

# ***IAI / IFC***

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

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**Dr. Thomas Liebich**  
*AEC3, München*  
*IAI International - MSG Lead*  
[liebich@uumail.de](mailto:liebich@uumail.de)

**Interop in AEC&fm**  
*Sydney, Australia*  
*29.-30.10.2001*



# IFC business case

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- **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

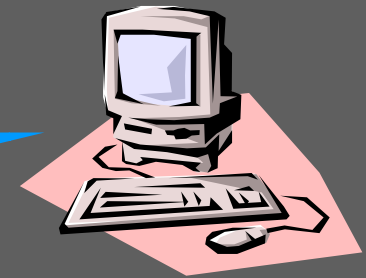
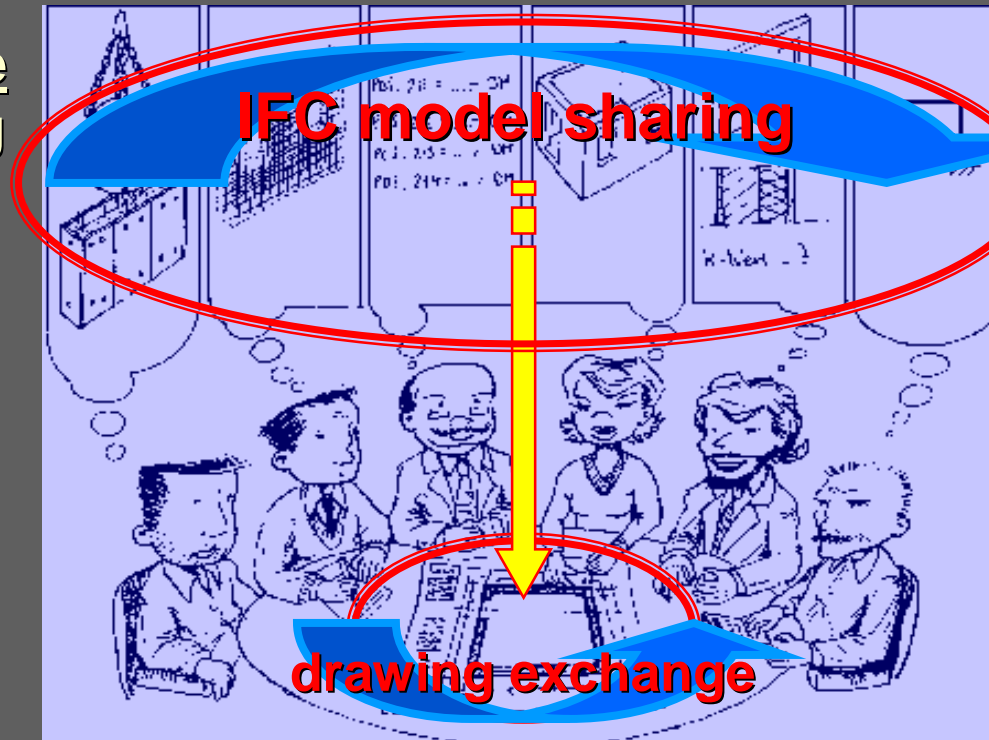
- move from documents (paper or files) to virtual building models
- move from pure exchange of documents to sharing of information

## information age

- share building model data

## industry age

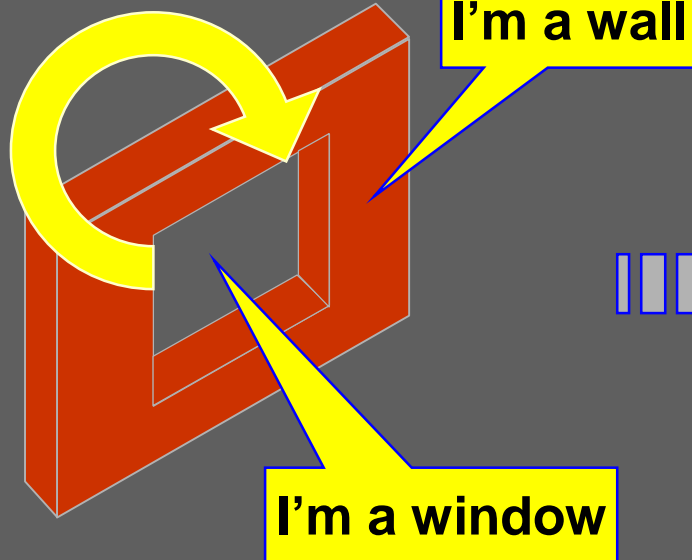
- exchange of paper, \*.dxf, \*.pdf, etc.



