

Visioner om bygningsmodellers udvikling

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Workshop for forskere, IT-udviklere og praktikere.
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BUILDING PRODUCT AND PROCESS MODELS

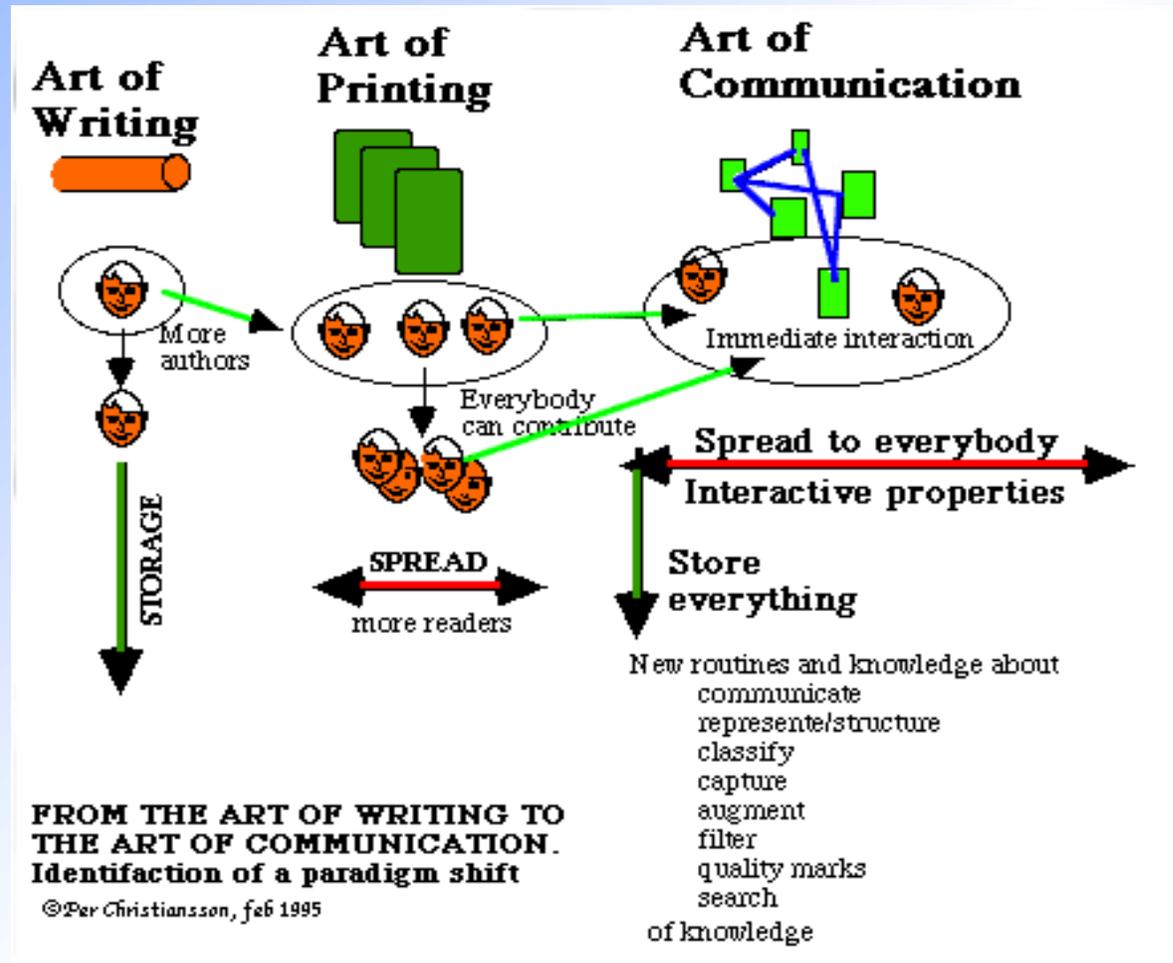
- The Paradigm Shift
- Building Process Change caused by ICT
 - Now
 - Later
- The Road Ahead



PARADIGMSHIFT TAKES TIME



Changing Paradigm



- Storage (representation) and Access (User Environment) media are separated

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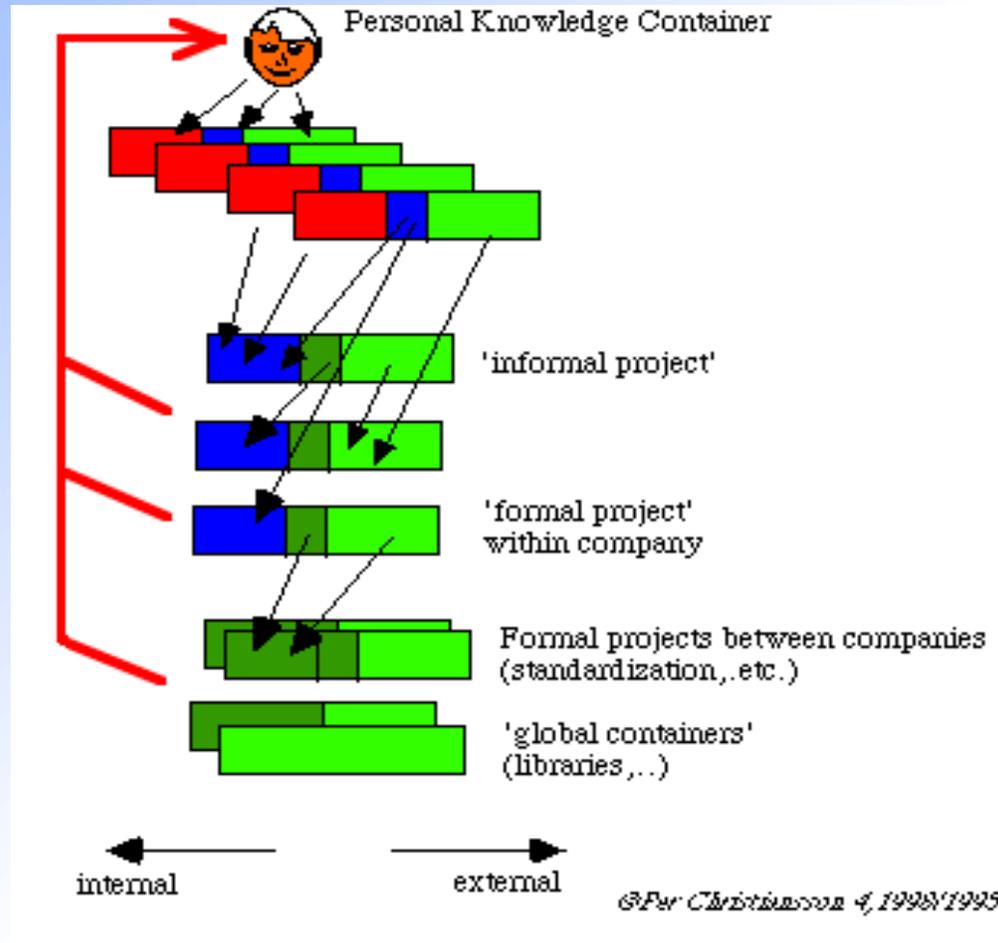


PARADIGMSHIFT TAKES TIME

- Early 80s - how can we **invoice CAD**(rawing) work?
(Clients saw the qualitative effects of studying alternative)
- Mid 80s - **3D** (affordable solid modelling tools) will now be commonly used!!
(early design needs, parametric models and degrees of formalisation, level of detailing, drawing to model thinking,....)
- Mid 80s - 4th generation 'db systems' and object orientation introduced.
(organisational and work change, **formalisation** needs to integrate company functions
- Late 80s - large scale integration of **hypertext** information containers in **Internet**
- Late 90s - 1 Internet year = 5 ordinary years.
(ICT **competence** needs increases, out-sourcing back lash)



