



# Interoperable ICT tools in Real Construction Projects

*Finnish Experiences of New Processes*

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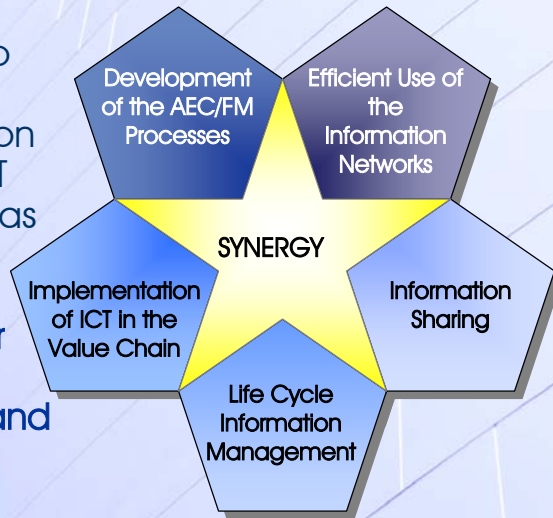
## Content of the Presentation

- Background
  - Vera - Information Networking in the Construction Process - technology program
- Helsinki University of Technology
  - The experiences of new integrated tools in the new main auditorium project, HUT-600
- Some conclusions and future development work



## Vera Program Target

The target is to promote the implementation and use of ICT and networks as the enabling technologies to re-engineer the design, construction and FM processes

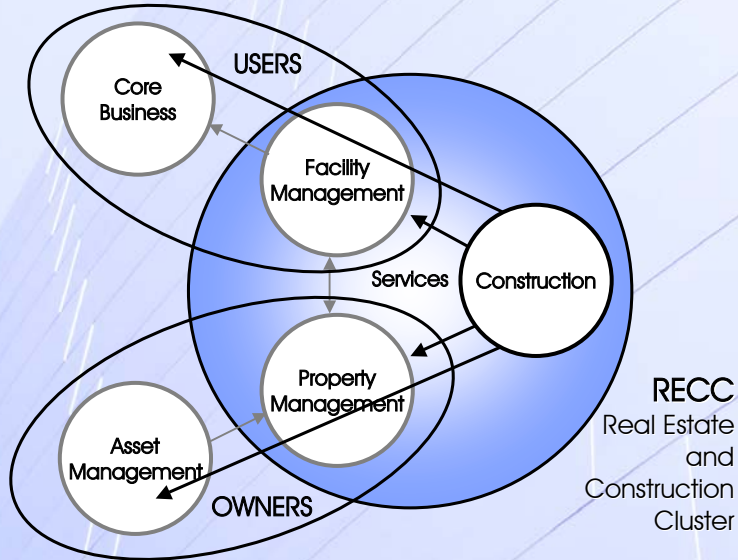


## Vera Schedule and Budget

- Schedule - six years; 1997 - 2002
- Total volume
  - ~48 % by Tekes 22 million €
  - ~52 % by the industry 24 million €
  - Total budget 46 million €
- Project allocation, September 2002
  - Research: 40 projects 5.4 million €
  - Industrial: 104 projects 36.0 million €
  - Total: 144 projects 41.4 million €
  - 85 projects (60%) connected to IFCs
- URL: <http://www.tekes.fi/english/vera/>



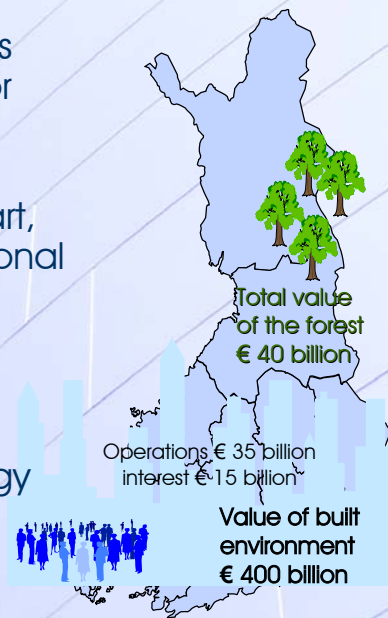
# New View to the Industry



# Finnish Real Estate & Construction Cluster

- Produces and maintains the built environment for business, services and living
- Constitutes the main part, **70%**, of the Finnish national assets
- Employs more than 500 000 people = **20%** of the work force
- Uses ~**50%** of the energy

