Standard Process for a Future Certification

Executive Overview

Based on the experience of the current certification procedure buildingSMART decided to develop an improved certification process. The new approach, as proposed and developed by the authors, has the following main goals:

- Move from the current concept of ability checks and to detailed quality checks
- Distinguish between quality assurance (to be done during software development) and quality control = certification (to be done independently from the software development process with the final software release)
- Develop a standardised testing process and environment which can be executed in different regions by authorised testers and which is repeatable
- Make use of automated testing as far as possible, including the possibility to include different testing tools
- Develop a management system which helps to minimise the administrative effort for facilitating certification
- Develop a database which collects test-results and which allows evaluation under different aspects (also e.g. public view, detailed results for members)

The improved future certification process is based on the following main components:

☑ Based on specific MVDs and IFC releases
☑ Calibration files for import testing
☑ Testing instructions describing import and export tests
☑ Automated export testing as far as possible
☑ Guided import testing with check-lists and templates
☑ Management system
- Facilitation of certification
- Capture test results
- Evaluate test results
- Built-up on a data base
- Web accessible

The new certification process with its five components has been developed and is available, the GTDS is running as a working pilot. The **next steps** should be decided now:

- Acknowledgement, that this will be the new official certification process of buildingSMART
- This will replace the current certification process
- Develop a business plan to support the new certification process

History and motivation

Several years ago, IAI / buildingSMART introduced a certification procedure which had the goal to check and certify, whether a specific software developer is able to implement the support of IFC in his application on a relatively high level of quality. While the focus of this procedure is rather on checking the ability, than on checking the achieved level of quality in detail, it implies, that each software developer is taking care of the quality in detail by himself.

Compared to earlier attempts, remarkable improvements in quality of IFC-support could be observed, since this certification had been introduced, especially in the implementation initiative based on IFC2x3 and the Coordination-View-Definition, which started 2005. However, the real benefits became visible not before 2008, since the relevant software releases had been introduced to the market.

In the overall opinion the achieved result had been appreciated, while at the same time it became clear that the reliability in quality details is not yet sufficient. Therefore ITM formed a task-force which worked out a paper containing requirements and proposals for improved quality in IFC-support. In general, the paper came to the conclusion, that the creation of quality during the development process (= quality assurance), and the checking of the achieved quality in a final product (= quality control / certification) has to be differentiated. The paper also made clear, that a future certification has to be modified from the current ability check to a detailed quality check. ITM asked Thomas Liebich and Rasso Steinmann to work out the basis for a future improved certification. Together with the iabi - Institute for applied Building Informatics and FZK - Research Centre Karlsruhe the following concept and pilot had been developed.

