IAI / IFC

Concept of the IFC Standard and the relation to ISO & XML

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IFC business case

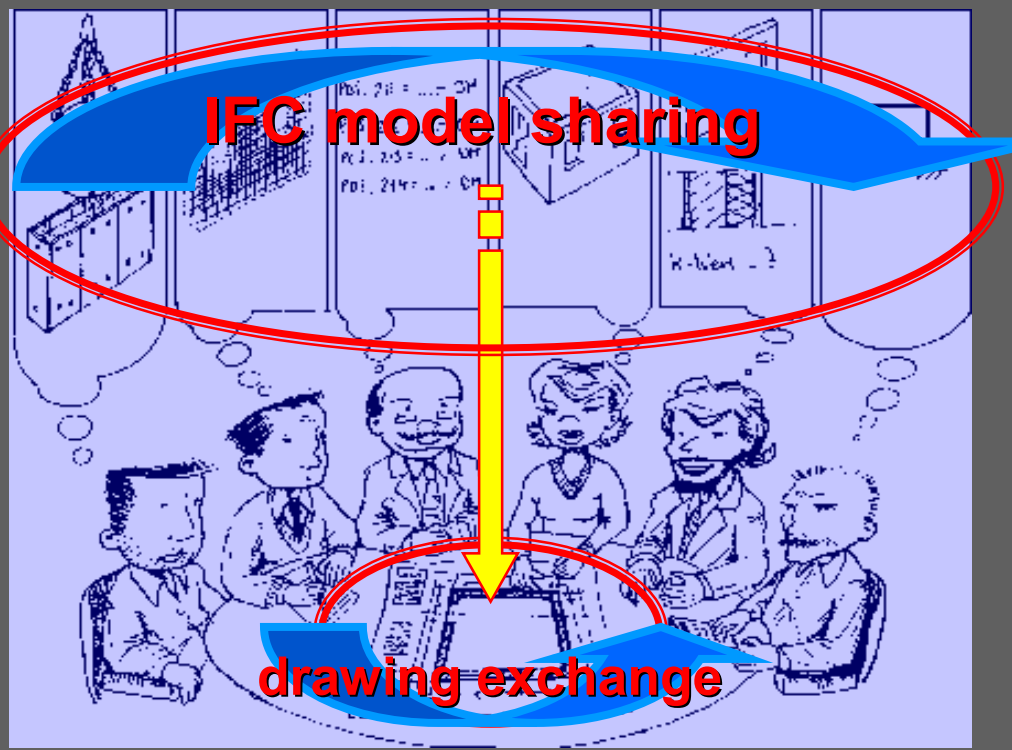
- data exchange and sharing of building and construction life cycle information
  - goes beyond CAD information
  - involves non-geometric applications
  - includes operation of buildings

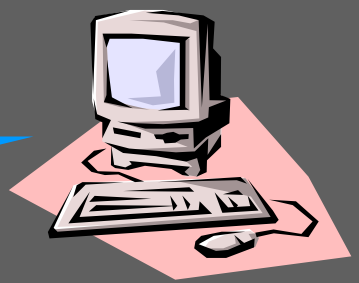
Why IFC? ... or new way of working

- move from documents (paper or files) to virtual building models
- move from pure exchange of documents to sharing of information

