



Vera - Information Networking in the Construction Process

Finnish National Construction IT Programme 1997-2002

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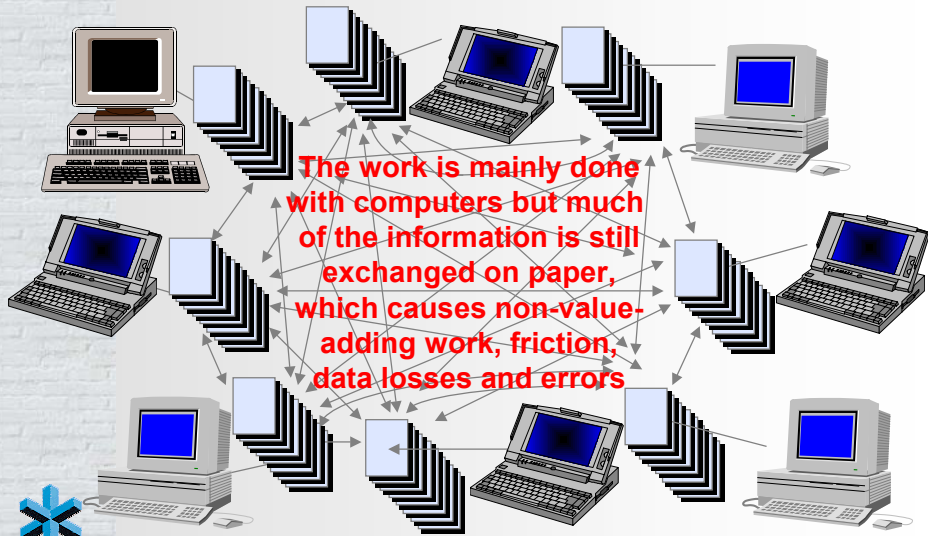
Information Management

- AEC/FM industry is an information intensive branch:
 - all design and engineering activities
 - procurement and delivery control
 - call for bids, making offers and comparing alternatives
 - contract management
 - cost and utilisation degree control
 - maintenance planning and budgeting
 - technical and security system control in buildings...





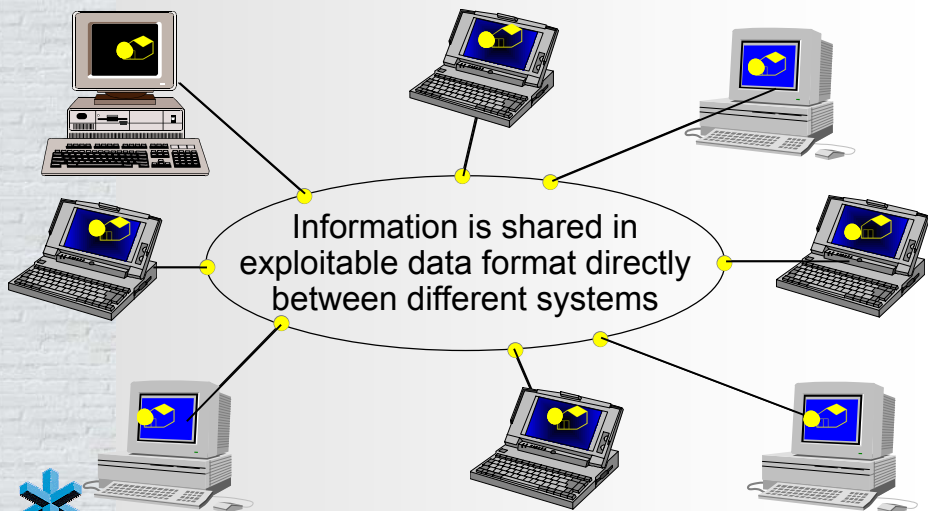
Current Situation



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Goal in the Future



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Driving Force for Changes

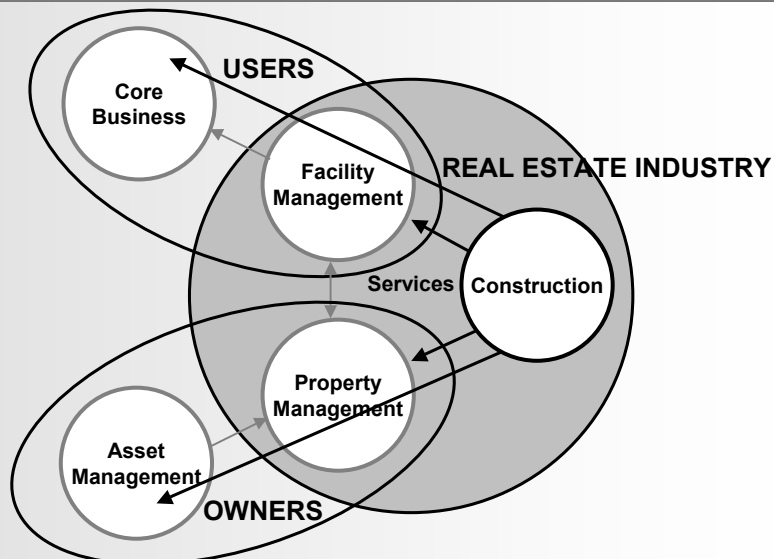
- Facility and property management:
 - more complex requirements for buildings
 - more accurate information for FM activities
 - more profit for the investments in buildings
 - inflation does not help as it used to do
 - environmental and life cycle issues are coming more and more important
- The need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