**Can we afford NOT to develop our industry?**







**PRODUCT MODEL**

**4D**

**IFC VR-EVE**

*Final project evaluation report available at*  
<http://www.stanford.edu/group/4D/download/c1.html>

Martin Fischer and Calvin Kam / CIFE - Stanford University



**Senate**  
PROPERTIES

## **Why PM (Product Model) pilot?**

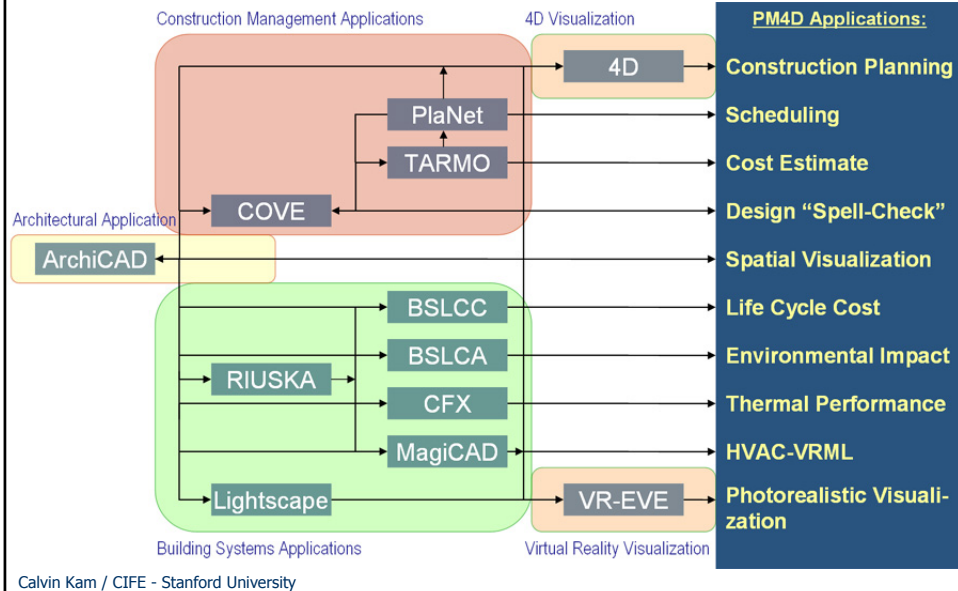
- **Research goals:**
  - *Use of product model in the early phases of a project*
  - *Information exchange using product model*
  - *4D-approach*
- **Management goals**
  - *Proof of concept for new technology*
  - *Life-Cycle calculations – LCC / LCA*
  - *Visualization*
  - *Cost control: Design and construction phases*

IAI Seminar  
4

April 2002



## Design and Analysis Tools in PM4D Approach



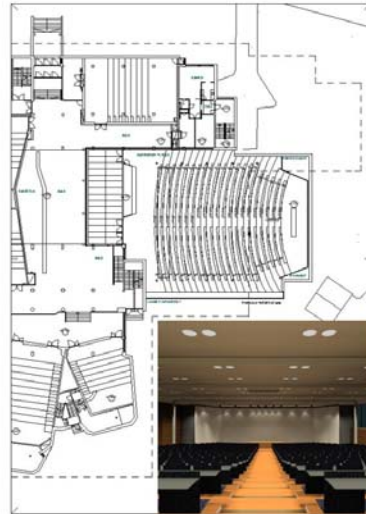
## Design & Engineering Processes

- Shared models can contain complex rules for behavior and relations between objects
  - Easy and cost efficient evaluation and simulation at any project stage
    - requirement management through the process
    - thermal, lighting and performance simulation
    - more accurate cost estimation
    - environmental evaluation...
  - Semi-automated design integration and code checking
- New service areas for architects & engineers
  - LCA/LCC services
  - Information maintenance
  - FM services...

# HUT Auditorium600

# PRODUCT MODEL IN USE

- Architects virtual building model is the basis for the other specialist models in the design organisation.
- Data exchanged is 3D
- Easy transfer of product model for simulations in IFC and other formats
- The structural and building services design work possible in 3D
- Production planning possible in 4D
- Alternative design proposals can easily be presented in VR or other formats for visual presentation
- All above throughout the design process