information age
- share building model data

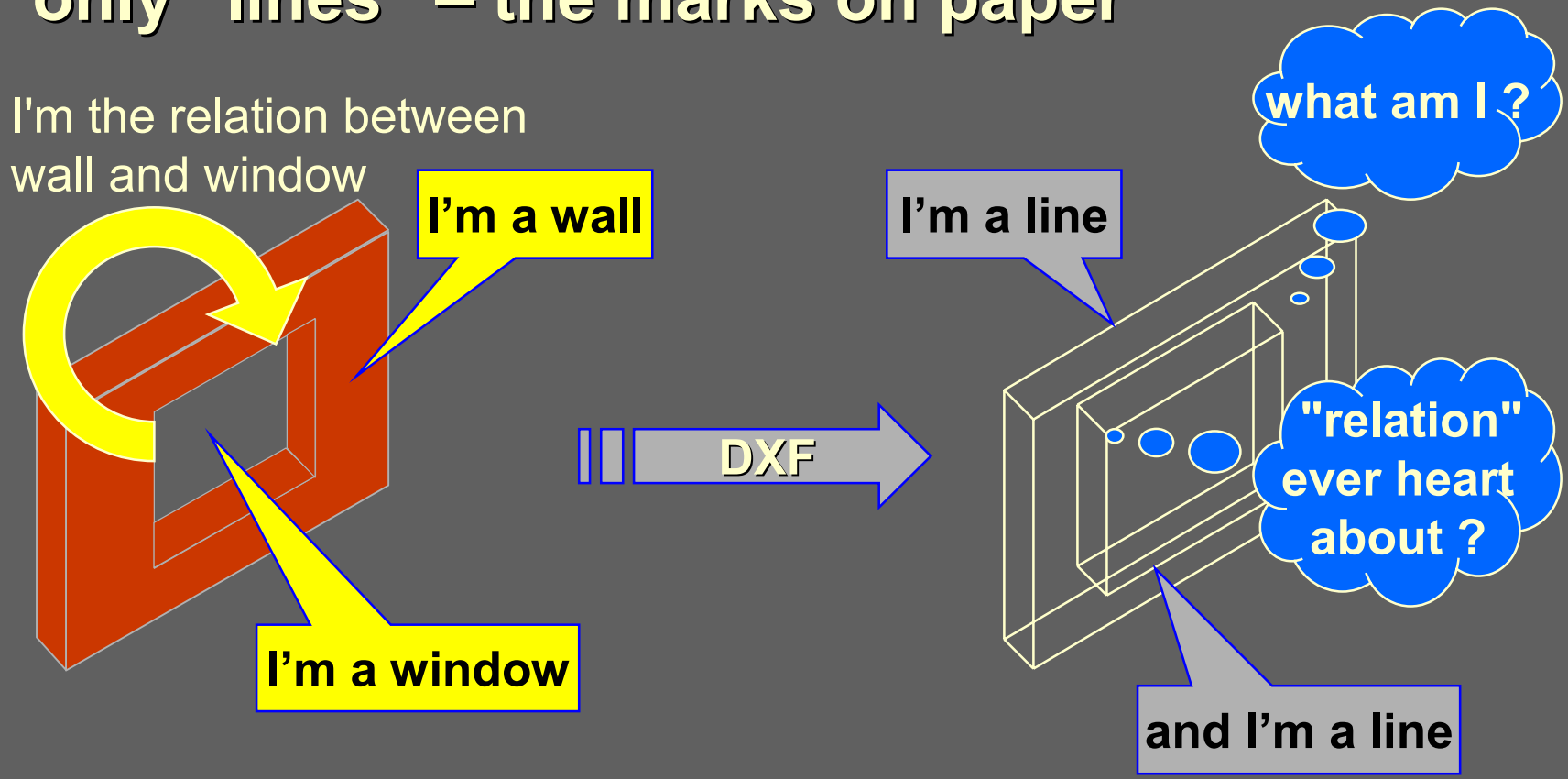
industry age
- exchange of paper, *.dxf, *.pdf, etc.





You can’t do this the old way

- **if the object information is lost, there are only “lines” – the marks on paper**



IFC implementation support

- **IFC development was software developer driven since it started**
- **Today all leading CAD companies support IFC by native implementations**
- **Many Non-CAD solutions are available for data sharing in different life cycles**