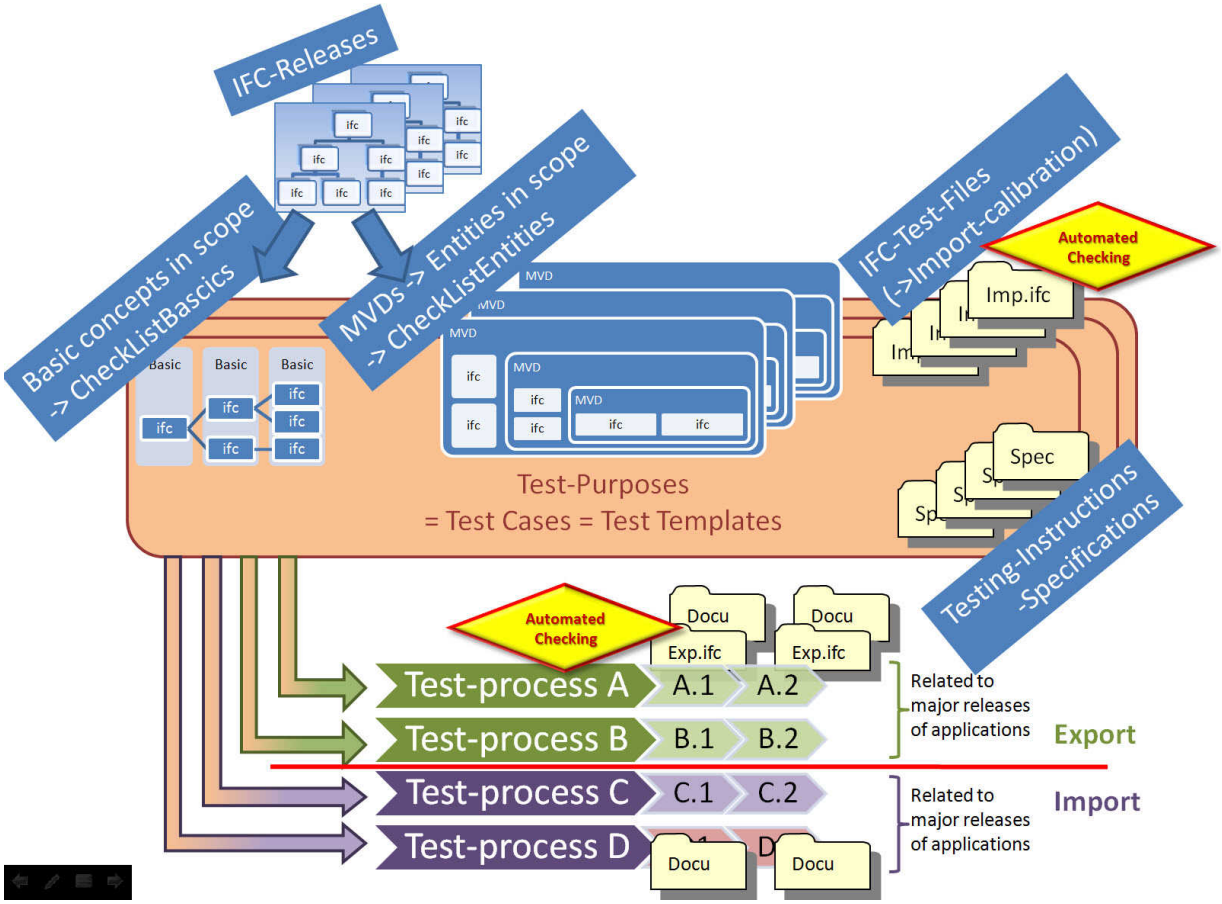
Fundamentals

Based on the ITM-task force paper and on feedback from discussions with ITM and stakeholders like software end-users, authorities, building-owners, ..., the following fundamentals had been identified for the basis of a future improved certification:

- Quality check instead of ability check
- Differentiation between quality assurance and quality control, while certification is regarded as quality control
- Certification of final software releases, not of pre-releases
- As the goal moved to quality control a re-certification becomes necessary, e.g. for each major software release
- Each detailed test has to be documented in instructions, so that it is repeatable and can be executed at any location by any competent and authorised institution and person
- Automatic export testing tools need to be developed and integrated as far as possible
- Check-lists have to be available to guide import testing
- There is a need for a management system which helps to facilitate the tests and which provides evaluations of the test-results in a transparent way.
- The certification-tests (instructions and calibration files) will be available to software developers in advance, so that they can use them during quality assurance. This is important, because in future final releases and no longer pre-releases will be certified.

Concept and pilot for a future and improved certification

Especially the change from ability check towards quality check has a significant impact on the future specification of certification. It is important, that the specification is standardised, so that it is repeatable and can be executed in different regions. Otherwise certification results would not be comparable. The following concept for a standardised certification specification and the pilot for a certification management system had been developed on the basis of the fundamentals:



Improved MVDs

Based on the experience of past years it became clear, that MVDs need to be improved. Especially cross-discipline data-transfer requires specific attention, because the appearance of specific building components differs significantly in specialised software. E.g. a wall looks quite different in an architectural and in a structural analysis application.

Therefore it became clear, that also the current Coordination View needs to be improved, by straighten it to specific exchange requirements of players in the design and construction process.

Testing instructions

Each test has to be described in detail, so that it can be executed by different people independently and can be repeated without doubt.

For export-tests the necessary functionality to be executed in an application has to be explained, in order to create an IFC-file, which contains the expected scope of data.

Examples need to be elaborated so that the tester can compare, whether he created the proper data.

For import-tests the instruction needs to describe, how the imported data needs to be checked in the importing application in order to ensure that the data transfer is done without relevant losses. Especially in the cases of cross-discipline data-transfer, the different data-appearances in specialised software needs to be taken into account. While exported IFC-files can be checked up to a certain extend, the import-tests can only be done manually.
AEC3 has developed a sample testing instruction.

Repository for Test files
The basis for import-tests is a library of very well tested calibration-files. On the one side these files need to address specific building components and combinations of them respectively interactions between them. Ideally these files should contain focussed data, so that problems can be addressed more easily. On the other side there is also the need of bigger files, which are containing whole buildings.
In addition there is also the need of wrong files on purpose, in order to test the behavior and robustness of applications in these cases.
A starting point for testing files is the huge set of IFC-files, which had been collected in past certifications.
It is important to understand, that these files have to be renewed in the case of future IFC-releases.

