IFC-based Product Model Exchange

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CIFE Summer Program 2001
Stanford University, CA
September 13, 2001

Granlund Today

Figures

- Founded 1960
- Personnel 260
- Export 15 %
- Turnover 88 milj. FIM (14 mill. USD)

Activities

- Building services (BS) design
- Facilities management (FM) consulting
- Software development for Design and FM
- Building life cycle data management

Offices

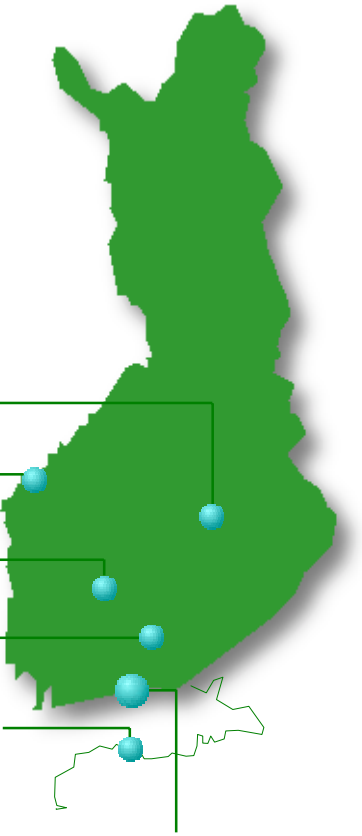
Granlund Kuopio

Granlund Vaasa

Granlund Tampere

Granlund Lahti

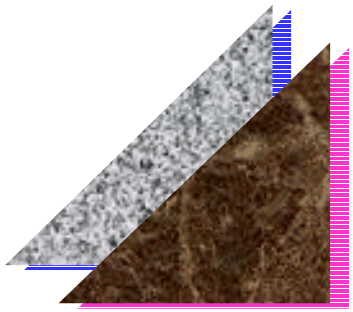
Granlund Eesti Tallinn



Granlund Helsinki

The Integrated Building Design and Construction Process

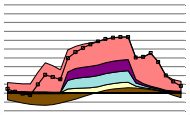
- Performance and cost targets for the building Collaboration
- Continuous maintenance of project data through the whole building life cycle
- Communication between disciplines and project phases
- Re-use of design data
- Use of design and performance analysis models and tools for component and system optimization
- Interoperability between different software
- Internet (Project Management & eBusiness)
- Collaboration and partnership among building owners, architects, engineers, financiers and other key players



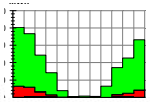
Integrated Design Process Tools

Simulation and analysis tools

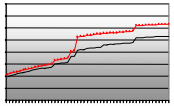
Comfort Simulation



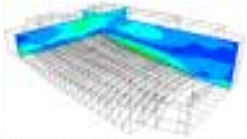
Energy Simulation



Life cycle analysis LCC / LCA

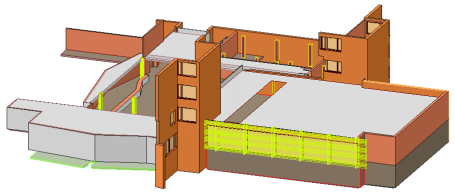


CFD Simulation



Visualization Lighting simulation

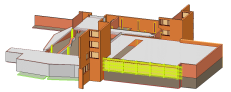
3D model of the building (IFC)



Design, production and FM tools

- Architect design
- Structural design
- HVAC design
- Production planning
- Facilities management

4D Simulation



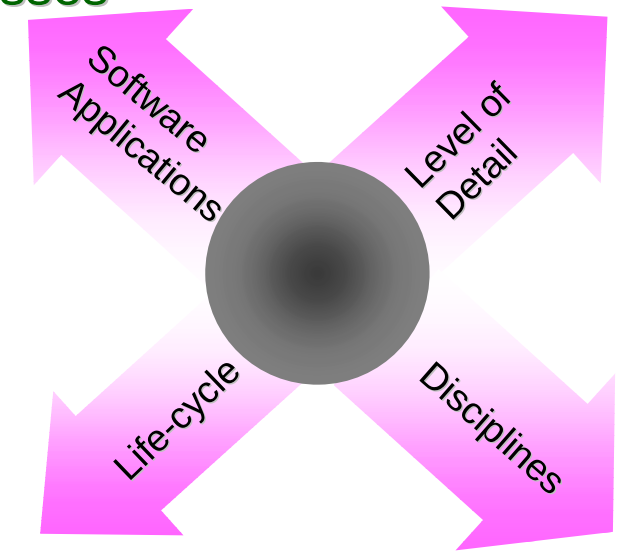
Virtual reality

What can you expect from the IFC Model?

IFC Object Model is "enabling interoperability between AEC/FM applications from different software vendors"

IFC information Axes:

- disciplines involved in AEC/FM processes
- life-cycle stages of AEC/FM projects
- level of detail required
- software applications used



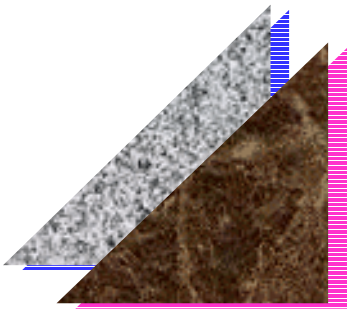
IFC model has to be structured:

- diversification to cope with various information axes
- centralization to harmonize and integrate the various modules

TEKES

Some possible IFC use cases

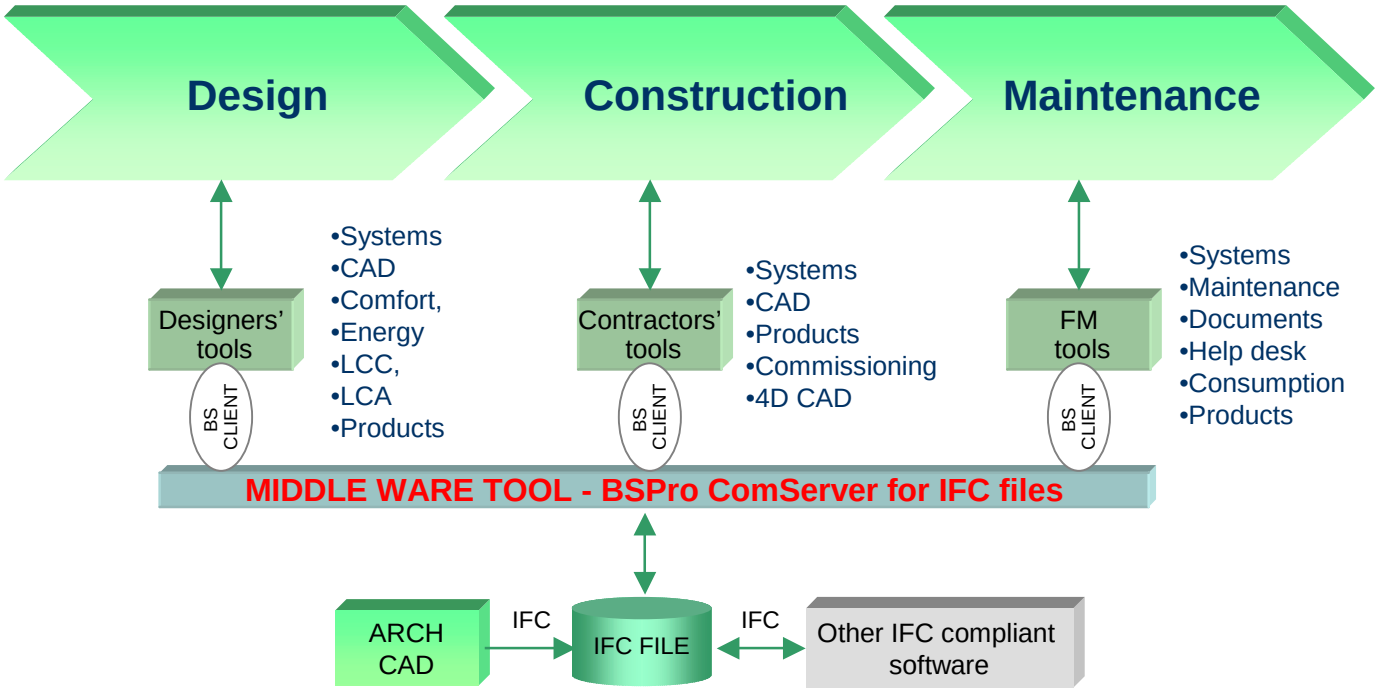
- Exchange of basic building model with 3D shape between CAD systems
- Visualisation of building model
- Building design ⇨ Time scheduling
- Building design ⇨ Quantity take-off ⇨ Cost estimation
- Building design ⇨ HVAC design ⇨ Thermal load calculations
- Space and surface temperature calculation ⇨ CFD-modelling
- HVAC design ⇨ Energy code checking
- Building design ⇨ Basic structural design
- Building design ⇨ FM / Maintenance
- Building design ⇨ FM / Occupancy planning



