Værdien af IT i Byggeriet

Per Christiansson

Aalborg Universitet
http://it.civil.auc.dk

Effektiv IT-anvendelse i byggeriet

Teknik&Data, Odense, February 5, 2003

INDHOLD

IT-værktøjer er ikke skræddersyet byggeriet
Hvornår er IT et værdifuldt hjælpemiddel?
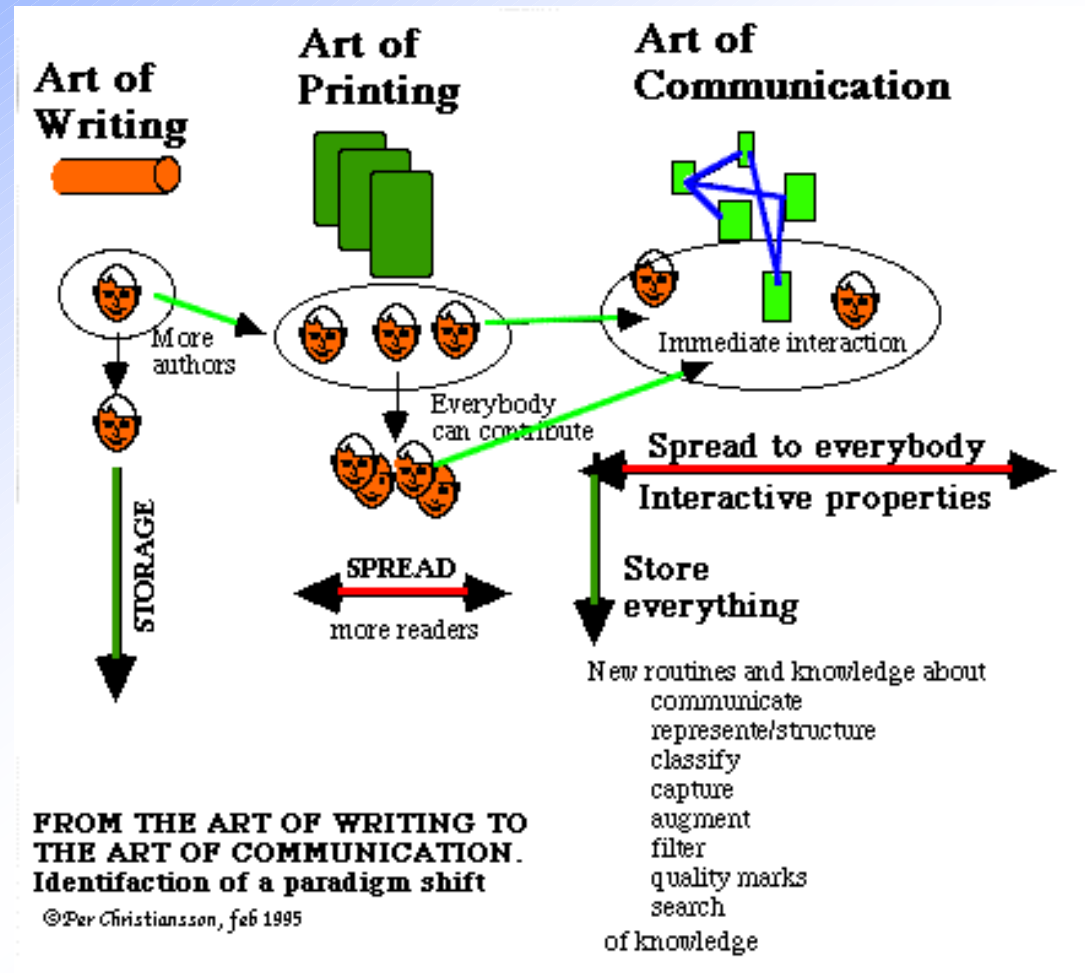Mennesker og IT - motivation og helhedsforståelse

- PARADIGMSHIFT TAKES TIME
- COLLABORATION . USER ENVIRONMENTS
- INTERACTION WITH DIGITAL MODELS
- MODEL INTEGRATION
- KNOWLEDGE MANAGEMENT
- SUCCESS CRITERIA
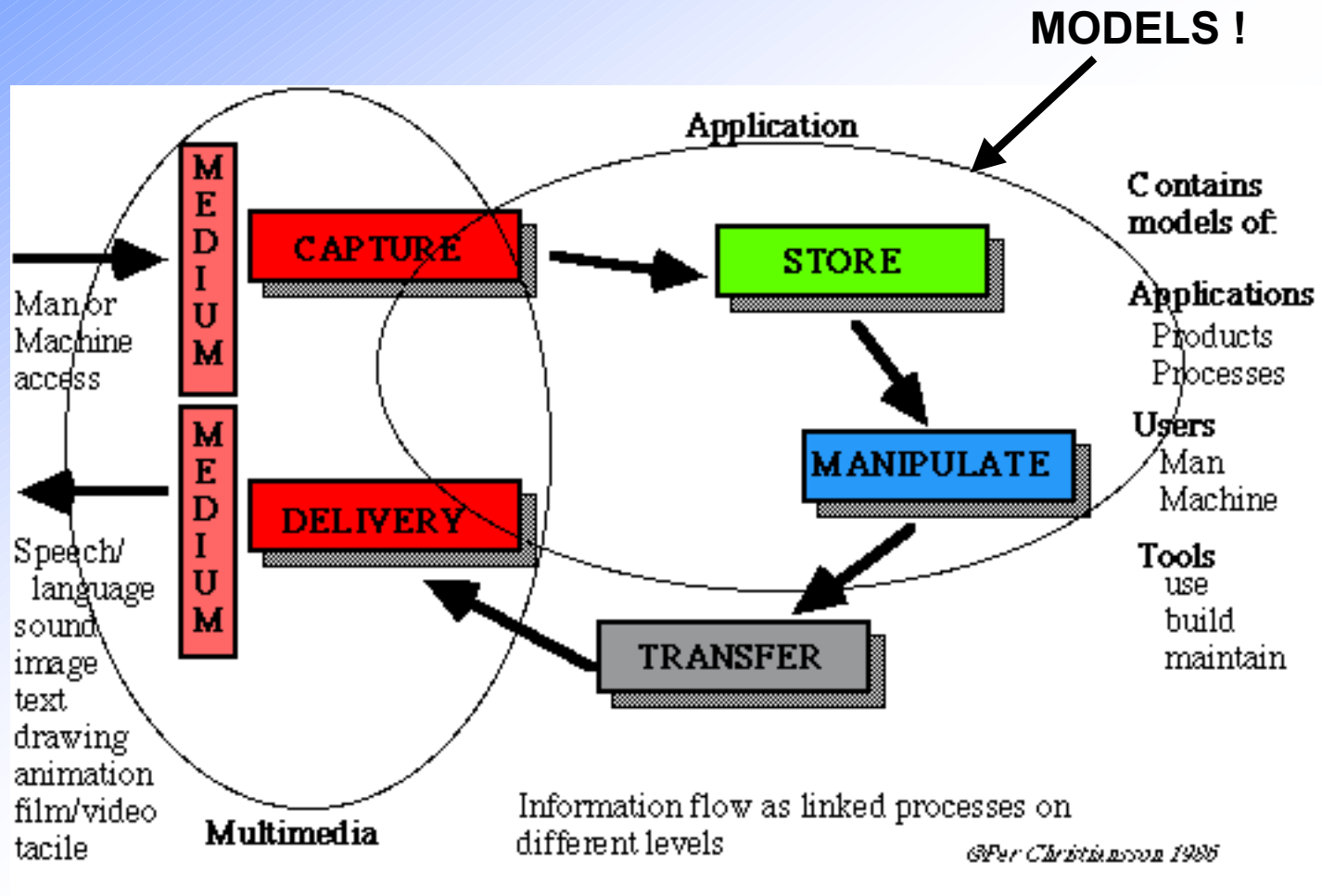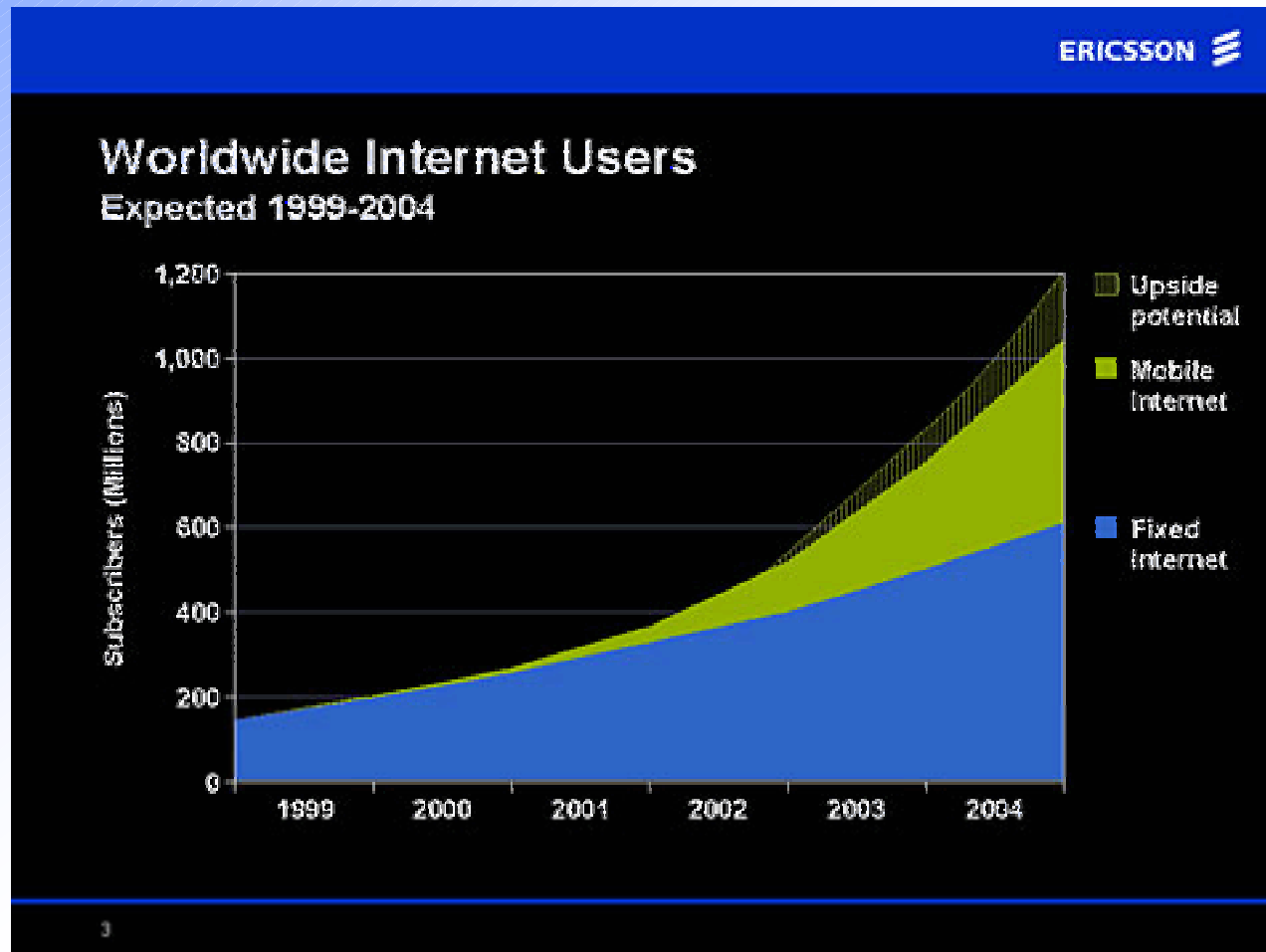- REFERENCES

PARADIGMSHIFT TAKES TIME

Changing Paradigm

Art of Writing

Art of Printing

Art of Communication

More authors

Immediate interaction

Everybody can contribute

STORAGE

SPREAD
more readers

Spread to everybody
Interactive properties

Store everything

New routines and knowledge about
- communicate
- represente/structure
- classify
- capture
- augment
- filter
- quality marks
- search

of knowledge

FROM THE ART OF WRITING TO
THE ART OF COMMUNICATION.
Identifaction of a paradigm shift

©Per Christiansson, feb 1995

IT is NOT just another tool that we have to learn to use

IT (ICT) Definition

MODELS !