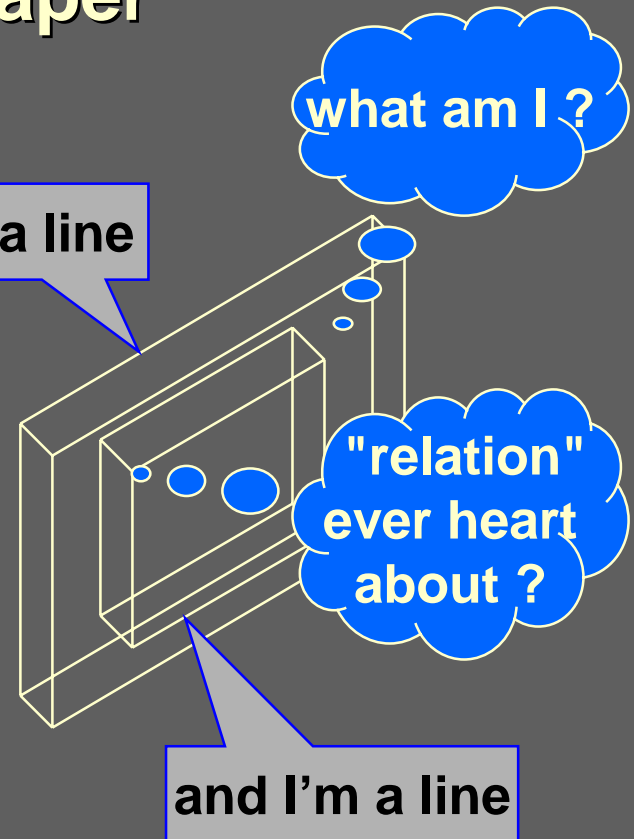
# You can't do this the old way

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

I'm the relation between  
wall and window



I'm a line



# IFC implementation support

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- 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>