list of IFC solutions on the market

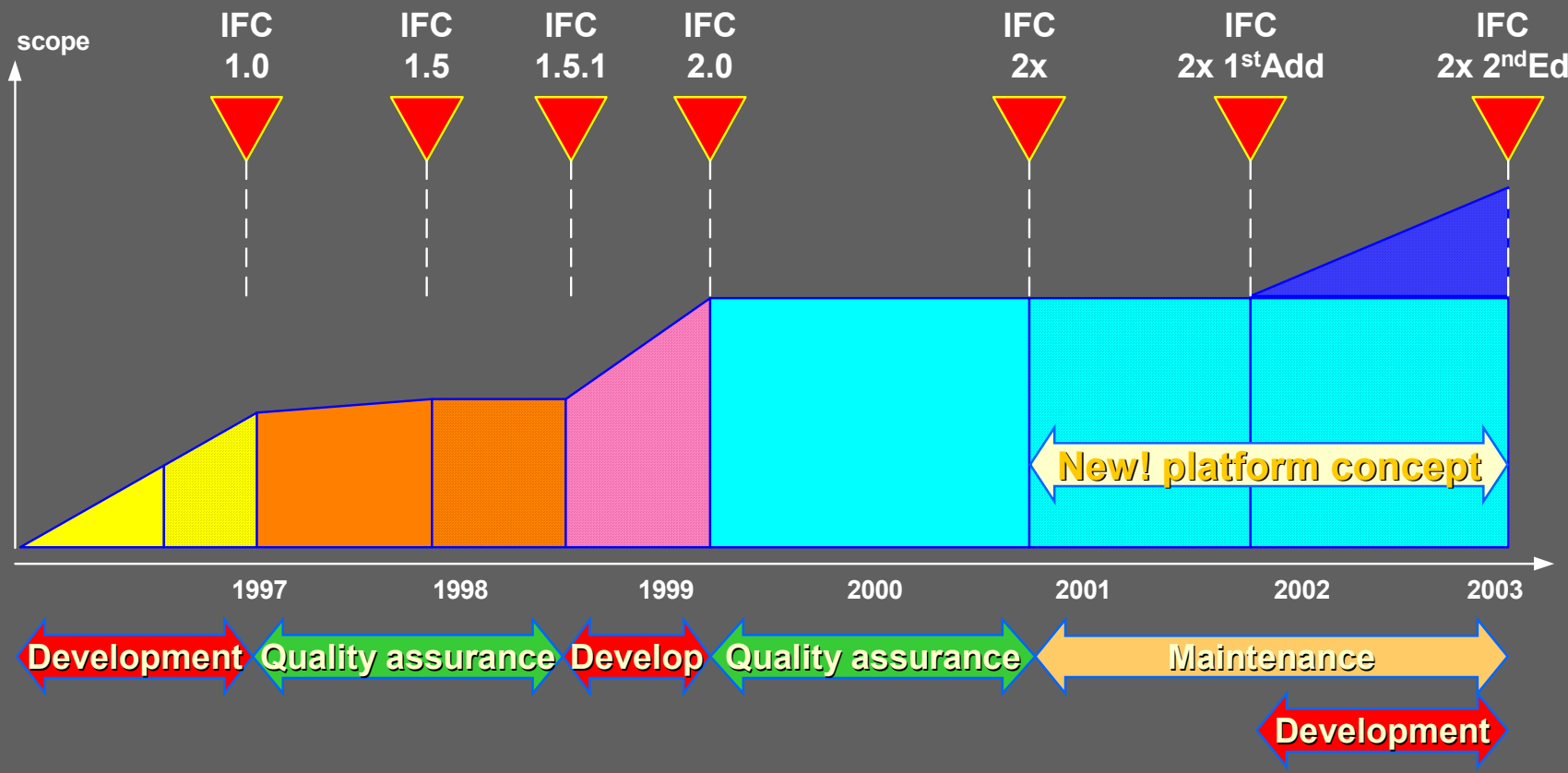
- link to http://www.bauwesen.fh-muenchen.de/iai/ImplementationOverview.htm

IFC projects and feasibility studies

- *... it's getting real*
- projects already started
  - Helsinki – main auditorium of university
  - London – teamwork 2001 and beyond
  - Frankfurt – development of the Westhafen
  - Singapore – automated code checking
  - others
- feasibility studies
  - Univ. of Federal Forces, Germany
  - Nuclear power research center, Germany
  - Laings construction Ltd., UK
  - others

IFC development timeline

- *... it was a long way to go !*

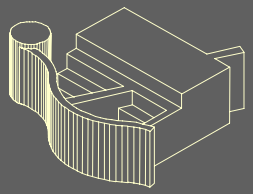


IFC current version of specification

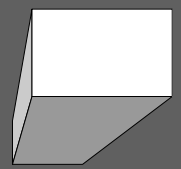
IFC 2x

- **Xtra** domain support
- **Xtensible** for new requirements
- **XML support** for ifcXML

Units of Functionality in IFC2x (1/3)

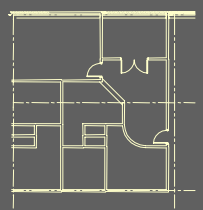


Geometry (explicit)
- B-rep
- CSG

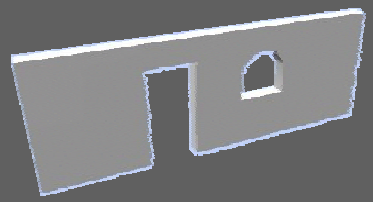


Geometry (Sweep)
- volume - extrusion, rotation
- areas - extrusion, rotation

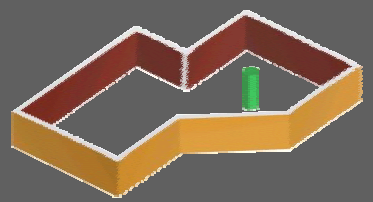
Topology
- element connectivity,
- schematic design



Building Elements
- Walls, Openings, Doors
- Roofs, Stairs, Ramps, etc.