Application

M E D I U M		CAPTURE		STORE
Man or Machine access				
M E D I U M		DELIVERY		MANIPULATE

Man or Machine access

Speech/ language sound image text drawing animation film/video tacile

Multimedia

TRANSFER

Information flow as linked processes on different levels

©Per Christiansson 1986

Contains models of:

Applications
Products
Processes

Users
Man
Machine

Tools
use
build
maintain

Mobile Internet development

Expected devlopment of Mobile Internet. Ericsson Inc., Sweden, at
CeBIT 24 Feb 2000

Future IT

- Wireless networks with fibre based backbone

- Portable units (computers, service/communication units)

- Peer-to-peer societies/interest-groups/villages

- Family servers

- XML tagged communication standards and Semantic Web.

- Personal storage of information/knowledge within physical reach

- All information ('good' and 'bad') accessible through dynamic logical containers

- Many flat panel communication units in homes

- Virtual spaces for communication and learning

- Personal global positioning units

- Manifold of parallel personalised market and service places

- Embedded intelligence (installation components etc.) with Internet connectivity

Paradigmshift takes Time

- **Early 80s - how can we invoice CA**D(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,….)
  Mechanical industry (ship, car, components,…) integrates around CAD 3D
  kernel (Parasolid, ACIS).

- **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.**
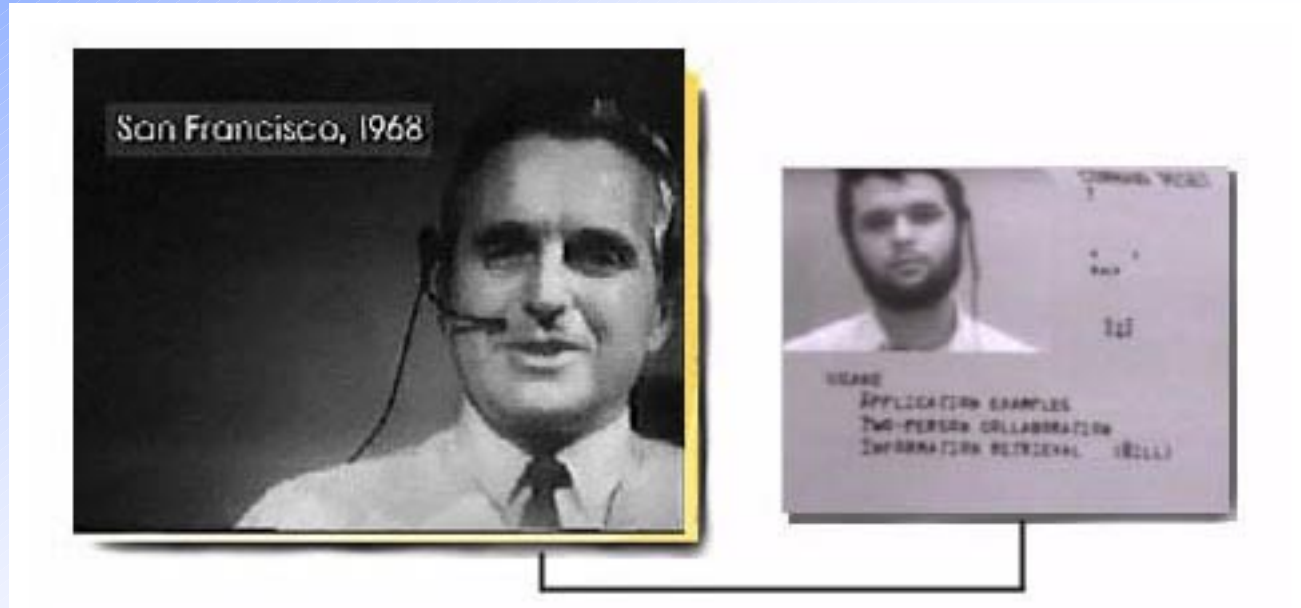 **(ICT competence needs increases, out-sourcing back lash)**

Building Process Oscillations

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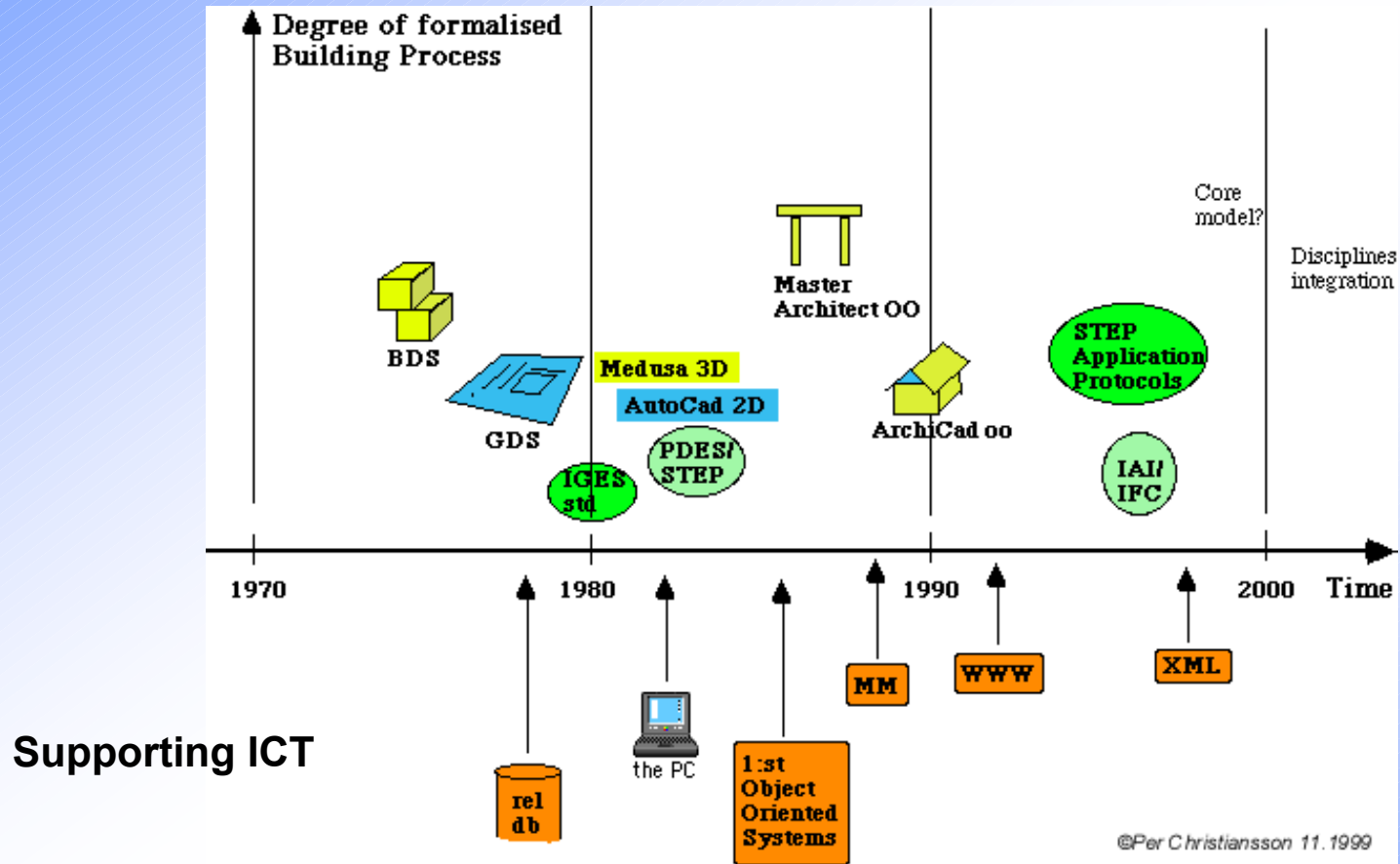
COLLABORATION

USER ENVIRONMENTS

Collaborative Work 1968

(from http://sloan.stanford.edu/MouseSite/1968Demo.html)

"On December 9, 1968, Douglas C. Engelbart and the group of 17 researchers working with him in the Augmentation Research Center at Stanford Research Institute in Menlo Park, CA, presented a 90-minute live public demonstration of the online system, NLS, they had been working on since 1962 ....This was the public debut of the computer mouse. But the mouse was only one of many innovations demonstrated that day, including hypertext, object addressing and dynamic file linking, as well as shared-screen collaboration involving two persons at different sites communicating over a network with audio and video interface."

Collaborative Work 1988

Experimental set-up at KBS-Media Lab, Lund University, 1991, with video communication and screen sharing using Timbuktu from Farallon.

We started to use

- *email* 1986 (there were 2386 email servers at that time compared to millions now).

- 1988 *Timbuktu* Farallon (remote screen control, application sharing, file transfer) . (1993 over the Internet).

- 1990 *CuSeeMe* Pine Software 1993 released a whiteboard extension to CuSeeMe

- 1990 *Aspects* (joint editing of drawings, word processor documents and bitmaps)
    MacEuclid for creating, editing and analysing reasoned arguments

- *1994 First Class* from Softarc (a so called BBS/Billboard system for structured email discussions).

- 1994 KBS-Media Lab launched their *web site* to support easy information access over the Internet.

- During European Academic Software Award (EASA) 1994 in Heidelberg a student group presented an *application sharing software for the PC Windows* platform.