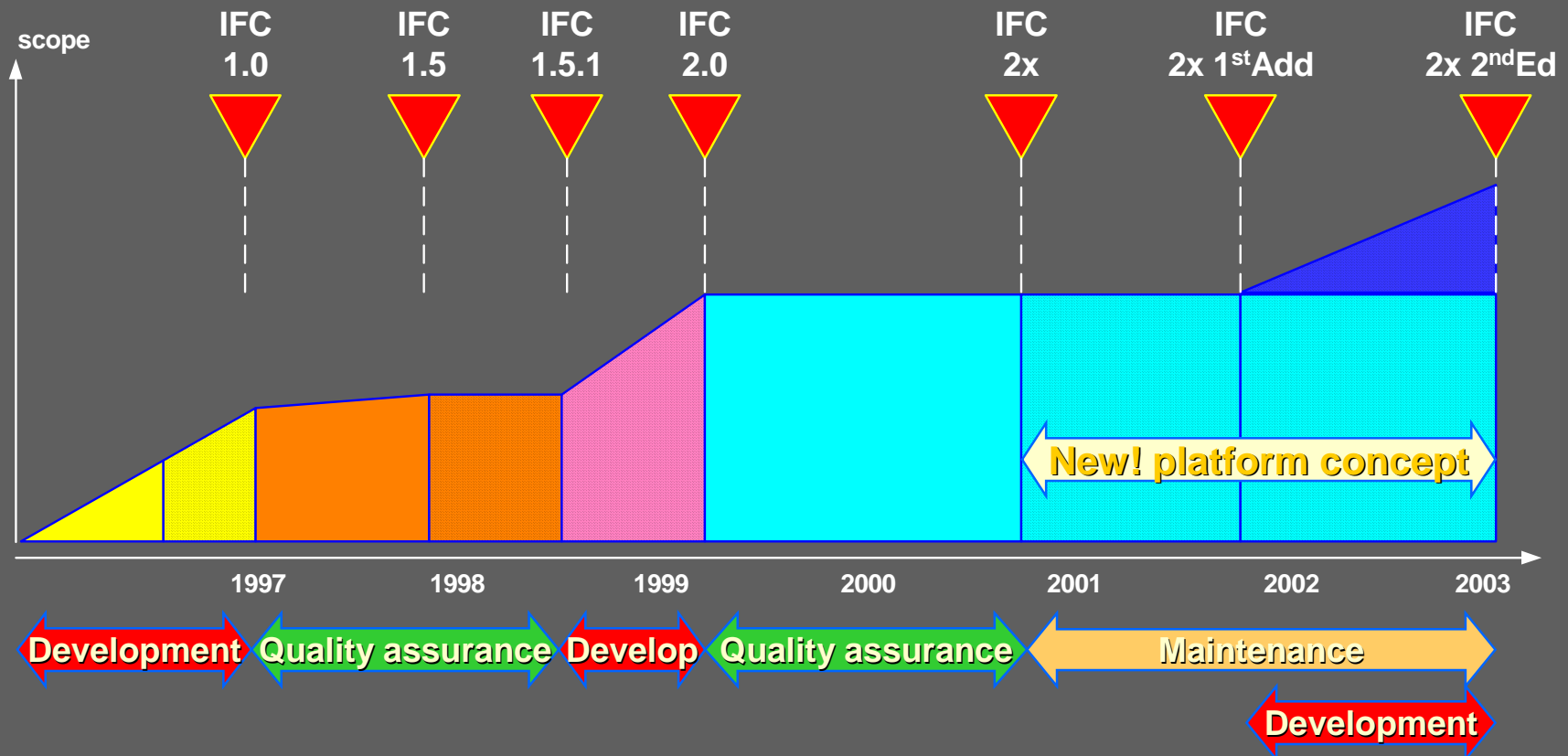
# IFC projects and feasibility studies

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- *... 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

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## IFC 2x

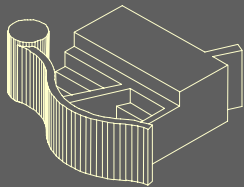
**X** tra domain support

**X** tensible for new requirements

**X** ML support for ifcXML



# Units of Functionality in IFC2x (1/3)



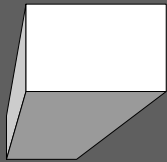
## Geometry (explicit)

B-rep  
CSG



## Relations between Building Elements

Wall Connections  
Holes  
Chases  
Zones



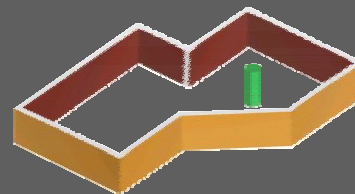
## Geometry (Sweep)

volume - extrusion, rotation  
areas - extrusion, rotation



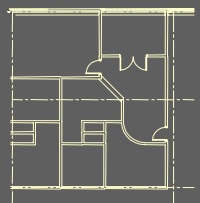
## Topology

element connectivity,  
schematic design



## Spaces and Spatial Structure

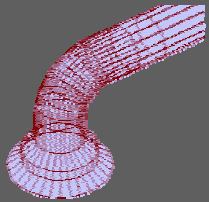
Space  
Building Storey  
Building  
Building Site



## Building Elements

Walls, Openings, Doors  
Roofs, Stairs, Ramps, etc.