Integrated automatic export testing
Up to a certain extend IFC-files created during an export-tests can be checked automatically by checking tools. Especially issues like validations against the IFC-schema or against implementation agreements can be checked automatically. While there are already some checking tools available, they need to be modified, so that they can be integrated in the certification management system (see GTDS) so that any exported IFC-files w be checked automatically. These checking tools need also to be extended so that rules like implementation agreements will be taken into account. The results of the checking tools need to be exported into an agreed XML-format, so that it can be stored by the management system.
It is important to understand, that there are certain limitations in automatic testing and that not everything can be covered by it within reasonable means. Therefore there is always the need for additional manual checks.
FZK has developed a pilot for a testing tool, which takes into account also implementation agreements and which is integrated in the management system.

Check-List guided import testing
Especially for import-tests but also for export-tests there is a need for manual checks. These can be done by visual control, by using specific testing-tools or by examining the actual data-file. It is important the the results will be captured in a structured and standardised way, so that they can be evaluated later. The certification management system (see GTDS) therefore needs to provide prepared check-lists, which can capture the test results.

G**lobal**T**esting**D**ocumentation**S**erver* ***- Certification Management System

Currently, testing-results are being captured and documented in Excel-sheets which turned out difficult to handle and to evaluate as more and more applications became certified. Also tests had been executed by different organizations and people, who documented them in own and private sheets. As this had been done in non-standardised structures and on a file-basis, the testing-results are not really accessible and with this basically lost for software improvements.
The calibration files plus further explaining documents had been stored in a directory structure, which worked so far, but never was really comfortable.
Also the files created by export-tests had been collected in an own directory structure, which a again was not really comfortable and easy to access and to examine.
The calibration files as well as the files from export-tests has been stored with Groove-technology, which is very comfortable to share, but only if Groove is installed.
In order to overcome these limitations the GTDS was developed in order to serve as a certification management system.

The working pilot of GTDS contains the following functionality:

- Data base driven (built with Oracle data base technology)
- Accessible over the web just with an internet browser, without the need to install any tools (built with Oracle web front end)
- Hosted on a server at a professional provider in order to ensure availability and bandwidth (rented server at 1&1, a company of United Internet)
- Structure to define test-purposes and sets of test-purposes. A test-purpose serves as a template to create actual test-processes out of it. A test-purpose is related to a specific IFC-release and MVD and contains any required calibration files and testing instructions. A whole certification can be defined as a set of test-purposes.
- Test-purposes can be allocated to users who could be software developers as well as certifiers. By activating an allocated test-purpose the actual test-process will be created, which can capture and store any test-results. Each test-process is clearly storing the history of tests, so that improvements can be traced.
- If a software developer applies for certification, the whole set of test-purposes covering a specific certification can be allocated to him by one mouse-click. This reduces significantly administrative overhead. Software developers will gain full transparency by this function, what will be checked during the actual certification.
- Test-purposes and test-process are differentiated between import- and export-testing.
- Any test-results are being captured in the history of the test-processes. Test-results may be automatically produced reports, manually filled-in check-lists and any exported IFC-files
- Evaluation of test-results under various aspects
- Any IFC-file uploaded to GTDS will be automatically checked by integrated checking tools. Currently the pilot checking tool from FZK is integrated.
- There is a standardised XML-structure to collect test-reports from any checking-tools which might be integrated in GTDS.
- GTDS provides check-lists for capturing manual testing-results. There is a more general checklist, to be used for an end-user-level tester, and a detailed checklist to be used for an expert-level tester.
- Field-tests: While access to the "official" calibration files probably will remain exclusively to members registered for certification, in addition there is a functionality for open field-tests, which very likely is accessible to

buildingSMART-members (access policy to be decided by buildingSMART). The field-test is a meeting point similar to the current ISG-Groove-space, with the advantage, that it can be accessed over the web just with a internet browser.

- GTDS serves as a IFC-file storage while the access can be managed from public up to protected for specific organizations or authorities.
- IFC-files will always be stored in it original form. In addition they will be stored in XML-structure, so that they can be examined on this level. E.g. one would be able to compare IFC-files.

Certification and Aquariums

Aquariums are expected to deliver requirements for data communication and integration in specific business scenarios. Ideally these requirements will be defined as MVDs in the final status (Aquarium > requirements > IDM > MVD > software-implementation with quality assurance > quality control = certification). In addition to the requirements Aquariums could also deliver the testing documentation for certifications. With this certifications could also prove, that specific software applications are fulfilling the requirements of Aquariums.

Certification Steps

The current certification procedure has two steps:
1st STEP: check against a set of calibration files
2nd STEP: Approval by end-users
A 3r STEP was introduced: Check whether adequate end-user-documentation and help regarding handling IFC is available.
While 1st and 3rd STEP worked quite well, already, 2nd STEP was never satisfactory, due to lack of investment by end-users.
In future, it s very likely, that we will skip the current 2nd STEP, while the 1st STEP will significantly be improved.

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