VTT

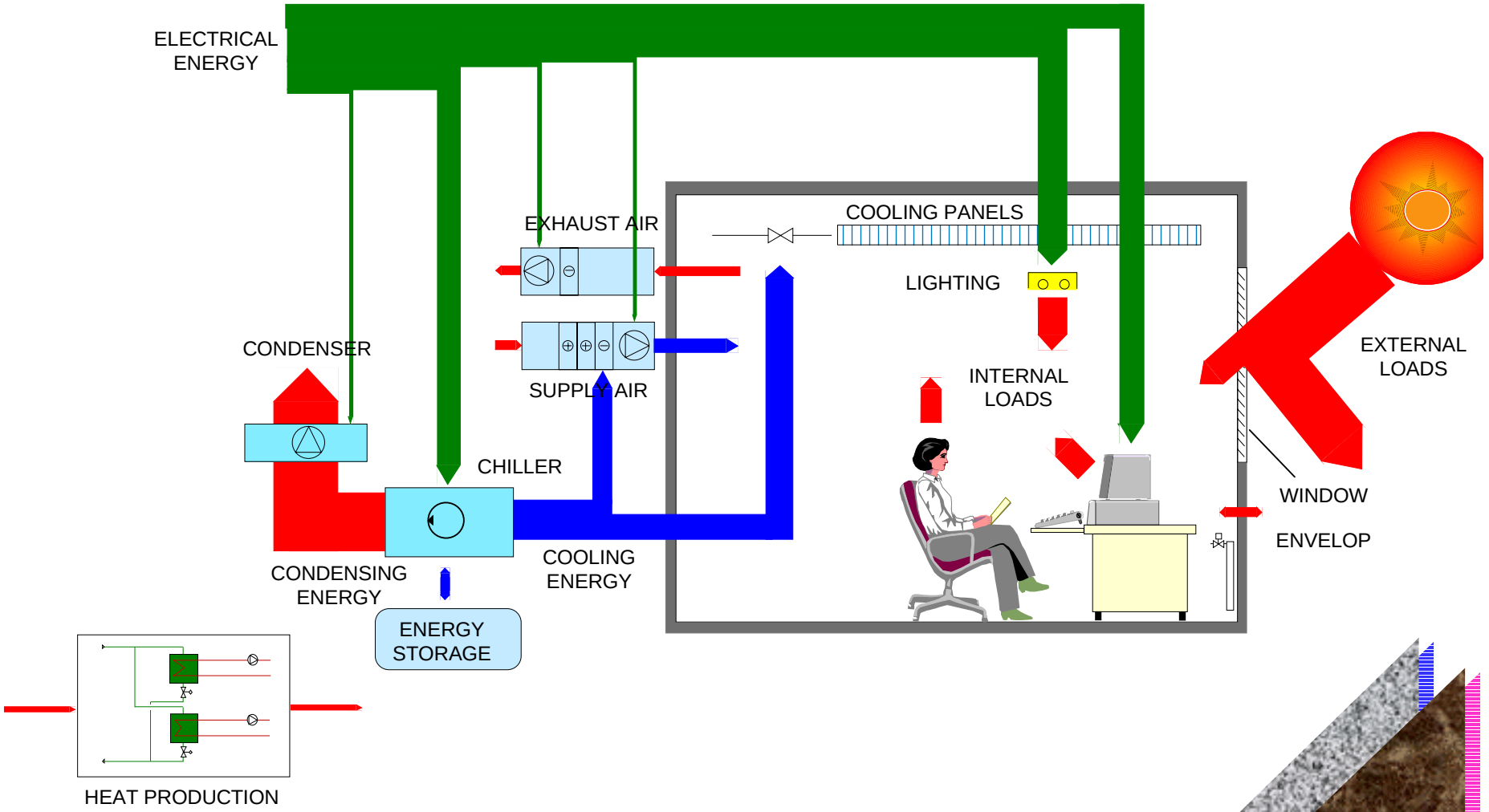
Arto Kiviniemi

Vision of BS Software Integration



Life cycle data repository for building services

Managing IAQ and Thermal Conditions



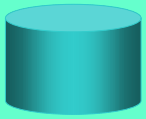
Life Cycle Data Management

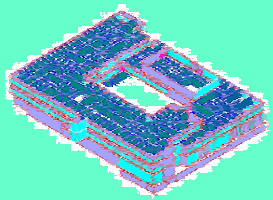
BUILDING SERVICES DESIGN

Design tools

- System Design
- 3D Modeling
- Simulation
- LCC
- LCA
- CFD
- Visualization

CAD





3D space model

CONSTRUCTION COMMISSIONING

Building services database

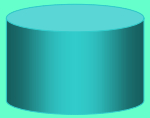
Data input module

As-built data Commissioning

FACILITIES MANAGEMENT

Technical facilities management

FM Tool



Other facilities management systems

Data exchange links

Building automation

Software Integration

GRANLUND SOFTWARE
BSPro

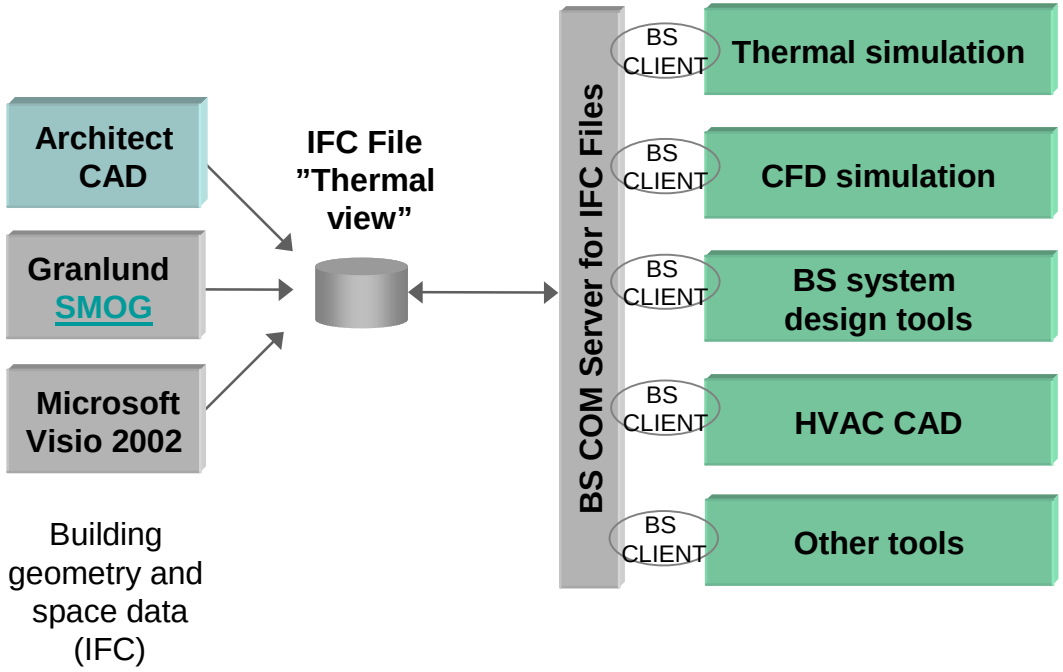
The product has been certified by the IAI to comply with the IFC 1.5.1 standard

- A middleware tool for exchanging IFC-compliant data
- Easy linking of new and existing software
- Current version handles building geometry and thermal data
- Based on Microsoft's COM technology