HUT Auditorium600 • A-KONSULTIT architects • © jyrki iso-aho

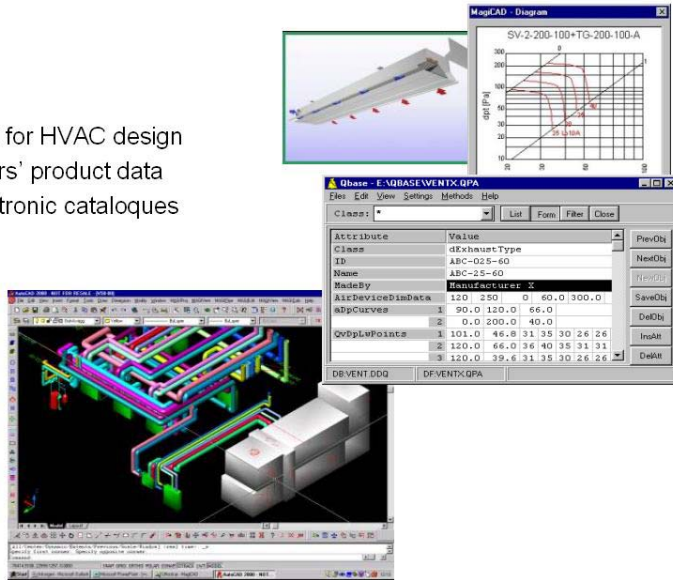
V4 • 25.8.2001

<p><b>Energy Simulation</b></p> <ul style="list-style-type: none"> <li>• Thermal simulation tool for entire building life cycle</li> <li>• Currently based on DOE 2.1E</li> <li>• Developed in collaboration with LBNL</li> <li>• IFC compliant by <a href="#">BSPPro link</a></li> </ul>	<p><b>Comfort Simulation</b></p> <ul style="list-style-type: none"> <li>• Thermal simulation tool for entire building life cycle</li> <li>• Currently based on DOE 2.1E</li> <li>• Developed in collaboration with LBNL</li> <li>• IFC compliant by <a href="#">BSPPro link</a></li> </ul>
<p><b>Visualization and Lighting Simulation</b></p> <p>Photorealistic visualisations Lighting simulations Links to product data</p>	<p><b>CFD Simulation</b></p> <p>CFD = Computational Fluid Dynamics</p> <ul style="list-style-type: none"> <li>• CFX tool by AEA Technology</li> <li>• Simulation of temperature stratification and air velocities</li> <li>• Especially for high spaces with high cooling loads</li> <li>• IFC compliant by <a href="#">BSPPro link</a></li> </ul>

## MagiCAD

Progran Oy

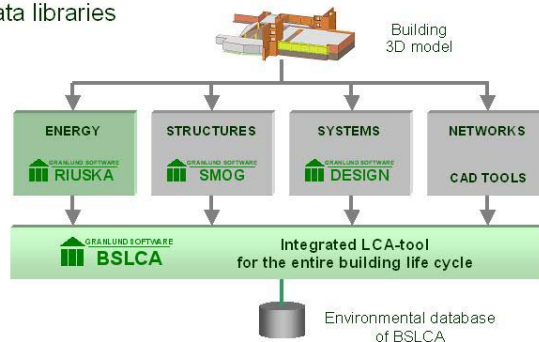
- 3D CAD tool for HVAC design
- Manufacturers' product data
- Links to electronic catalogues



# Environmental Analysis (LCA)



- Integrated tool for ecological design
- Buildings, technical systems, equipment
- Throughout the design process
- Granlund's LCA data libraries





# Construction Process

- Wide utilization of design data
- Information as a part of the product:
  - Building maintenance database based on as-built information will be delivered as a part of the production
  - eCommerce is not just procurement and transactions; product information must be a part of the eCommerce
    - electronic product libraries with direct interface to design and procurement software and building data models ⇒ IFC compliant XML

