IFC4 – the new buildingSMART Standard

Official Release Date of buildingSMART’s IFC4 – 12. March 2013

What’s new in IFC4?

presented by

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IFC4 as full ISO standard

Now: IFC4 as Full International Standard ISO 16739 (publication stage 60-60 as of 21.03.2013)
What is new, and why support IFC4

IFC4 at a glance

- enhances the capability of the IFC specification in its main architectural, building service and structural elements with new geometric, parametric and other features
- enables numerous new BIM workflows – including 4D and 5D model exchanges, manufacturer, product libraries, BIM to GIS interoperability, enhanced thermal simulations and sustainability assessments
- links all IFC property definitions to the buildingSMART data dictionary
- improves readability and ease of access to the documentation with numerous implementation concepts and fully linked examples
- contains ifcXML4 schema, fully integrated into the IFC specification in addition to the EXPRESS schema
- is fully integrated with new mvdXML technology and allows easy definition of data validation services for IFC4 data submissions
- corrects technical problems found since the release of the IFC2x3
- enables the extension of IFC to infrastructure and other parts of the built environment

Why implement IFC4?

- Keep your customers happy by improving your IFC support
- Take advantage of the technical improvements of IFC4
- Remember, it is now possible to formally support model view definitions and validate them
- Benefit from IFC the easy way with Simple ifcXML
- Broaden your IFC support with the new IFC4 objects and workflows – it will help you to attract new customers
- Reach a wider market with IFC4 – as a full ISO standard, it will become a pre-condition for tenders in some markets
Some facts ...

6 years of development

- ~ 8 person/year direct development effort
  - Time spend by buildingSMART Model Support Group (50% volunteered)
  - More spend by external reviewers, project development teams, bSI community

- > 1200 issues / proposals / change requests handled
  - All are logged and are traceable at http://www.buildingsmart.org/jira
  - Each contributing to better coverage, higher quality, more precise documentation

Single goal: secure IFC as the true openBIM standard worldwide
History of IFC Development

- IFC 1.0 to IFC 2.0 – early prototypes use: 2000 - 2002
- IFC 2x to IFC 2x2 – early adopters use: 2002 - 2008
- IFC 2x3 – in practical use today use: 2008 - 2016
- IFC 4 – forthcoming use: from 2014 onwards
Major improvements – No.1

- Consistency throughout the IFC schema
  - Same concept, same modeling style
  - Reduction of the “multiple ways to do”
  - Symmetrical specialization trees

- Complete the building / building service element catalogue
  - Adding missing element types (like shading device, solar device, burner, communication appliance, or electric distribution board)
  - General overhaul of the building service and control definitions, and of port connectivity

- Separation between general element definitions and parametric definitions
  - Adding standard case definitions for elements
Major improvements – No.2

- **Structural steel and timber**
  - Definition of material profile association,
  - Alignment at a cardinal point,
  - Anisotropic material properties

- **Structural analysis and detailing**
  - Enhancement of analysis model
  - Better support of detailing (simplified multiple placements, e.g. for fasteners, rebar)
  - Foundations enhanced by types

- **Standardized quantities for QTO**
  - Definition of international base quantities, defined as separate XML schema + configuration files linked to IFC spec
Major improvements – No.3

- **Energy and other performance analysis**
  - Improvement of space boundaries, adding spatial zones and external spaces (against ground, water, air), shading devices

- **Environmental impact values**
  - Adding environmental impact indicators and values to elements and element types

- **Site planning**
  - General geographic feature element enabling basic site planning and GIS connection

- **GIS coordinate system transformation**
  - Enabling the mapping of a building design into a GIS system and vice versa
Major improvements – No.4

- Major efficiency improvement
  - Rework of the scheduling definitions, adding calendar support, switch to ISO 8601 time format, simplification of task relations.
  - First prototypes show full support for MS Project and 75% decrease of model footprint

- Add type/occurrence concept for processes
  - Re-usable definitions for tasks, events and procedures

- Major efficiency improvement for 5D
  - Similar rework for cost items and construction resources, now linked to schedule and BIM
Major improvements – No.5

- Enhancement of geometry resource
  - Adding support for non-uniform rational b-spline representation (NURBS)
Major improvements – No.6

- Enhancement of geometry resource
  - Support for tapering in extrusions
  - Support for arbitrary sweeps
  - Non-planar surfaces and surface bounds
Major improvements – No.7

- Effective geometry for mobile applications
  - Tessellated geometry
  - with optional vectors per vertex
  - with optional color per face
  - with optional texture maps per face
Major improvements – No.8

- Enhancement of lighting and shading component
  - texturing, including multi-textures
  - lighting, including light distribution
  - following the X3D standard
Major improvements – No.9

- Connectivity and system models
  - redesign of the building service part
  - enhancements on connectivity
  - port usage improved
  - documentation update throughout

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Port Connection Use [Implicit]: logical connectivity with optional realizing element

Port Connection Use [Explicit]: physical connectivity with ports connected as constructed

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IFC4 Overview on "What's new" | Thomas Liebich | 12-Mar-2013
**Major improvements – No.10**

### Property Set Definition
- covered by the following languages:
  - German “de-DE”
  - French “fr-FR”
  - Japanese “ja-JP”
  - Korean “ko-KR”
  - Chinese “zh-CN”

### Quantity Set Definition
- covered by the following languages:
  - German “de-DE”
  - French “fr-FR”
  - Japanese “ja-JP”

Defined in XML Definitions rendered into IFC documentation.
Major improvements – No.11

Integration of IFC content in IFD

IFD GUID

Guid: f7d662e01ac3437c813a29287858ec80

Definition: Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building.