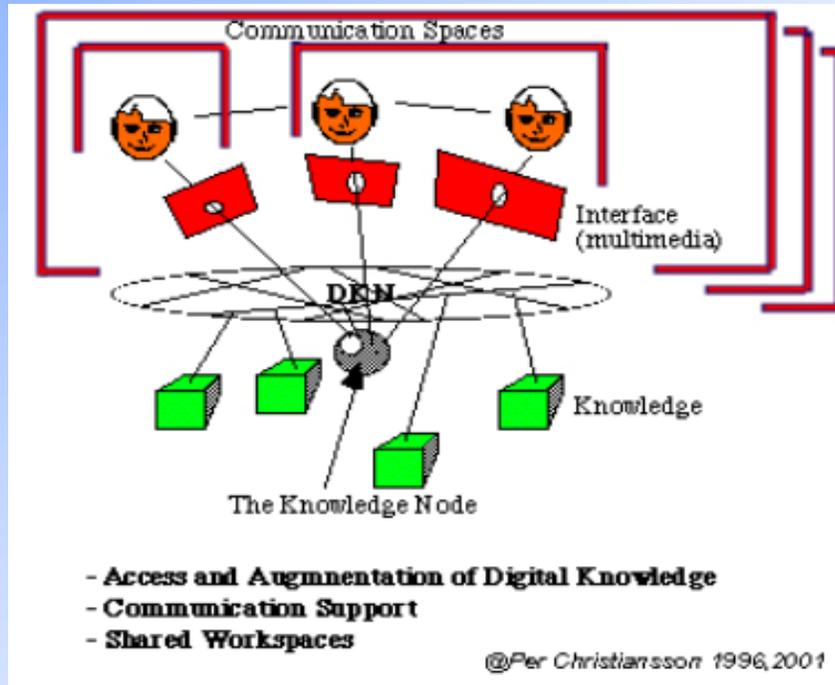
Knowledge Communication



Knowledge is communicated between knowledge containers covering different subjects and time domains



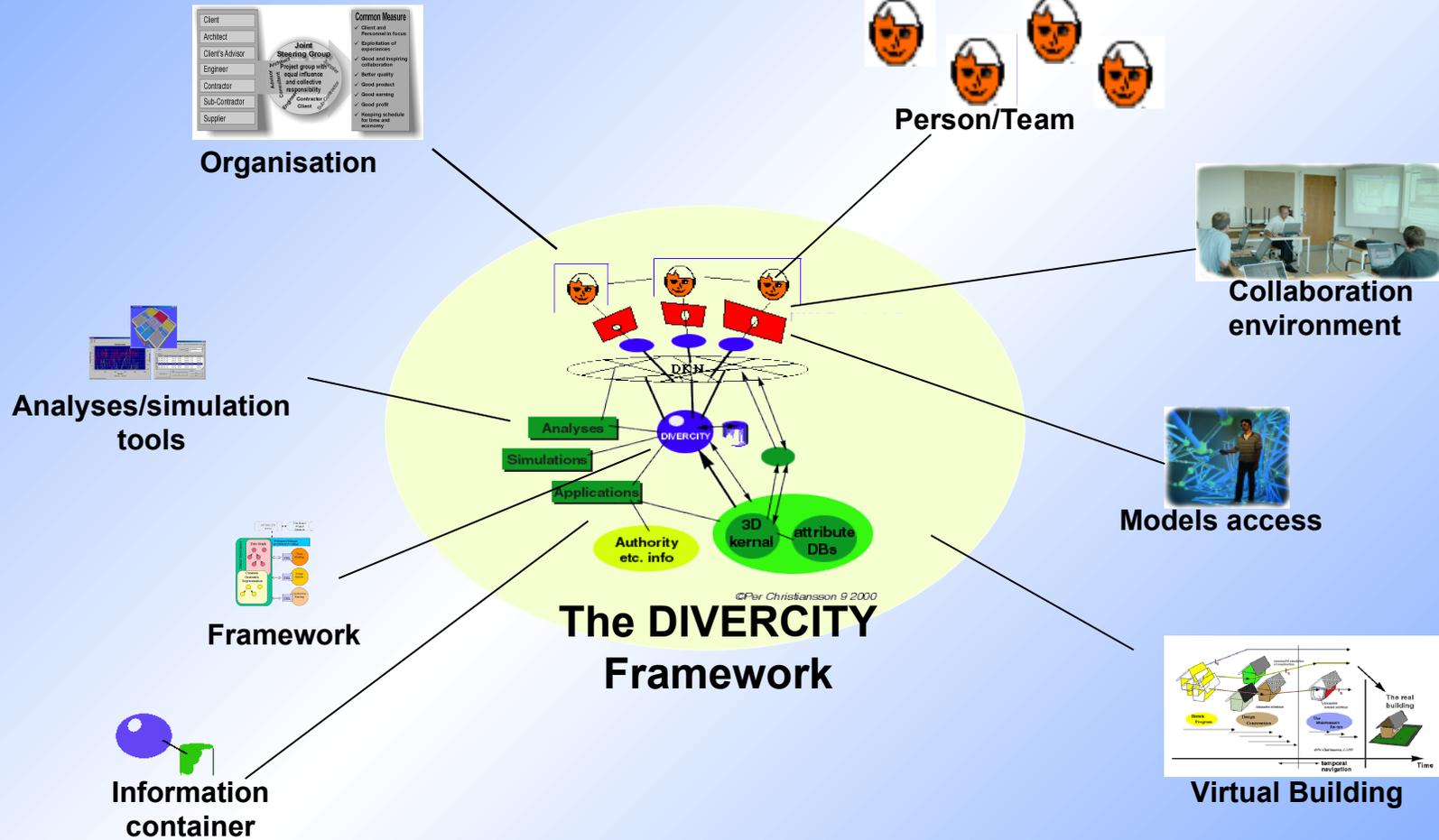
The Knowledge Node Concept



- **Participants**; number of, type (persons, agents)
- **Collaboration subject/context & Form of interaction**; design, reviews, purchase, learning, brainstorm, negotiation, discussion,
- **Communication content** to support interaction; e.g. speech, sound, images, music, video, whisper, body language, 3D objects, control information;.....
- **Meeting spaces** and room definitions; physical, virtual, static, dynamic, mobile and combinations.
- **Collaboration artefacts**; communication channels, user applications, and information containers



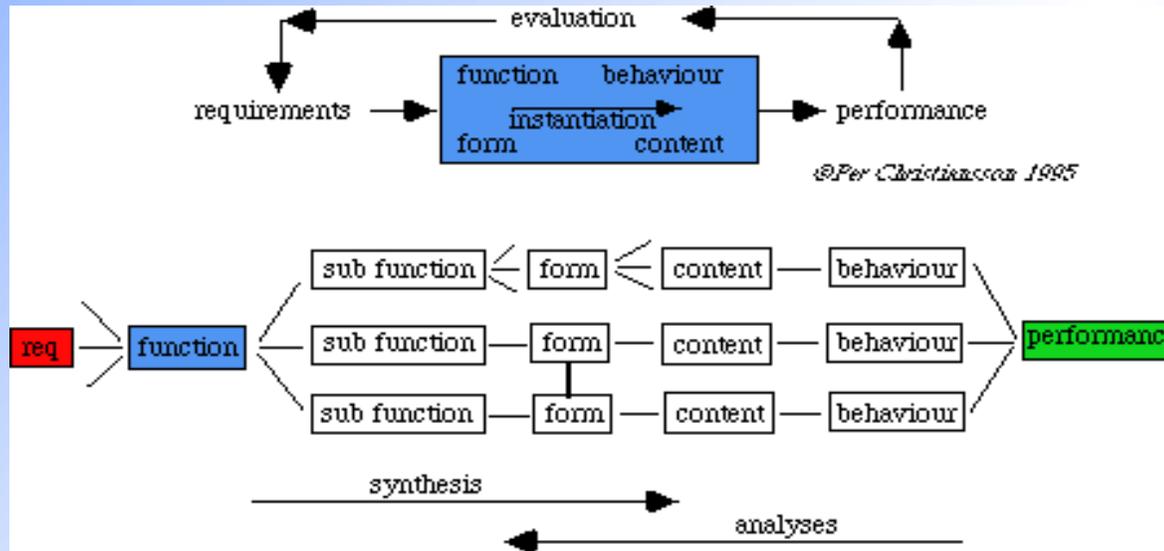
BUILDING PROCESS CHANGE?