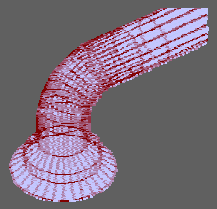


Relations between Building Elements
- Wall Connections
- Holes
- Chases
- Zones



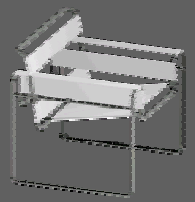
Spaces and Spatial Structure
- Space
- Building Storey
- Building
- Building Site

Units of Functionality in IFC2x (2/3)



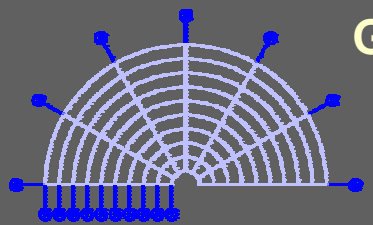
Equipment
ducting, piping
chillers, fans, etc
loose equipment

Costing
Cost of objects
Cost planning
Cost estimates

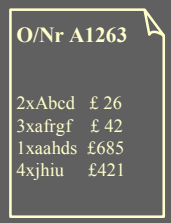


Furniture
furniture items
system furniture

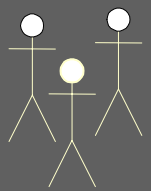
Work plans
schedules
resource allocation



Grid
linear, circular grids
positioning to grid



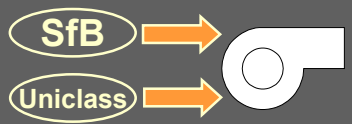
Orders
Work Orders
Change Orders
Purchase Orders



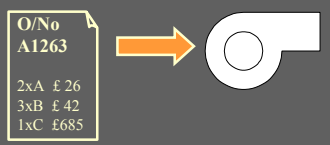
Actors
People
Organisations
Addresses

Units of Functionality in IFC2x (3/3)

