

Software Interoperability and Information Networking in the Construction Industry

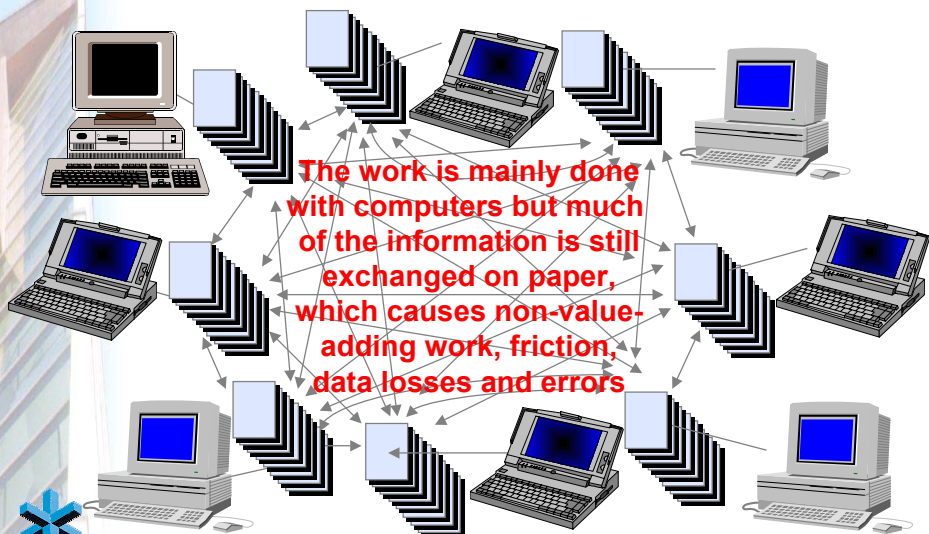
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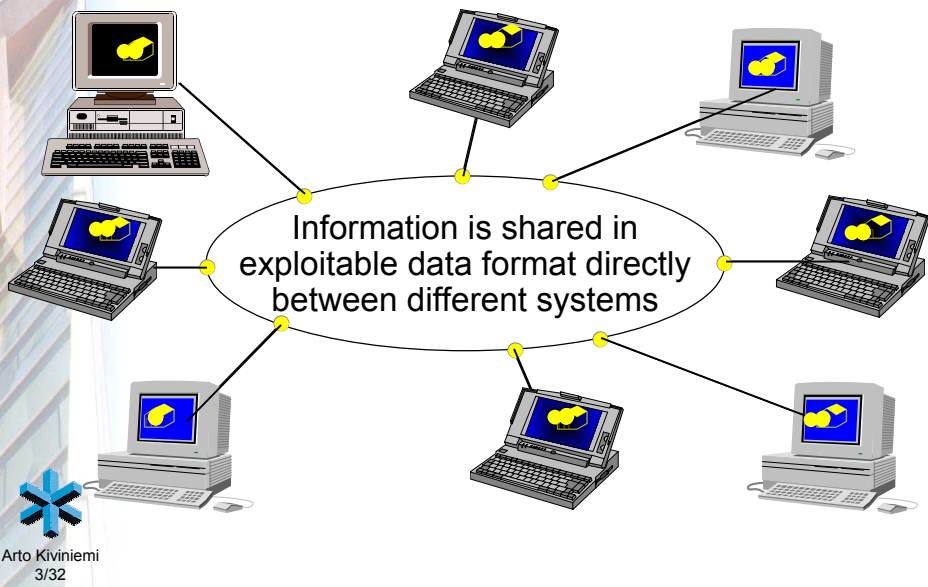
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Current Situation



Goal in the Future



Requirements for Networking

- Infrastructure
 - high-capacity networks
- Information language
 - standardised data structures
 - software support for data sharing
- Tools
 - computers connected to the networks
 - software support for collaboration
- Culture
 - will to collaborate
 - ICT know-how



