Technical Roadmap

April

2020

Technical Roadmap buildingSMART

Getting ready for the future

Version: 30 April 2020

“Getting ready for the future”

buildingSMART needs to create scalable interoperability for data standards, tools and the underlying technologies

Industry Foundation Classes

IFC 4.3 developments

Now maintained in UML class diagram; published on GitHub

Developments on updating building domain and backlog of technical issues are being processed.
ISO process has started.

Quality management

Online quality management and transparent development tooling (Travis)

Thorough testing

High vendor engagement made it the best tested release of IFC.

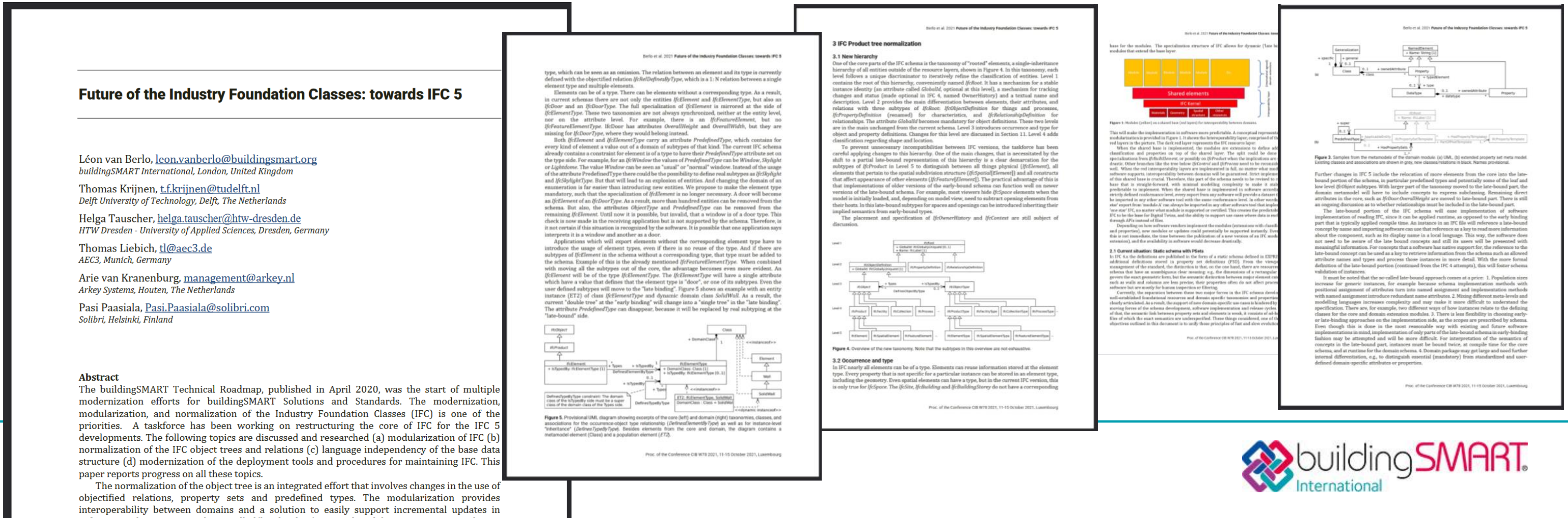
Micro cosmos

Direct integration with bSDD, Translations, documentation, etc.

Towards IFC 5

“the future of IFCs”

About 120 years of IFC experience has come together to define the principles of IFC 5.
Nine months of fortnightly meetings sets out a first step. Still a long way to go...



Future of the Industry Foundation Classes: towards IFC 5

Léon van Berlo, leon.vanberlo@buildingsmart.org
buildingSMART International, London, United Kingdom

Thomas Krijnen, t.f.krijnen@tudelft.nl
Delft University of Technology, Delft, The Netherlands

Helga Tauscher, helga.tauscher@htw-dresden.de
HTW Dresden - University of Applied Sciences, Dresden, Germany

Thomas Liebich, tl@aec3.de
AEC3, Munich, Germany

Arie van Kranenburg, management@arkey.nl
Arkey Systems, Houten, The Netherlands

Pasi Paasiala, Pasi.Paasiala@solibri.com
Solibri, Helsinki, Finland

Abstract
The buildingSMART Technical Roadmap, published in April 2020, was the start of multiple modernization efforts for buildingSMART Solutions and Standards. The modernization, modularization, and normalization of the Industry Foundation Classes (IFC) is one of the priorities. A taskforce has been working on restructuring the core of IFC for the IFC 5 developments. The following topics are discussed and researched (a) modularization of IFC (b) normalization of the IFC object trees and relations (c) language independency of the base data structure (d) modernization of the deployment tools and procedures for maintaining IFC. This paper reports progress on all these topics.