# YIT Cost and Value Engineering Tool

YIT

COVE



Product Model

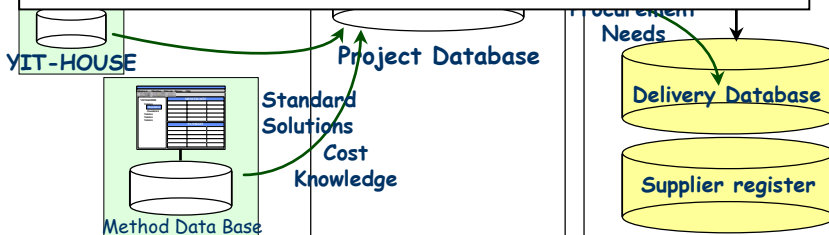
Quantity

Tender Calculation

Task Management

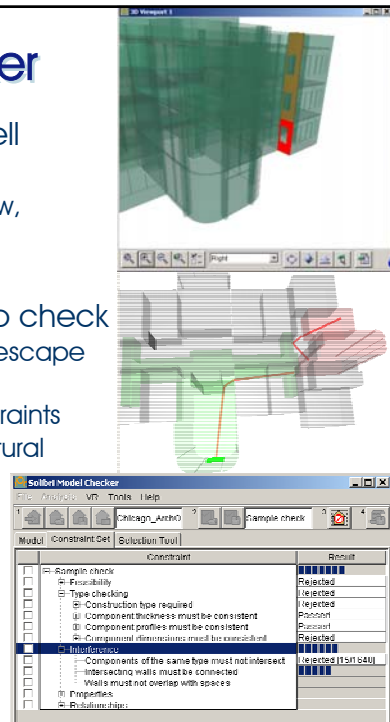
Delivery Management

The model based system saves **50-80%** of the work in cost estimation, and the accuracy in the early stages improves from **+/- 15%** to **+/- 3%**



## Solibri Model Checker

- First commercial Design Spell Checking product
  - Released at AEC Systems Show, Chicago June 19th 2001
- VR for visual checking
- Any number of constraints to check
  - Best practices, interferences, escape routes
  - Able to download more constraints
  - IFC support, but no IFC's structural limitations
  - User can adjust or create constraints
- Communication with HTML/XML reports



## Lifecycle Management

- Key people are the clients; building owners and facility managers
  - they will have the most benefits
  - they can set the requirements
- Better tools for early decision making
  - LCA and LCC tools
  - maintenance simulations
- Better tools for FM/PM
  - better budgeting tools
  - better utilization of resources
  - better management for preventive maintenance
  - lower costs for maintenance

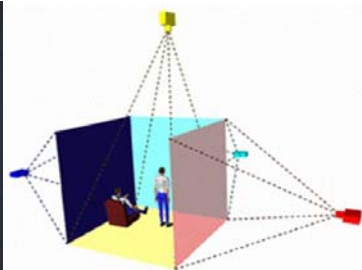
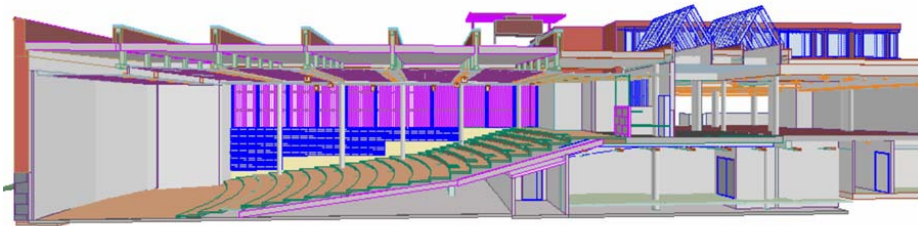


## What did we benefit?.....

- Life cycle studies and alternative comparisons
  - *Full life-cycle analysis available in early design*
  - *Decisions based on accurate information*
  - *Minimizing of risks in decision making*
- Reliable budget and cost control
  - *Supply management: quantities*
  - *Impact of each change evaluated*



## Decision Support by Visualization and VR Technology





## How do we continue?.....

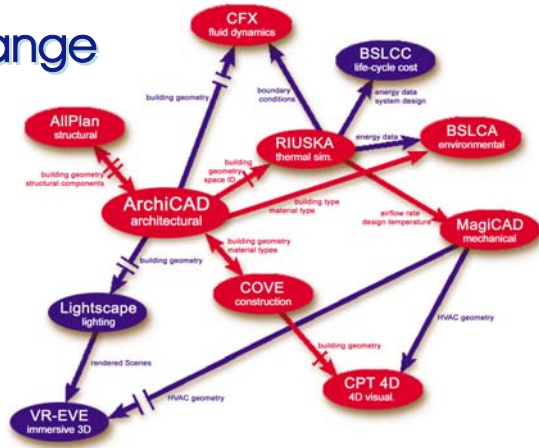
- A new pilot project using PM (Product Model) approach
  - *Piloting Product Model in Pre-Project Planning*
- Modeling of existing buildings
- Participating in PM development
- Facilities management software developers – get along
- New Business practices
  - *processes, roles, responsibilities*
  - *requirements to use PM-enabled tools*

Some Conclusions &  
Future Development



# Data Exchange

Main product model applications, information sharing examples, and experiences learned from the HUT-600 project - middleware and internal database are omitted