Alternative 1:
IFC compliant
architect CAD tools

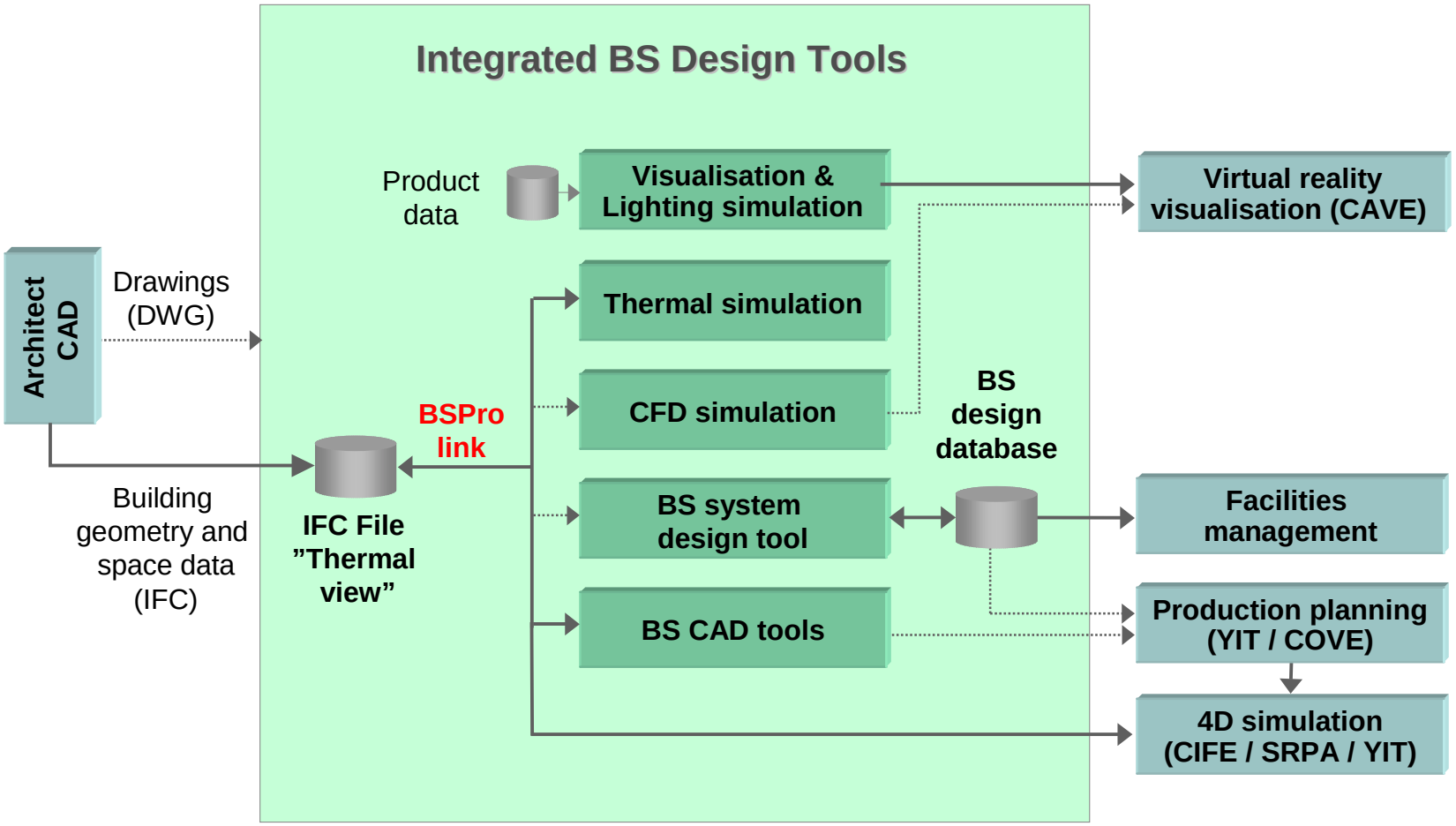
Alternative 2:
Granlund's
3D modeler

Alternative3:
Other IFC compliant
3D modeling tools



Integration of BS Design Tools

PM4D Project / HUT 600 Auditorium Case



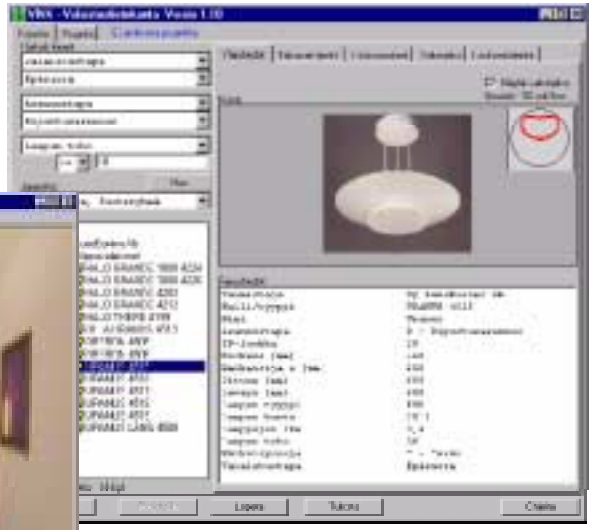
Visualization and Lighting Simulation

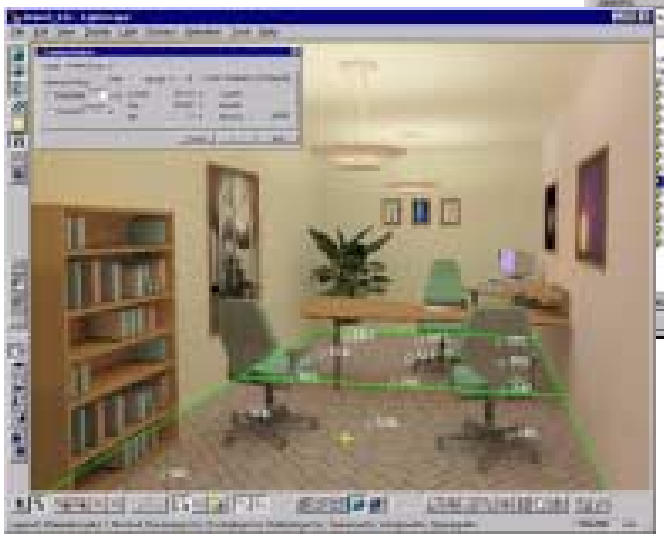
GRANLUND

Photorealistic visualizations

GRANLUND SOFTWARE
VIVA

LightScape™

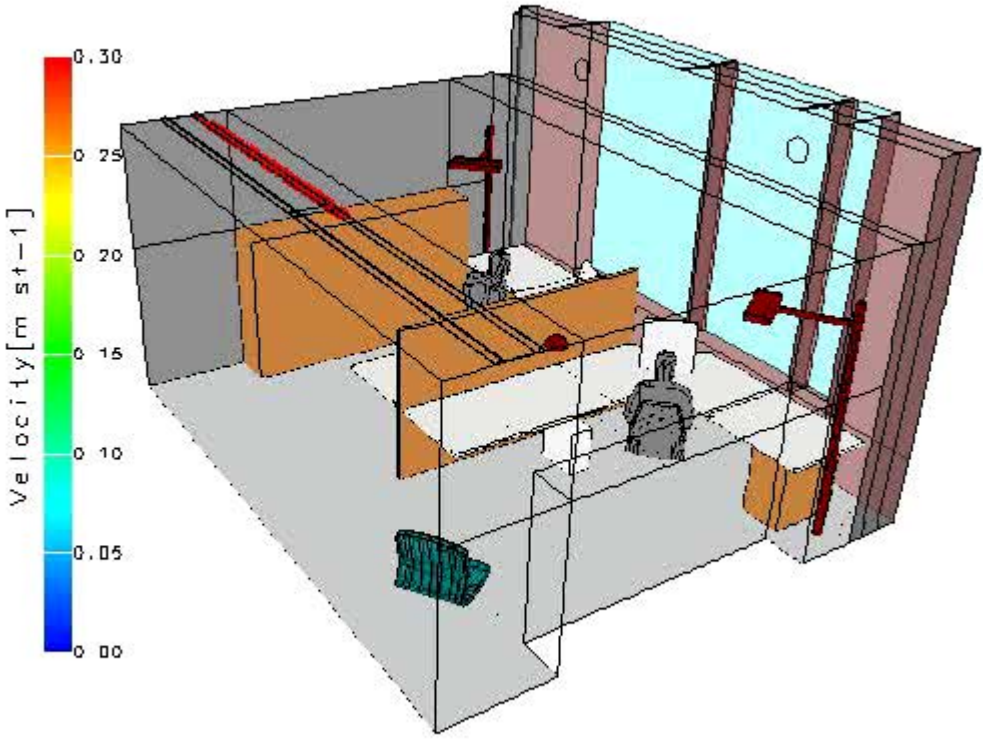




Lighting simulations
Links to product data

Computational Fluid Dynamics Simulation (CFD)

- CFX is a product of AEA Technology
- Simulation of temperature stratification and air velocities
- Especially for high spaces with high cooling loads
- IFC compliant by BSPro link
- Visualization of a certain moment or animation



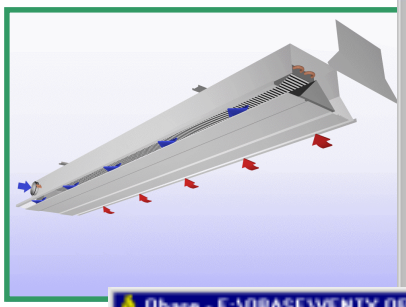
CFX

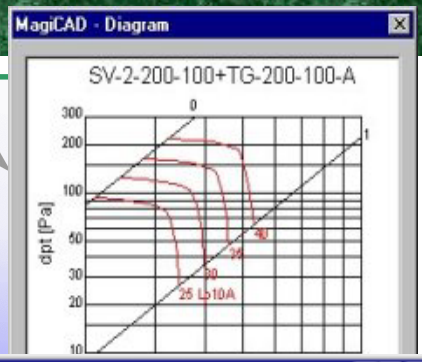
HVAC Design

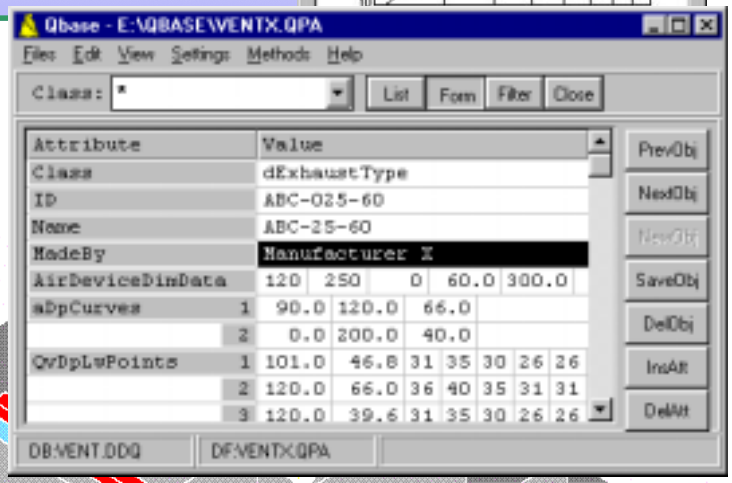
MagiCAD

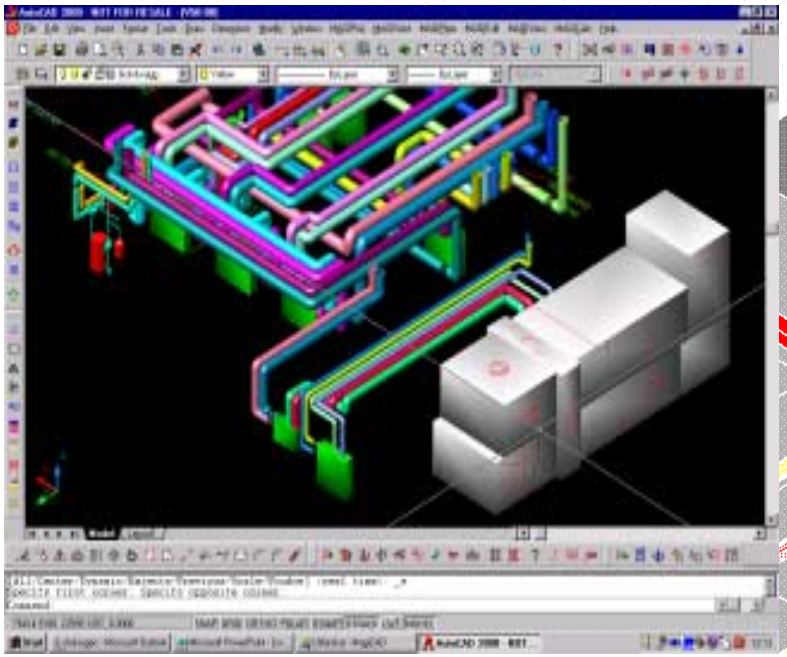
PROGMAN OY
Future HVAC Solutions Now

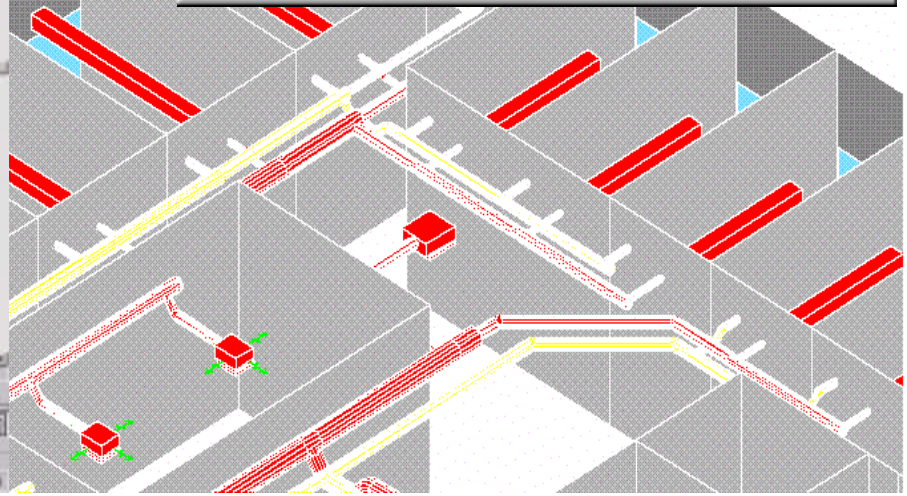
- 3D CAD tool for HVAC design
- Manufacturers' product data
- Links to electronic catalogues