Common Information Language

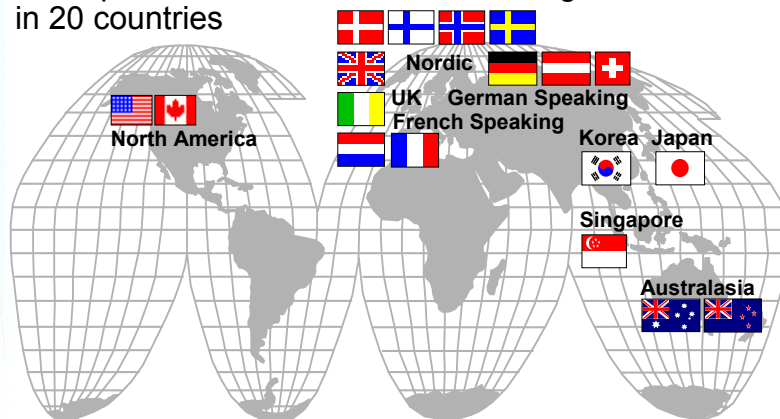
Information Networking
in the Construction Process



IAI - International Alliance for Interoperability



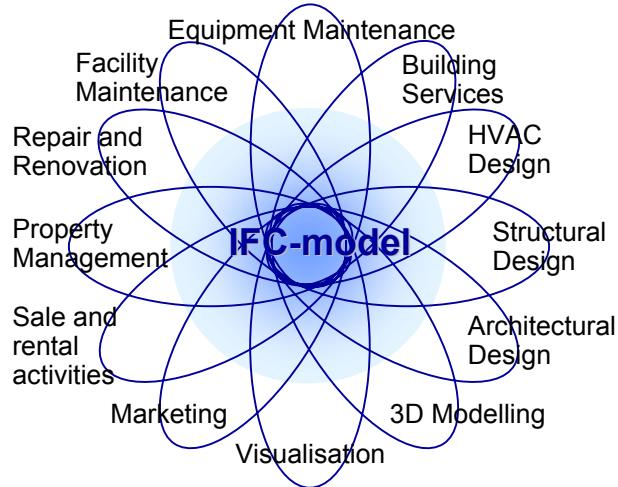
Defining IFC (Industry Foundation Classes) - an industrial product data model describing buildings
First commercial IFC implementations available
9 Chapters, more than 650 member organisations
in 20 countries



Different views to the building



Many activities in the construction industry and FM tasks, only the bare data information



Concepts Supported in IFC



- Cross industry
 - projects, buildings, building storeys, design grids, constraints (design, building codes, budgets), networks (topology), library links over Internet
- Architectural design
 - spaces, walls, doors, windows, columns, beams, floors, roof slabs, curtain walls, roofs, stairs, ramps, restrooms, elevators, escalators, cabinets, counters, accessories
- HVAC design
 - HVAC equipment (all kinds), ducting and piping systems, thermal load calculations
- Construction Management
 - costs & cost schedules (for quantities and cost estimating), work tasks & work groups (for work planning & scheduling)
- Facilities management
 - furniture, office equipment, occupants, panel systems, asset information, work orders & move plans (for occupancy planning / move management)
- Building codes
 - energy code checking, occupant escape from fire, handicapped access to buildings



Current IFC Products



- acadGraph - Alberti for spatial design
- Autodesk - AutoCAD Architectural Desktop 2
- Bentley - MicroStation and CAD platform
- DOE-PNNL -energy code checking
- Fujitsu, architectural CAD
- Graphisoft - ArchiCAD
- LBNL - visualisation, energy simulation
- M&M - RoCAD, HVAC engineering
- MB Software - low-cost architectural CAD
- NEC - NcadArc, architectural CAD
- Nemetschek - CAD for architects, CAD and FEM for structural engineers, CAD for contractors and FM software
- Olof Granlund - IFC interface to SMOG and Riuska (thermal performance simulation)
- Point Gruppen - ADT2 localisation, IFC interface to PointARXi
- Primavera - scheduling
- Progman - MagiCAD, HVAC CAD
- Sofistik - SofiCAD, structural engineering
- Timberline - cost estimation
- Microsoft Visio - low-cost 2D-CAD
- YIT - COVE, process management for contractor



Vera Technology Programme



Vera Information Networking in the Construction

Process Finnish national Construction IT Programme by Tekes (National Technology Agency)