# Units of Functionality in IFC2x (2/3)



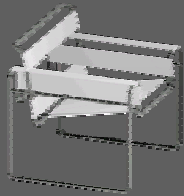
## Equipment

ducting, piping  
chillers, fans, etc  
loose equipment



## Costing

Cost of objects  
Cost planning  
Cost estimates



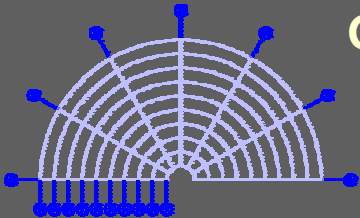
## Furniture

furniture items  
system furniture



## Work plans

schedules  
resource allocation



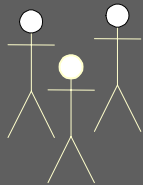
## Grid

linear, circular grids  
positioning to grid

O/Nr A1263	
2xAbed	£ 26
3xafirgf	£ 42
1xaaahds	£685
4xjhiu	£421

## Orders

Work Orders  
Change Orders  
Purchase Orders



## Actors

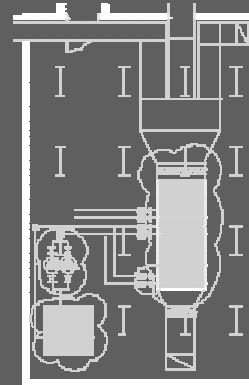
People  
Organisations  
Addresses

# Units of Functionality in IFC2x (3/3)

2xAbcd  
£ 26  
3xafrgf  
£ 42



## External Data



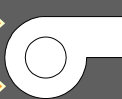
## Facilities Management

- Asset Identification
- Maintenance History
- Inventories
- Move Management

SfB



Uniclass



## Classification

## Search for and retrieve product information

- manufacturer information
- electronic catalogues
- library data

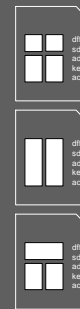
O/No  
A1263  
  
2xA £ 26  
3xB £ 42  
1xC £685











## Associated Documents



*ifcXML*



# 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 

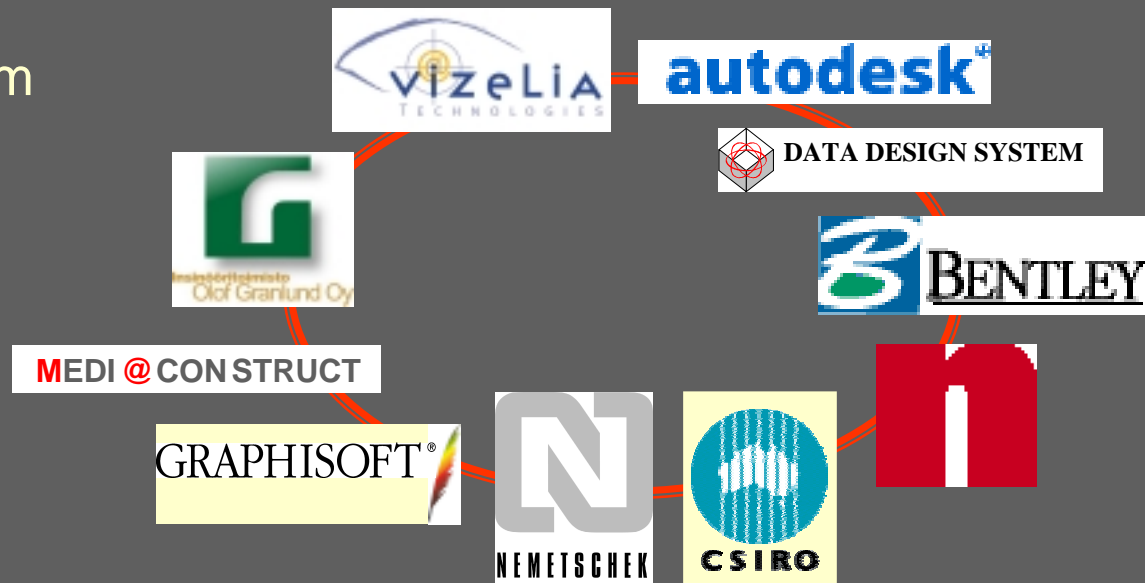
# IFC2x – current implementations

- Implementers roundtable

- Autodesk
- Bentley System
- CLAIRE project
- CSIRO
- Data Design System
- Graphisoft
- Nemetschek
- novaSPRINT
- Olof Granlund
- Vizelia