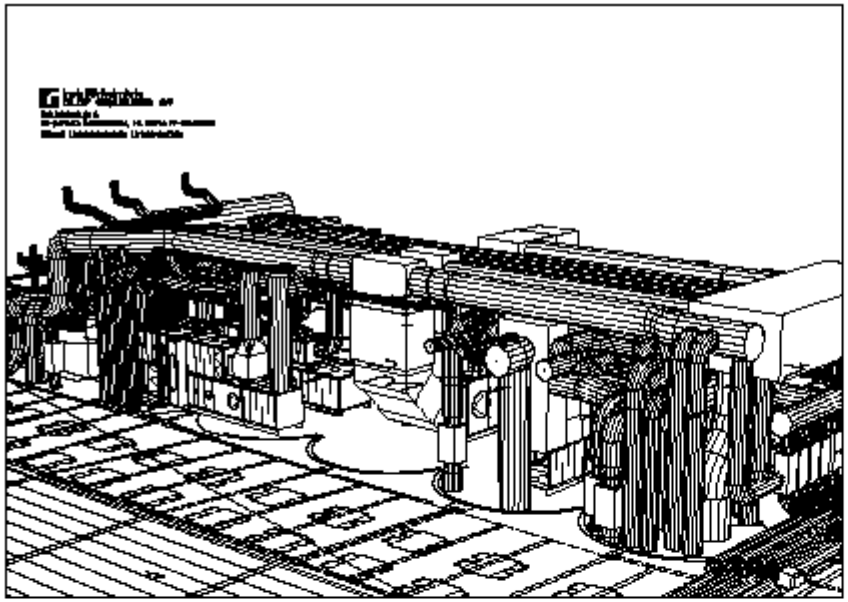


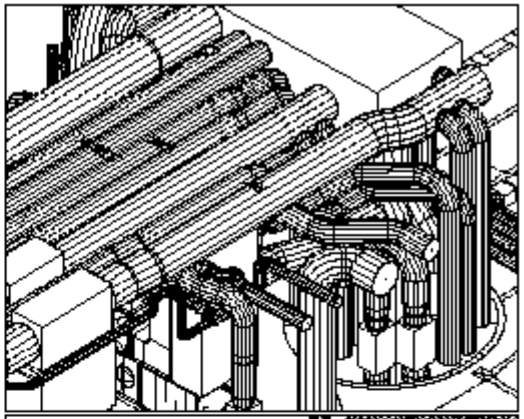


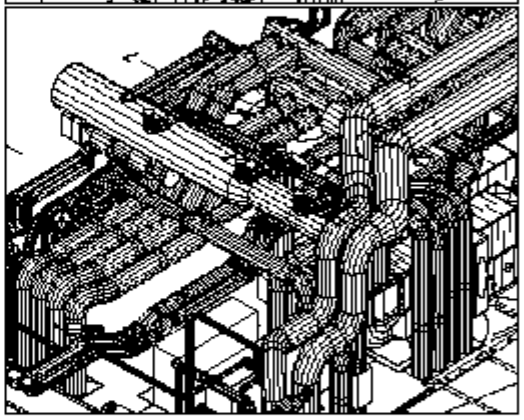


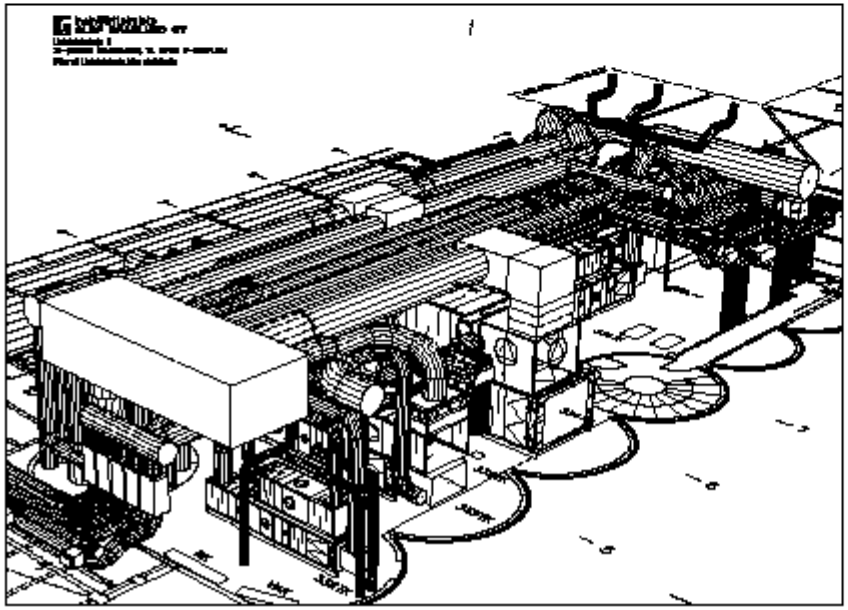


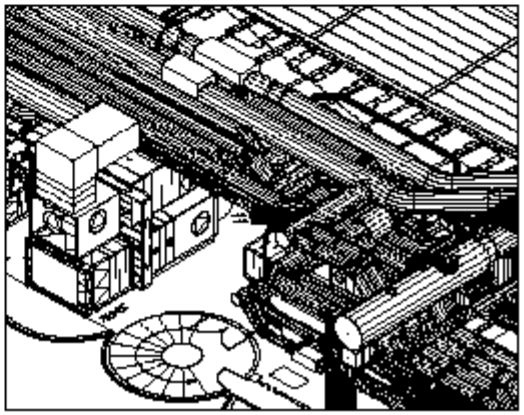
HVAC Design - 3D views from Product Model