IMPROVED VIRTUAL BUILDINGS and BUILDING PROCESS MODELS



From Product idea to use, re-use

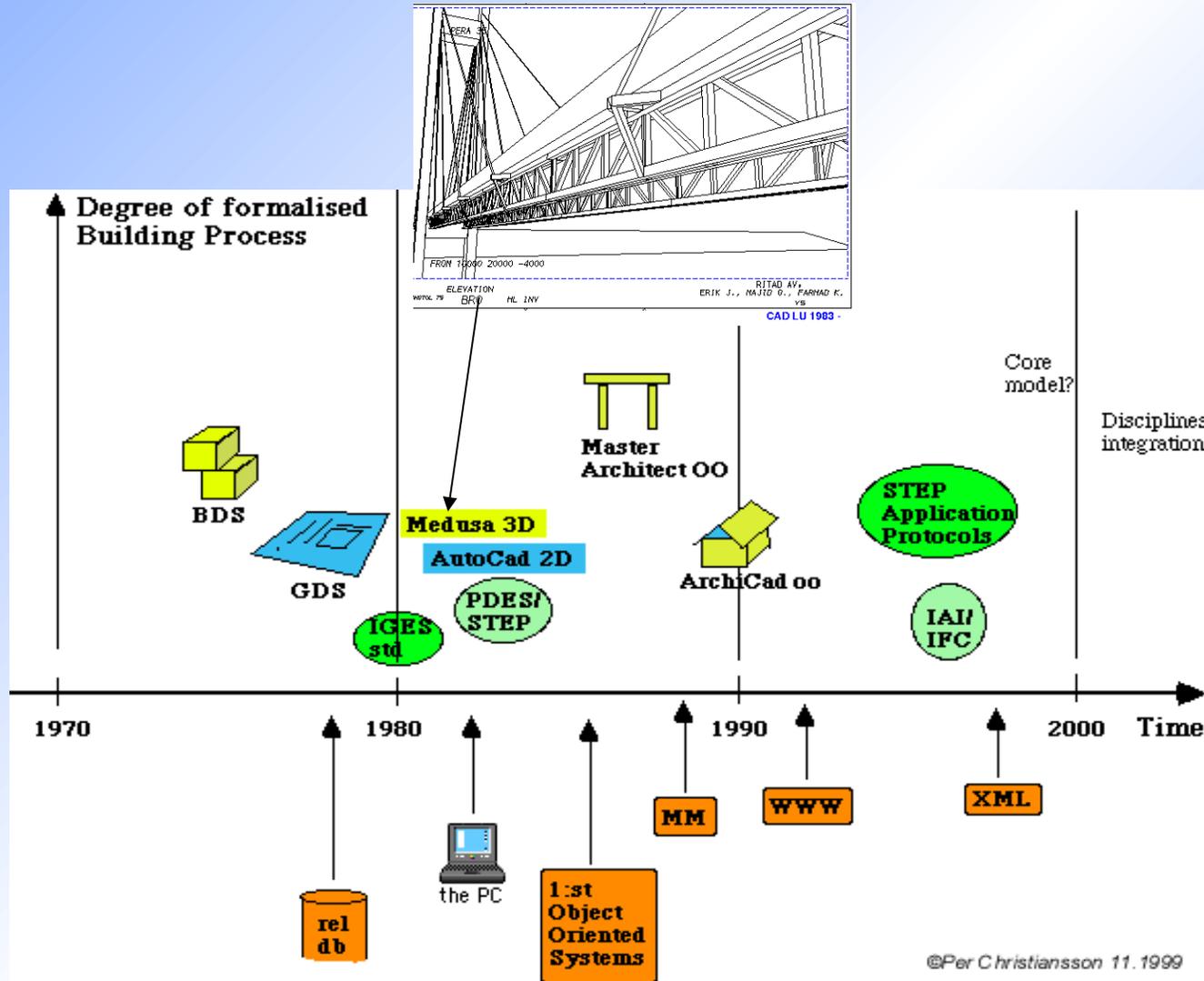


Requirements are translated to functional requirements

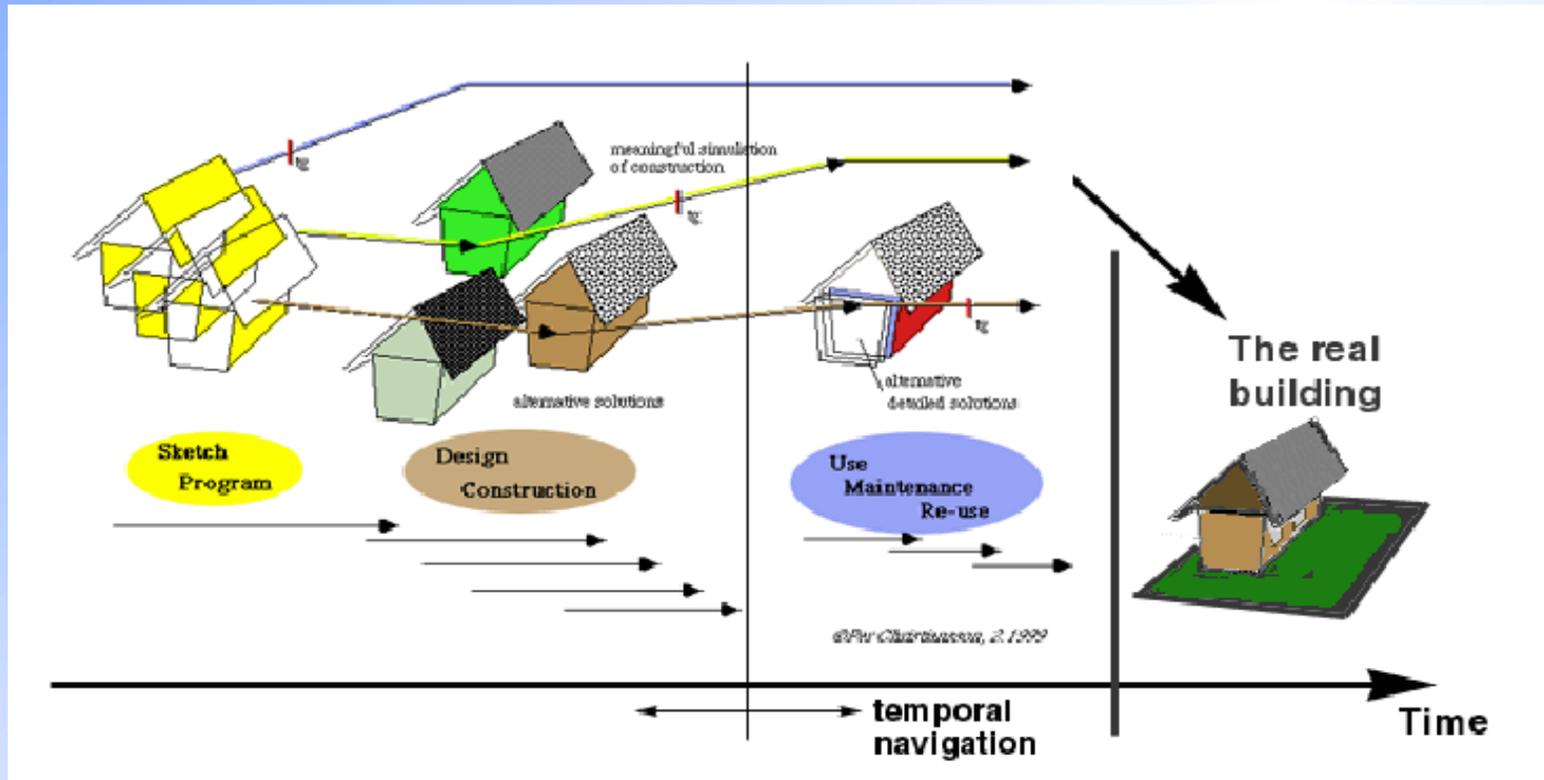
- which in the design process leads to instantiated design parameters
- which leads to new functional requirements etc.
- Complex time dependent functional couplings will arise
- The same VB must also be able to support different design paradigms (creative, innovative or routine)