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New View to the AEC/FM Industry



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Technological Possibilities

- Software technologies
 - product model development - IFC, STEP
 - object oriented software
 - middleware, model servers, data repositories
- Information networks
 - virtual workgroups
 - project data access
 - product data access
 - information management through web
 - e-business



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Some Studies of Potential Savings

- Germany
 - savings of 2 billion DEM/year just by improving the quality of DXF data
 - hypothesis: work decrease of 50% in the receiving company
 - *Wolfgang Haas 1998*
- Finland
 - potential savings of 7% in the construction costs by efficient IT use
 - This estimation did **not** include any savings which could come by reducing errors with better information management
 - *Enkovaara & Heikkonen 1998*
- AEC3 (several countries)
 - removal of information re-keying would enable savings of 16% in the construction
 - *Thomas Liebich & Jeffrey Wix 1999*
- CAD & other building data exchange in USA
 - DOD uses US\$ 40 million per month in additional work because of the lack of standards
 - DOD is 4% of US markets -> 25*40M per month in US -> US\$ 12 billion per year in USA
 - *Dana Smith, US Department of Defence 1999*



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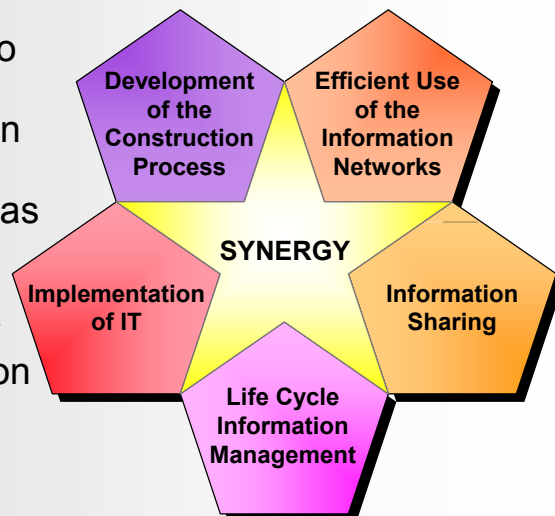
Goals and Resources in the Vera Programme

Information Networking
in the Construction Process



Vera Programme Components

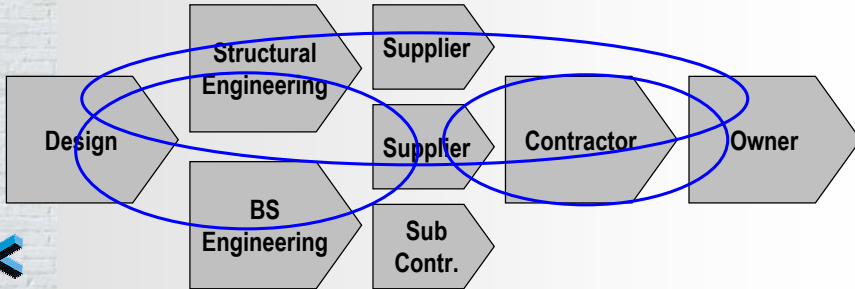
The target is to promote the implementation and use of IT and networks as the enabling technologies to re-engineer the construction process





Project Principles

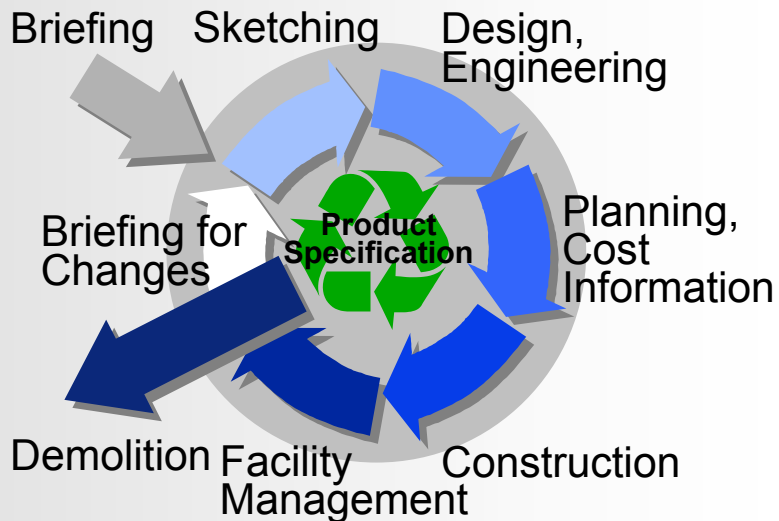
- Develop the construction process and IT solutions simultaneously and promote R&D in networks
 - Projects which include several parts of the value adding chain in construction process
 - No interest in projects for just one domain