The normalization of the object tree is an integrated effort that involves changes in the use of objectified relations, property sets and predefined types. The modularization provides interoperability between domains and a solution to easily support incremental updates in

3 IFC Product tree normalization

3.1 New hierarchy

Figure 4. Overview of the new taxonomy. Note that the subtypes in this overview are not exhaustive.

3.2 Occurrence and type

Figure 5. Provisional UML diagram showing excerpts of the core (left) and domain (right) taxonomies, classes, and associations for the occurrence-object type relationship (*DefinesElementByType*) as well as for instance-level "inheritance" (*DefinesTypeByType*). Besides elements from the core and domain, the diagram contains a metamodel element (Class) and a population element (*ET2*).

Figure 1. Modules (yellow) on a shared base (red layers) for interoperability between domains

2.1 Current situation: Static schema with PSets

Figure 3. Samples from the metamodels of the domain module: (a) UML, (b) extended property set meta model. Existing classes and associations are shown in grey, new classes/relations in black. Names provisional.

IDS

IDS phase 1 complete

The Information Delivery Specification (IDS) had a massive commitment from industry.

Phase 1 delivered version 0.4.2. Phase 2 starts soon and is supporting vendors with consistent implementations.

Global participation

All major continents (and chapters) have been involved in the use-case analysis.
~ 60 people actively involved.

Huge market commitment

All major players committed to supporting it.
Clear roadmap for additional features.

Thoroughly tested

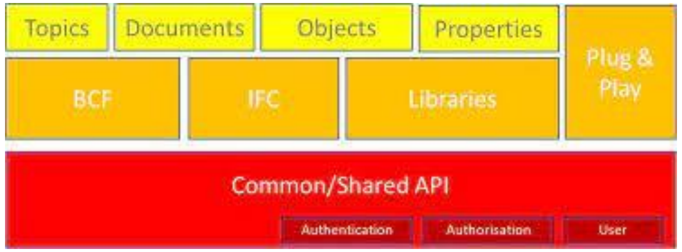
Already implemented in tools
and used in practice.
Using proven XSD restrictions & patterns.

openCDE API portfolio

Foundations API and BCF API update

The modularization of the APIs has continued in the openCDE program. The Foundations API agreements have been split of from BCF, creating Foundations API 1.0 and BCF (API) 3.0.

Documents API is currently in development and also based on Foundations 1.0.
Property API is coordinating with bSDD.



Steady progress

Strong project roadmap executed with professional recourse scheduling

Dedicated team

Vendors building, implementing and testing APIs collaboratively.

Use-case driven

User based testing provides input to development and roadmap

New bSDD online

bSDD
a service by buildingSMART International

The new buildingSMART Data Dictionary is up and running.

Usability driven; API first service.

Linked data functionalities (URIs, GraphQL, etc)

Market match

Business case for end-users was the starting point.
The new bSDD has a clear pitch of how users can save money.

Foundation

bSDD is the foundation for other Solutions and Standards like UCMS and IDS.

Instruct

Many hackathons, content owner workshops and test panels have been hosted to fine-tune and perfect the service.

Trust

Next challenge is to grow tools and content. Market use is highest priority.