- 1997 *LUVIT*, Lund University (WWW learning environment)

Collaborative Work

In the COOCOM project (Co-operation and Communication in the Building Process), 1993, industry participants (SKANSKA, FFNS Architects, and LKF facility managers) performed local and distributed ICT supported collaboration (local joint document editing, remote screen sharing using ISDN connection with support group at SKANSKA, and structured discussions). Walk-throughs of the design object were also available using the Virtus Walk-through system. (Modin, 1995)

Distributed learning   1/2

Remote lecture and application sharing between Aalborg and Lund Universities 1999 in teacher/secretary course (parallel ISDN based video communication and Internet based application

Distributed learning   2/2
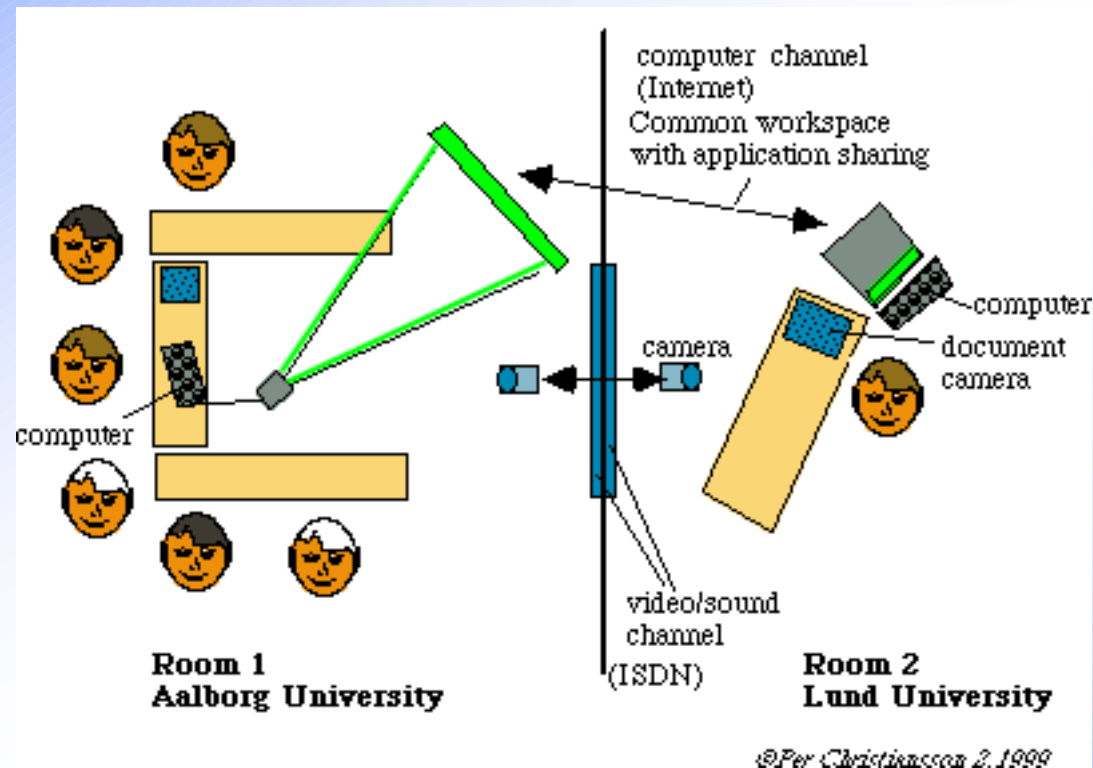
Parallel communication over ISDN (video conference) and Internet (application sharing).

The Knowledge Node Concept

Communication Spaces

Interface (multimedia)

DKN

Knowledge

The Knowledge Node

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

@Per Christiansson 1996, 2001
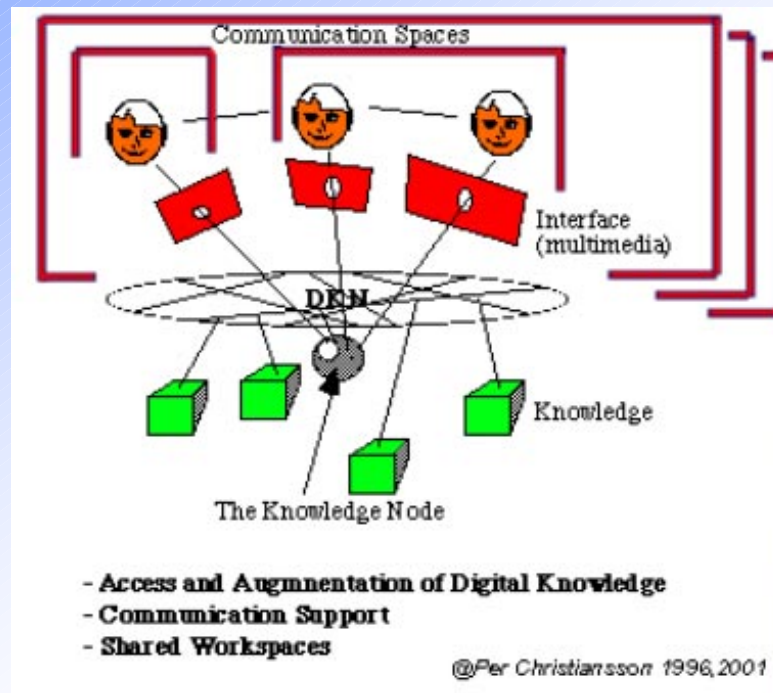
- **Participants**; number of, type (persons, agents
- **Collaboration subject/context & Form of interaction**; design, reviews, purchase, learning, brainstorm, negotiation, discussion,
- **Communication content** to support interaction; e.g. speech, sound, images, music, video, whisper, body language, 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

INTERACTION
WITH
DIGITAL MODELS

DIVERCITY project infrastructure
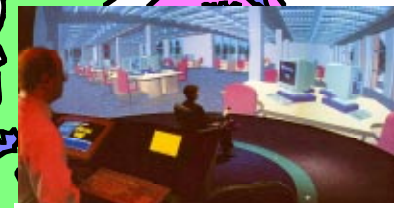
DIVERCITY project data

Distributed Virtual Workspace for enhancing Communication within the Construction Industry
EU 'IST-1999-13365
http://www.e-divercity.com/

- Shared cost RTD project - Key Action II.2.2

  (New Methods of Work / Workplace Design / Team Work)

- Project period March 2000 - September 2002
  Expected duration: 30 months

- Total cost: 3 M Euro (app.) -
  Commission funding: 2 M Euro

- Consortium (10 partners - 5 countries):

- Objective : Design & Develop a Distributed Virtual Workspace adapted for the Construction Industry
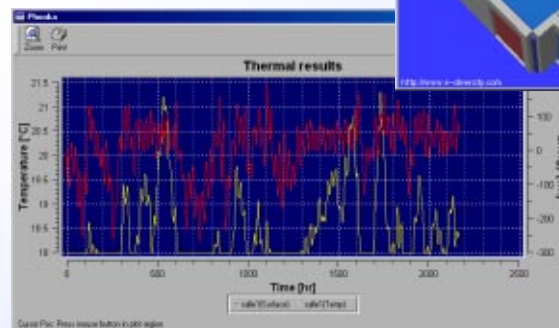
Import Model of Product to Application

CAD-Tool (ArchiCad)