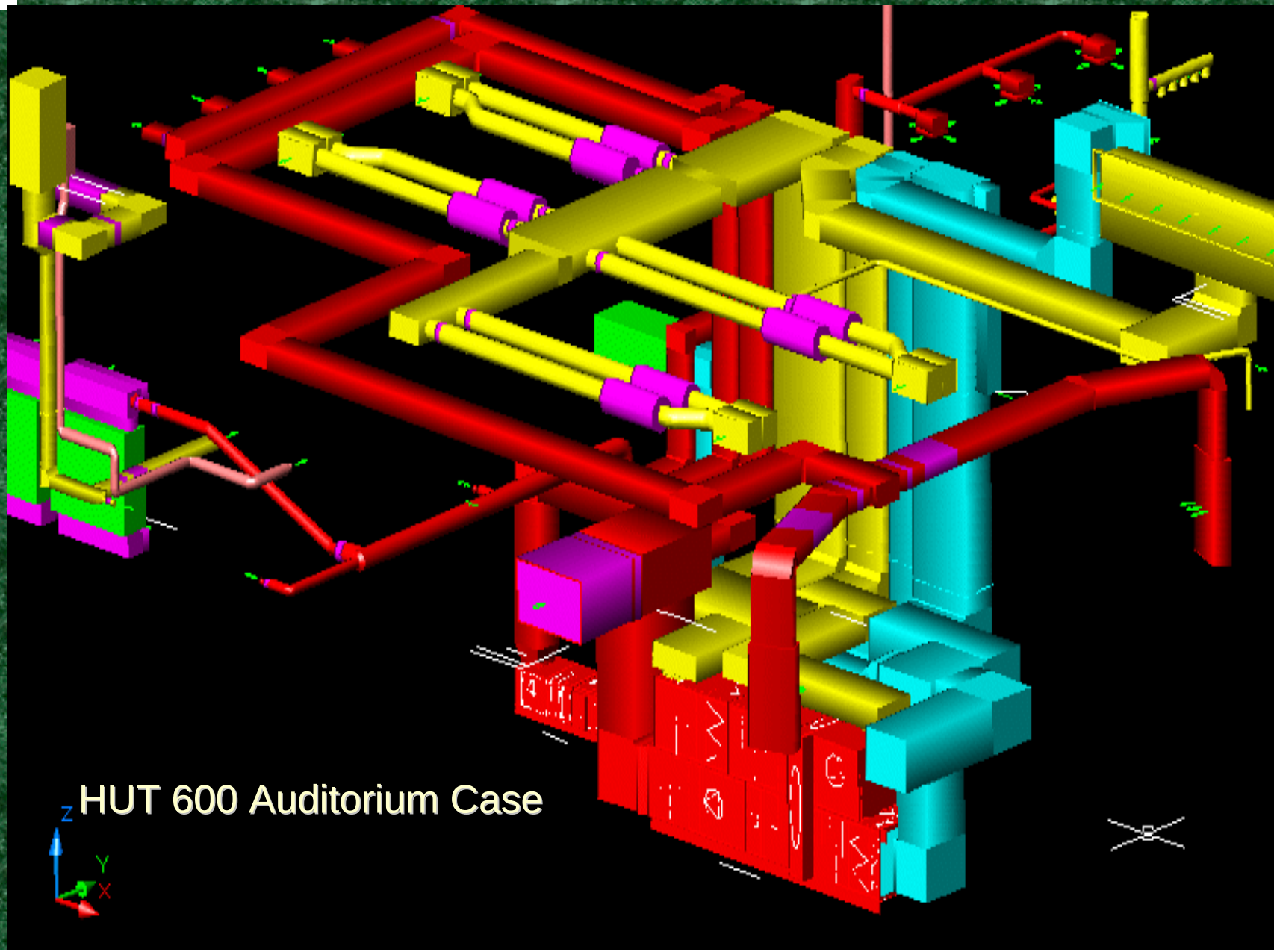








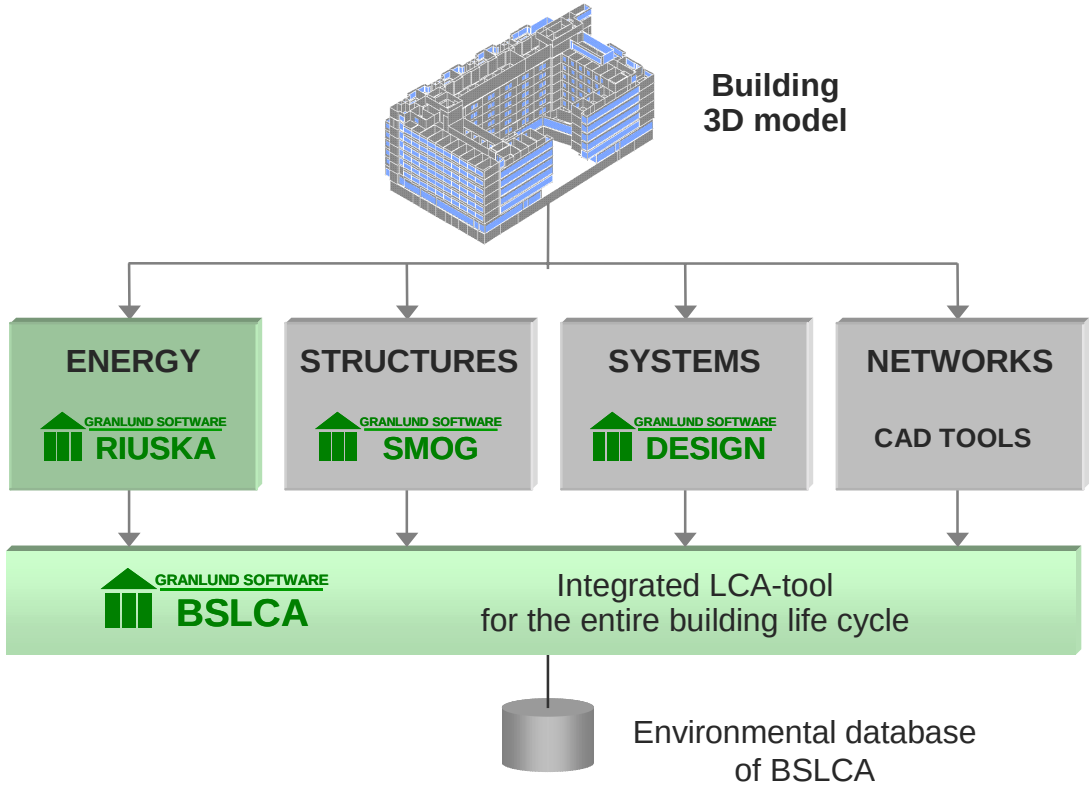
3D Product Model of HVAC System



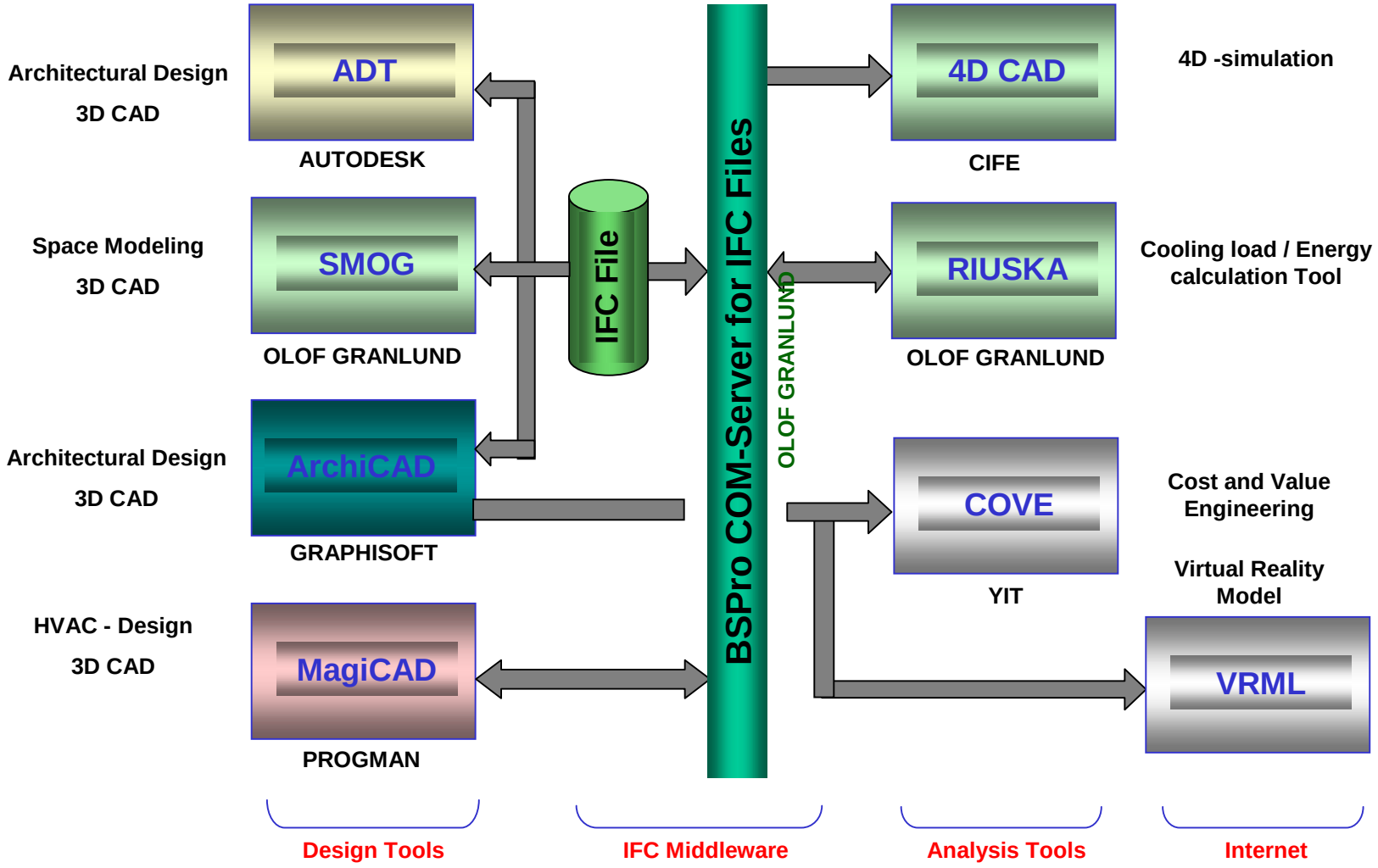
Environmental Analysis (LCA)

GRANLUND SOFTWARE BSLCA

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



"Live"-demonstration description



Agenda for the CIFE Workshop session

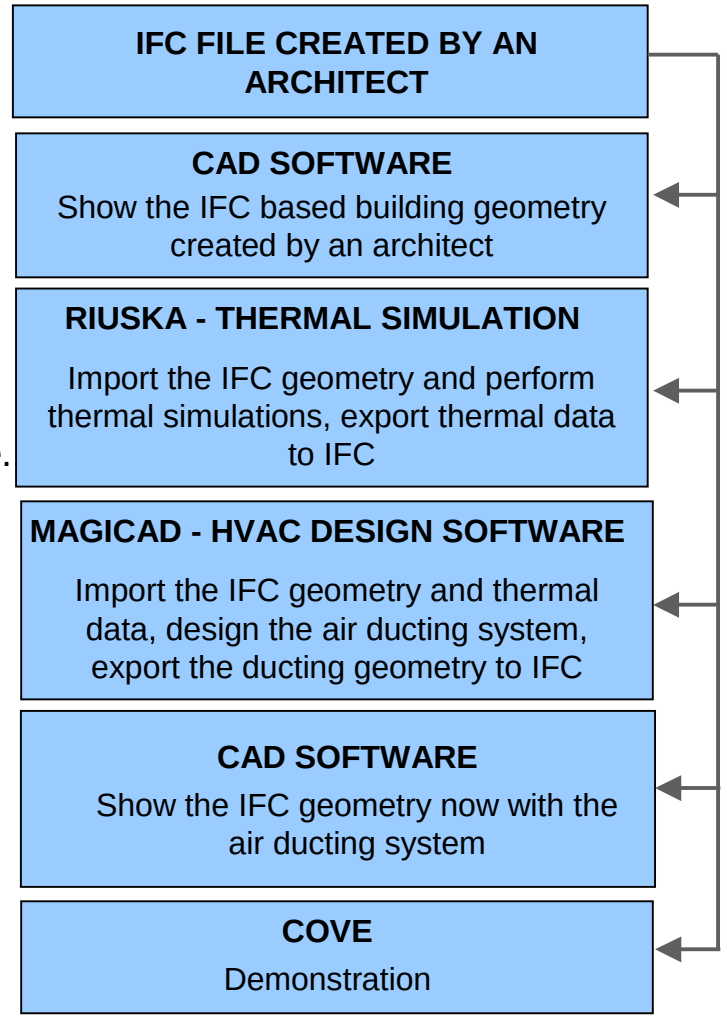
Martin F. :
- Open the session

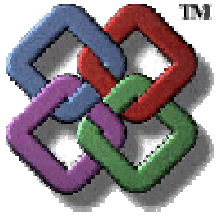
Jarmo L. :
- Speaks about COVE

Reijo H. :
- Speaks about model exchange

Antti K. :
- Live demo about the model exchange.