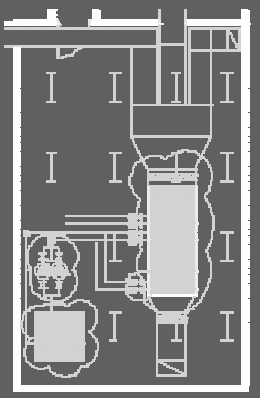
External Data



Classification

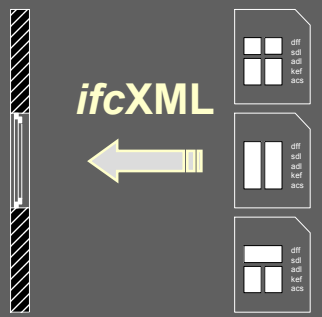


Associated Documents



Facilities Management

- Asset Identification
- Maintenance History
- Inventories
- Move Management

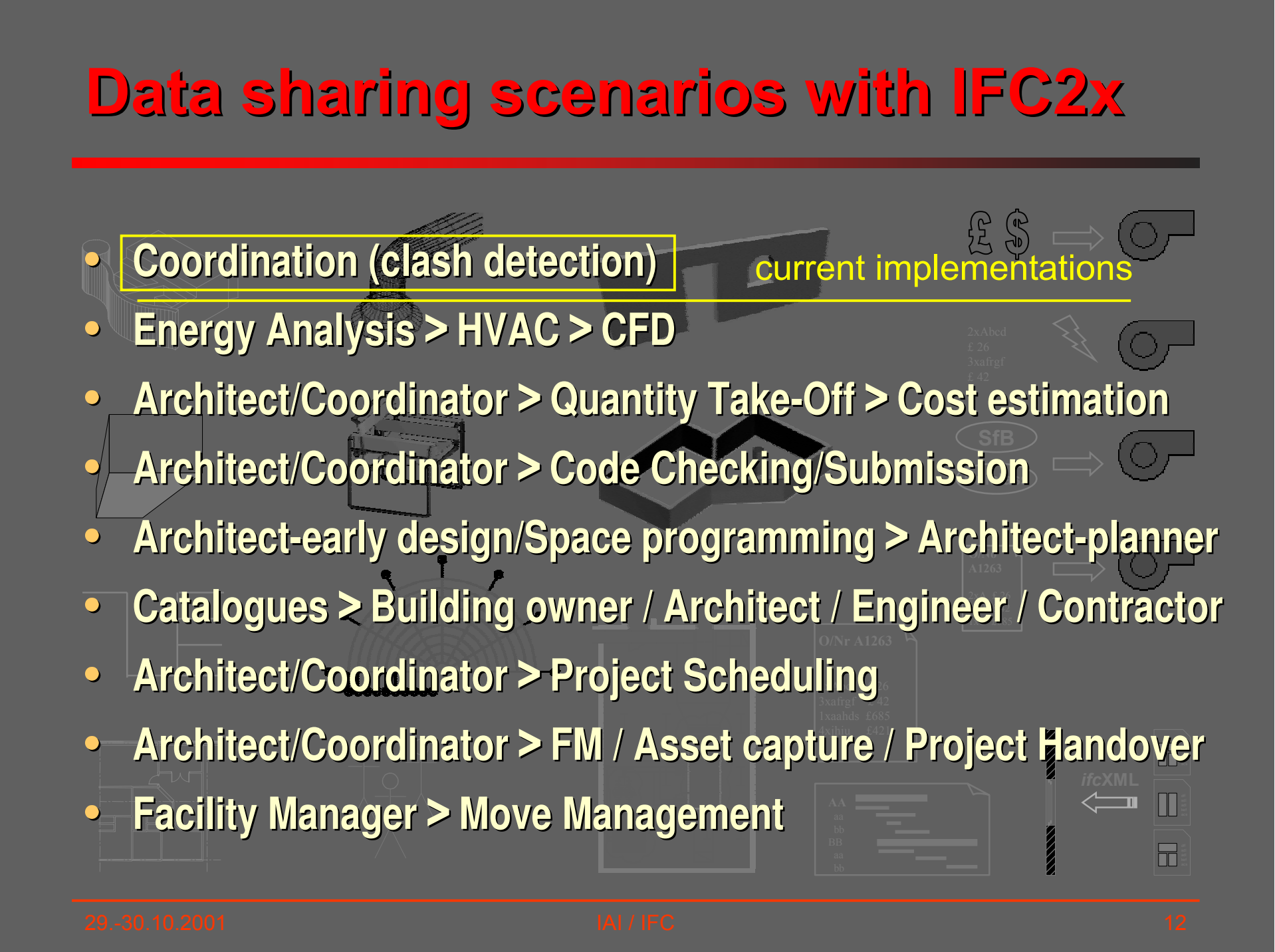


Search for and retrieve product information

- manufacturer information
- electronic catalogues
- library data

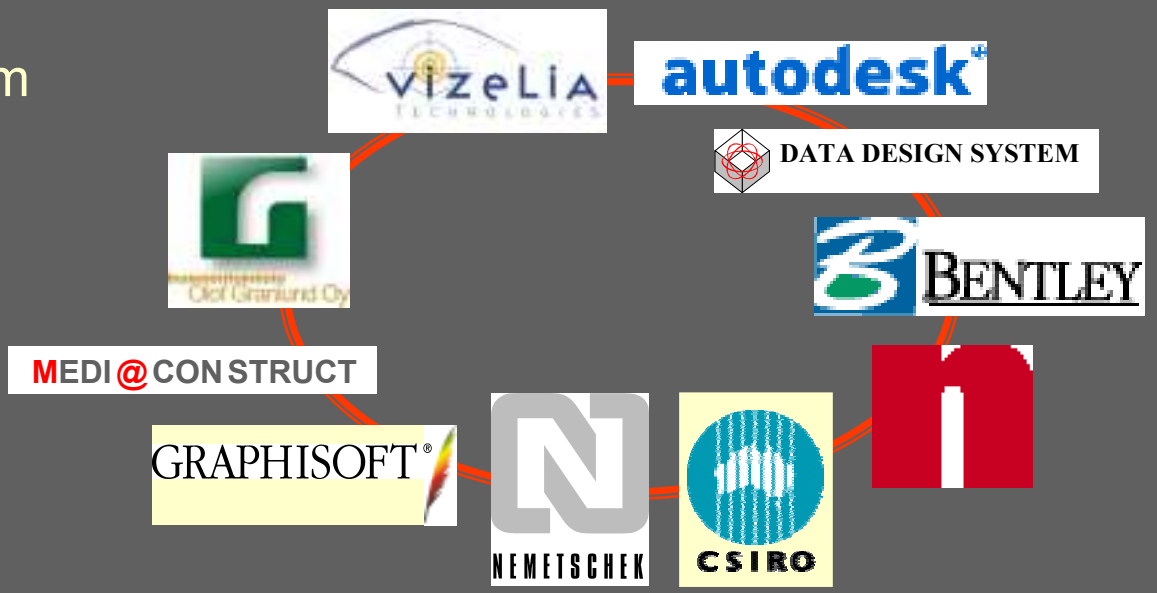
Data sharing scenarios with IFC2x

- Coordination (clash detection) current implementations
- Energy Analysis > HVAC > CFD
- Architect/Coordinator > Quantity Take-Off > Cost estimation
- Architect/Coordinator > Code Checking/Submission
- Architect-early design/Space programming > Architect-planner
- Catalogues > Building owner / Architect / Engineer / Contractor
- Architect/Coordinator > Project Scheduling
- Architect/Coordinator > FM / Asset capture / Project Handover
- Facility Manager > Move Management



