

personal coordinates

Dr.rer.nat.Volker Krieger

TMM AG / Fact GmbH in Böblingen - BIM Enabling, Lab Planing
ISO, CEN, DIN, VDI, buildingSMART e.V., BTGA - Information Management BW-
Engineers GmbH Stuttgart, Riyadh und Abu Dhabi - BIM, MEP, Labs
Egnaton e.V. - Terminology, BIM, IFC4Lab
Open Source Projects - milliways.online, hyperbuild.info, hyperchem.info,
labSMART.de



Christian Kolb

WALDNER Laboreinrichtungen SE & Co. KG - BIM Implementation,

Egnaton e.V.,
buildingSMART e.V.,
buildingSMART, Project Group [PG] IFC4Lab,
ISO, DIN



BIM@Egnaton

Information Management

ISO 19650 and ISO 16739

standards enable...

link to this presentation

https://docs.google.com/presentation/d/1r8sFOuADVp6Lo_4DNBmUFZ6-gzaINI_3lqgiQgZ-g3c/edit?usp=sharing

the agenda

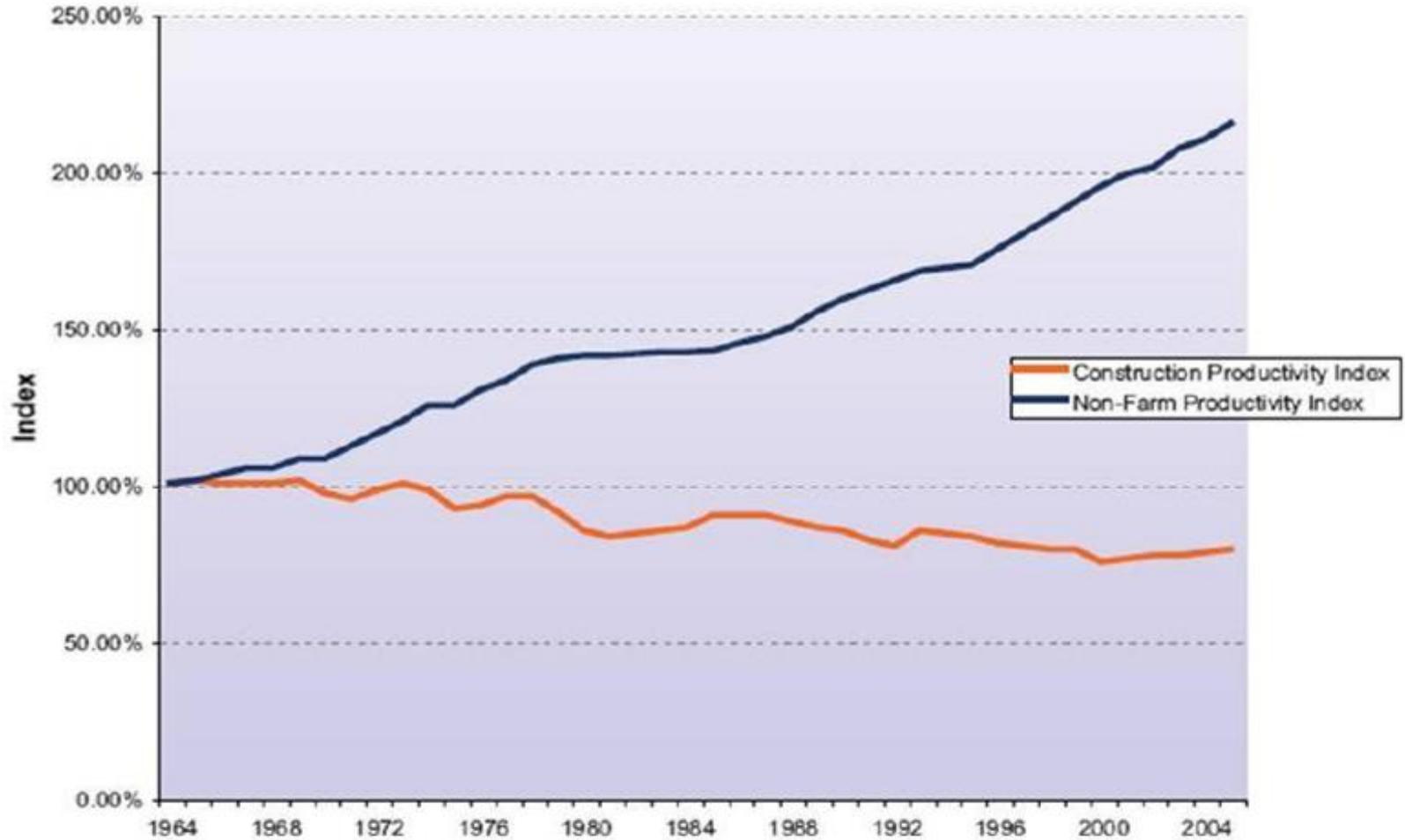
[VK]