- LUNCH
- Hands-on Session





IAI and Development of IFC

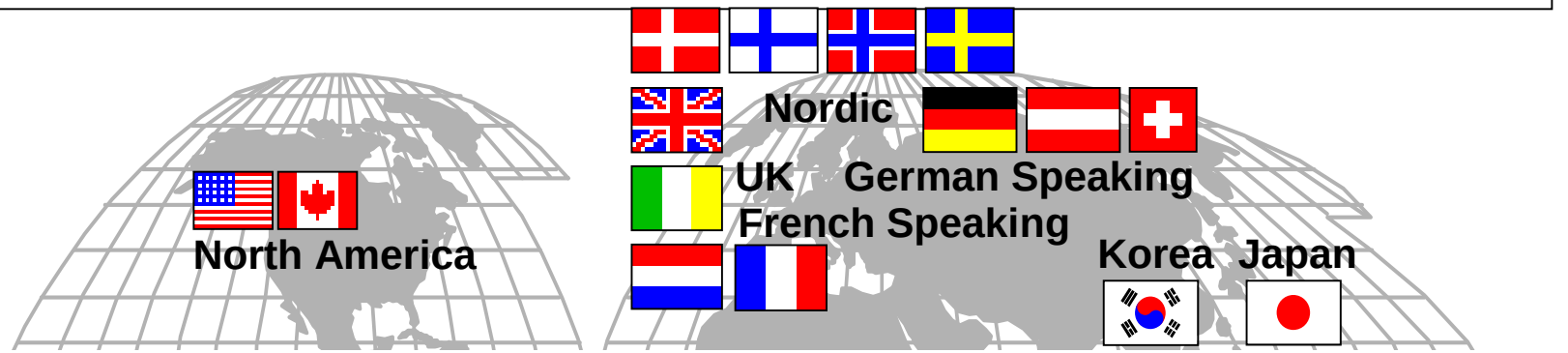
Arto Kiviniemi

IAI - International Alliance for Interoperability

Defining IFC (Industry Foundation Classes), a product data model specification describing buildings

First commercial IFC implementations available

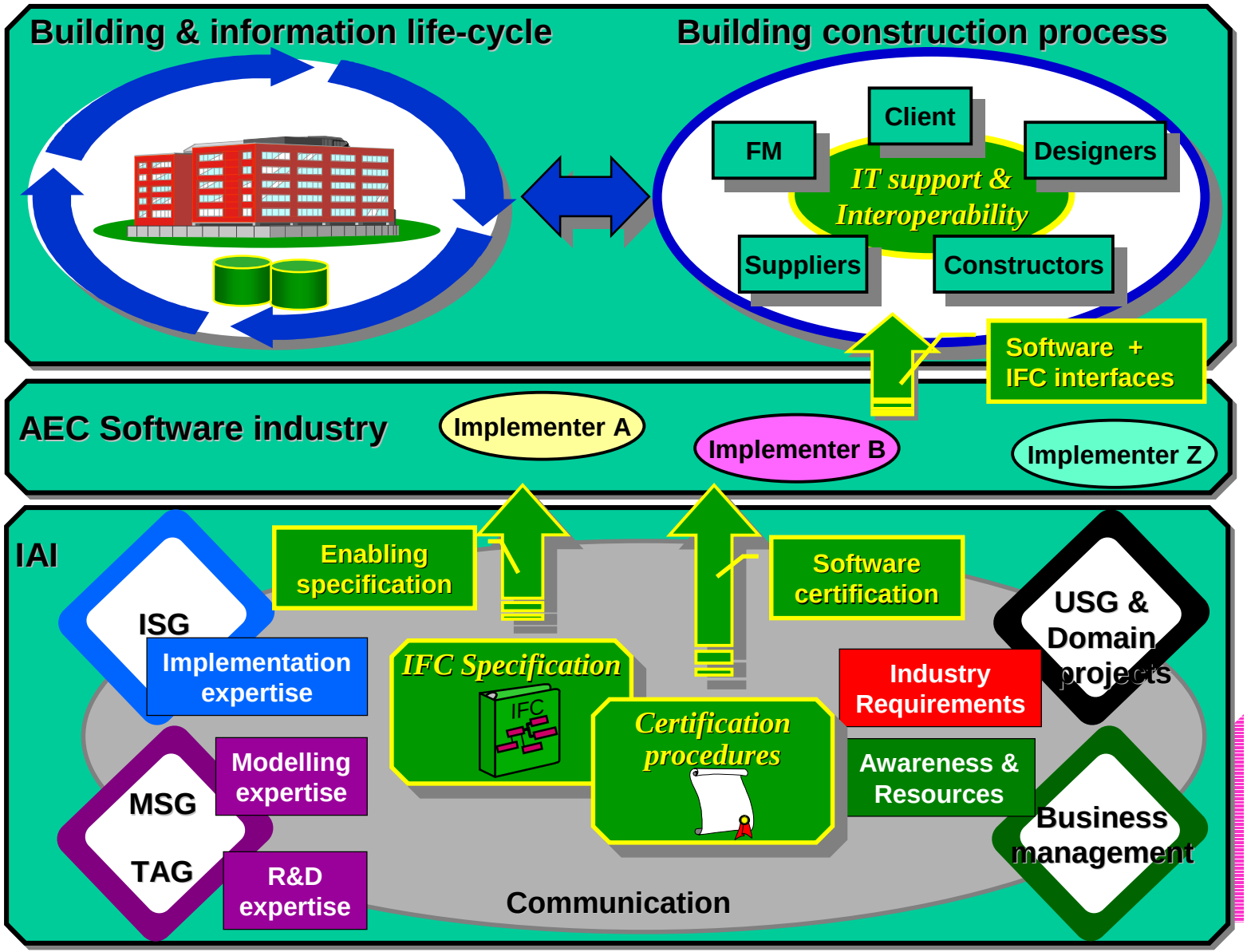
9 Chapters, more than 650 member organizations in 20 countries



Mission: **To enable software interoperability in the AEC/FM industry.**

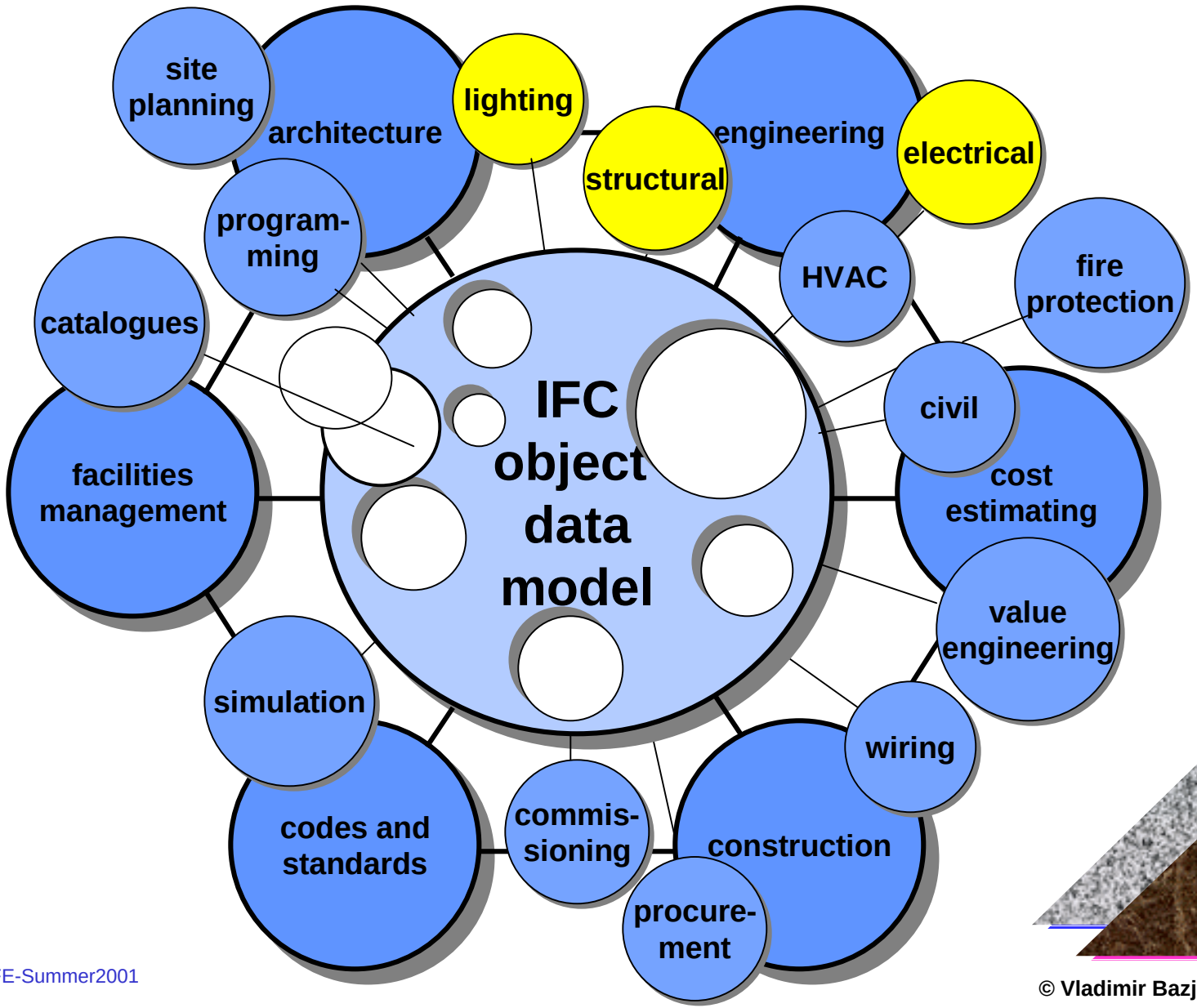
- AEC/FM industry professionals working with software professionals to define standard exchange specification IFCs, open for implementation and use by all software vendors.
- Design for specification to be extensible, evolving over time, providing global solution.