- Deadlines

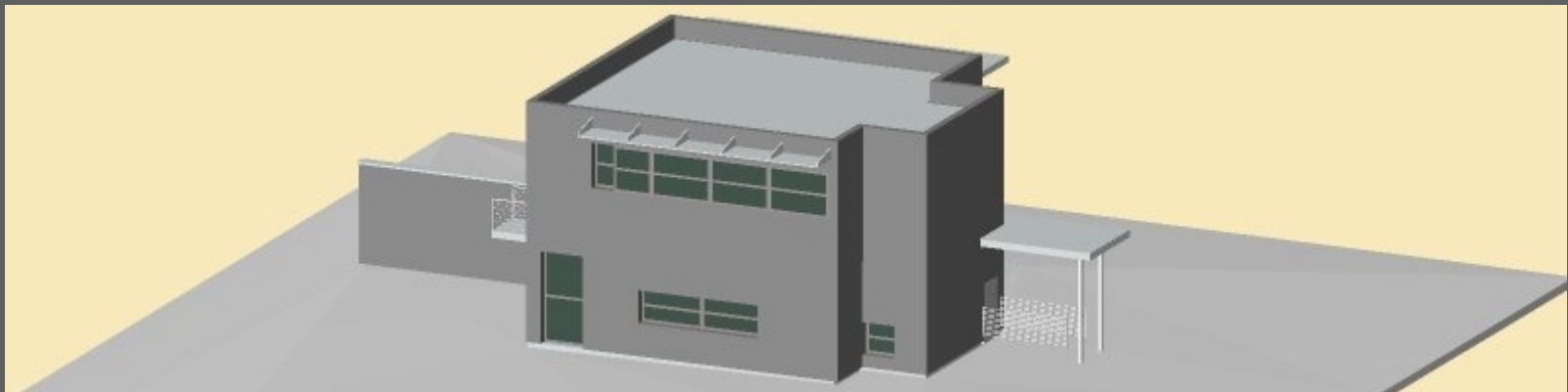
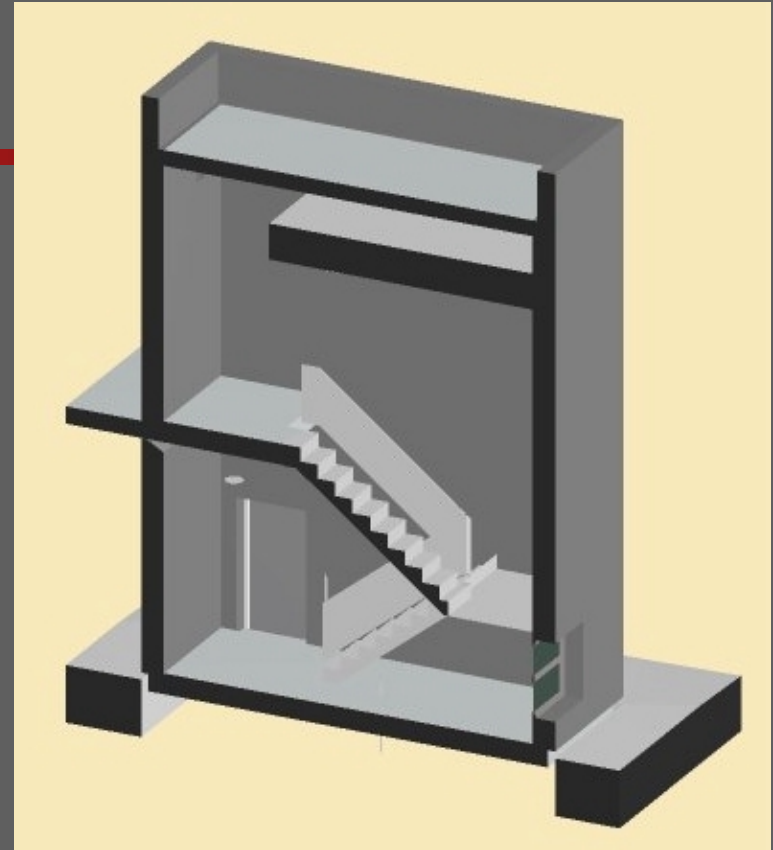
- Prototypes ACS 01
- Certification in 2002



# IFC2x test case

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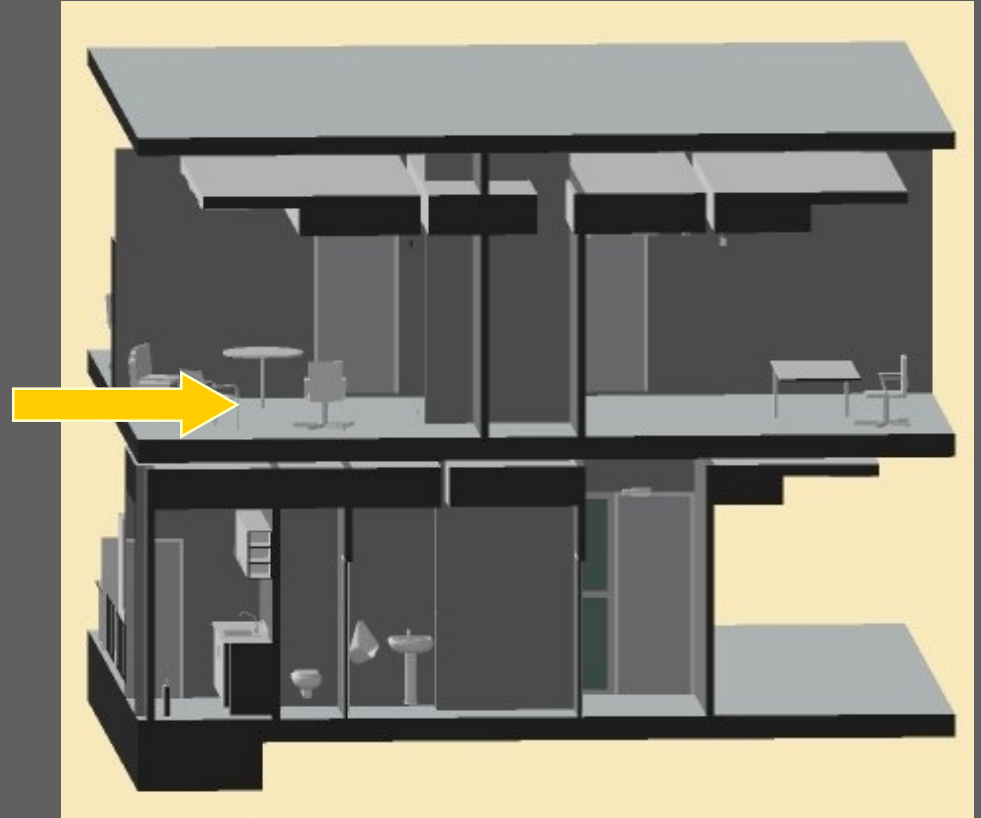
- shell and core, with
  - project structure
  - site data
  - building elements
  - furniture & fixtures
  - HVAC equipment