Building Process Oscillations



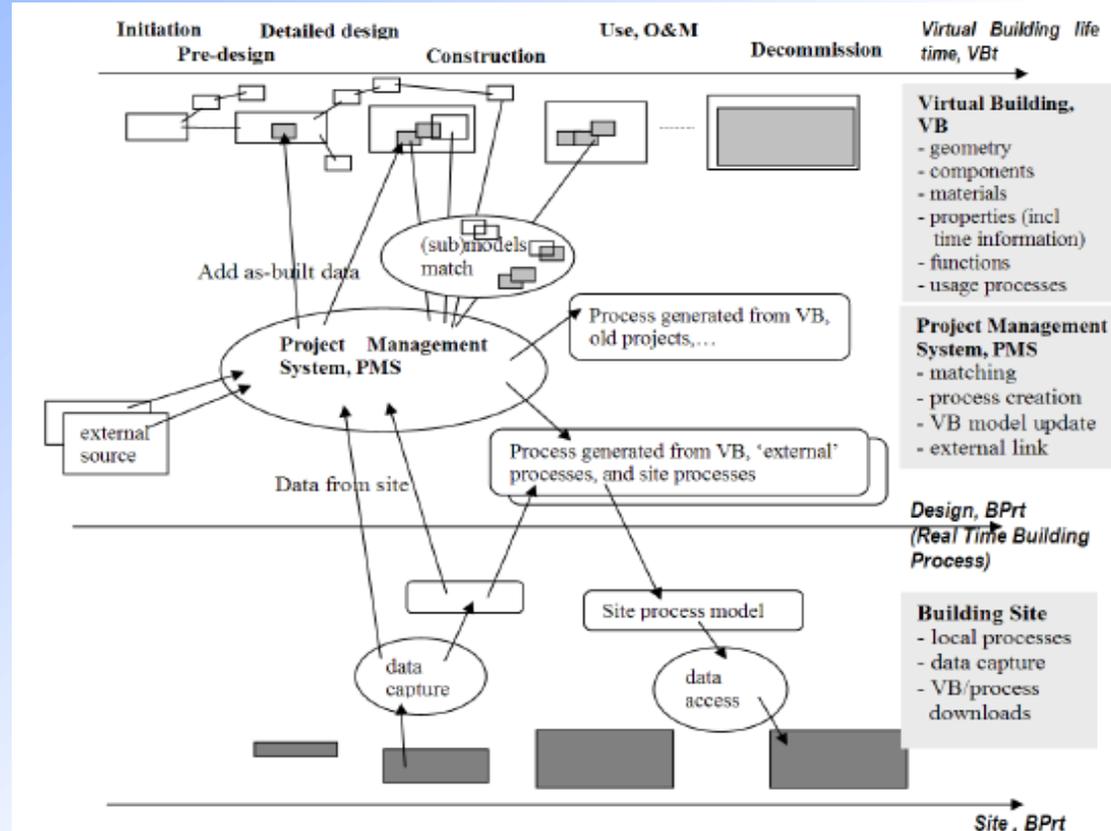
The Virtual Building Model



The virtual building contains all documentation of the building including drawings, models, documents etc. It will normally contain **redundant** information and **temporal** information describing **discipline models** and **sub models of the building** over time. **Tracks** of alternative solutions. **Two time lines** -real time during collaboration and time points in the life cycle of a design artefact.



The PMS in context

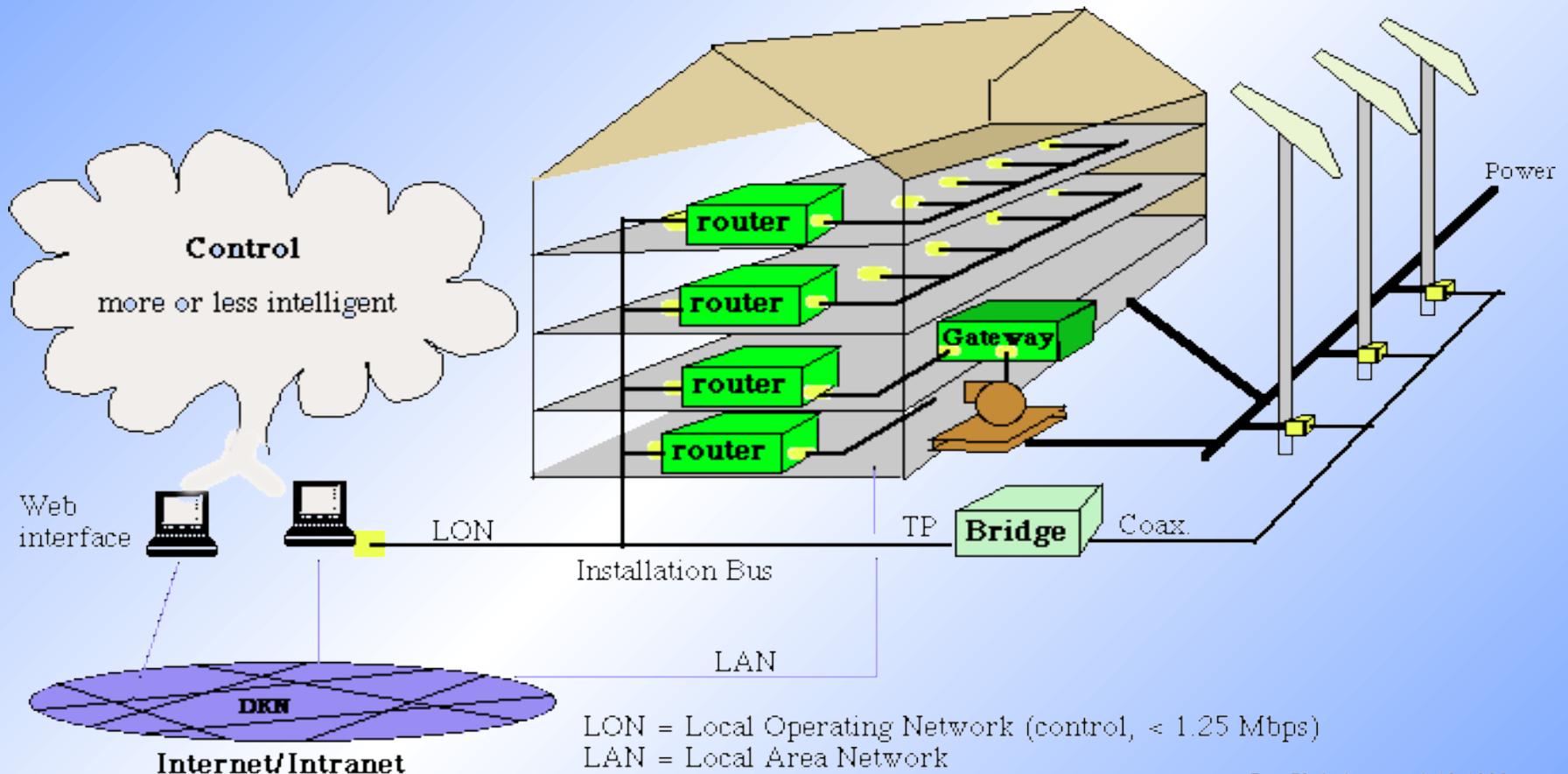


The Project Management System (PMS) will integrate Virtual Building models, Site Process models, and external information containers. It will also manage **matching and updating of the VB sub models** as well co-ordination with building site activities. **BPrt** = Building Process real time, **VBt** = Virtual Building time to describe time points in life of Virtual Building (sub)models.