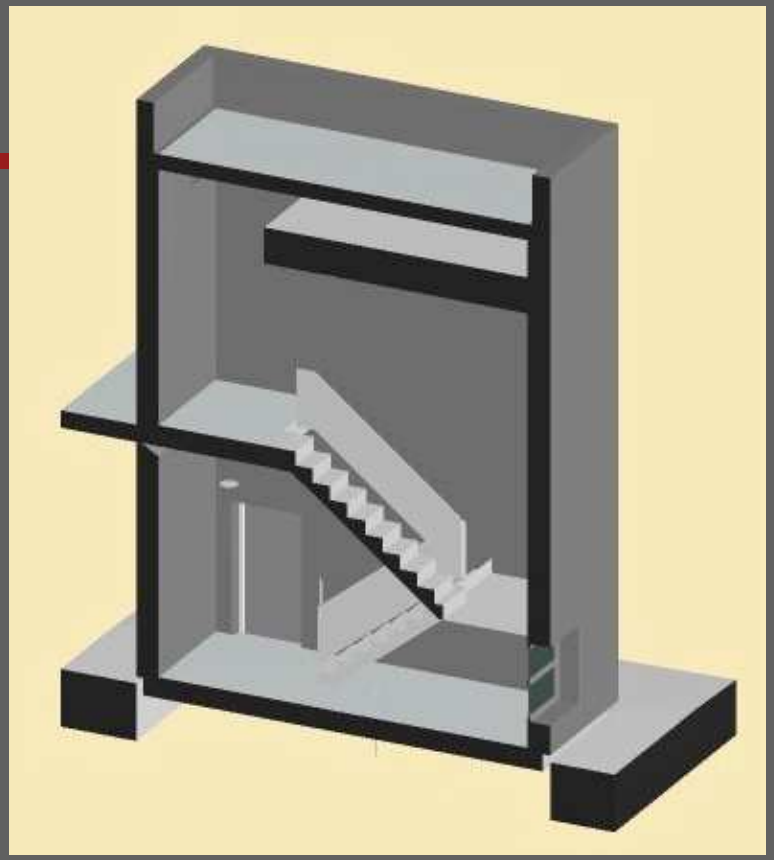
IFC2*x* – current implementations

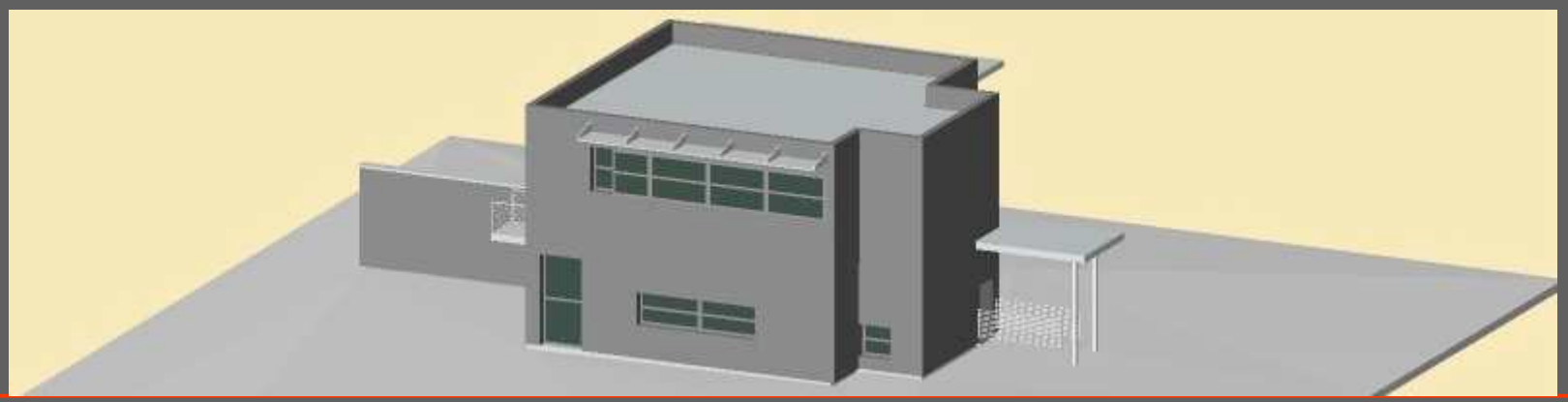
- Implementers roundtable
  - Autodesk
  - Bentley System
  - CLAIRE project
  - CSIRO
  - Data Design System
  - Graphisoft
  - Nemetschek
  - novaSPRINT
  - Olof Granlund
  - Vizelia
- Deadlines
  - Prototypes ACS 01
  - Certification in 2002