UCMS

Use-case management

Direct Benefits

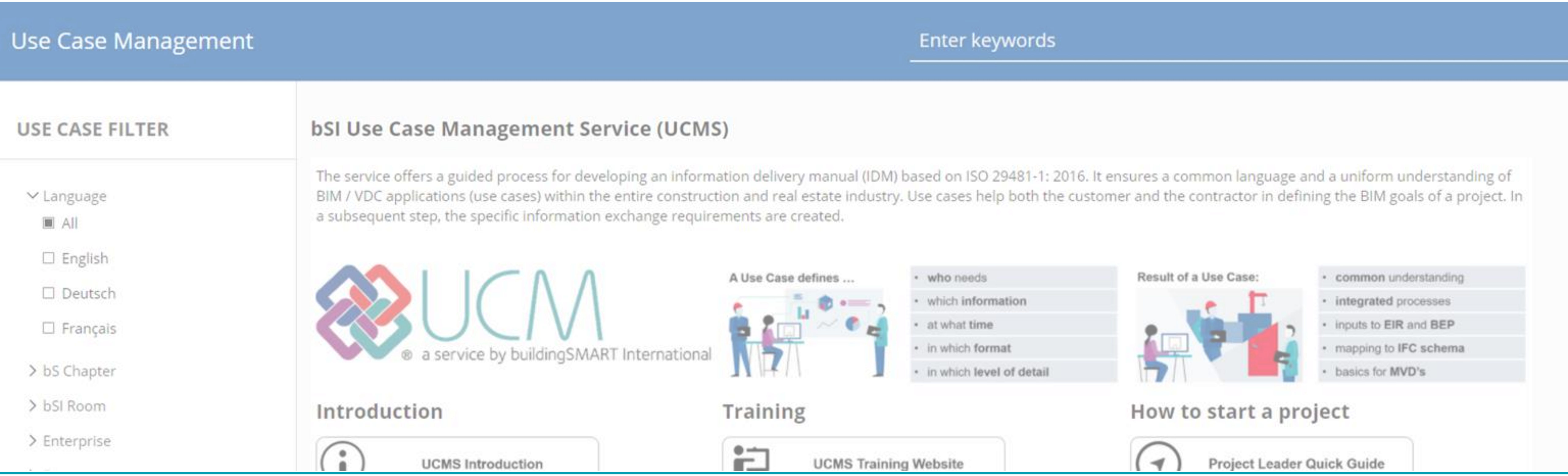
Direct benefits to mainstream users

Opportunity

Great roadmap and potential revenue stream

Synergy

Clear vision for integration with IDS and bSDD



bSI Use Case Management Service (UCMS)

The service offers a guided process for developing an information delivery manual (IDM) based on ISO 29481-1: 2016. It ensures a common language and a uniform understanding of BIM / VDC applications (use cases) within the entire construction and real estate industry. Use cases help both the customer and the contractor in defining the BIM goals of a project. In a subsequent step, the specific information exchange requirements are created.

A Use Case defines ...

- who needs
- which information
- at what time
- in which format
- in which level of detail

Result of a Use Case:

- common understanding
- integrated processes
- inputs to EIR and BEP
- mapping to IFC schema
- basics for MVD's