(from Christiansson P., Dawood N. N., Svidt K, 2002, "Virtual Buildings (VB) and Tools to Manage Construction Process Operations".



The Intelligent and Responsive Building

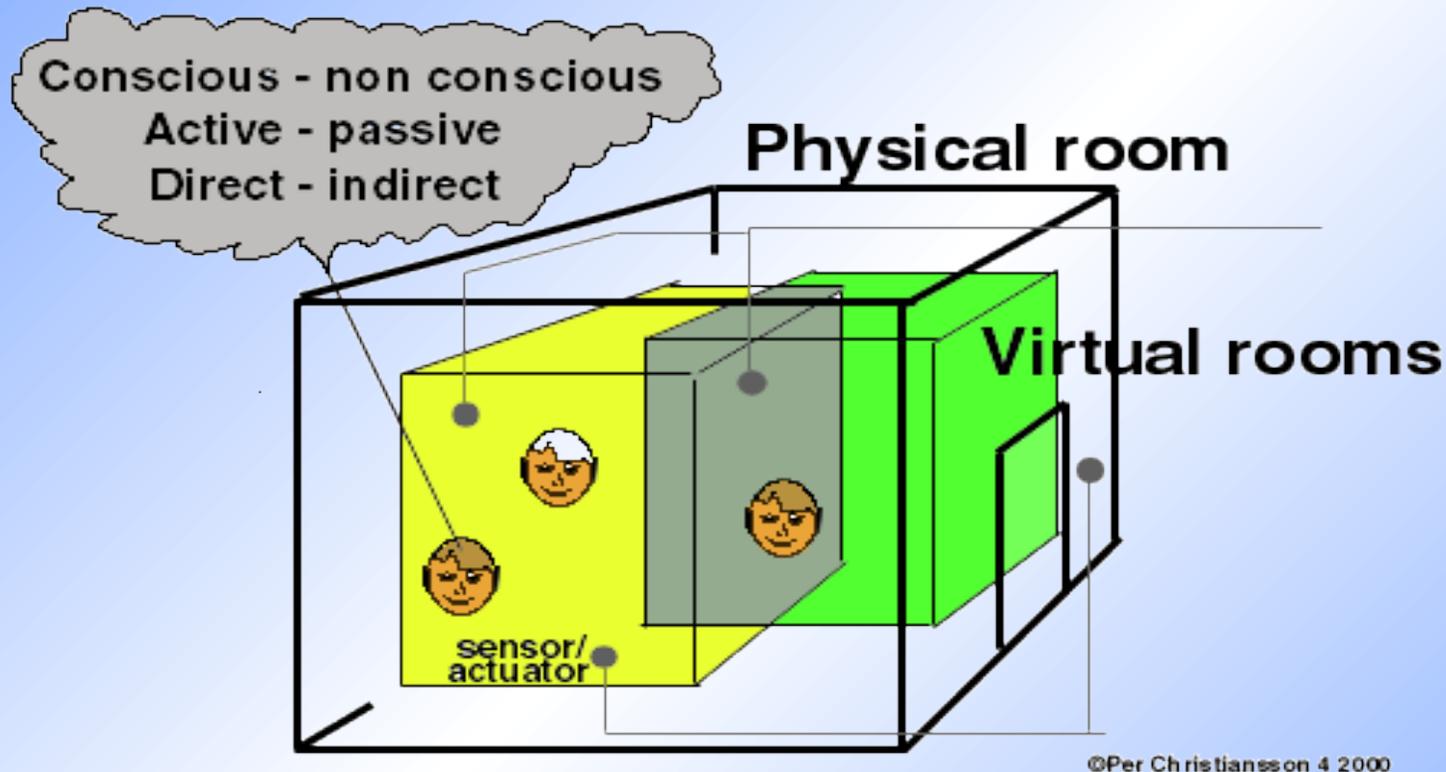


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The building can also itself house ICT tools to support required functionalities/systems/processes



Virtual Rooms



- The IBI should be responsive to the user needs and easily be **re-programmable**.
- We may have to **define virtual rooms** to house different activities at different times and even occupying different spaces (for learning, creativity, virtual meetings, thinking, relaxation, sleeping, etc.) in the buildings.
- The building shall **support communication** in all respects also the communication directly involving it's users.

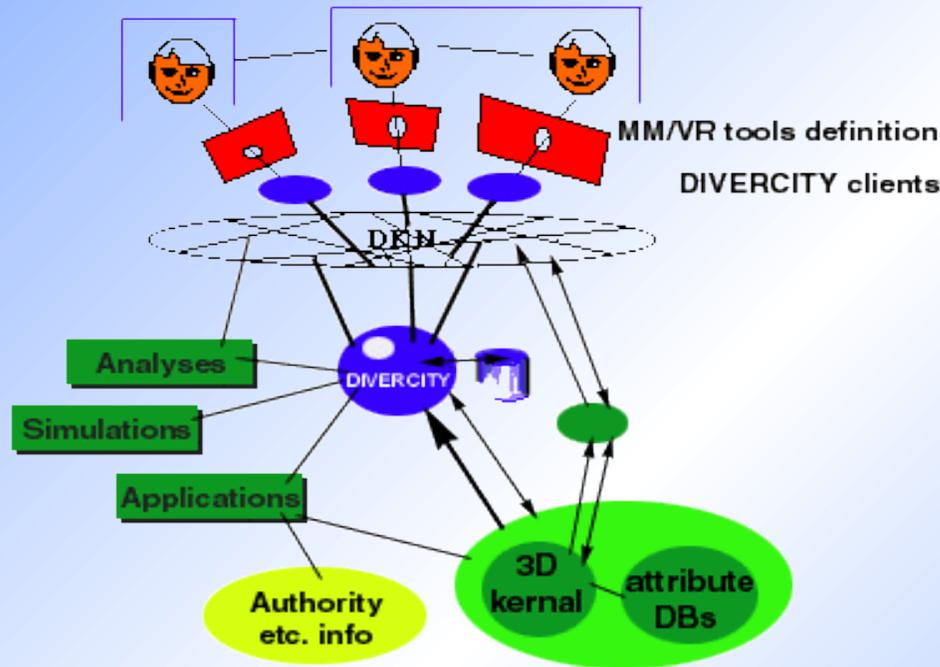
The physical form and functionality of the rooms will be more tightly related to the underlying IBI systems.