IAI / IFC, the Big Picture



Arto Kiviniemi

Current Status of IFCs



TEKES

VTT

Concepts Supported in the Current IFCs

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

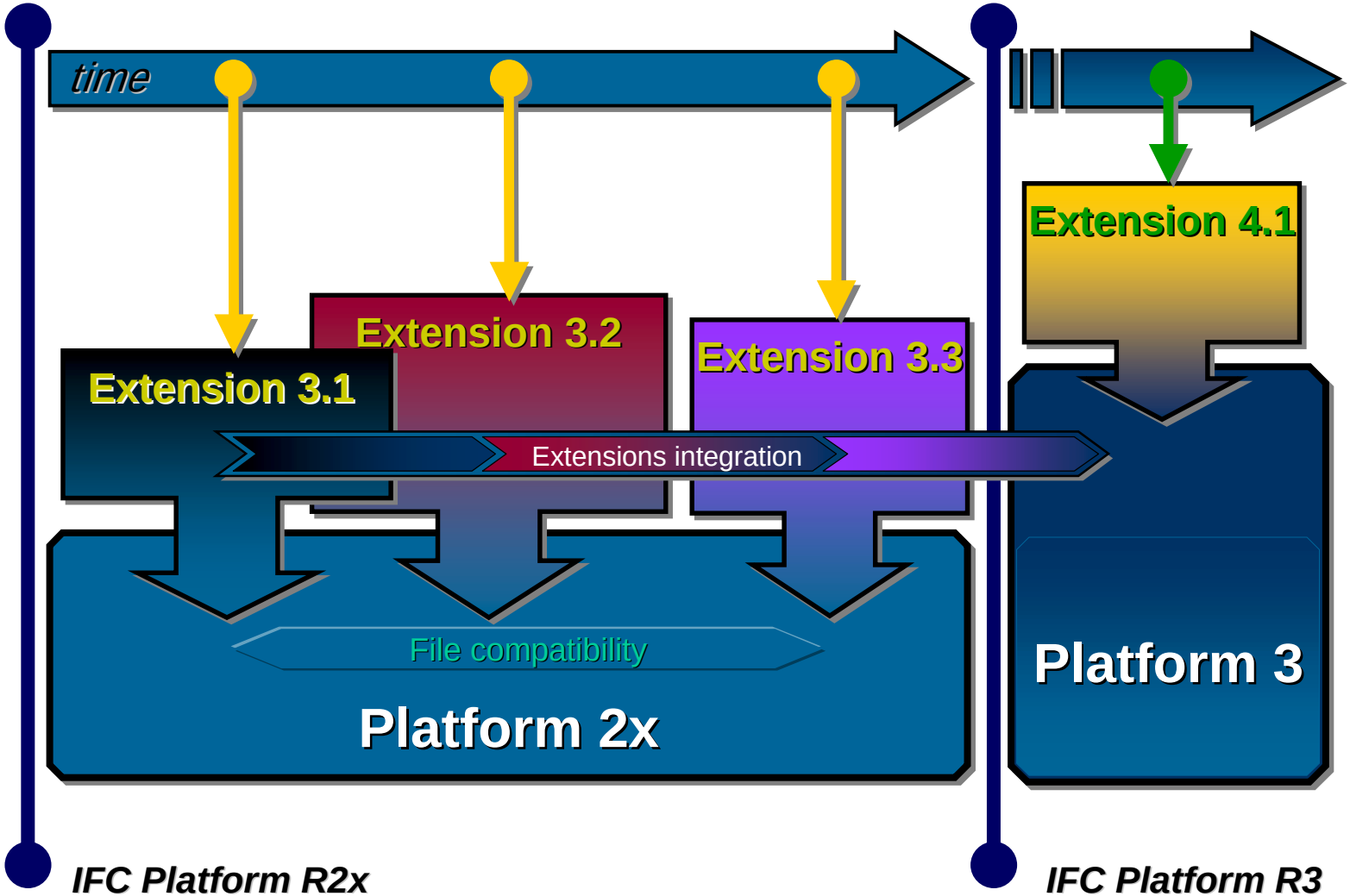
– energy code checking, occupant escape from fire, handicapped access to buildings

TEKES

IFC Releases

- Software products supporting R1.5.1 available, first certified in May 2000
- Support for R2.0 being implemented in software, certification of 12 products in May, 2001
- IFC 2x specification being finalised and published in October 2000
  - Providing a stable core specification, a ”platform” for future extensions
- IFC 2x implementation ongoing within ISG, pre-products late 2001, first certifications in May, 2002
- Release 3 projects to extend IFC 2x running, specifications expected in 2001

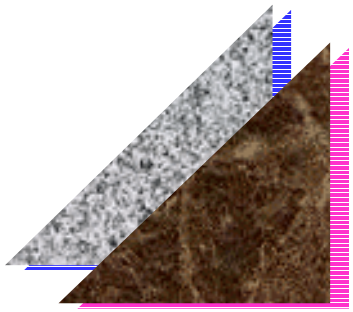
Platform Approach



Active IFC - Implementers

Certified Products:

- Autodesk (ADT) IFC 1.5.1
- Claire project (IFC Viewer) IFC 2.0
- Data Design System (E-, HVAC-, Construction Partner) IFC 1.5.1
- Graphisoft (ArchiCAD) IFC 1.5.1 and IFC 2.0
- Han Dataport (Elite NT Architectur) IFC 1.5.1
- Olof Granlund Oy (BSPro, Riuska) IFC 1.5.1 and IFC 2.0
- LBNL (BSClient for Energy+) IFC 2.0
- Microsoft (Visio 2002 Professional) IFC 2.0
- Nemetschek (Allplan) IFC 1.5.1
- PNNL (COMcheck-EZ) IFC 2.0
- Skanska (Facets) IFC 2.0
- Solibri (Model Checker) IFC 2.0
- Tomberline (PECAD) IFC 2.0
- TOPS (IFC to VRML Converter) IFC 2.0
- YIT (COVE) IFC 2.0
- Eurostep (IFC Toolbox) IFC 2.0



IFC 2x Implementation

Key implementers

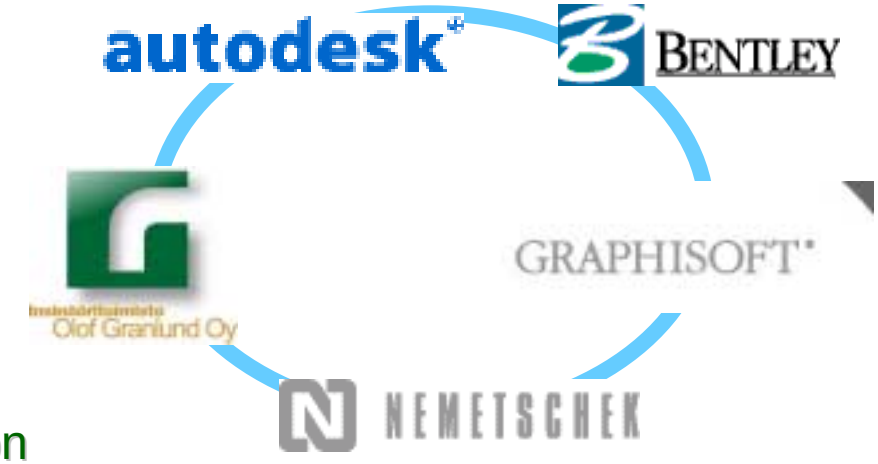
- Autodesk (CAD)
- Bentley System (CAD)
- Graphisoft (CAD)
- Nemetschek (CAD)

  +

- Olof Granlund (M+E)
- Data Design Systems (M+E)
- Han Dataport (Architecture)
- Vizelia (FM)
- Nova Sprint (Code checking)