bSDD

Data & Information Validation

Broad market

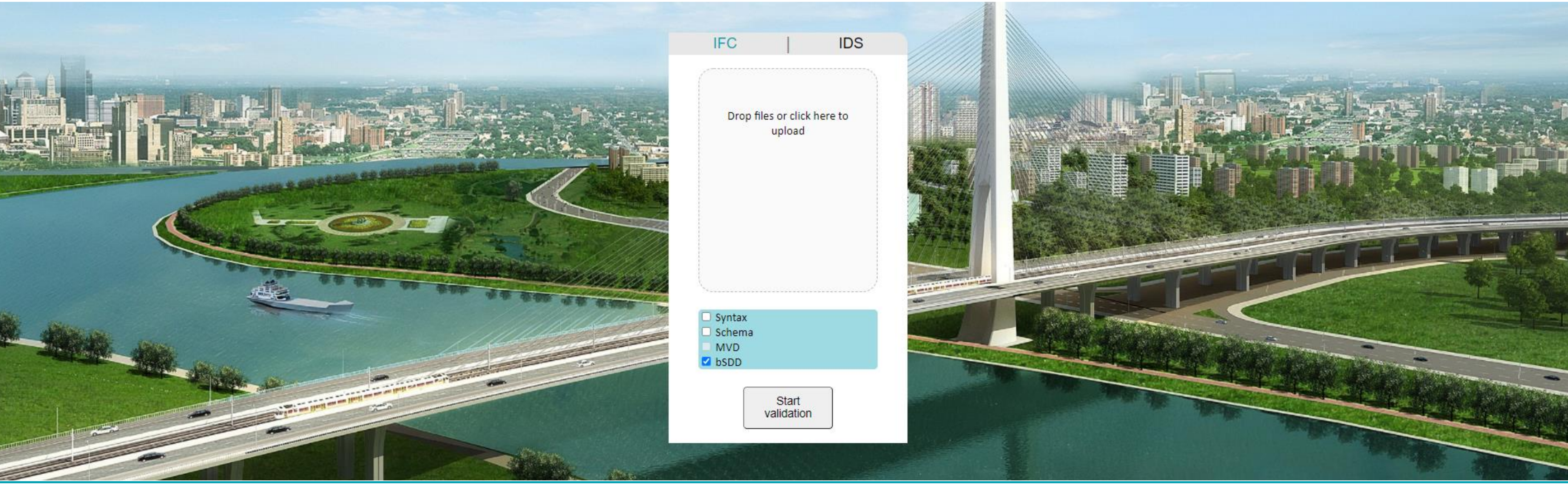
High prio request for IFC and bSDD

Digital signature

Tag your file as ‘valid’ using a digital signature

Insights

Data insights for future purposes



☐ Syntax
☐ Schema
☐ MVD
☑ bSDD

bSDD

Data & Information Validation

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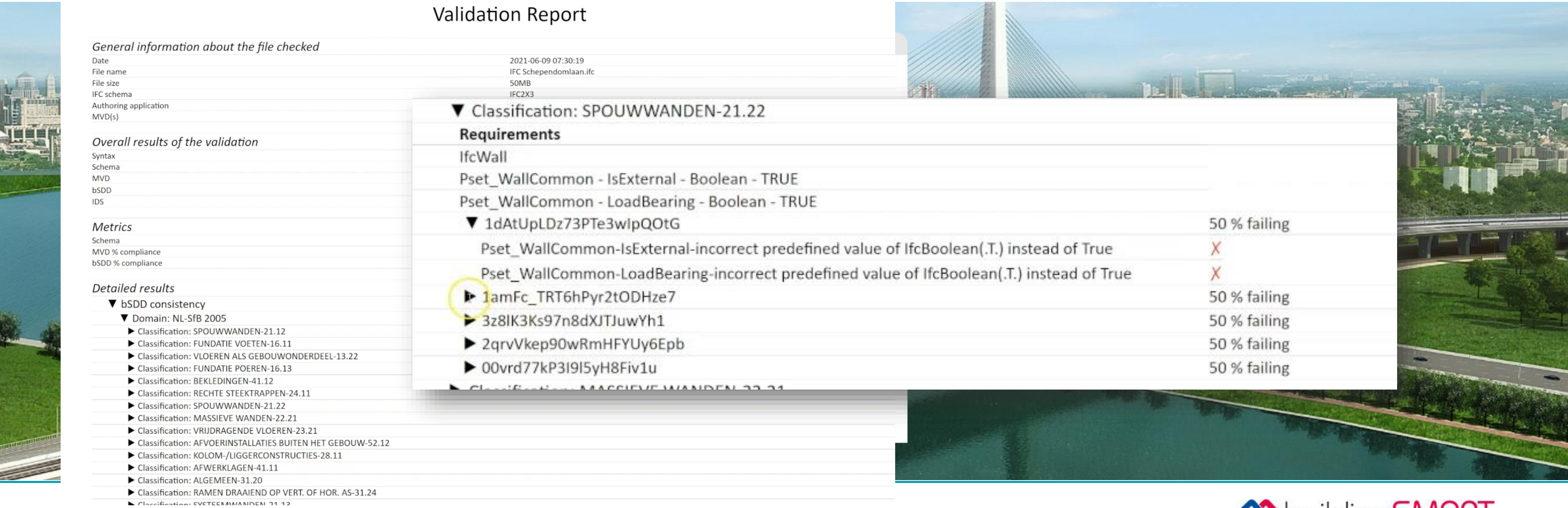


Validation Report

General information about the file checked

Date	2021-06-09 07:30:19
File name	IFC Schependomlaan.ifc
File size	50MB
IFC schema	IFC2X3
Authoring application	
MVD(s)	

Overall results of the validation

Syntax
Schema
MVD
bSDD
IDS

Metrics

Schema
MVD % compliance
bSDD % compliance

Detailed results

▼ bSDD consistency
▼ Domain: NL-SfB 2005
▶ Classification: SPOUWWANDEN-21.12
▶ Classification: FUNDATIE VOETEN-16.11
▶ Classification: VLOEREN ALS GEBOUWONDERDEEL-13.22
▶ Classification: FUNDATIE POEREN-16.13
▶ Classification: BEKLEDINGEN-41.12
▶ Classification: RECHTE STEEKTRAPPEN-24.11
▶ Classification: SPOUWWANDEN-21.22
▶ Classification: MASSIEVE WANDEN-22.21
▶ Classification: VRIJDRAGENDE VLOEREN-23.21
▶ Classification: AFVOERINSTALLATIES BUITEN HET GEBOUW-52.12
▶ Classification: KOLOM-/LIGGERCONSTRUCTIES-28.11
▶ Classification: AFWERKLAGEN-41.11
▶ Classification: ALGEMEEN-31.20
▶ Classification: RAMEN DRAAIEND OP VERT. OF HOR. AS-31.24
▶ Classification: SYSTEEMWANDEN-21.13