DIVERCITY - Distributed Virtual Workspace for enhancing Communication within the Construction Industry

EU IST-1999-13365

<http://www.e-divercity.com/>



The objective of the project is to produce a **prototype virtual workspace** that will enable the three key phases (client briefing, design review, construction) to be visualized and manipulated, and to *produce a set of VR tools that aid the construction design and planning process.*

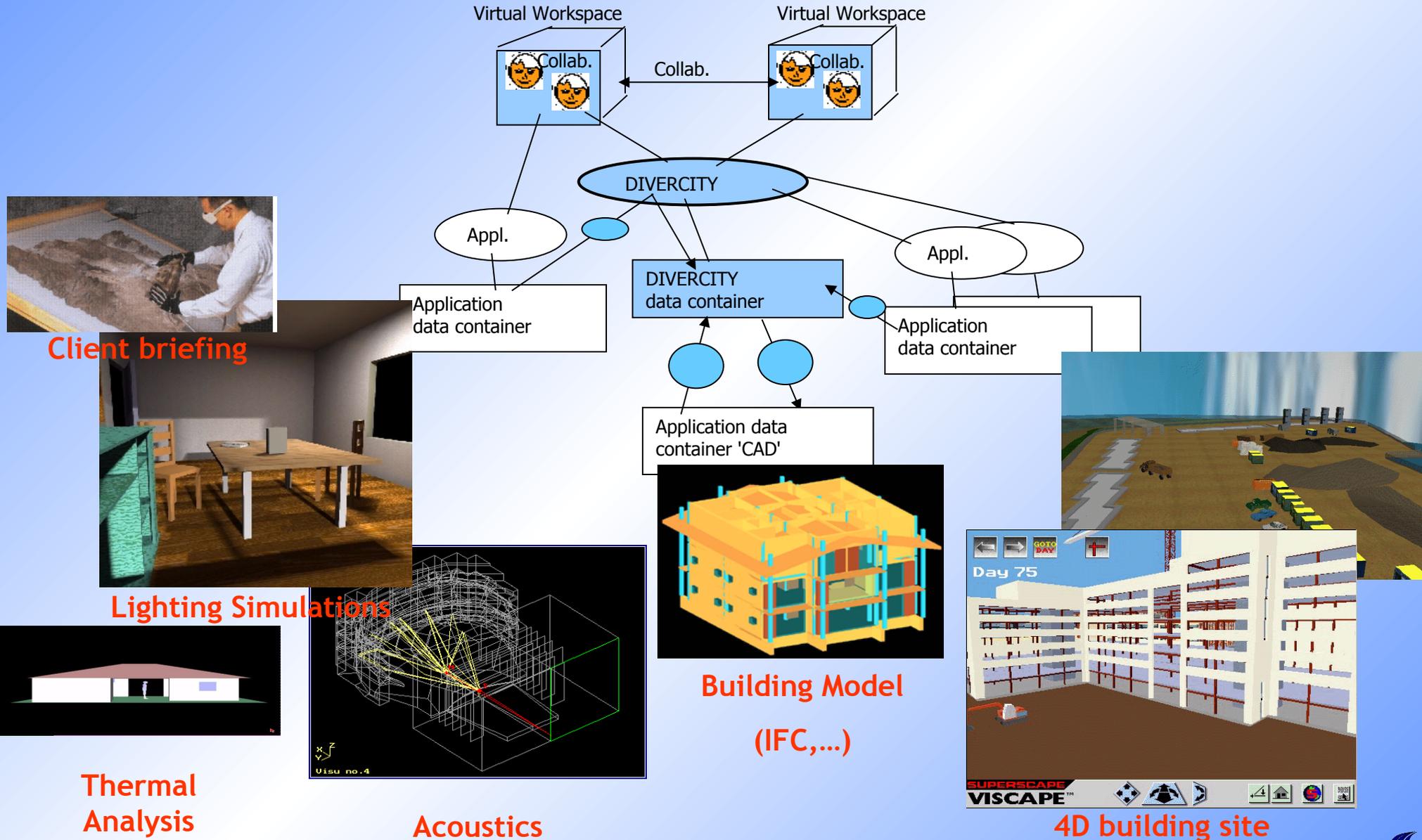
DIVERCITY supports

- communication between persons
- multiple building product/process information access
- building process activities

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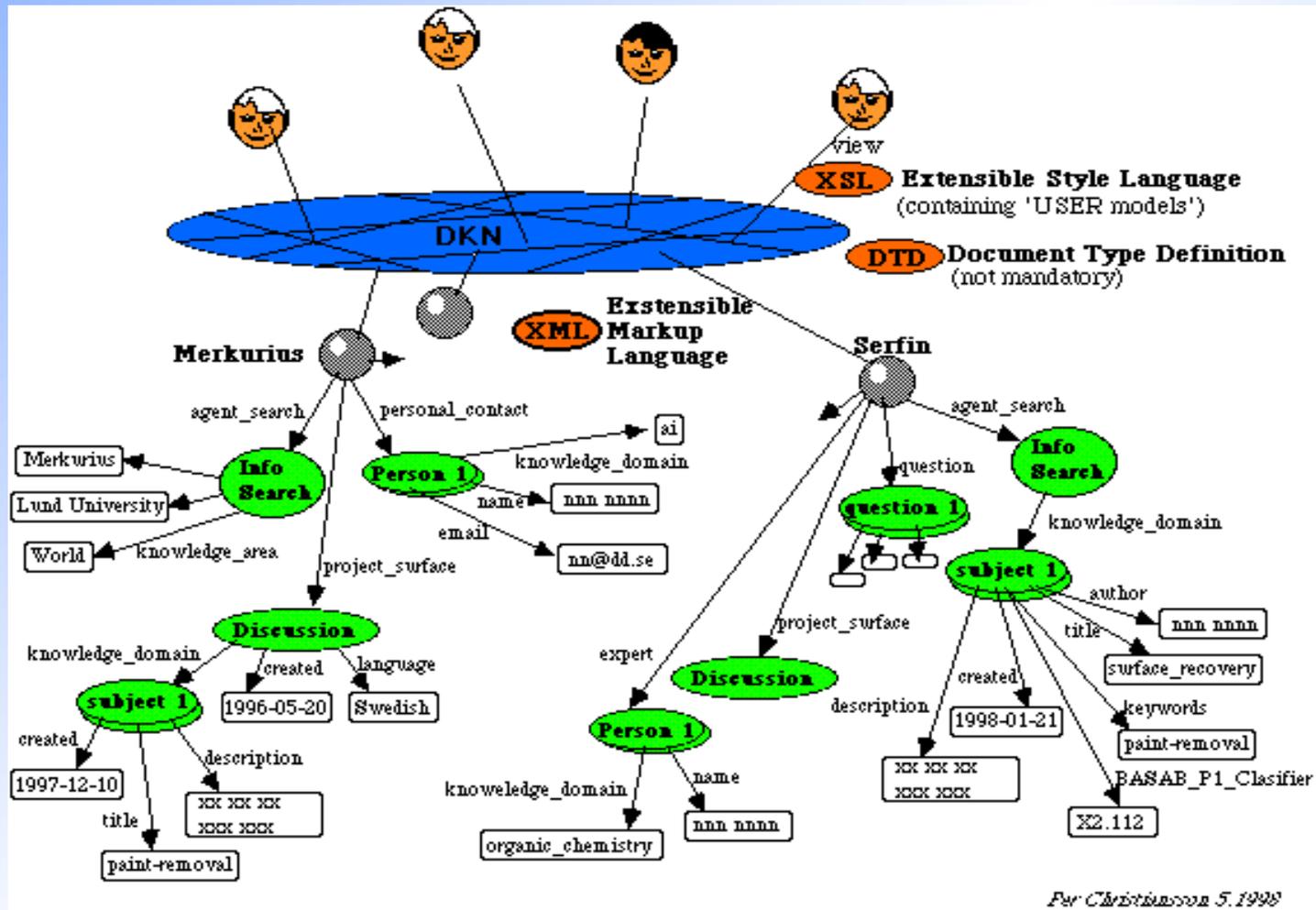
DIVERCITY function, form, content, behaviour



WHAT NEXT?