Names:
- de-DE: Außenbauteil
- fr-FR: Est extérieur
- ja-JP: 外部区分
- zh-CN: 是否外部构件

IFC4 Overview on “What’s new” | Thomas Liebich | 12-Mar-2013
Major improvements – No.12

New richness of extensible property and quantity definitions

- Direct mapping from old Property Set Definition (PSD) format to new property templates
- Fully automated schema validation of buildingSMART and regional property set definitions supported
- Integration of multiple language references
- Publication of full list of IFC Property Sets (all-in-one-file) as
  - An IFC definition file, utilizing new property set and property templates (*IFC4.ifc*)
  - An ifcXML definition file, utilizing new property set and property templates (*IFC4.ifcxml*)
  - Lookup http:// for each property set into the buildingSMART data dictionary
  - Fully rendered Web-pages

<table>
<thead>
<tr>
<th>Property and quantity templates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property sets and quantity sets are defined within IFC-SPF and IFC-XML files.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>ASCII file</th>
<th>HTML file</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFC-SPF property and quantity templates</td>
<td>ifc4.ifc</td>
<td></td>
</tr>
<tr>
<td>IFC-XML property and quantity templates</td>
<td>ifc4.ifcxml</td>
<td></td>
</tr>
</tbody>
</table>
Major improvements – No.13

Full integration of simple ifcXML into IFC4 specification

- the simple ifcXML transformation is included in IFC4 development tools and specification
- IFC4 documentation is bilingual (no separate deliverables for IFC EXPRESS and XSD)
- Same IFC documentation can be used for IFC EXPRESS and ifcXML developments
Major improvements – No.14

A single solid in ifcXML for IFC2x3

50 XML lines = 100%

50 XML lines = 100%

Same single solid in ifcXML4

7 XML lines = down to 14%

6 times more efficient
Major improvements – No.15

- **Documentation improvement**
  - Documentation, explanations and many examples are added to improve understanding and readability of the spec
  - direct URL addressing of each IFC construct (entity, type, pset, etc.)

Based on the composed URL:

<IFC specification URL/>+<release name/>+<version/>+<html/>+<link/>+<name of IFC construct>+<.htm>

Each IFC entity, type, property set or quantity has its own URL, for example:

Major improvements – No.16

Full integration of mvdXML into IFC4 specification

- Concept templates (chapter 4)
- Concepts assigned to roots (chapter 5, 6, 7)
- mvdXML available as baseline to MVD developers

Common Use Definitions
The following concepts are inherited at supertypes:
- IfcRoot: Identity, Revision Control
- IfcBuildingElement: Surface 3D Geometry

Instance diagram

Object Typing
The Object Typing concept applies to this entity as shown in Table 80.

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>IfcBeamType</td>
</tr>
</tbody>
</table>

Table 80 – IfcBeam Object Typing

Property Sets for Objects
The Property Sets for Objects concept applies to this entity as shown in Table 81.

<table>
<thead>
<tr>
<th>PredefinedType</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre_BeamCommon</td>
</tr>
<tr>
<td></td>
<td>Pre_ReinforcementBarPitchOfBeam</td>
</tr>
</tbody>
</table>

A.1 Common Use Definitions
Model view definition
Model view definitions are defined within MVD-XML files.

<table>
<thead>
<tr>
<th>Description</th>
<th>ASCII file</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVD-XML model view definitions</td>
<td>IFC4.mvdxml</td>
</tr>
</tbody>
</table>
Major improvements – No.17

- IFC4 unit test case examples
  - A set of unit test cases added to the IFC4 documentation
  - Each with a downloadable ifc file, and a fully commented and linked html file
  - Link also from the entity definition to all available unit test files (to be extended)
Major improvements – No.18

IFC-DOC tool – new case tool for IFC

- Windows utility used for producing IFC documentation and Model View Definitions
- IFC4 documentation automated to ensure consistency and cross-linking
- Generates HTML, diagrams, schemas (EXPRESS, XSD), and all documentation.
- Create Model View Definitions in mvdXML format, validate IFC files against MVDs
- Edit definitions, property and quantity sets, concepts, templates, translations.
- Upload and download to bSI Repository
- Free and open source for bSI members
- Download at www.buildingsmart-tech.org
IFC4 on the web – published today!

IFC4 Release Summary

by Thomas Liebich — last modified Mar 11, 2013 04:30 PM

IFC4 Release

Official landing page to publish the current IFC4 release. It contains the downloads of the IFC4 specification and the EXPRESS and XSD schema. Additional links to IFC4 related resources will be published here as well.

IFC4 specification downloads

- download EXPRESS file
- download XSD file
- download HTML documentation
- online IFC EXPRESS schema location
- online ifcXML schema location
- online access to HTML documentation

IFC4 development resources and documents

Links to upcoming development resources and other implementation documentation will be gradually published here. In the meantime, please check the publication of the intermediate pre releases of IFC4 for additional information and examples.

http://www.buildingsmart-tech.org/specifications/ifc-releases/ifc4-release