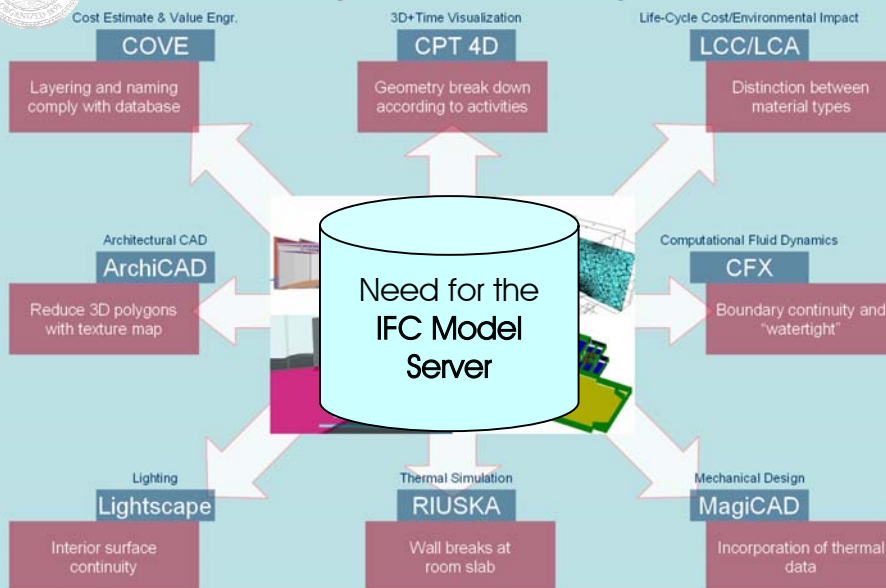


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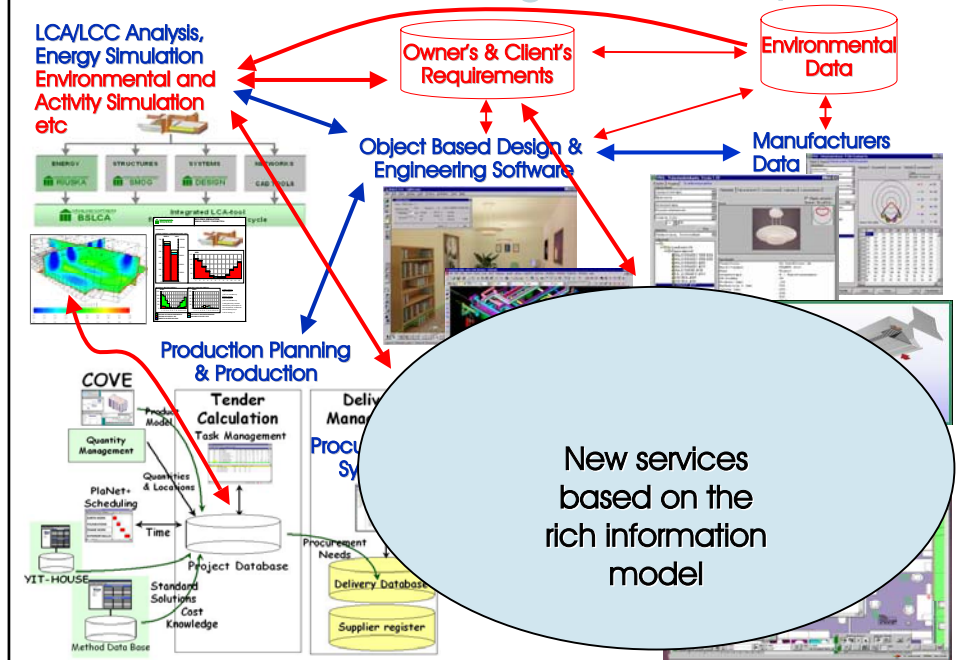
- Non IFC-compliant application (Chapter 4.2)
- IFC-compliant application (Chapter 4.2)
- One-way info. sharing (Chapter 5.1)
- One-way info. sharing through IFC (Chapter 5.2)
- Interventions required (Chapter 5.1)
- A few correctable errors (Chapter 6.2)
- Major errors in sharing (Chapter 6.2)
- Two-way Info. sharing through IFC (Chapter 5.2)



# Different Input Data Requirements



# Value Network of Integrated ICT Systems



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ホームページでもご案内しています。

<http://www.finland.or.jp/index-j.html>