▼ Classification: SPOUWWANDEN-21.22	
Requirements	
IfcWall	
Pset_WallCommon - IsExternal - Boolean - TRUE	
Pset_WallCommon - LoadBearing - Boolean - TRUE	
▼ 1dAtUpLDz73PTe3wlpQOtG	50 % failing
Pset_WallCommon-IsExternal-incorrect predefined value of IfcBoolean(.T.) instead of True	✗
Pset_WallCommon-LoadBearing-incorrect predefined value of IfcBoolean(.T.) instead of True	✗
▶ 1amFc_TRT6hPyr2tODHze7	50 % failing
▶ 3z8lK3Ks97n8dXJTJuwYh1	50 % failing
▶ 2qrvVkep90wRmHFYUy6Epb	50 % failing
▶ 00vrd77kP3I9I5yH8Fiv1u	50 % failing
▶ Classification: MASSIEVE WANDEN-22.21	

buildingSMART International

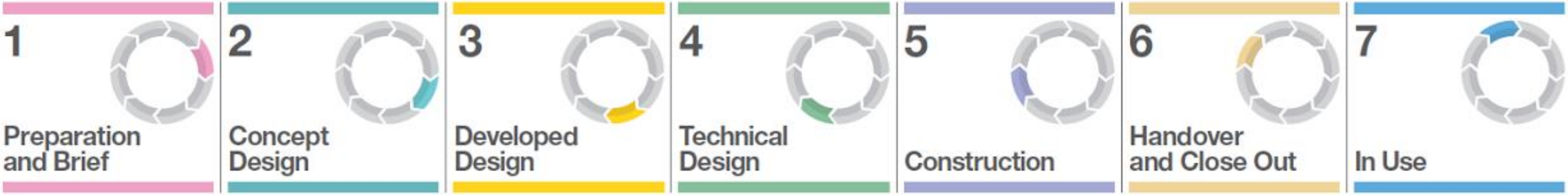
2nd year

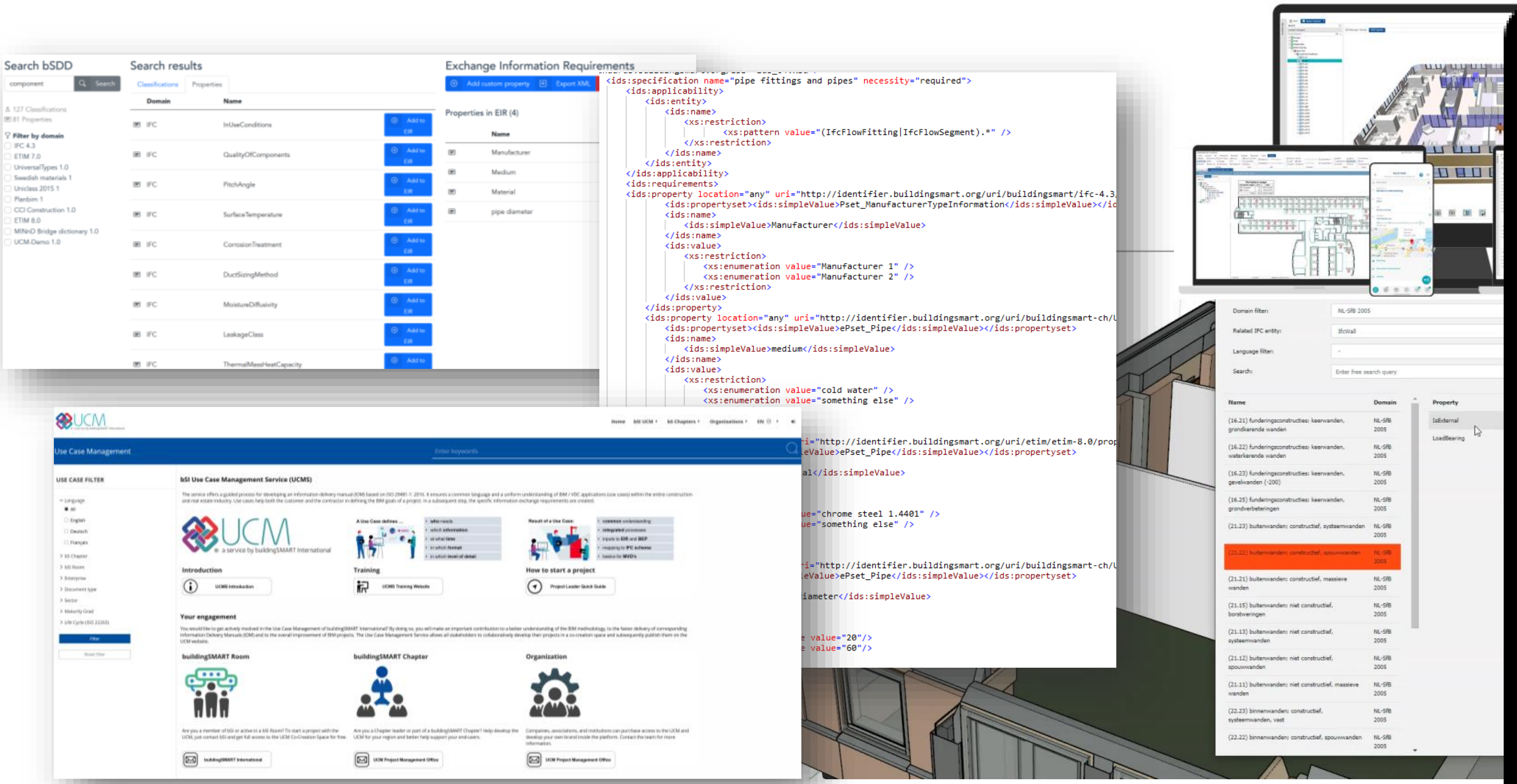
2021

The year of integration and participation

Huge participation by stakeholders in development of standards and services.

Clear integrated development of UCMS, bSDD, IFC, IDS, etc.





Domain	Name
IFC	InUseConditions
IFC	QualityOfComponents
IFC	PitchAngle
IFC	SurfaceTemperature
IFC	CorrosionTreatment
IFC	DuctSizingMethod
IFC	MoistureDiffusivity
IFC	LeakageClass
IFC	ThermalMassHeatCapacity

Name
Manufacturer
Medium
Material
pipe diameter

```
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                </xs:restriction>
            </ids:name>
        </ids:entity>
    </ids:applicability>
    <ids:requirements>
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            </ids:name>
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                </xs:restriction>
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        </ids:property>
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            <ids:name>
                <ids:simpleValue>medium</ids:simpleValue>
            </ids:name>
            <ids:value>
                <xs:restriction>
                    <xs:enumeration value="cold water" />
                    <xs:enumeration value="something else" />

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leValue>ePset_Pipe</ids:simpleValue></ids:propertyset>

