACaPo data model for digital handover.

DACaPo XML Skemas

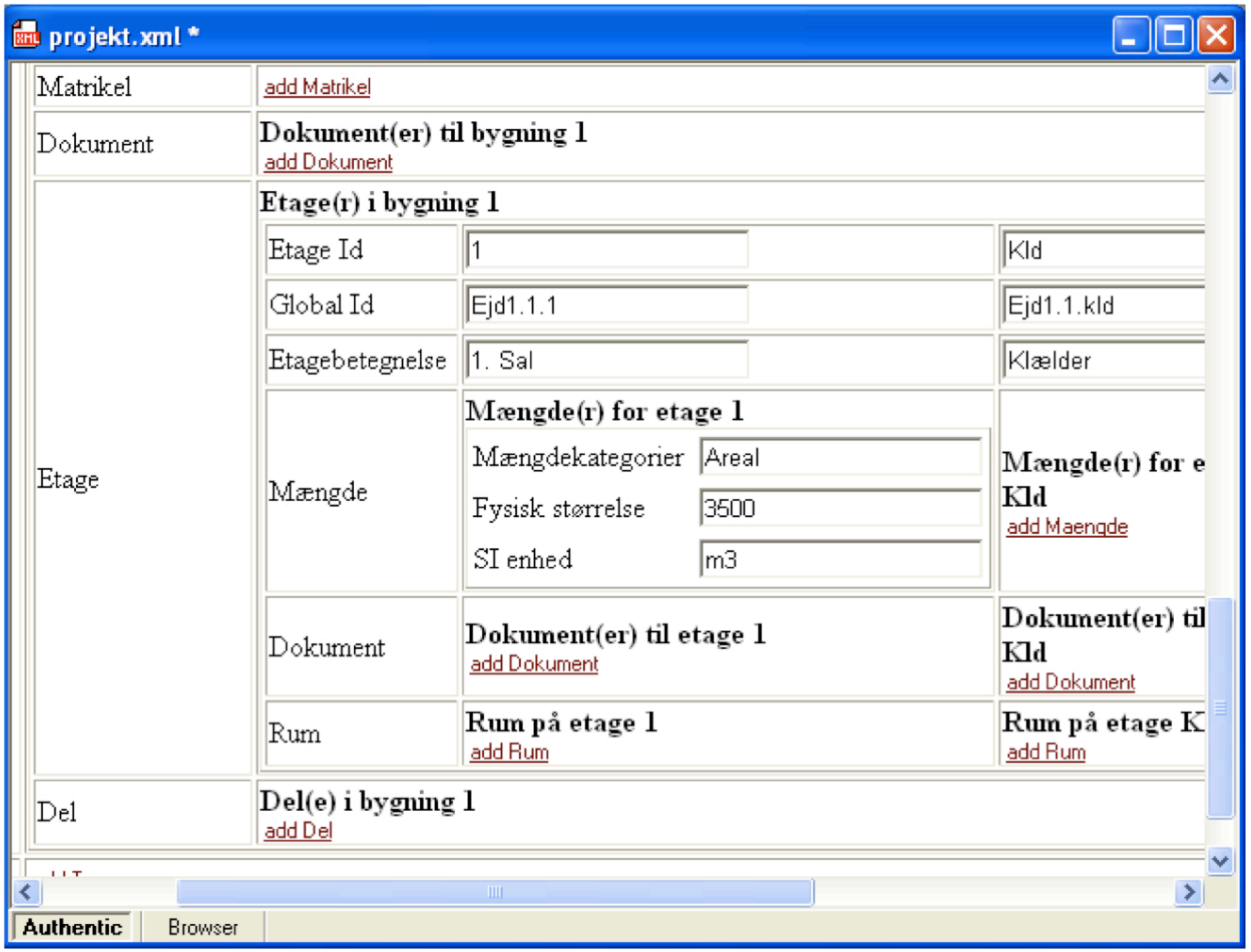
Three DACaPo XML schemas are defined (model, document, type).

Stored on public repositories. Will support e.g. O&M peer-to-peer solutions.

Document classes are Site, Building, O&M, and Economy

Within document classes documents are defined with label document type (kind) according to representation form (degree of structure such as locked/unlocked, editable, file/object) and file format (TIF, PDF, DOC, XLS, RTF, XML, DWG, DGN, and IFC).

DACaPo Support Tool



DACaPo Support tool example.
(Etage=story, Mængde=quantity, Rum=room, Del=part)

DACaPo Support Tool user interface.

CONCLUSIONS

There is a great need for end user *learning of new model based ICT tools* and object oriented representations as a *complement* to traditional document handling approaches.

The *universities* plays a central role in *educating* engineers in these domains, also in the perspective of life long learning and attracting students from industry. See also Christiansson 2004a) and (Christiansson 2004b).

A very positive bi-effect of more building process participants with high ICT competence is that we hopefully better can *involve the building industry in specification of extensions of the existing modeling and analyses tools*, to handle domain specific XML information also in a distributed semantic web environment with semantically coupled information containers.

END