Meta Data Structuring



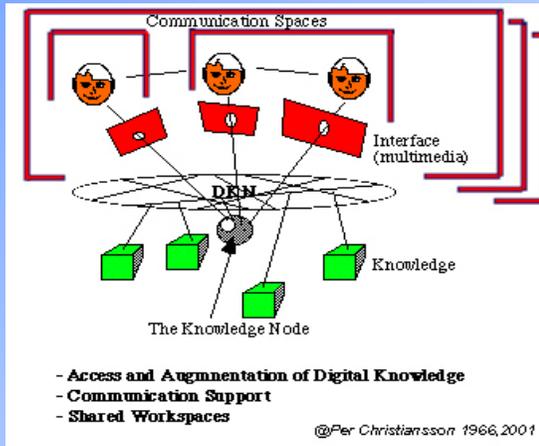
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Exemplified on The Mercurius and Serfin Projects

(from Christiansson, 1998)



SEMANTIC WEB



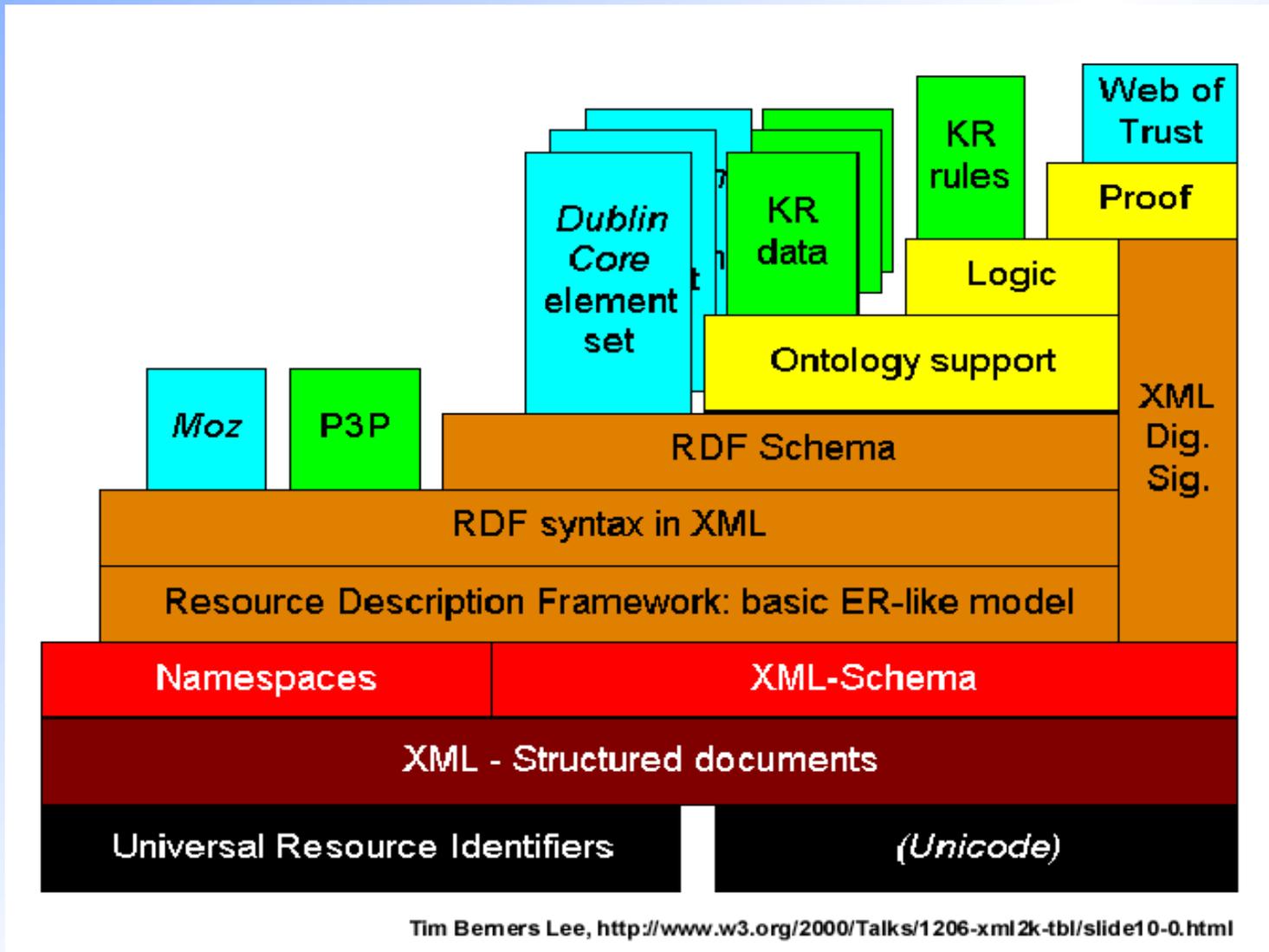
The Resource Description Framework (RDF) - developed by the World-Wide Web Consortium (W3C) - provides a **framework for metadata interoperability across different Internet based resource description communities** with focus on semantics rather than meta data syntax and structure.

The semantic webs (Berners-Lee, et al., 2001) will use eXtensible Markup Language (XML) RDF, and Ontologies (with taxonomy and a set of inference rules) as basic building substances.

RDF will allow the resource description communities to primarily focus on the issues of semantics rather than the syntax and structure of metadata). *Schema* defines the meaning, characteristics, and relationships of a set of properties.