al</ids:simpleValue>

ue="chrome steel 1.4401" />
ue="something else" />

ri="http://identifier.buildingsmart.org/uri/buildingsmart-ch/U
leValue>ePset_Pipe</ids:simpleValue></ids:propertyset>

iameter</ids:simpleValue>

e value="20"/>
e value="60"/>
```

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The service offers a guided process for developing an information delivery manual (IDM) based on ISO 29481-1: 2016. It ensures a common language and a uniform understanding of BIM / VDC applications (use cases) within the entire construction and real estate industry. Use cases help both the customer and the contractor in defining the BIM goals of a project. In a subsequent step, the specific information exchange requirements are created.

Introduction

Training

How to start a project

Your engagement

[illegible]

buildingSMART Room

buildingSMART Chapter

Organization

Domain filter: NL-SfB 2005

Related IFC entity: IfcWall

Language filter: -

Name	Domain
(16.21) funderingsconstructies: keerwanden, grondkerende wanden	NL-SfB 2005
(16.22) funderingsconstructies: keerwanden, waterkerende wanden	NL-SfB 2005
(16.23) funderingsconstructies: keerwanden, gevelwanden (-200)	NL-SfB 2005
(16.25) funderingsconstructies: keerwanden, grondverbeteringen	NL-SfB 2005
(21.23) buitenwanden: constructief, systeemwanden	NL-SfB 2005
(21.22) buitenwanden: constructief, spouwwanden	NL-SfB 2005
(21.21) buitenwanden: constructief, massieve wanden	NL-SfB 2005
(21.15) buitenwanden: niet constructief, borstweringen	NL-SfB 2005
(21.13) buitenwanden: niet constructief, systeemwanden	NL-SfB 2005
(21.12) buitenwanden: niet constructief, spouwwanden	NL-SfB 2005
(21.11) buitenwanden: niet constructief, massieve wanden	NL-SfB 2005
(22.23) binnenwanden: constructief, systeemwanden, vast	NL-SfB 2005
(22.22) binnenwanden: constructief, spouwwanden	NL-SfB 2005

Property
IsExternal
LoadBearing

https://vimeo.com/615822399

SCAN ME

3rd year

2022

Production Stage

Still a lot to do!

