

IFC R2.0 Certification Testing: Overview of "Model Checking Software"

v1.0 - 2001/05/23

Patrick Houbaux – CSTB – France

Introduction

IAI's certification software testing is a procedure for testing software's conformance against a given release specification of the IFC model and also with a given subset of this model called a "view" for a specific business process.

The aim of this certification procedure has two main objectives:

1. to provide quality insurance for the IFC implementation of software editors
2. to give to the end-user the assurance that software will exchange the IFC specification in a consistent way so that he doesn't have to worry about the content of an IFC file when he wants to exchange data with other actor in the process he is involved into.

The certification procedure has already been done for a subset called "CAD view" of the IFC model Release 1.5.1 since this IFC release almost contains only design concepts.

The number of concepts has increased from IFC1.5.1 to IFC 2.0 in different domains (HVAC, FM, thermal loading, etc.) so that it's impossible now to process a certification along only one view of the IFC model.

The implementation agreements of the IFC 2.0 model contain the definition of a number of views. These definitions have been established through the BLIS project, which is the only international project that deals with IFC 2.0 implementation.

Around 30 software companies worldwide have agreed these views.

This document deals with the specification of software that will check business software export/import in the IFC file format with the definition of the BLIS views. Only SPF format has been retained for this certification procedure.

Objectives

The aims of this "checking software" is to test generated IFC file with the content of a given view and with the value of the entities' attributes compared to a given predefined reference model. This software could also generate a detail report highlighting where the file is conformant to the attribute's values of the reference model.

So far this software will do 2 main tasks, let say that this software is a set of 2 small software tools:

1. Checking the content of an IFC model software: Concept_checker
2. Comparing IFC file to a reference IFC model software: Diff_checker

Software Overview

Concept Checker: Testing the content of an IFC 2.0 file with a view

The main objective is to provide a checking tool for an IFC file's contents compare to a view definition.

This tool will proceed as follow:

1. choice of a view
2. going through all concepts defined in this view definition
3. checking if each concepts defined in the view is populated in the IFC model
4. going through all attributes defined for each concept in the view definition (c.f. BLIS view documentation)
5. checking if each attribute defined in the view definition is populated
6. if an attribute is a reference to another concept, the attributes of this concept are also checked

This software can also be used to check if the following “minimal” concepts are in the IFC checked model:

Containment structure

- Project
- Site
- Building(s)
- Building storey(s)
- Space(s)

Placement structure

- Site to project
- Building(s) to site
- Building storey(s) to building
- Building elements to building storey

Connections between spaces and doors/windows/openings

Space to wall connections (space boundaries)

Wall to wall connections (logical, no connection geometry)

Groups (+ systems and zones)

Support for units

- metric (mm, cm, m, m2, m3)
- imperial (inch, feet, square feet, cubic feet)
- angle (radian, degree)

Project type (construction type) for

- Wall
- Door
- Window
- Column
- Beam
- Roof slab
- Floor slab
- Roof

Manufacture information for

- HVAC objects
- Plumbing fixtures
- Electrical fixtures
- Electrical appliances
- Cabinets
- Counters and shelves
- Furniture

Using description for certification: The facilitator start to load an IFC file, and then choose a view to be check. The list of the concepts defined in the view is displayed. Then the facilitator chooses randomly a concept in the list and check if the attributes of the concept are well instantiated.

Difference Checker: Testing the entities' attribute value of an IFC 2.0 file

The main objective here is to provide a tool that will make an "object-diff" (like a diff text could do) between an IFC 2.0 model and a given predefined reference model.

This tool will browse all entities in the IFC model and compare all attributes recursively to the corresponding entities in the defined reference model (see Visio-FlowChartForDiffChecker_ph.pdf).

It will report automatically "the objects difference" between the two models in XML format.

Limitations:

- This software only needs to check EXPLICIT attributes since the INVERSE attribute are automatically given by the STEP tool box used for reading and writing the IFC file,
- At the current state of development this software compares unordered aggregates like ordered aggregates and if it finds some differences it reports a warning.

Result Code Meaning:

Result Code	(E)rror / (S)uccess / (W)arning	Meaning
0	S	The checked attribute has a value in the checked model and the value is the same
1	S	The checked attribute is unset in the reference model then it doesn't need to be checked
2	S	The checked attribute is unset in both reference and checked models
3	S	The checked aggregate is empty in the reference model and it could be filled in the checked model
4	S	The checked instance has already been checked in the diff procedure and the reference is the good one
5	S	The checked instance didn't report any errors in the diff process
100	W	The checked aggregates is an unordered aggregate and contains some differences with the corresponding reference aggregate
-1	E	The diff process reported some differences for this instance
-2	E	The checked attribute has a value in the checked model but the value is not the same comparing to the reference model
-3	E	The checked attribute should have a value but is unset in the checked model
-4	E	The checked instance has already been checked in the diff procedure but the reference is not the good one
-5	E	The instance with the GUID is not found in the checked model
-100	E	The number of member in the checked aggregate differs

Using description for certification: The facilitator of this software has to look at the generated report for the result of the testing and decide which Errors/Warnings are meaningful.