Milestones

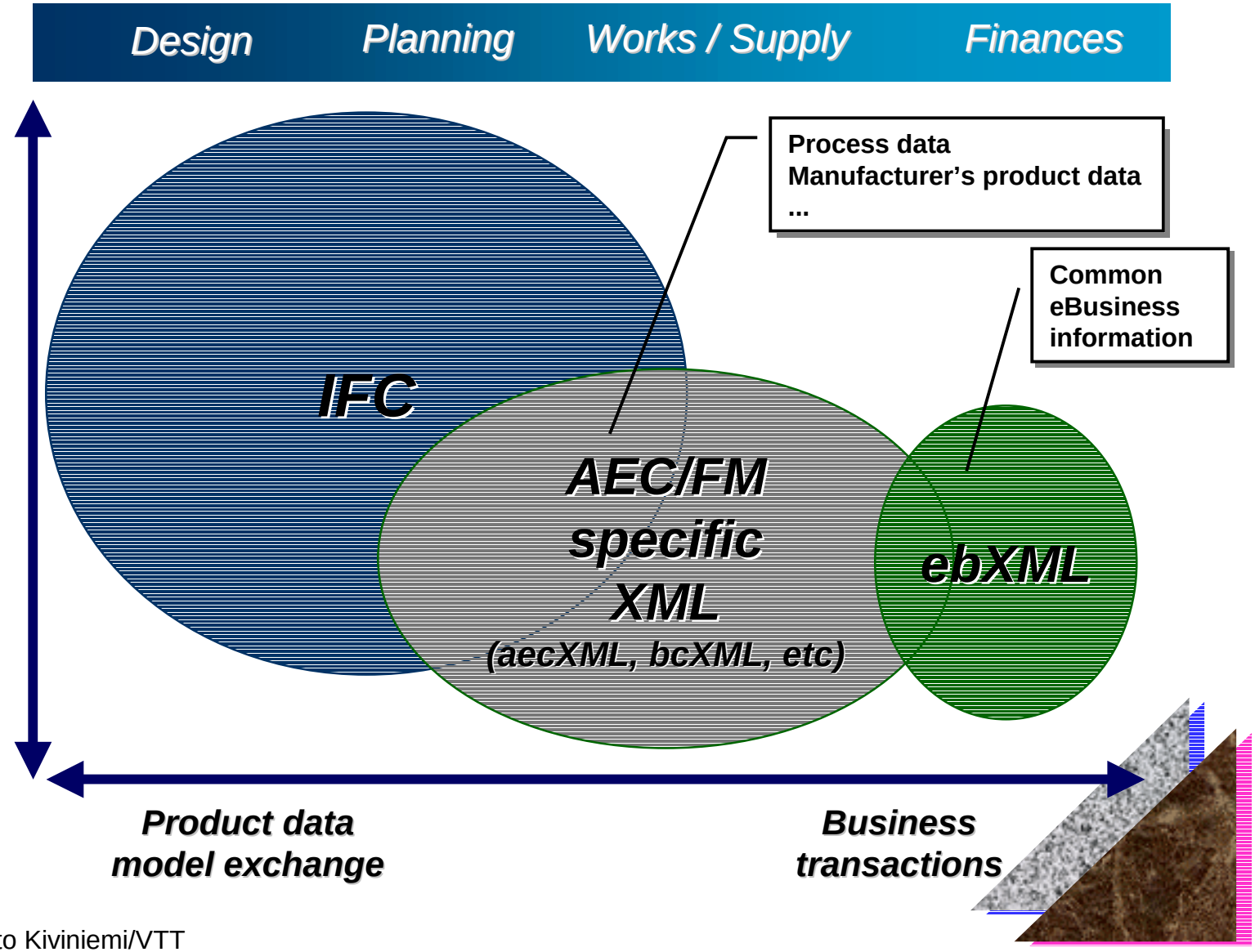
- pre-products at ACS 2001 (Frankfurt - November)
- Certification - May 2002
- products from mid 2002



Current status

- first sample files (for co-ordination view) ready

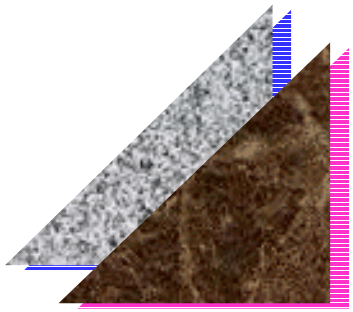
IFC and XML - One possible interpretation



Arto Kiviniemi

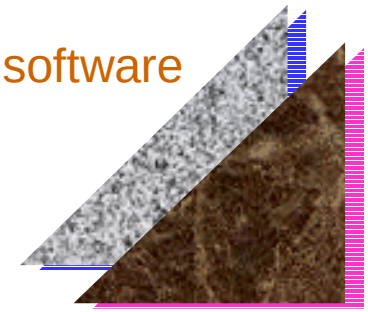
BS-8 Project

- **IAI Project: Building Services project number 8**
- **Completion of the IFC HVAC extension schemata**
  - HVAC equipment
  - HVAC systems
  - Controls
  - Connectivity
- **Participation**
  - Seven organizations in five countries
- **Support**
  - Governments (Australia, EU, Finland and U.S. - federal and state)
  - Private sector (Finnish and French)



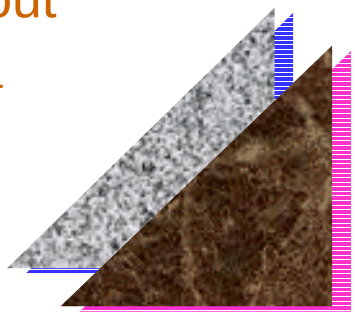
BS-8 Project Goals

- Extend IFC schemata to support the modeling and simulation of HVAC components and systems
- Support the use of various building simulation tools
- Import information from upstream applications in *.ifc or XML format
  - Building geometry
  - General and performance specifications of materials
  - General and performance specifications of quipment and furnishings
- Export information to downstream applications in *.ifc or XML format
  - Other HVAC applications
  - Cost estimating applications
  - Commissioning and building operations/maintenance software
  - Code-checking applications
  - Software that serves utility companies
  - Many other types of applications

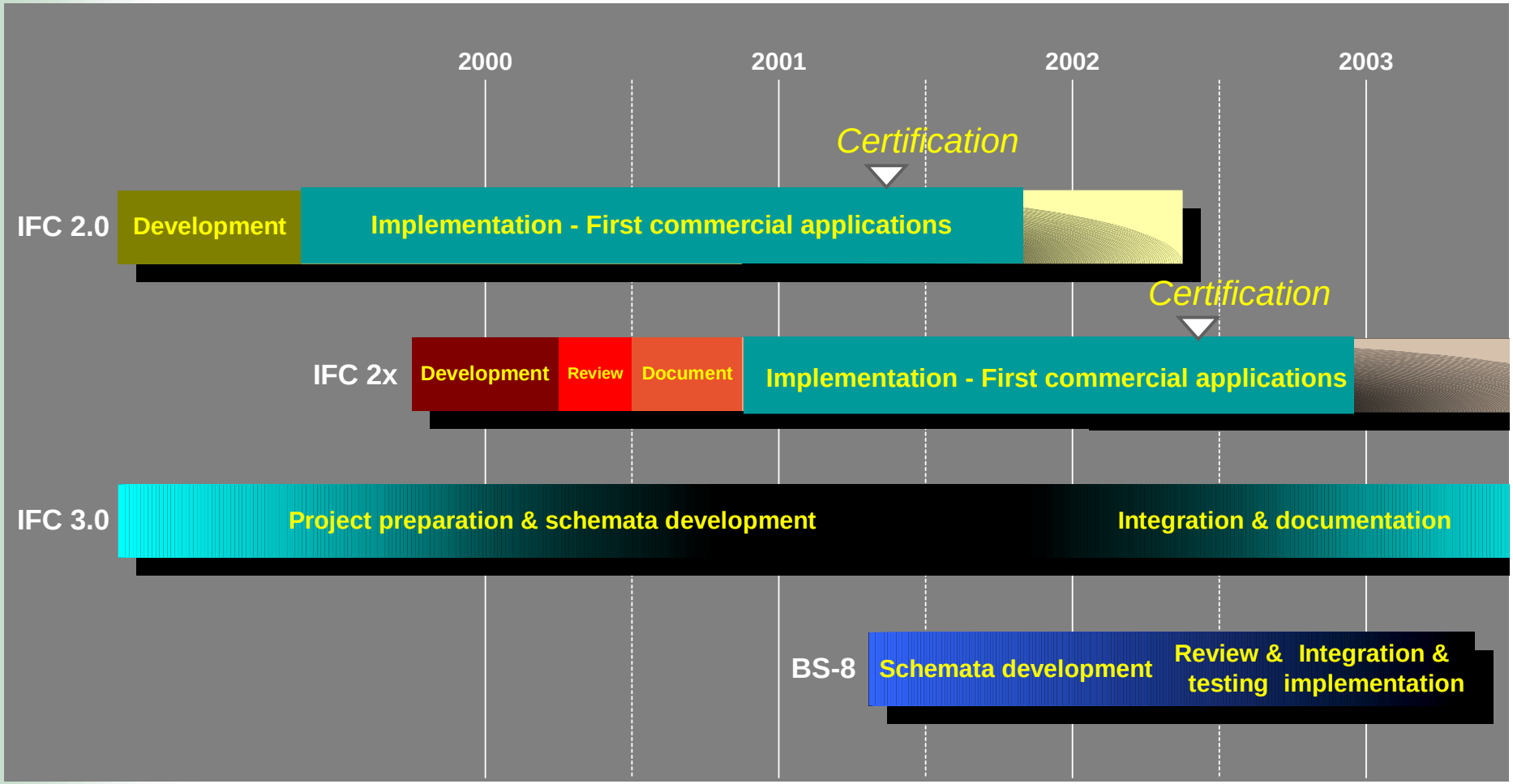


Processes Supported by BS-8

- **Fully supported process: Building energy performance simulation**
- **Implicitly supported processes**
    1. Dynamic load estimation
    2. HVAC design
    3. HVAC equipment selection
    4. Measurement and verification (HVAC view)
    5. Building performance metrics (HVAC view)
    6. HVAC system and equipment commissioning
    7. HVAC system and equipment retrofit
    8. HVAC system and equipment physical layout
    9. HVAC system and equipment product data (catalogues, external data bases)



BS-8 Project IAI Schedule



BS-8 Info Exchange

- **Project web site:**

  http://eetd.lbl.gov/btd/iai/bs8

  - file depository
  - issues/resolution log
  - up-to-date project information

- **Project contact:**

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More Info About Integrated Design Tools

IAI - web site	http://iaiweb.lbl.gov
BLIS - web site	http://www.blis-project.org
IFC - certified commercial software tools	http://www.bauwesen.fh-muenchen.de/iai/ImplementationOverview.htm
USDoe / EnergyPlus Interoperability	http://www.eren.doe.gov/buildings/energy_tools/energyplus/energyplus_ifc.html
Insinööritoimisto Olof Granlund Oy	http://www.granlund.fi
BSPro COM-Server	http://www.bspro.net