- **Schedule** - six years; 1997 - 2002

- **Total volume**

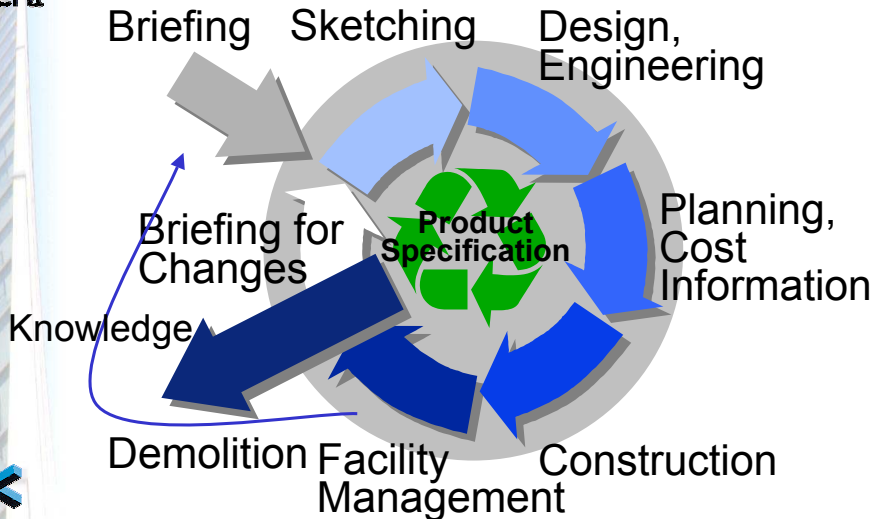
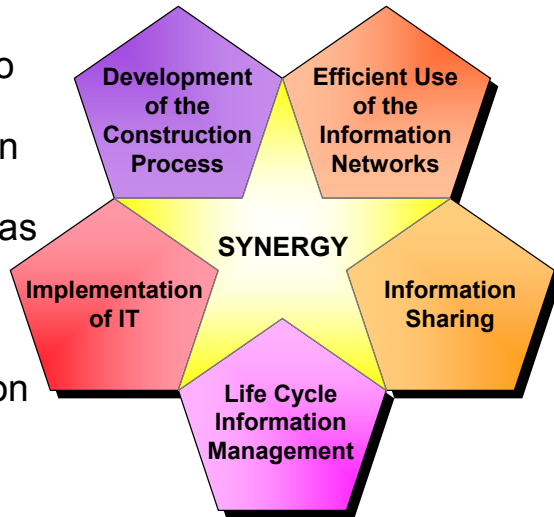
<i>Original budget</i>	~170 million FIM	(~28 million €)
Current estimation	~240 million FIM	(~40 million €)
~40...45 % by Tekes	~100 million FIM	(~17 million €)
~60...55 % by the industry	~140 million FIM	(~23 million €)

- **Current situation**

Research projects:	31	/ 20 million FIM	(3.3 million €)
Industrial projects:	70	/ 120 million FIM	(20.0 million €)
Total:	101	/ 140 million FIM	(23.3 million €)



The target is to promote the implementation and use of IT and networks as the enabling technologies to re-engineer the construction process