Increase bSDD plugin support.

IFC 5 developments continue.

Rethinking Software Certification.

New API projects.

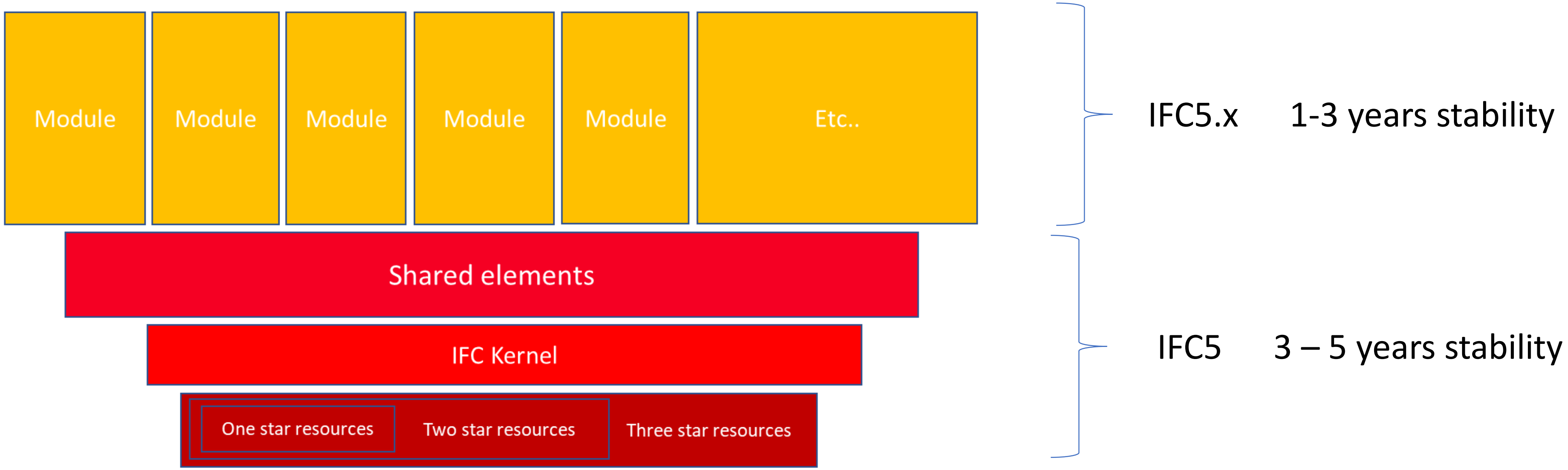
Next phase for UCMS, etc.