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Information Lifecycle



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Vera Programme

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

Mid-evaluation started in the beginning of January,
results will be published in April

- **Current situation**

Research projects: 26 / 14 million FIM (20 million SEK)

Industrial projects: 69 / 116 million FIM (170 million SEK)

Total: 95 projects / 130 million FIM (190 million SEK)

Short project presentations in the web: <http://cic.vtt.fi/vera/english.htm>

- **Volume**

Original budget ~170 million FIM (~250 million SEK)

Current estimation ~220 million FIM (~320 million SEK)

~45 % by Tekes ~100 million FIM (~145 million SEK)

~55 % by the industry ~120 million FIM (~175 million SEK)



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IAI/IFC Activities

Information Networking
in the Construction Process

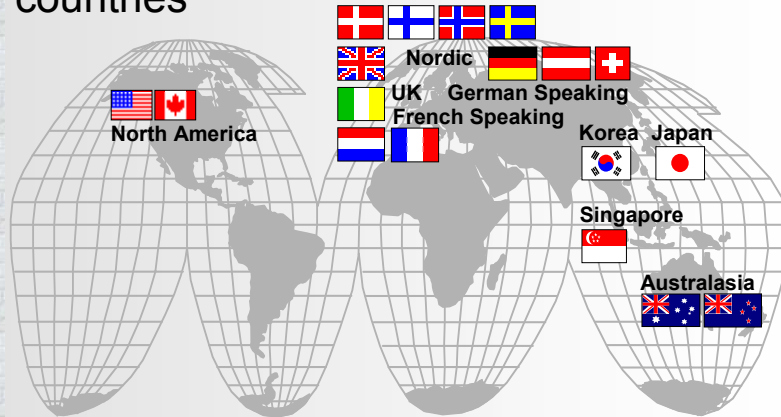


TEKES



International Alliance for Interoperability

- currently 9 Chapters
- ~ 650 member organisations in ~20 countries

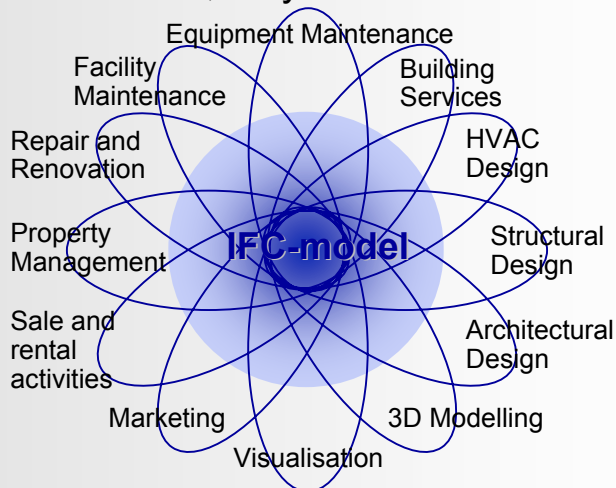


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Coverage of the IFC Model

- Many activities in the design and construction industry and FM tasks, only the basic information



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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



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IFC 1.5/2 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
- Visio Technical - low-cost 2D-CAD
- YIT - COVE, process management for contractor



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Why are we supporting IFCs ?

- One of the key elements for Vera programme is the information sharing
 - urgent need for a “common software language”
 - currently 42 projects with a connection to IFCs = 44% of the total volume
- IAI started at the right time for us
 - incremental development enables immediate implementation
 - IAI is the most active area on the data definition for construction industry
 - same modelling language with STEP ⇨ some areas can possibly expand to ISO work in the future



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Future Technologies

- First interoperable software generation(s) will be based on data transfer
- Next generations will be based more on data sharing - runtime interoperability
 - middleware
 - model servers
 - data repositories...
- Role of other data formats: SGML / XML ?
 - standardisation must happen both on general and industry level
 - same data structures for different formats



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Barriers to the Change

- The pre-study for the programme in 1996-1997 showed that the lack of IT skills and know-how in the industry is the major barrier to the wider implementation of IT
 - wide range of education is a necessity, but the problem is that it can not be funded in a technology programme
- The change to data sharing is not only technical - it is even more cultural
 - new work processes
 - true co-operation in projects



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Consequences for the Construction Process and the Role of the Client & Property Manager

Information Networking
in the Construction Process



TEKES



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
- New service areas for designers/engineers
 - LCA/LCC services
 - information maintenance
 - FM services...