IFC C++ generator

SPF file

C++ classes

Clent briefing PreCad
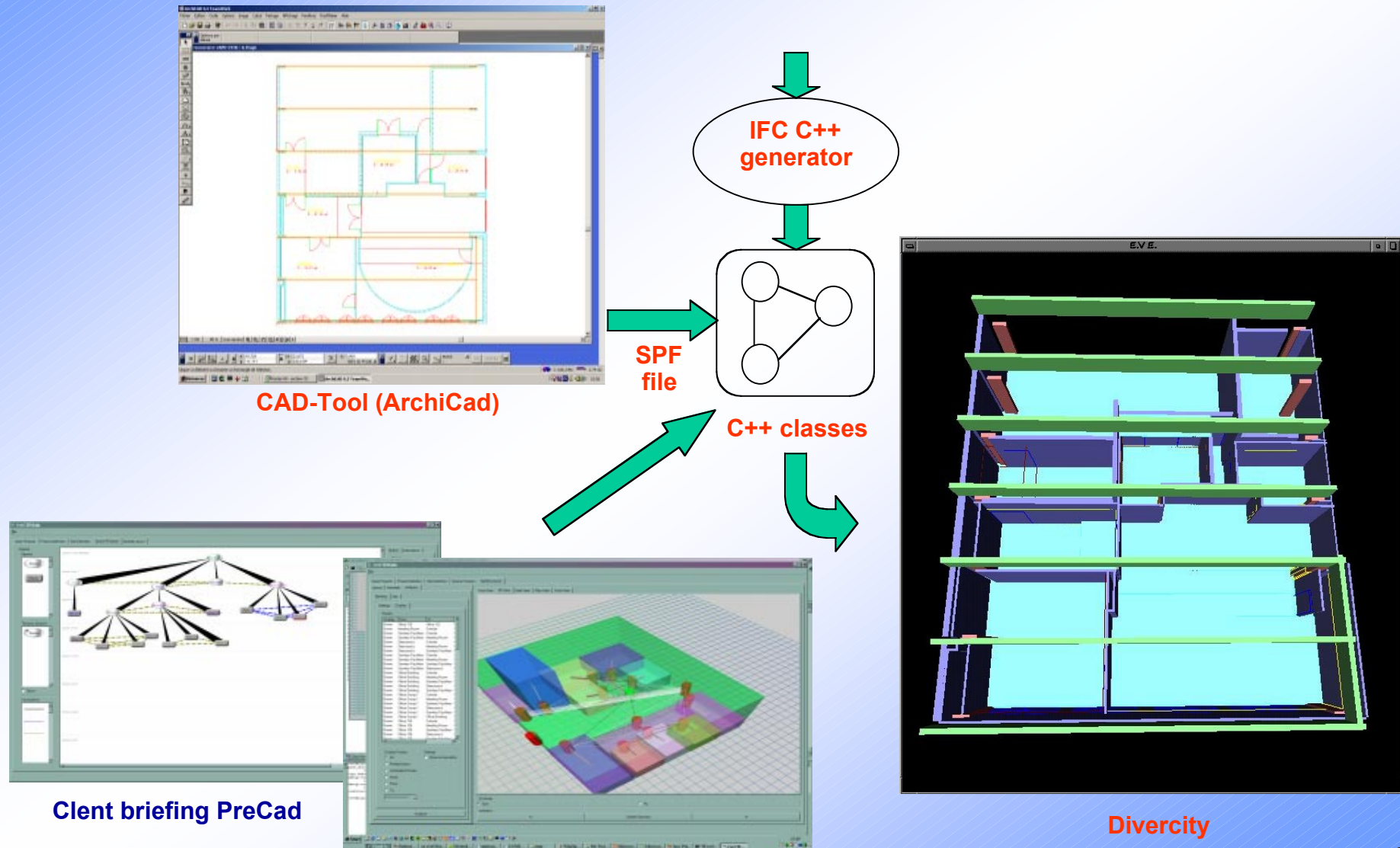
Divercity

DIVERCITY Design Review Applications
- examples

video

Acoustic module

Thermal analysis module

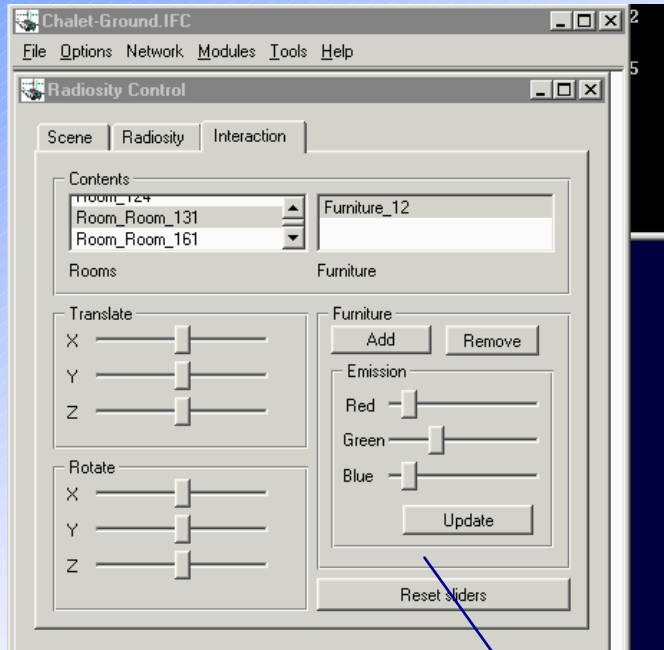**Lighting module**

DIVERCITY Design Review Lighting 1/2

- Interactive Radiosity
- Visibility Graph subdivision associated with light transfer links
- High shadows quality and optimised subdivision for real-time exploration (synchronous) (including object motion)
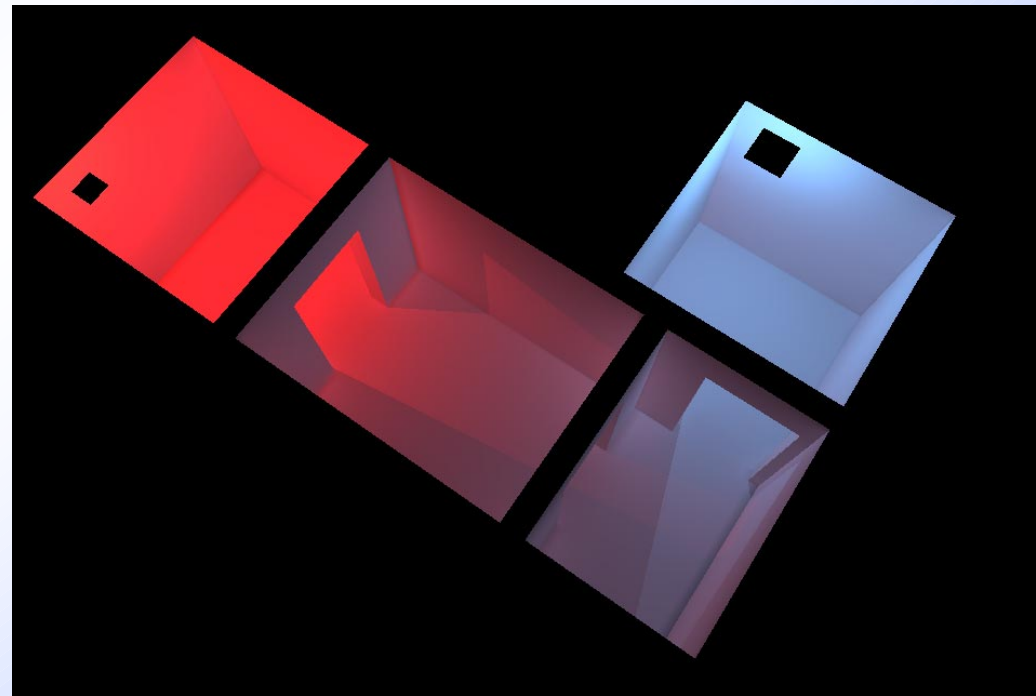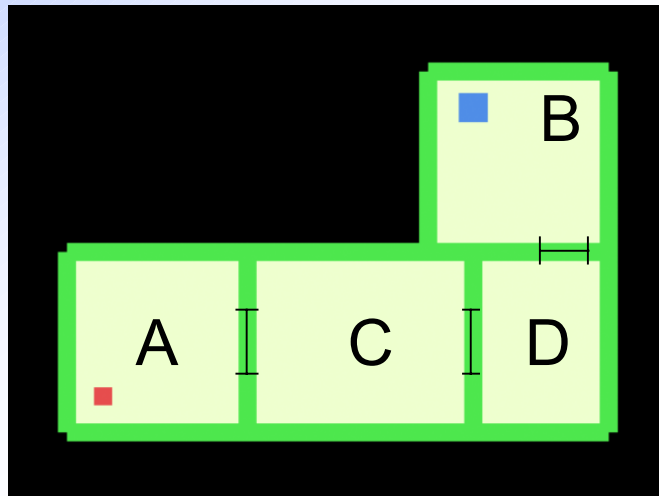
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DIVERCITY Design Review Lighting 2/2
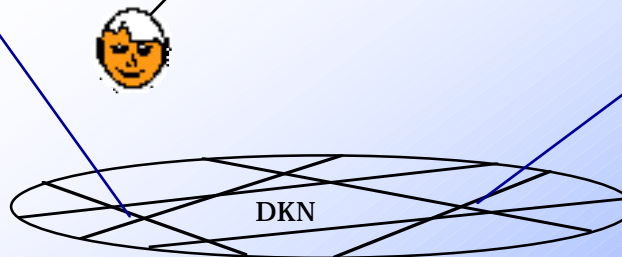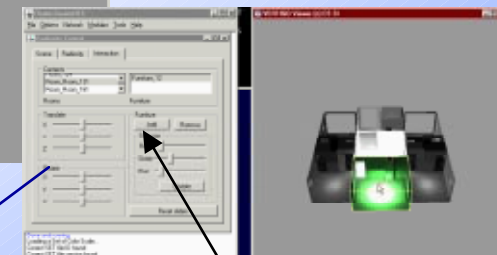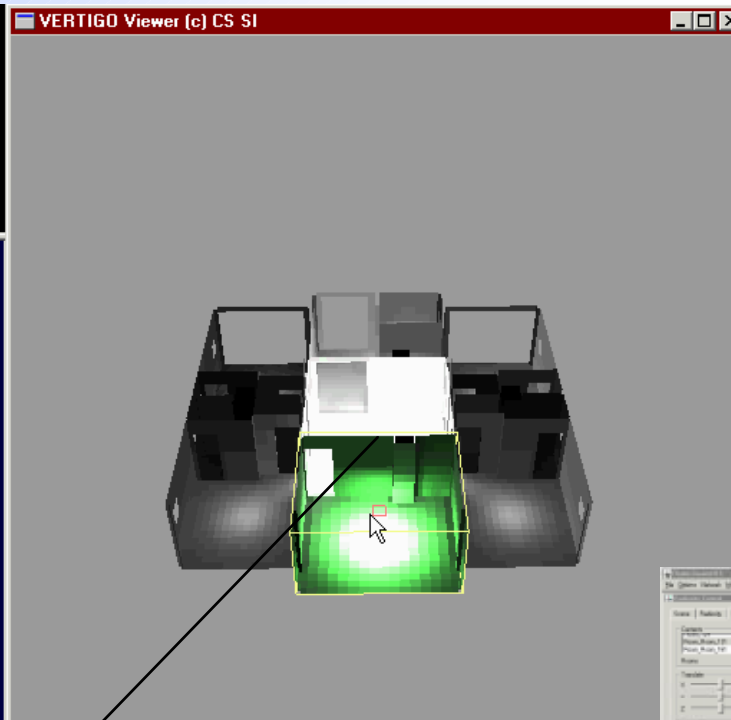
4D Visual Product Chronology

video

WebStep

Day 75

SUPERSCAPE VISCAPE™

Project Model

VTT Finland

Schedule for buildability

Construction progress monitoring

Building documentation

Virtual Reality in GIS Scale

The ANS project at Kjellerup commune by COWI Consulting Engineers and Planners Aalborg, and Aalborg VR Media Lab

Airflow visualisation in VR Cave

Air exhaust

Air inlet
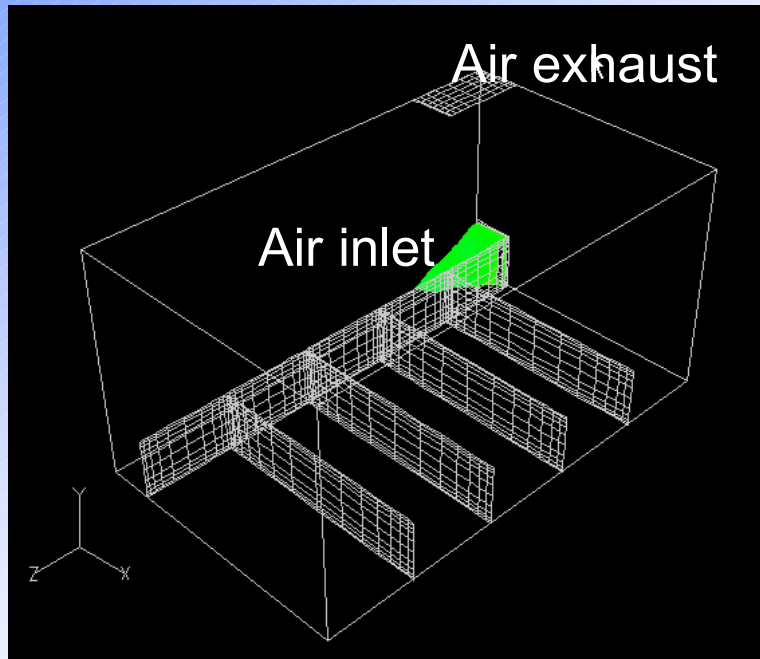
Displacement ventilation in a livestock building

Temperature field, Vector field, Streamlines, Particle movement

(Royal Veterinary and Agricultural University and Aalborg University)

film
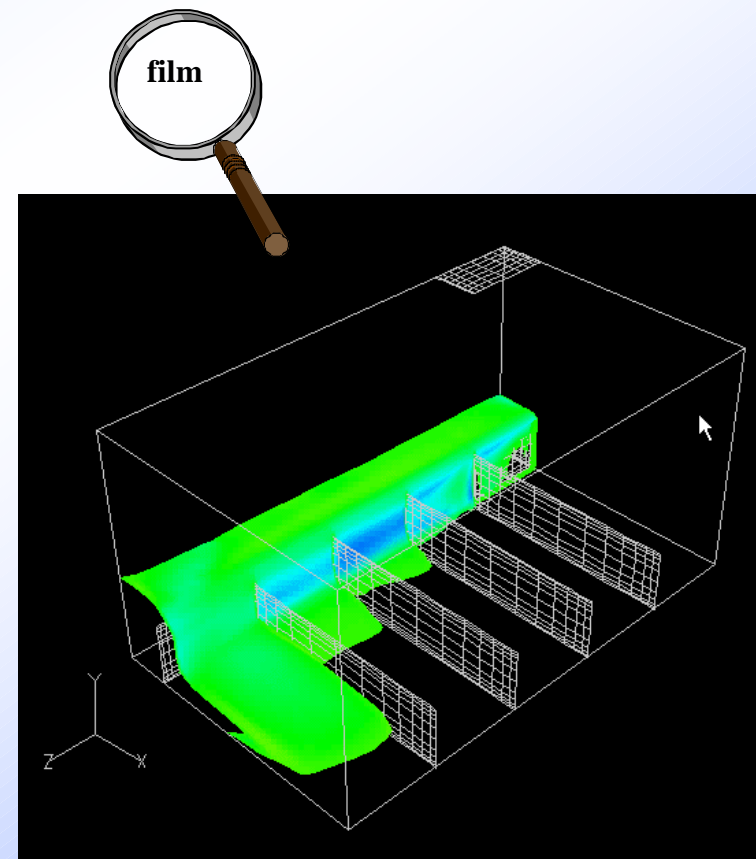
Interactive 3D WWW Models
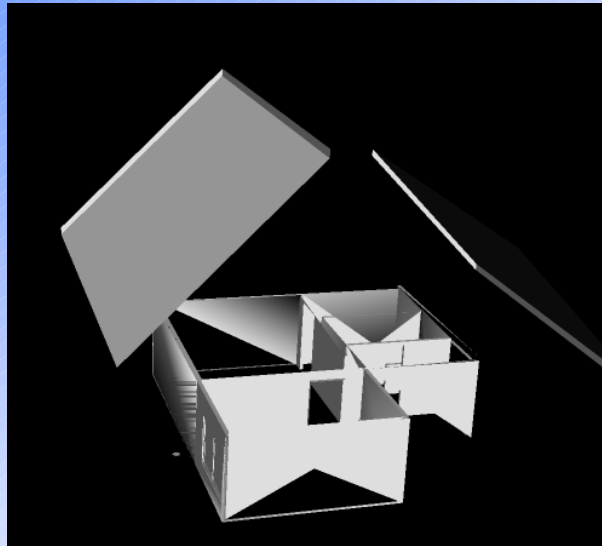
CULT 3D models