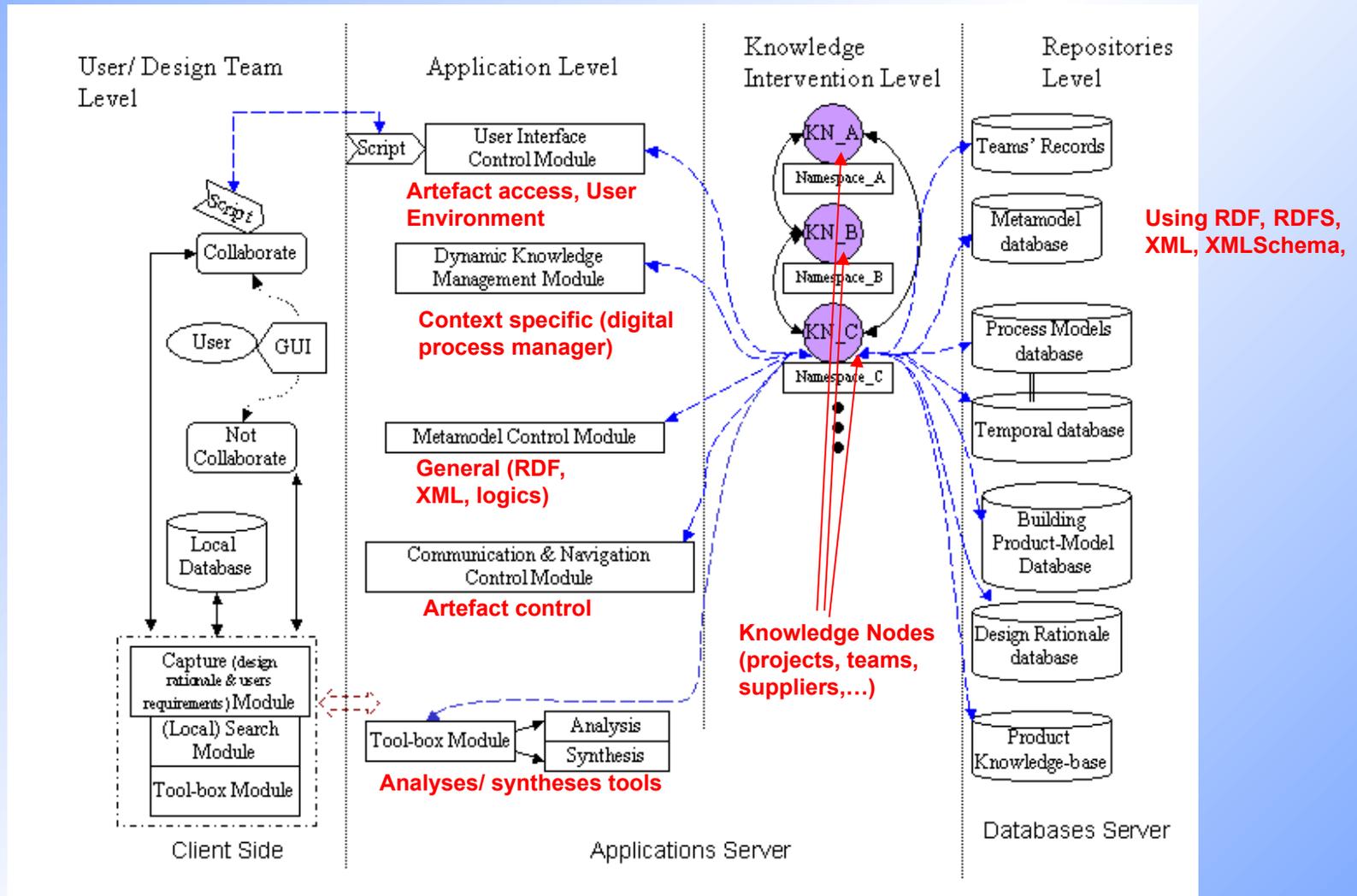
The Semantic Web



The semantic web will enable intelligent handling of URI based information containers.



IT-CODE System Architecture



(From Lai Y-C, Christiansson P, Svidt K, 2002, "IT-CODE -IT in Collaborative Building Design")



THE ROAD AHEAD



Success Criteria

- * *User participation* in User Environments and systems development The *building community* must and will actively participate in the *design, try out*, and *implementation* of *new IT tools* to support high quality building products in a life cycle perspective.
- * Design and try out of *new tools* for collaboration, communication and information handling.
- * Increased knowledge transfer and *ICT competence. Knowledge communication* crucial (companies, schools, public services).
- * Increase of *awareness* on fundamentals and methods for a beneficial change of building processes and organisation (knowledge exchange and management, demonstrations, implications, participatory design).
- * Increased *international* project participation.
- * Basic research, applied research and development activities are *all* required.
- * Utilisation of changed *communication networks* on all levels.
- * Utilisation of increased possibilities to build (low cost) *Virtual Worlds/rooms* and *Virtual Buildings* (with partly redundant knowledge representations, meta data, temporal and intelligent properties).
- * *Client*, building product *users, and suppliers* with greater influences in the design process.

We are all involved in a continuous change process and **design of the future** together (with constant re-assessments). Great possibilities and time to do some creative, bold, and holistic inceptions at universities/industries.



EU 6th Framework

(see also **IT-Byggenet Copenhagen presentation 21.10.2002**)

Increased Danish building Industry and R&D community Involvement in EU FP6?

FP6 is taking form with priority areas listed.

PRIORITY THEMATIC AREAS OF RESEARCH IN FP6

<http://www.cordis.lu/fp6/eoi-instruments/tp.htm>

There has during the summer been delivered around 15400(->20) Expressions of Interests (EOI) to the EU Commission where proposals to *large Integrated Projects* and **Networks of Excellence** are proposed.

Another instrument to build networks and aggregate potential participants for FP6 R&D projects are the so called Roadmap projects. E.g. the **RoadCon** and **Intelcity** projects.

<http://www.cordis.lu/ist/ka2/rmapworkingmethods.html>

<http://www.roadcon.org/>

(IST 2002: Partnerships for the Future Conference - 4-6 November, Copenhagen

<http://2002.istevent.cec.eu.int/>)



Contact



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

R&D and EDU collaboration within

- **Building process models**
- **Meta classification**
- **Knowledge Management**
- **Collaboration and Virtual Reality**
- **Collaborative work on specification and design of next generation systems (Industry/University)**



Lai Y-C, Christiansson P, Svidt K, 2002, "**IT in Collaborative Building Design (IT-CODE)**". First International Conference on Information Standardisation, Exchanges and Management in Construction - CISEMIC, eSM@RT. University of Salford, U.K from 22nd - 23rd November 2002. (9 pp)

Christiansson P., Da Dalto Laurent, Skjaerbaek J. O., Soubra S., Marache M., 2002, " **Virtual Environments for the AEC sector - The Divercity experience** ". ECPPM 2002 European Conference of Product and Process Modelling. eWork and eBusiness in AEC. 9-11 September 2002, Portoroz, Slovenia. (8 pp.)



Christiansson P., Dawood N. N., Svidt K, 2002, "**Virtual Buildings (VB) and Tools to Manage Construction Process Operations**". CIB W78 Conference on 'Distributing Knowledge In Building', Aarhus, Denmark. June 12-14, 2002. (8 pp.)

Christiansson, P, 2001, "**Capture of user requirements and structuring of collaborative VR environments**". AVR II & CONVR 2001. Conference on Applied Virtual Reality in Engineering & Construction Applications of Virtual Reality. (eds: O. Tullberg, N. Dawood, M. Connell. 201 pp.) Gothenburg October 4-5, 2001. (pp. 1-17). [Key note speech].

Christiansson P, Svidt K, Skjærbæk J O, Aaholm R, 2001, "**User requirements modelling in design of collaborative virtual reality design systems**". International Conference on Construction Information Technology. Mpumalanga, Soth Africa, 30 May - 1 June 2001. (pp. 40/1 - 40/12)

Christiansson P, 1998, " **Using Knowledge Nodes for Knowledge Discovery and Data Mining.**" *Lecture Notes in Artificial Intelligence 1454. Ian Smith (Ed.). Springer-Verlag Berlin Heidelberg 1998.* ISBN: 3-540-64806-2 (pp. 48-59). "Artificial Intelligence in Structural Engineering. Information Technology for Design, Collaboration, Maintenance, and Monitoring."



Svidt K., Bjerg B., Dorf Nielsen T., 2001, "**Initial studies on Virtual Reality Visualization of 3D airflow in ventilated livestock buildings**". AVR II & CONVR 2001. Conference on Applied Virtual Reality in Engineering & Construction Applications of Virtual Reality. (eds: O. Tullberg, N. Dawood, M. Connell. 201 pp.) Gothenburg October 4-5, 2001. (pp. 176-181).

Christiansson P, 2001, "**Experiences from Using Internet Based Collaboration Tools**". 'Konference om Arkitekturforskning og IT'. Proceedings Conference on Architectural Research and Information Technology. Nordic Association for Architectural Research. Arkitektskolen i Aarhus 27.-29. april 2001. (pp. 103-112).

Christiansson P, 2000, "**Knowledge Representations and information Flow in the Intelligent Building**". 'Proceedings of the Eighth International Conference on Computing in Civil and Building Engineering. ICCCBE-VIII 2000 (eds: Fruchter R, Pena-Mora F, Roddis K)', ISBN 0-7844-0513-1. American Society of Civil Engineers, Reston, Virginia, USA. (Stanford University, USA. August 14-17, 2000). (pp. 604-611).

Christiansson P, 1999, "**Properties of the Virtual Building**". 8th International Conference on Durability of Building Materials and Components. Information Technology in Construction. (ed. M. A. Lacasse, D. J. Vanier). NRC Research Press, Ottawa, 1999. ISBN: 0-660-17743-9. (pp. 2909-2919). (May 30 - June 3, 1999 Vancouver, Canada.)



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