IFC2x test case

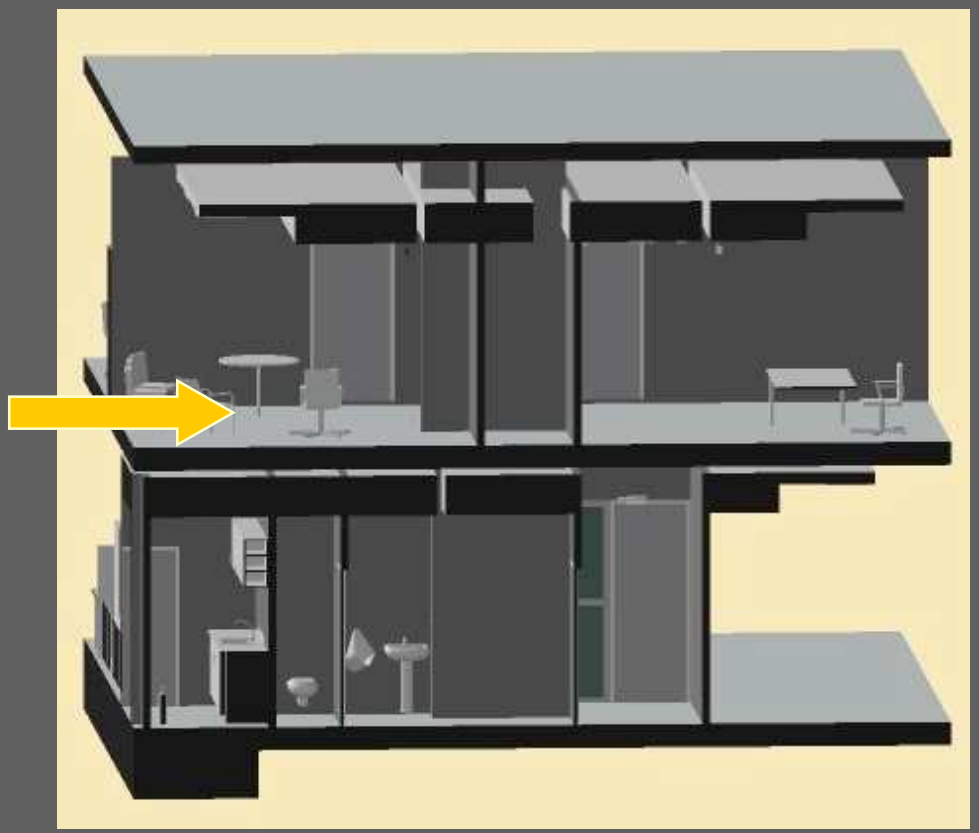
- shell and core, with
  - project structure
  - site data
  - building elements
  - furniture & fixtures
  - HVAC equipment