# IFC2x test case - 2

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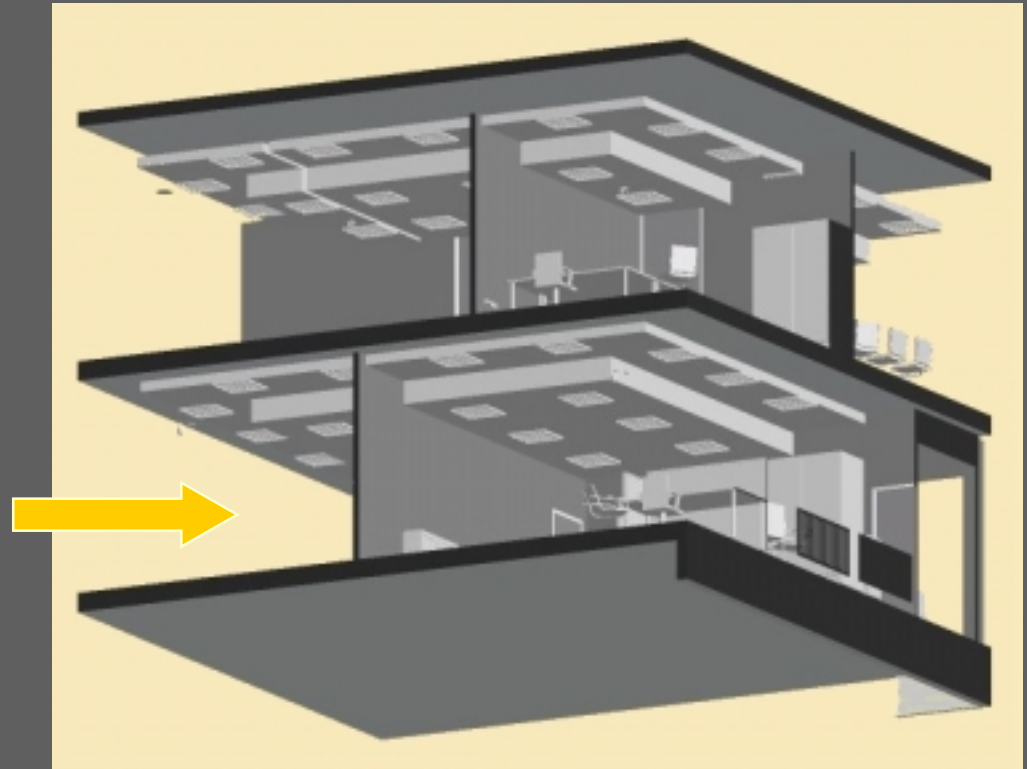
- shell and core, with
  - project structure
  - site data
  - building elements
  - furniture & fixtures
  - HVAC equipment



# IFC2x test case - 3

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- 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 assurance process

# IFC relationship to ISO

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- 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

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- 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

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- 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

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## ↳ language

– formal language neutral to any structure and content

➤ *"English", "German", "French"*

➤ "UML", "EXPRESS", "XML DTD", "XML Schema"

## ↳ model

– specific 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

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

same content

# why using XML ?

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- **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

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- **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

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