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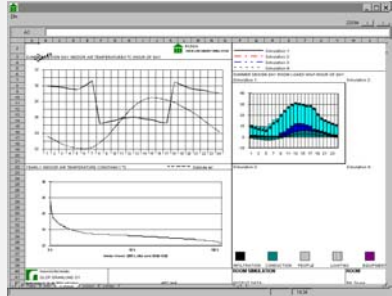
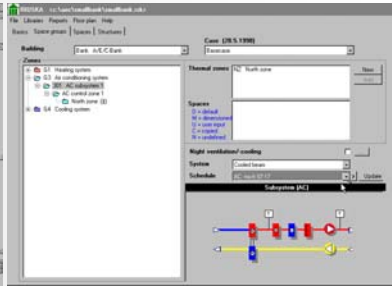
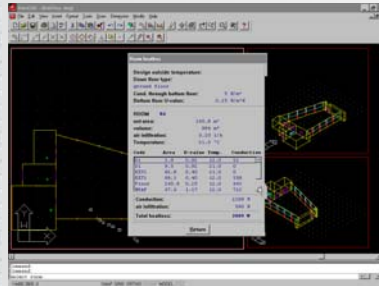


Design and Engineering Processes

- "Drafting" \Rightarrow information management
 - paper document \Rightarrow digital information
 - traditional documents \Rightarrow product models
 - "document" \Rightarrow a view of the model from a specified angle at a specified moment
 - the actor who needs a specific view can produce it directly from the data
 - **technical and juridical problems**
- Information will be produced for:
 - decision making and production
 - use and maintenance of buildings



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SMOG

(Space Modeler of Olof Granlund)

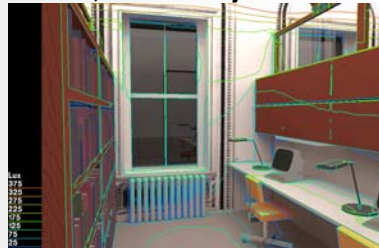
- use of IFC building objects
- based on the DOE simulation engine
- Supports both IFC R1.5.1 and R2.0 through the IFC/COM Server



Viva - a lighting design and simulation tool by Olof Granlund



IFC R2.0 SI-1: Photo Accurate Visualisation, Vladimir Bazjanac/LBNL





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 production
 - 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 ?
- Change will not happen if the lowest price is the only selection criteria



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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



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Lifecycle Management

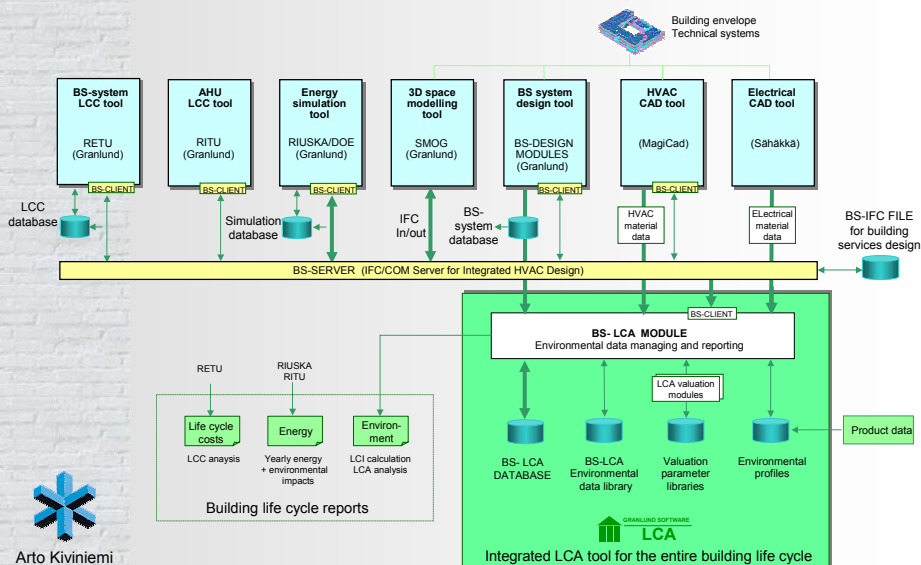
- Key people are the clients; building owners and facility managers.
 - they will have the most benefits
 - they can set the requirements
- Better tools for early decision making
 - LCA and LCC tools
 - maintenance simulations
- Better tools for FM/PM
 - better budgeting tools
 - more effective use of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



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BS- LCA Model of Olof Granlund



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ICT Strategy

- Technology already exists, **the problem is how to use it with your partners**
- Connection to your core business ?
 - **WHY**, what, how, when, who ?
 - model your processes
 - re-engineer the problem areas
- When you know **what you need for your own activities**, you can set the demands for information
 - strategic alliances/partnership



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“Knowledge is the
only meaningful
asset”



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