VRML models

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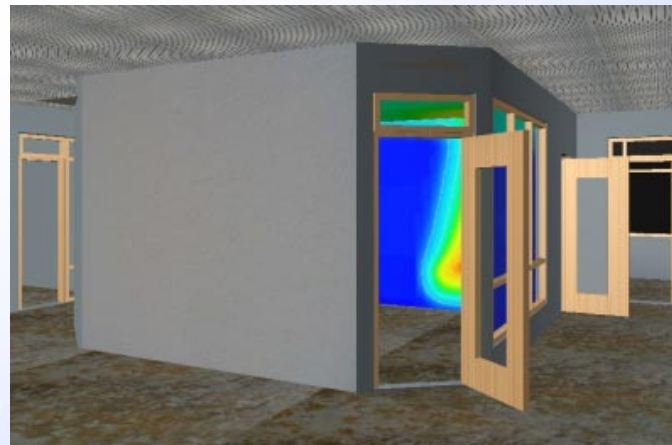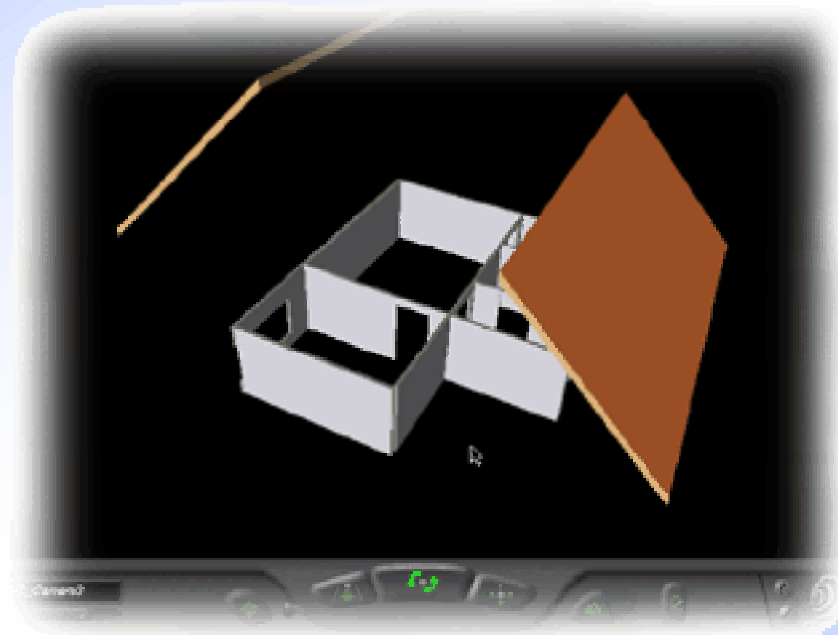
New Interaction tools - example

Sweeping the pad for selection

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New Interaction tools - example
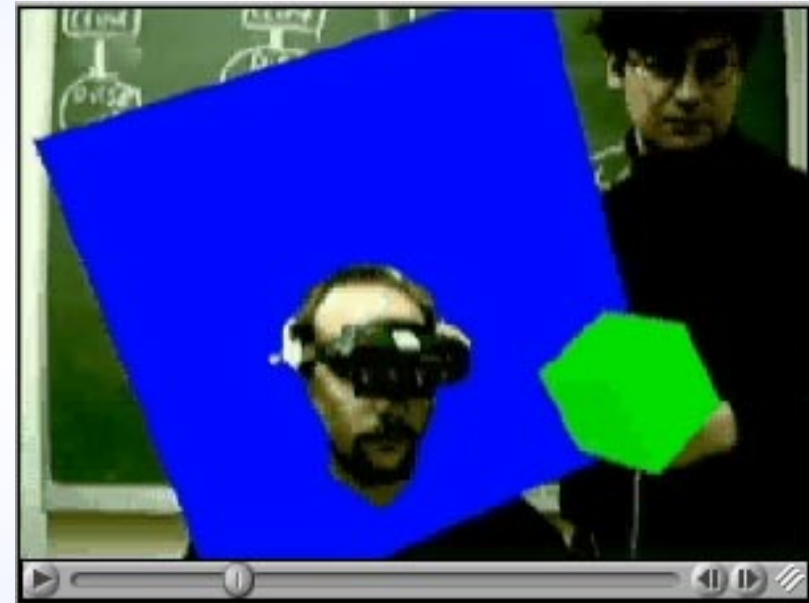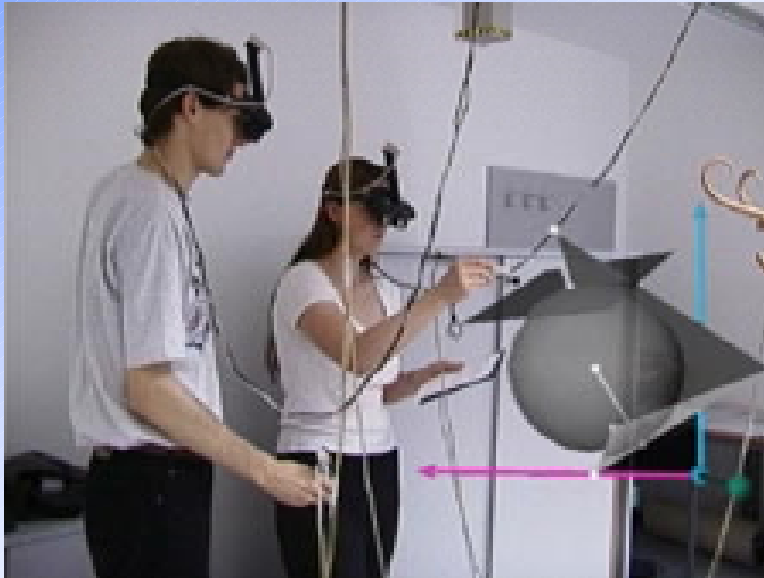
Left; " A tutor and student are working together in Construct3D. Both are constructively solving an example from vector analysis." from http://www.cg.tuwien.ac.at/research/vr/studierstube/construct3d/.

Right; 'Virtual object intersecting real head' http://www.cg.tuwien.ac.at/research/vr/occlusion/headmove.mov

MODEL INTEGRATION

Building Process Change?

Organisation

Person/Team

Collaboration environment

Analyses/simulation tools

Models access

Framework

Information container

The DIVERCITY Framework

Virtual Building

©Per Christiansson 9 2000
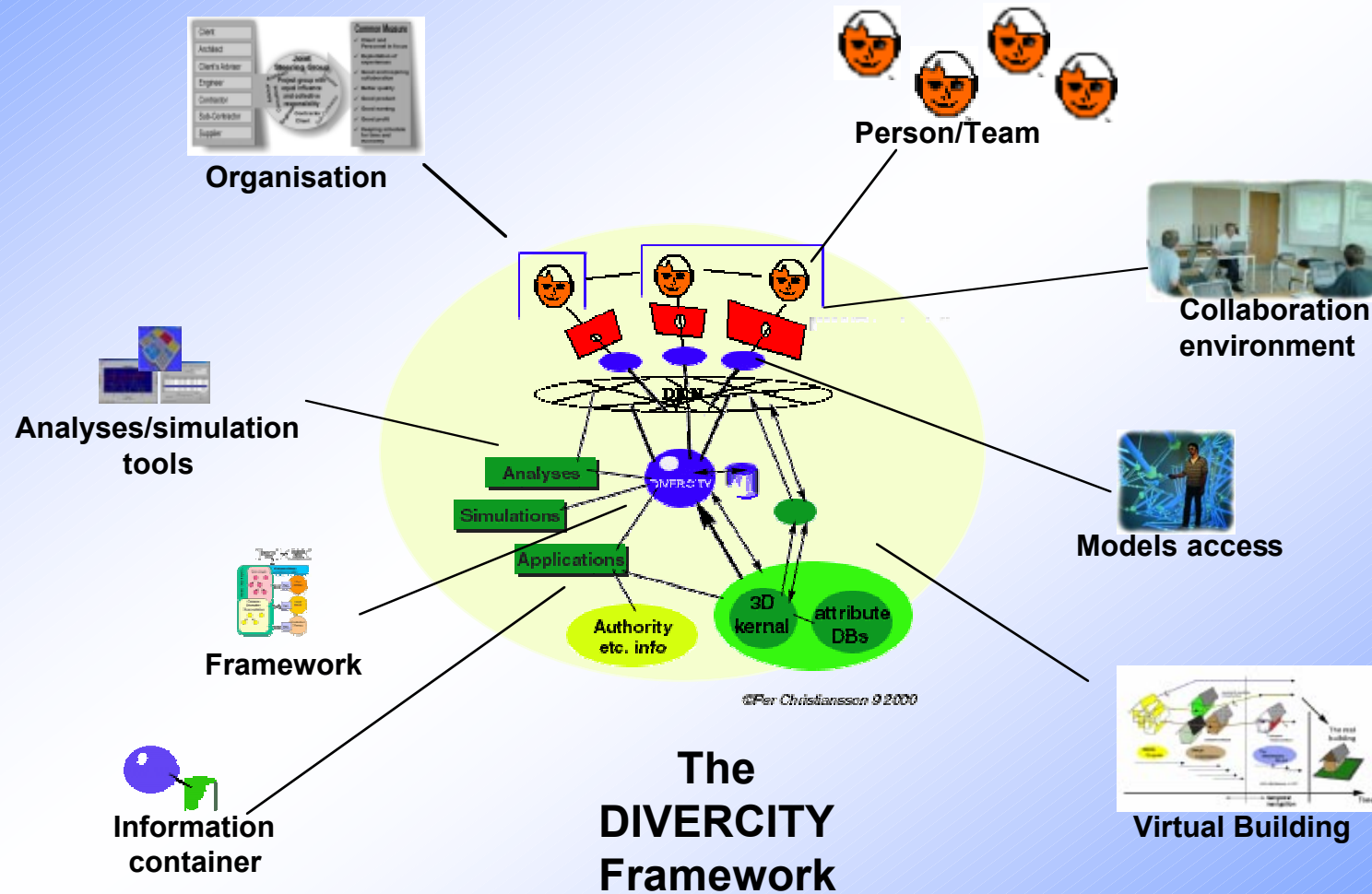
Changes in Process Organisation

Nb of important decisions

Time

Higher quality processes & products.