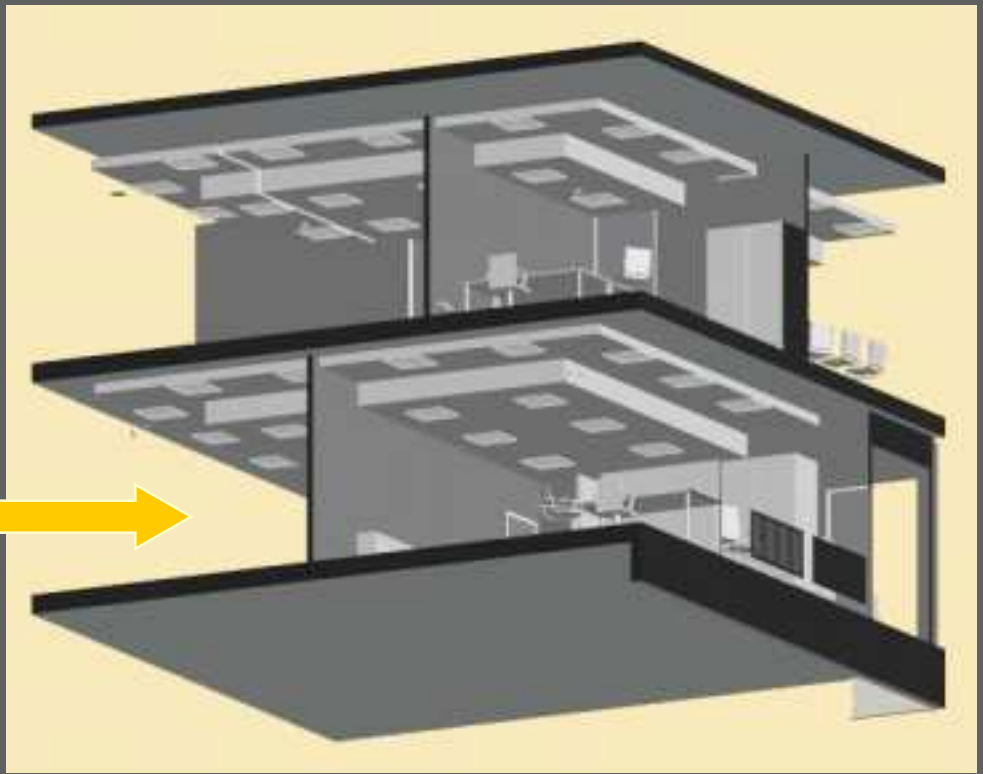
IFC2x test case - 2

- shell and core, with
  - project structure
  - site data
  - building elements
  - furniture & fixtures
  - HVAC equipment



IFC2x test case - 3

- shell and core, with
  - project structure
  - site data
  - building elements
  - furniture & fixtures
  - HVAC equipment



IFC2x implementation progress

- established implementers' roundtable
  - bi-monthly meetings
  - established view definitions
  - determined implementers' agreements
  - discussed implementation details
  - now starts the quality assurrence process

IFC relationship to ISO

- ISO TC184/SC4 defines the formal international standards
  - ISO/TC 184, *Industrial automation systems and integration*
  - Subcommittee SC4, *Industrial data*
- IAI has long lasting relations to ISO
  - SC4 and IAI signed the MoU
  - IAI has A-liasion status within SC4
  - *IAI forwarded IFC2x platform for ISO accreditation*

IFC2x for ISO accreditation

- IAI has submitted the IFC2x specification for ISO TC184/SC4 recognition
  - using the "harvesting of externally developed specification" procedure
  - currently as document ISO TC184/SC4 N1211
  - SC4 FUKUOKA resolution has kicked off the transposition process of IFC2x

IFC and XML – general questions

- common misunderstanding
  - *„now we have XML, do we still need IFC ?“*

↳ reality is:
  - XML is not a data exchange
  - XML is a language to specify data exchange

↳ or:
  - XML allows to define any document structure
  - the particular structure is specified by a model
  - the model can well be IFC !

language, model, content

- language
  - formal language neutral to any structure and content
    - *"English", "German", "French"*
    - "UML", "EXPRESS", "XML DTD", "XML Schema"
- model
  - specifc structure to markup content of same type
    - *"Formular", "Custom declaration"*
    - "IFC", "ebXML", "EDIFACT"
- content
  - particular instance following a markup
    - *"my 2000 tax declaration"*
    - "my project exchange to BS-engineer", "my door schedule"

same structure and content

- schema defined in EXPRESS

```
ENTITY SiUnit;
 name    : SiUnitName;
 prefix  : OPTIONAL
           SiPrefix;
END_ENTITY;
```

- schema defined in XML schema

```
<xsd:element name="SiUnit"
 type="SiUnitType"/>
<xsd:complexType name="SiUnitType">
  <xsd:attribute name="name"
    type="SiUnitNameType"
  <xsd:attribute name="prefix"
    type="SiPrefixType"
     use="optional"/>
</xsd:complexType>
```

same structure

- data exchanged in STEP physical file

```
#1=SIUNIT(.WATT.,
```

- data exchanged in XML file format

```
iUnit name="WATT" prefix="KILO"/>
```

same content

why using XML ?

- Advantages of XML
  - commonly used / XML knowledge widely available in companies and organizations
  - variety of development tools cheaply available
  - easy to integrate with browser and other standard software
- Disadvantages of XML (comp. EXPRESS)
  - exchange files considerable bigger (times 3 to 8)
  - consistency checking of exchange less rigid

IFC and ifcXML

Project model exchange

IFC2x
STEP Implementation

ifcXML
XML Implementation

same project model data

- **Model = Structure = IFC2x object model**
- **Language = Tools = ISO/STEP or XML**

ifcXML current status

- process started 1/2001
  - Version 0.9 – 3/2001 for comments and feedback
  - Version 1.0 – 7/2001 adopted by IAI as official XML representation of IFC2x
  - Version 1.1 – 10/2001 further aligned with ISO as input for FUKUOKA meeting
- aligned with ISO
  - ISO/SC4 WG11 edits ISO10303-Part 28
    - "XML language binding to EXPRESS schema and data"
    - Edition 2 (2002) defines the binding to XML schema
  - currently two major inputs
    - CEB – electric boat
    - ifcXML – IAI
    - 90% aligned today

End