Tools and Processes

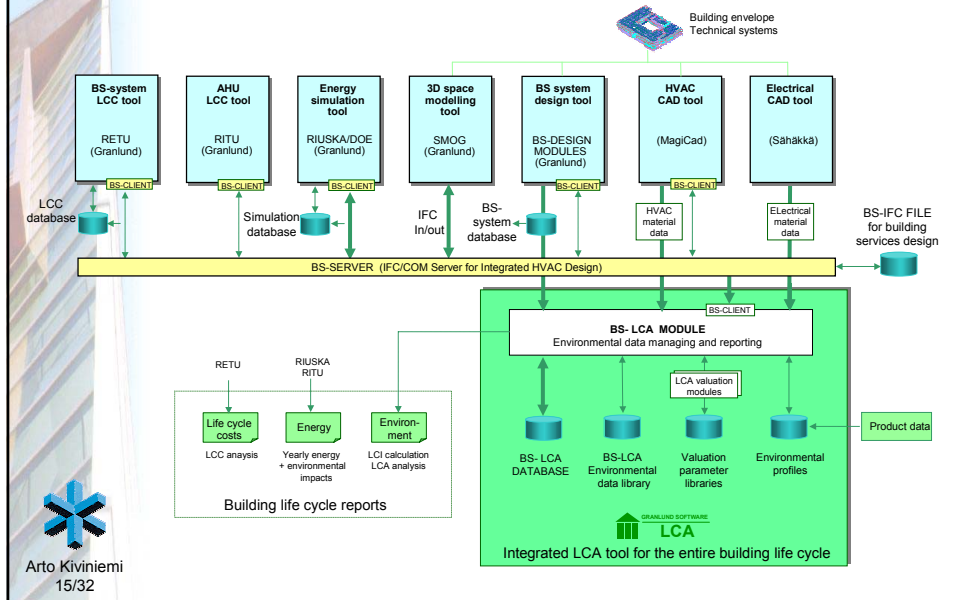
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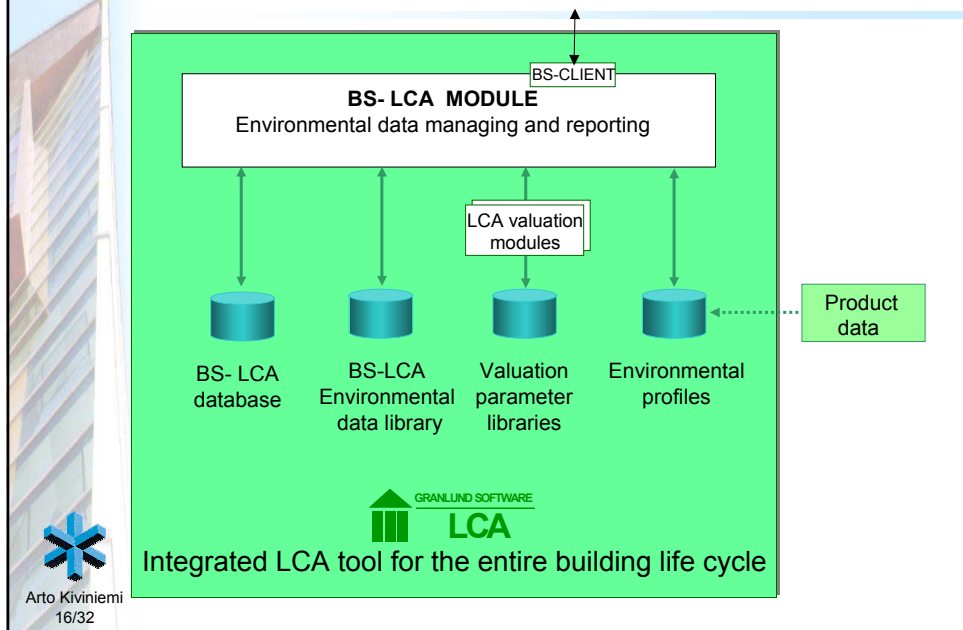
Design and Engineering Processes

- Models can contain complex rules for behaviour and relations between objects
 - (semi)automated design integration and code checking
 - easy and cost efficient evaluation and simulation at any project stage
 - thermal, lighting and performance simulation
 - more accurate cost estimation
 - environmental evaluation
- New service areas for designers/engineers
 - LCA/LCC services
 - information maintenance
 - FM services...

BS- LCA Model of Olof Granlund



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Construction Process

- Information as a part of the product:
 - building maintenance database based on as-built information will be delivered as a part of the building
 - product information must be a part of the electronic procurement and commerce
 - electronic product libraries with direct interface to design and procurement software and building data models - XML ?
 - environmental profile must be included in the product data



SPADEX Spatial Data Exchange Project

AIO Group Oy ARXi

- IFC-file Open
- Modifications
- Additions

Olof Granlund Oy SMOG/RIUSKA

- Spatial data mgt
- Heat loss calc.
- Cooling load calc.
- External data base
- Energy simulation

YIT Corporation COVE

- Production methods
- Alternatives
- Cost estimation
- YIT
- External data base
- Production planning