The dream coming through?
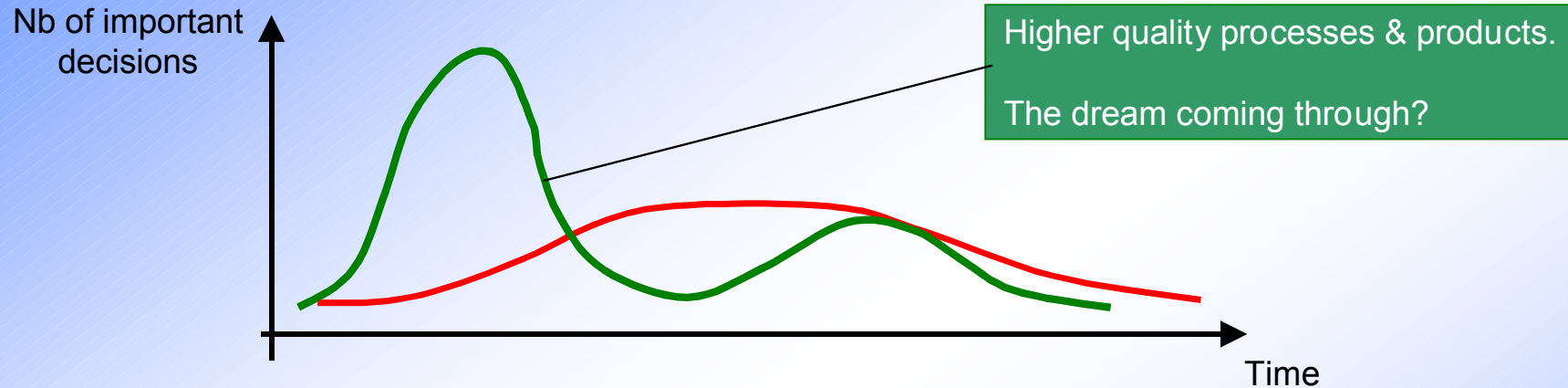
Partnering

som eksempel på samarbejdsform

Slutbrugere
Bygherre
Facility Management
Bygherre-rådgiver
Entreprenør
Arkitekt
Ingeniør
Leverandør

Fælles Styregruppe
Entreprenør   Ingeniør
Projektgruppe
med ligeværdig
Bygherre   Arkitekt
indflydelse og
kollektivt ansvar
Bygherrerådgiver
Leverandør

Fælles mål:
- Client, slutbrugere og medarbejdere i centrum
- Udnyttelse af erfaringer
- Godt og inspirerende samarbejde
- Bedre kvalitet
- Godt produkt
- God indtjening
- Overholdelse af økonomi
- Overholdelse af tid

Fælles standarder, metoder og udvekslingsformater
- Kommunikation
- CAD-manual
- Beskrivelsestemplates
- Tidsstyringsprogrammer
- Økonomistyringsprincipper
- Fakturering
- Kvalitetskontrol
- Fordelingsnøgler
- Erfaringsudveksling
- Mødefrekvenser og indhold

@Jens Ove Skjæsbæk. COWI A/S. 2002

Dramatic changes in procurement philosophies, as a result of the internet (partnering model). Partnering model showing the stakeholders joining a common project group with mutual goals (COWI A/S Denmark)

The DIVERCITY Framework

Virtual Workspace   Virtual Workspace

Collab.   Collab.   Collab.

Collab.

DIVERCITY

Appl.   Appl.

Application data container

DIVERCITY data container

Application data container

Application data container 'CAD'
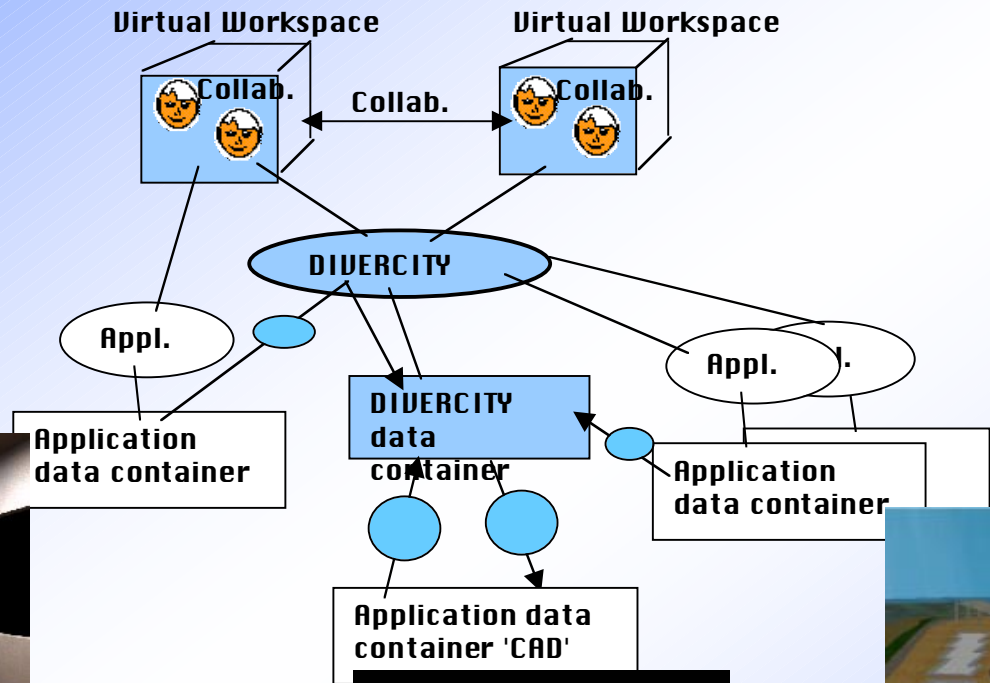
Client briefing

Lighting Simulations
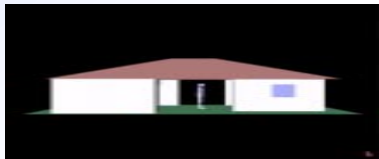
Thermal Analysis
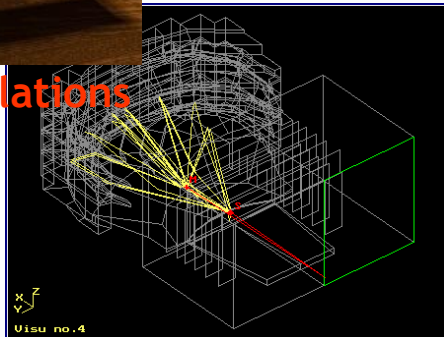
Acoustics
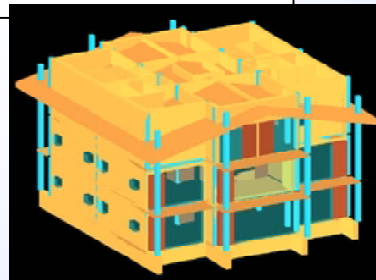
Building Model (IFC,...)

4D building site

Day 75

SUPERSCAPE VISCAPE™

Virtual Building Process
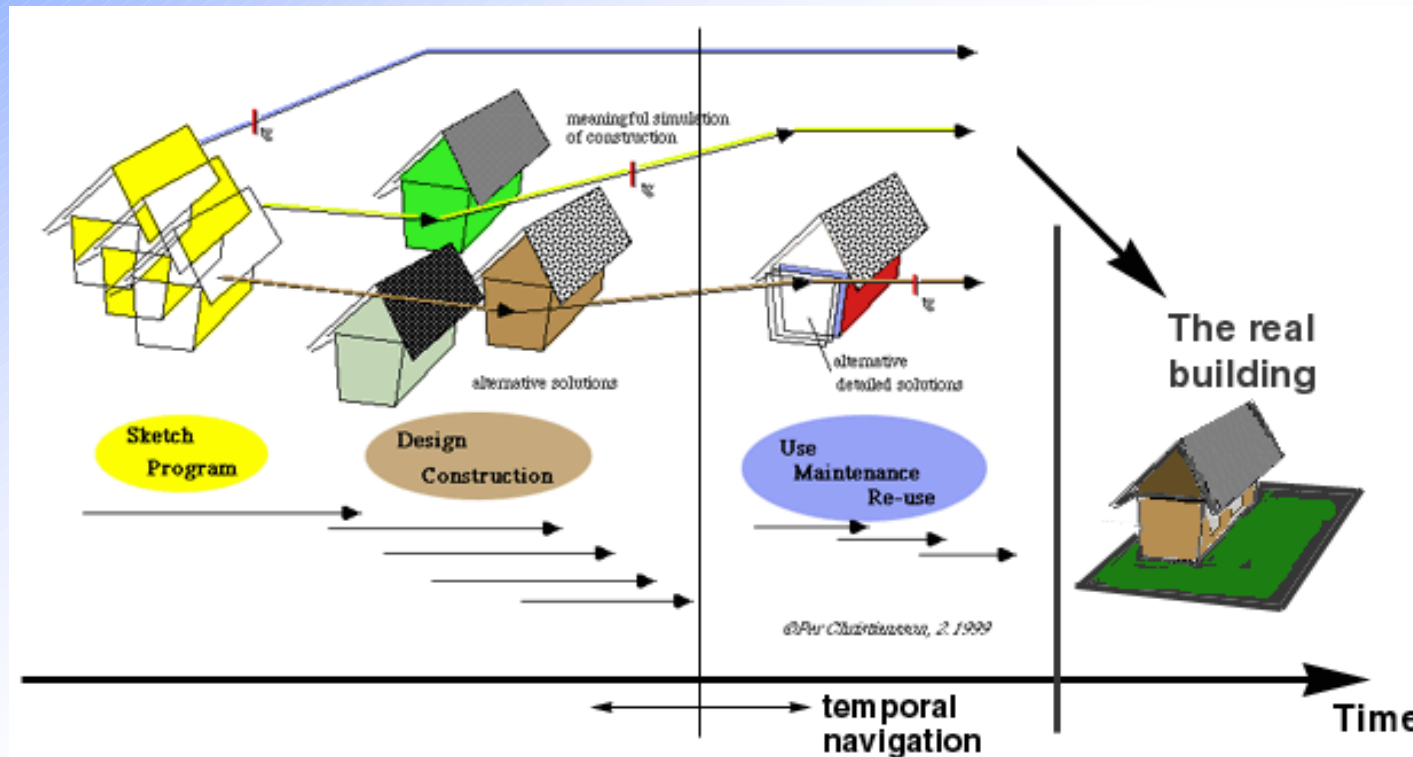
Tracks of alternative solutions. Two time lines -real time during collaboration and time points in the life cycle of a design artefact.

The Intelligent and Responsive Building

Control
more or less intelligent

Web interface

LON

Installation Bus

TP

Bridge

Coax.