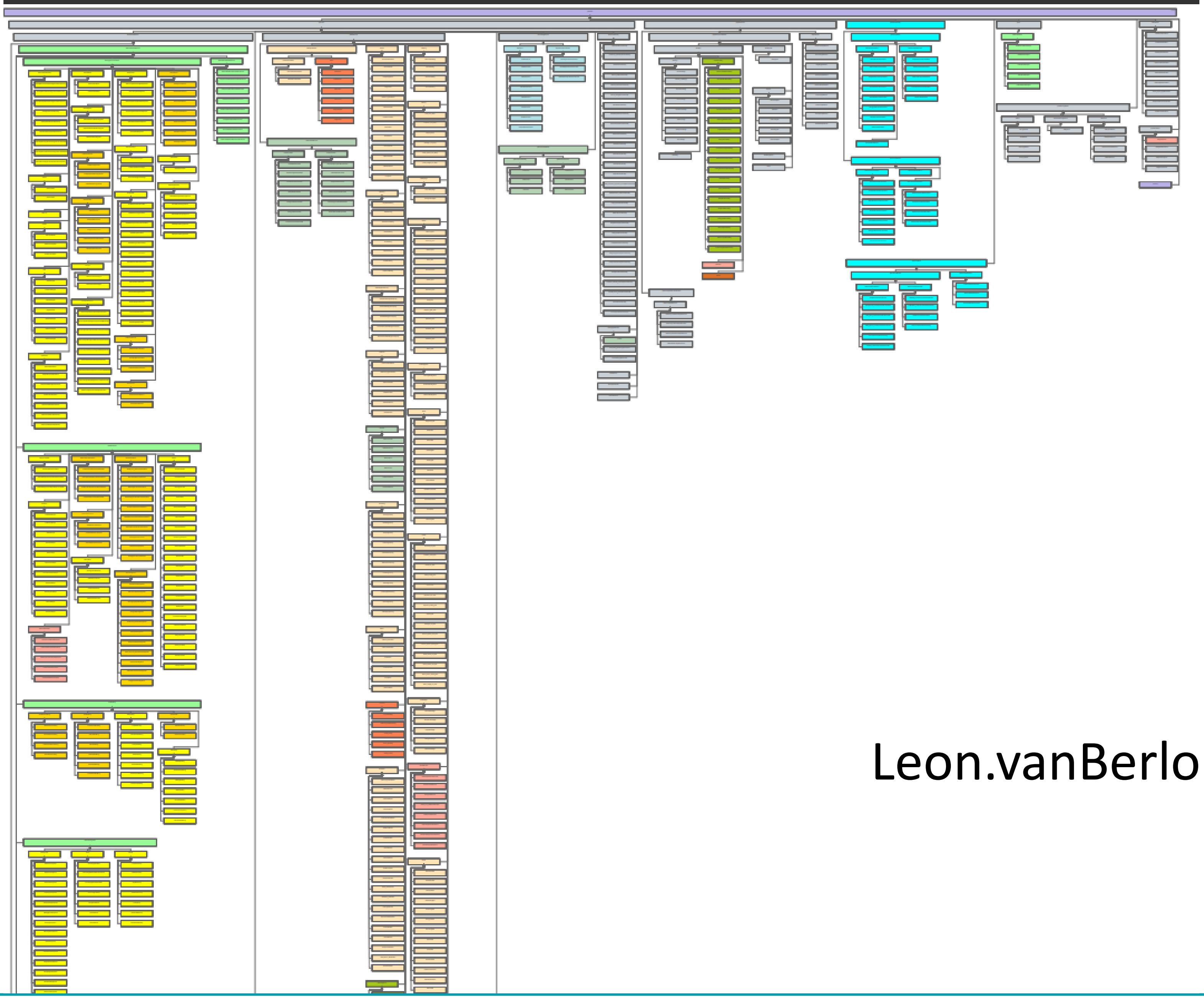
IFC 5

IFC Modularization & Normalisation

Principles for IFC 5 are set out in the Technical Roadmap. First explorations can be found in the paper.

2022 will see the publication of the “IFC Precept”.
A bold and drastic statement about the future of IFCs; setting direction for all future releases.





Leon.vanBerlo@buildingsmart.org

IFC precept

IFC “What if....”

2022 will see the publication of the “IFC Precept”.
A bold and drastic statement about the future of IFCs; setting direction for all future releases.

IFC Precept is setting the design principles and rules for IFC 5 to adhere to. It is the start and the endpoint for IFC developments.

“A bold and drastic statement about the future of IFCs.....”

- Using latest STEP version (for geometry and linking files)
- Decoupling geometry and semantics
- Rethinking Software Certification
- Linking external data sources (sensors, point clouds, etc)
- New use-cases like incremental updates
- GIS integration from the core
- API and Query capabilities in mind
- Dynamically extendable
- ....

Help!

- Write quality checks for IFC 4.3.x development (Python)
- Help script UML to XSD, ifcOWL, ifcJSON, etc..
- Make a bSDD plugin
- Help with upgrading STEP geometry core for IFC 5
- Help with upgrading STEP linked files concept
- Test/implement IDS
- Help start Property API definition / project
- Create bSDD ontology to facilitate RDF interface & SparQL endpoint
- Connect bSDD to GS1 Link resolver
- Rethink / setup Software Certification (also for BCF!)
- Develop / test digital signatures in Validation service
- IFC Precept

But also….

We are open…

- To bcfOWL (and ifcOWL, bsddOWL, ….)
- To Parametric Geometry / IFC
- For similarity evaluation of IDSs
- To all topics on code compliance checking
- To any kind of extensions
- To changes needed for robotisation
- To blockchain & smart contract solutions
- To other kinds of geometry kernels
- To all kinds of realities (virtual, augmented, extended, etc)
- To whatever you feel a digital twin solution is
- To improving IFC for dynamic data
- To SHACL and other semantic web technologies
- To get your use-cases for incremental updates of an IFC dataset
- To adding other stuff to IFC (from inspections, pointclouds, etc)
- To automation of whatever use-case you have
- ………

Please help!

Leon.vanBerlo@buildingsmart.org
+31 6 423 674 65