A-Insinööri Oy ConcreteCad

- Element schedule
- Bill of materials
- Production drawings

Progman Oy MagiCAD

- Ventilation system modeling
- Material schedule

VTT ProMoTe

- VR model creation
- Graphical interface to model
- Visualization

SPADEX IFC - FILE

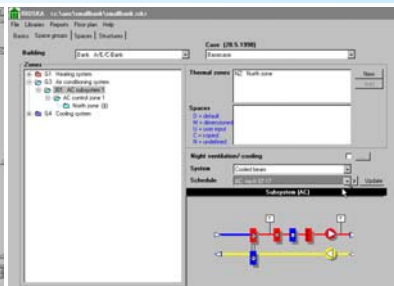
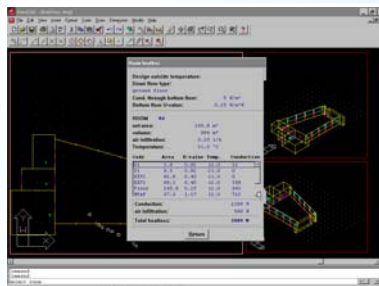


Lifecycle Management

- 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
 - less unused spaces
 - better management for preventive maintenance
 - lower costs for maintenance



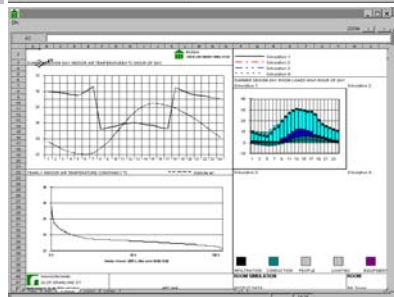
New Tools for Simulation



SMOG/RIUSKA

by Olof Granlund

- use of IFC building objects
- based on the DOE simulation engine
- Supports both IFC through an IFC/COM Server





Culture

Information Networking in the Construction Process



Barriers to the Change

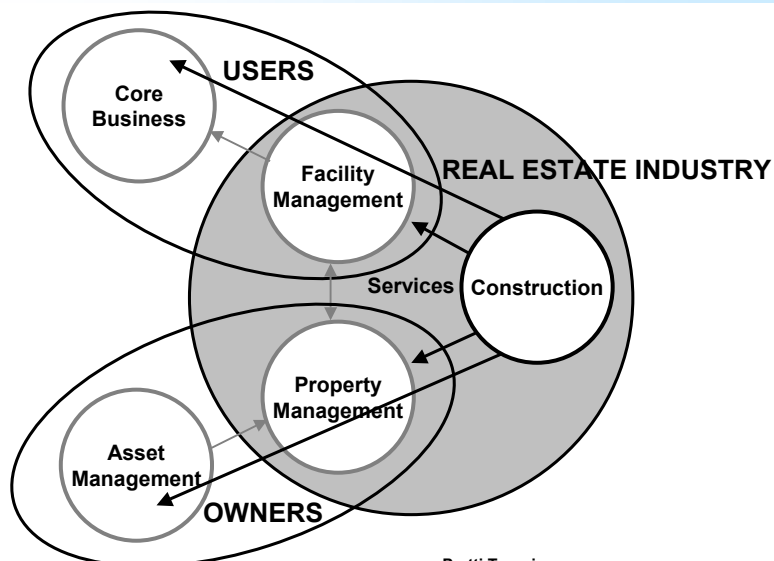
- The change to data sharing is not only technical - it is much more cultural
 - new work processes
 - sufficient IT skills
 - true co-operation in projects
- The pre-study for the Vera programme in 1996-1997 showed that the lack of IT skills and know-how in the industry is the main barrier to the wider implementation of IT
 - wide range of education is a necessity

Driving Forces for Changes

- Facility and property management:
 - more complex requirements for buildings
 - more accurate information for FM activities
 - more profit for the investments in buildings
 - inflation does not help as it used to do
 - environmental and life cycle issues are coming more and more important
- The need to improve productivity
 - removal of non-value adding work
 - re-use of information
 - better process and information management



New View to the AEC/FM Industry



New Business Concepts

- "Drafting" ⇒ information management
 - paper document ⇒ digital information
 - traditional documents ⇒ product models
 - "document" ⇒ a view of the model from a specified angle at a specified moment
 - **technical and juridical problems**
- Information will be produced for:
 - decision making and production
 - **use and maintenance of buildings**
- Minimising the cost ⇒ maximising the added value