Power

Gateway

router
router
router
router

LAN

DKN

Internet/Intranet

LON = Local Operating Network (control, < 1.25 Mbps)
LAN = Local Area Network
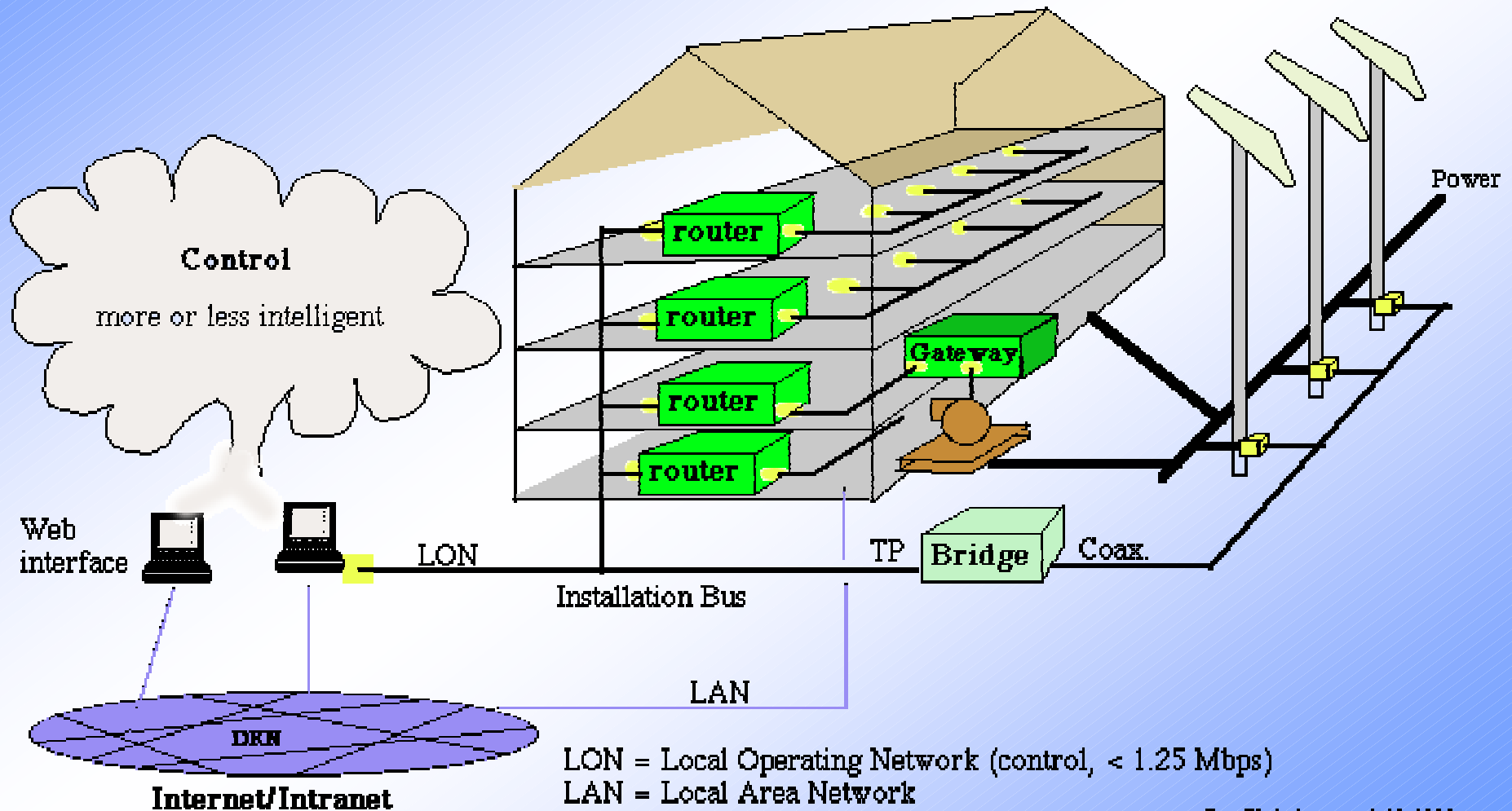
Per Christiansson 1.12.1999

Digital City Services

externa digitala nät

satellit

alt. informationsväg

informationskanal

Kommungemensamt nät

Fastighets-bolag B

©Per Christiansson 10.1997

Routers, switchar,
hubbar

CUSTOMERS

SERVICE PROVIDERS

B

D   A   C

INFRASTRUCTURE PROVIDER

©Per Christiansson 30.8.2000
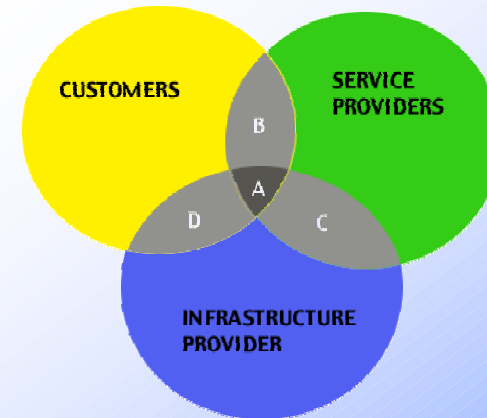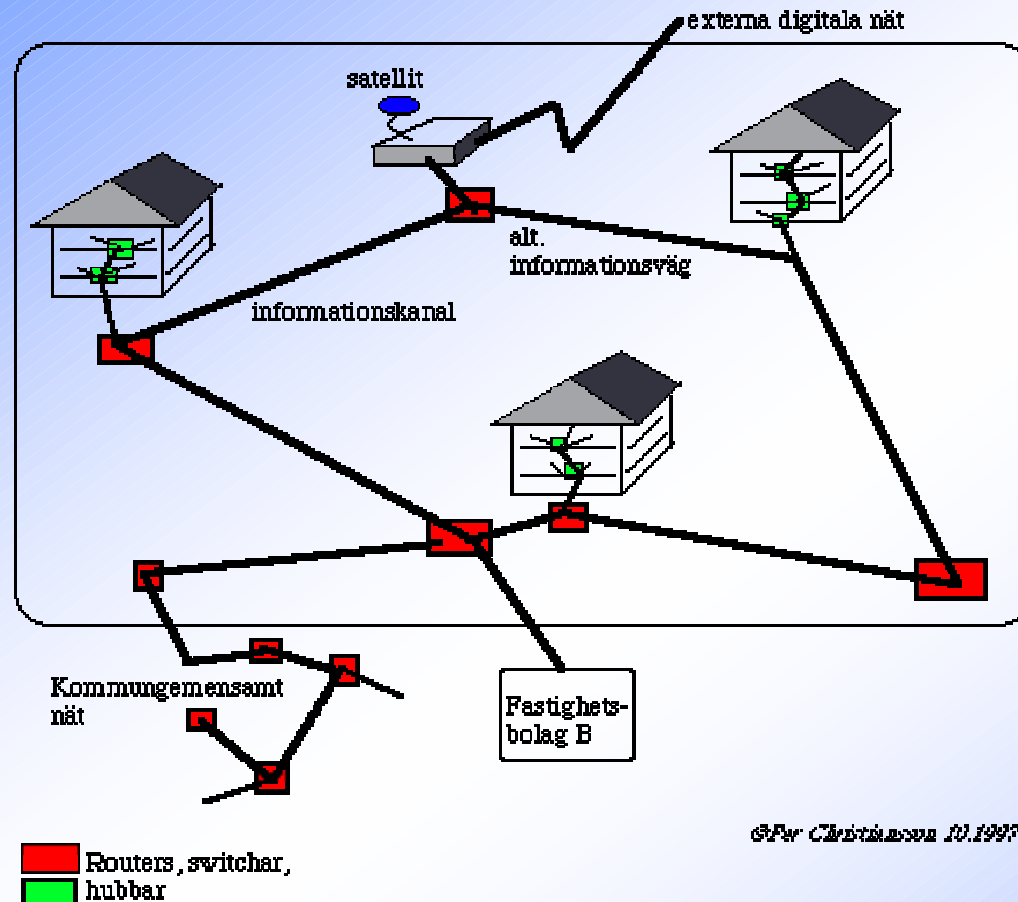
Deifine and develop new services

KNOWLEDGE MANAGEMENT

The Organisational View

Next Generation Building Portals

SELLERS

Procure Collect Buffer Transfer Link Display Knowledge store Optimise

BUYERS
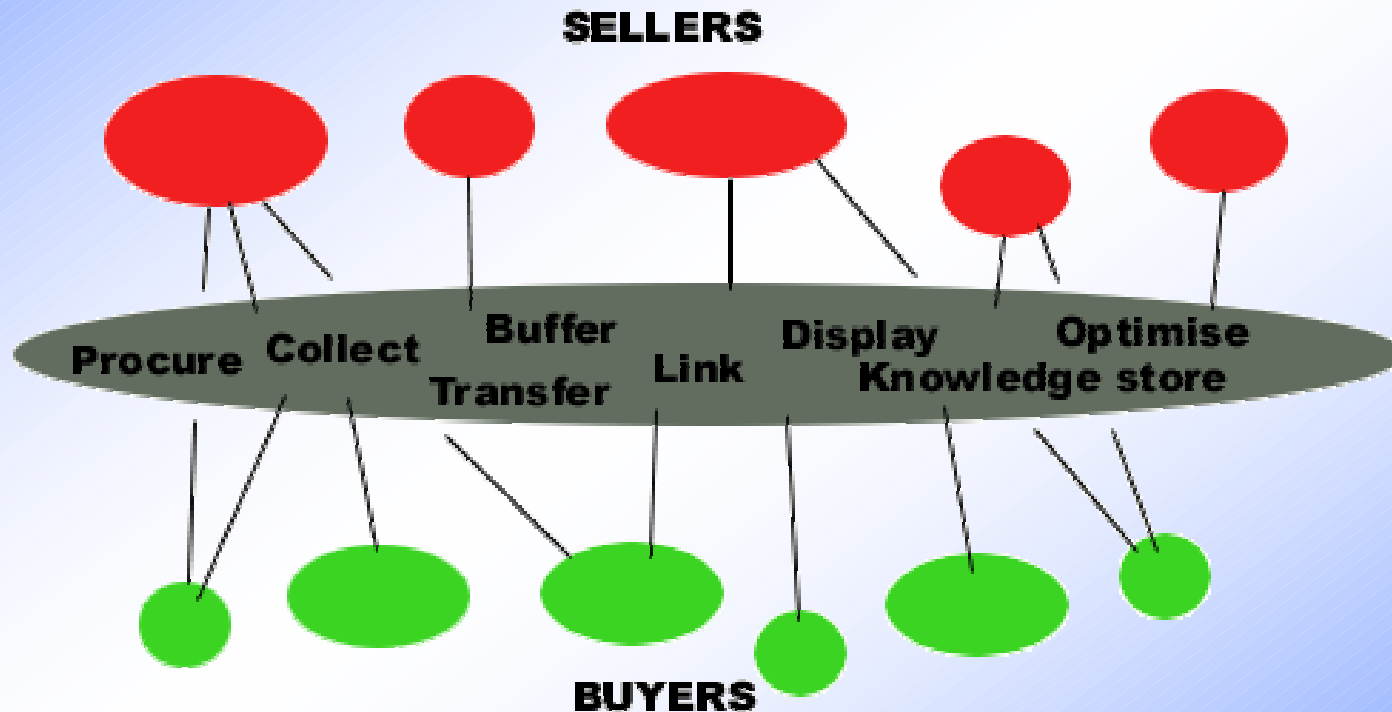
We want to buy, we want to sell - components, digital objetcs, information

©Per Christiansson 11.2000

Knowledge Management

As knowledge to higher degree than before becomes digitally stored the demand for formalised descriptions (**models**) increases

- organisation process and project models
- product models
- production system models
- user models (personal and team)
- new types of services ans applications models
- ICT tools models

Knowledge Management **Tools**

- knowledge capture tools
- storage tools
- tools for knowledge abstraction and generalisation
- reasoning tools
- knowledge communication tools
- knowledge delivery tools
- knowledge discovery tools

The Semantic Web

Ontologies
Metadata

Information
containers

SERVICES

SEMANTIC 'middleware'

(Relational) databases

Web documents (xml, html)

Images

Videos

Documents
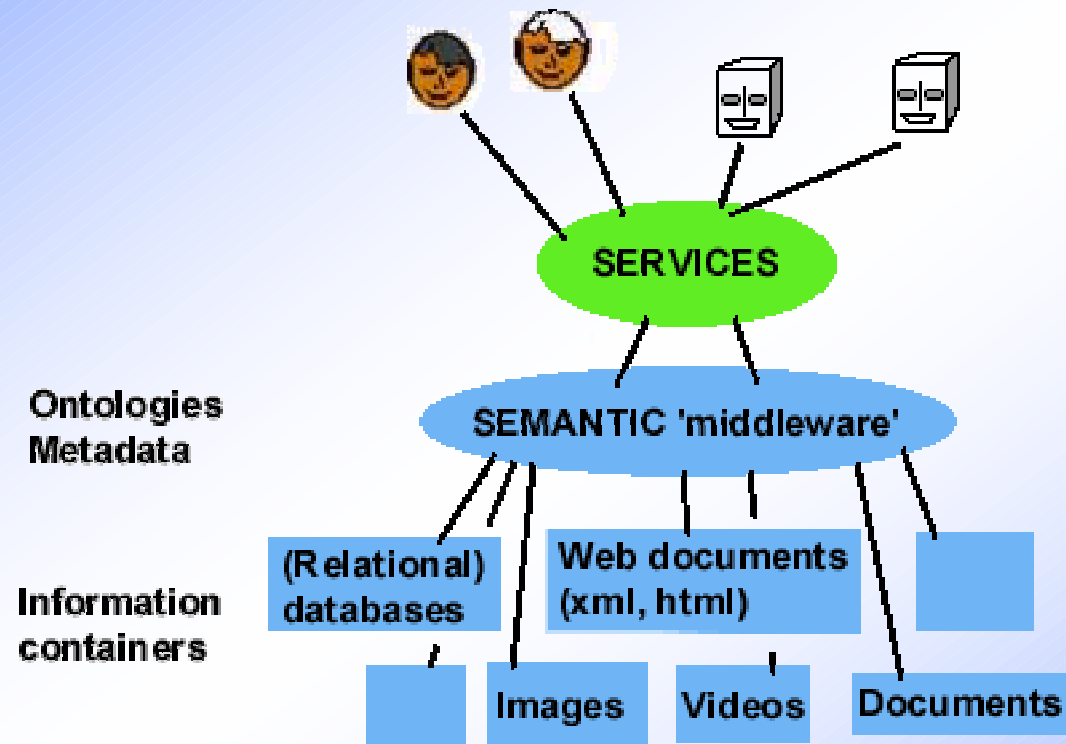
@Per Christiansson 15.1.2003

The next generation World Wide Web.

New services will be introduced in the Semantic Web

The Semantic Web

Tim Berners Lee, http://www.w3.org/2000/Talks/1206-xml2k-tbl/slide10-0.html
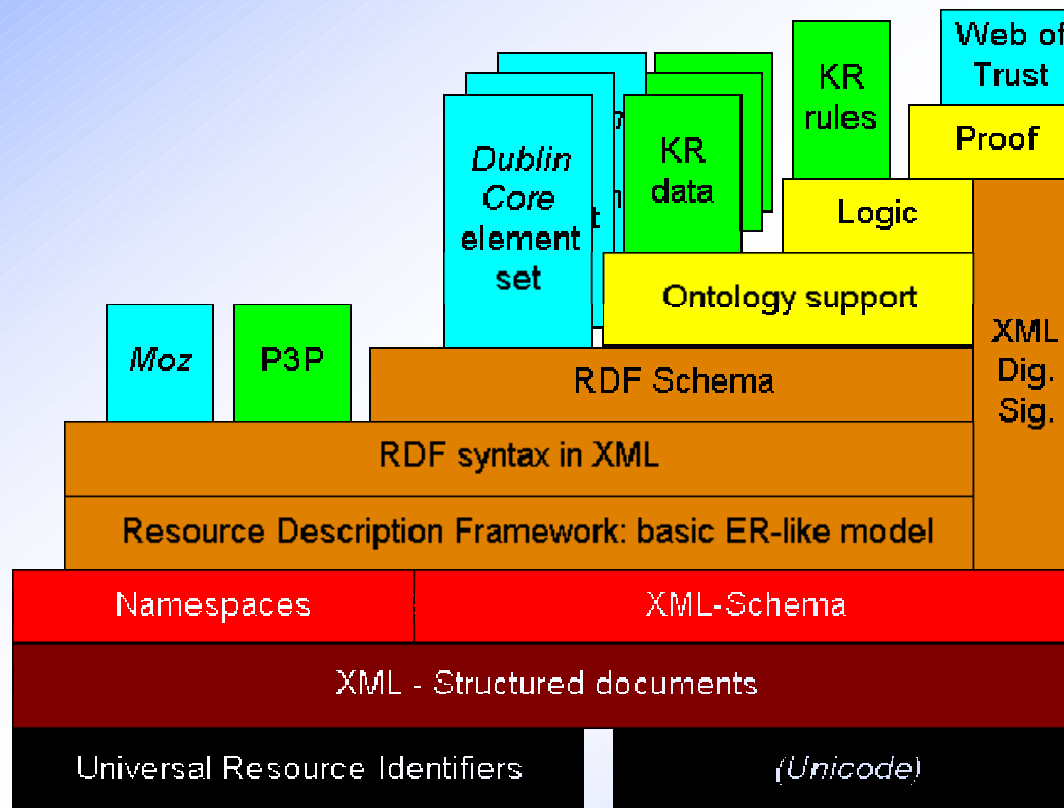
The next generation World Wide Web

MOTIVATION

UNDERSTANDING COMPLEXITY

PARTICIPATION IN CHANGE PROCESS

Building Process Knowledge

IT-Knowledge

Requirements Solutions
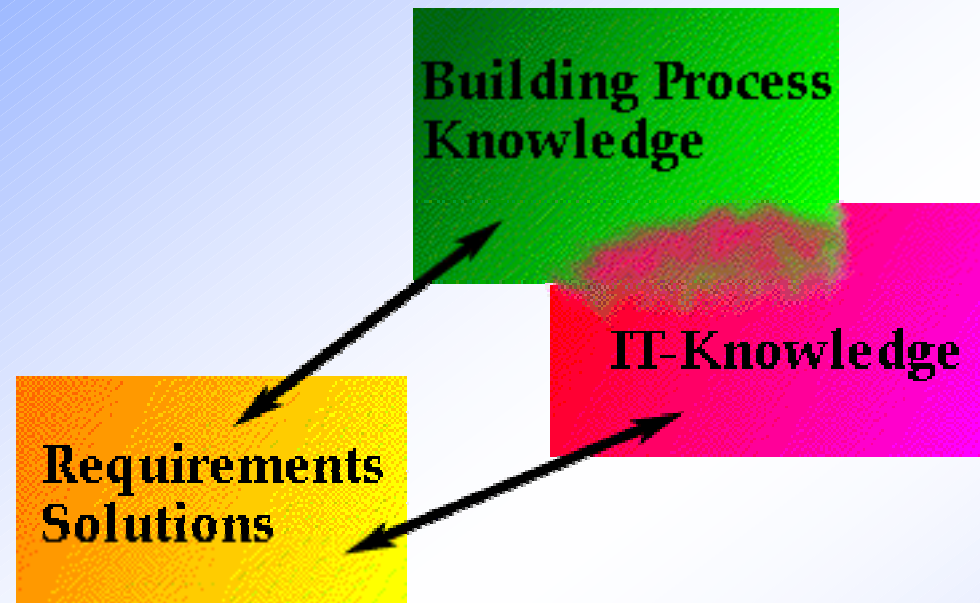
Builders must have ICT competence to be able to formulate requirements on and participate in the design and implementation of tomorrows building process IT-tools.

The IT community cannot (should not) by themselves build tomorrows AEC tools.

Success Criteria   1/3

- ICT *must not* be regarded as one of these tools that we only have to learn to use but as an integral part of the company and project knowledge management system.

- Increased knowledge transfer and *ICT competence. Knowledge communication* crucial (companies, schools, public services).

- Acquire *deep understanding* of ICT influence on organisation, work methods, user environments, and information handling.

- 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.

We are all involved in a continuos 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 both universities and industries

Success Criteria 2/3

- The formulation and refinement of digital *models* of the building process must be driven by the end users. (Products, processes, components, tools, users/teams)

- Participatory design (industry - university) of new *tools* and *services* that in many cases are not yet defined.

- *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* (collaboration, communication and information handling) to support high quality building products in a life cycle perspective. *Client*, building product *users, and suppliers* with greater influences in the design process.

- Development of *scenarios* (from idea - demolition of building) encompassing credible ICT tools.

We are all involved in a continuos 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 both universities and industries

Success Criteria   3/3

- 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).

- Agreements on *vocabularies* and *concepts* within and between stakeholders starting with meta project level and more detailed team and component deliverers specifications.

We are all involved in a continuos 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 both universities and industries

REFERENCES

Prof. Per Christiansson ⬥ IT in Civil Engineering ⬥ Aalborg University   http://it.civil.auc.dk

Education. IT in Civil Engineering courses   1/3

- **Civil Engineering**

  - IT in the Building Process (semester 6)

  - **Building Management**

    - Virtual Buildings (sem7)

    - Multimedia & Knowledge Management (sem8)

    - Integrated Building Process (sem9)

- **Architecture & Design**

    - Intelligent Models (sem6)

    - Computer Aided Design

Education. IT in Civil Engineering courses 2/3

- **Master of IT distributed open education** (3*1/2 years)
  - Human Computer Interaction, HCI (year 1)
  - Multimedia Interface Design and Computer - Collaborative Work (year2)
  - Knowledge Management within Companies and Projects (year2)
  - Virtual Building models (year 2)
  - Intelligent Buildings and the Digital City (year3)
  - Engineering Databases (year3)

Education. IT in Civil Engineering courses 3/3

- **Life Long Education** (Livslang uddanelse) (short courses)

    - IT i Byggeriet (1999, 2001)

- **Internal** courses for teachers and secretaries

R&D at IT in Civil Engineering Aalborg University

IT in Civil Engineering

http://it.civil.auc.dk/it/projects/

Research areas at IT in Civil Engineering

VIRTUAL BULDINGS AND IT-SUPPORTED COLLABORATION

- **IT in Collaborative Building Design.** PhD project within Danish Center for Integrated Design. CID
- **Distributed Virtual Workspace for enhancing Communication within the Construction Industry -** **DIVERCITY** (EU project)
- **IT at the Building SITE** (National Danish project)

INTELLIGENT BUILDINGS AND DIGITAL CITIES

KNOWLEDGE MANAGEMENT AND KNOWLEDGE TRANSFER

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References (1/3)

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