- information management and digitization
- the history of Building Information Modelling (BIM) and 19650
- the business model of 19650
- 19650 series and BIM landscape

[CK]

- IFC
- IFC4Lab (roadmap, processmap,)TecBox

the production deficit



Reference: Paul Teicholz, Ph.D., Professor (Research) Emeritus, Dept. of Civil and Environmental Engineering, Stanford University

the history of BIM

2002
Autodesk

2016
EU BIM
Task
Group

CONSTRUCTING THE TEAM
by Sir Michael Latham

*Joint Review of Procurement and Contractual Arrangements
in the United Kingdom Construction Industry*

2014
Industry
Foundation
Classes 4.0

1994-1998
Latham and Egan
Reports (UK) –
Lack of
collaborative
working and 50%
site time waste
because of Info
Mismanagement

1995
Allian
Interoperability (IAI) –
predecessor of
buildingSMART

Naranjas“ –
Building
Information
Modeling

Final Report

July 1994

2 –
rative
Production of
Information

2010
Open Source
BIM Server
Uni Utrecht

2016
UK BIM Level 2
as obligatory
Standard



1990
AutoCAD
Release 11
exports to MS-
Excel

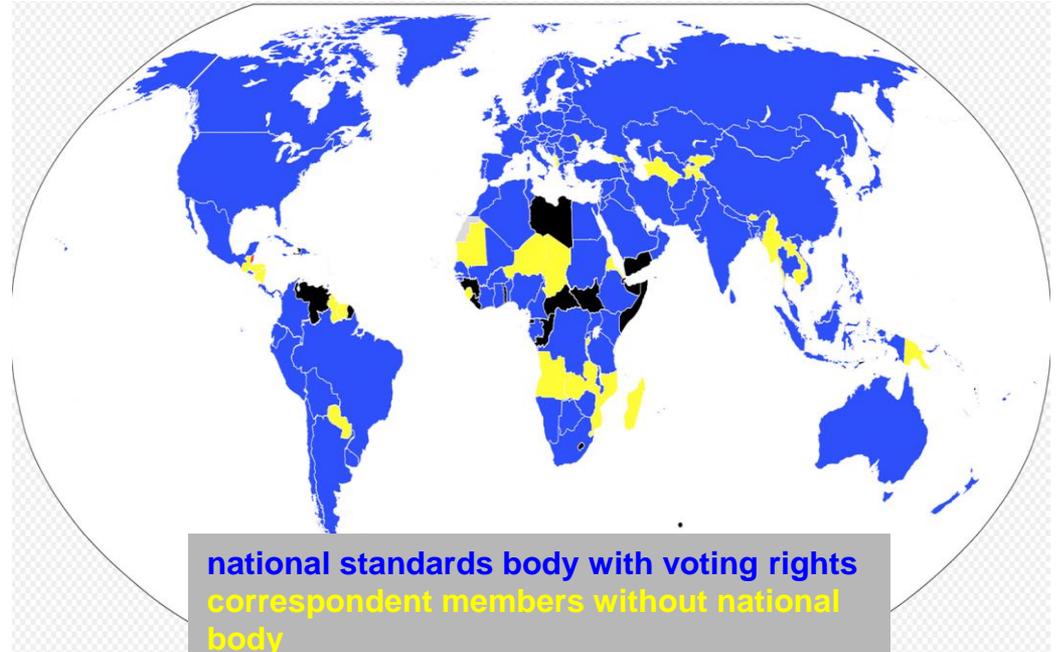
2020

2007
First
German
wikipedia
entry for
BIM

2015
DIN starts BIM
Normning

German BIM Task
Group Planen
Bauen 4.0 GmbH

International Standards Organization (ISO) - ἴσος *isos* = *equal*(backronym)



founded 1947 in Geneva

three official languages (english, french, russian)

some figures as of 2021

- 23791 international standards
- 794 committees (SC)
- 335 technical committees (TC)
- 165 national members
- 121 full member bodies

some facts to know

- 193 countries on earth (UNO)

The business model of 19650

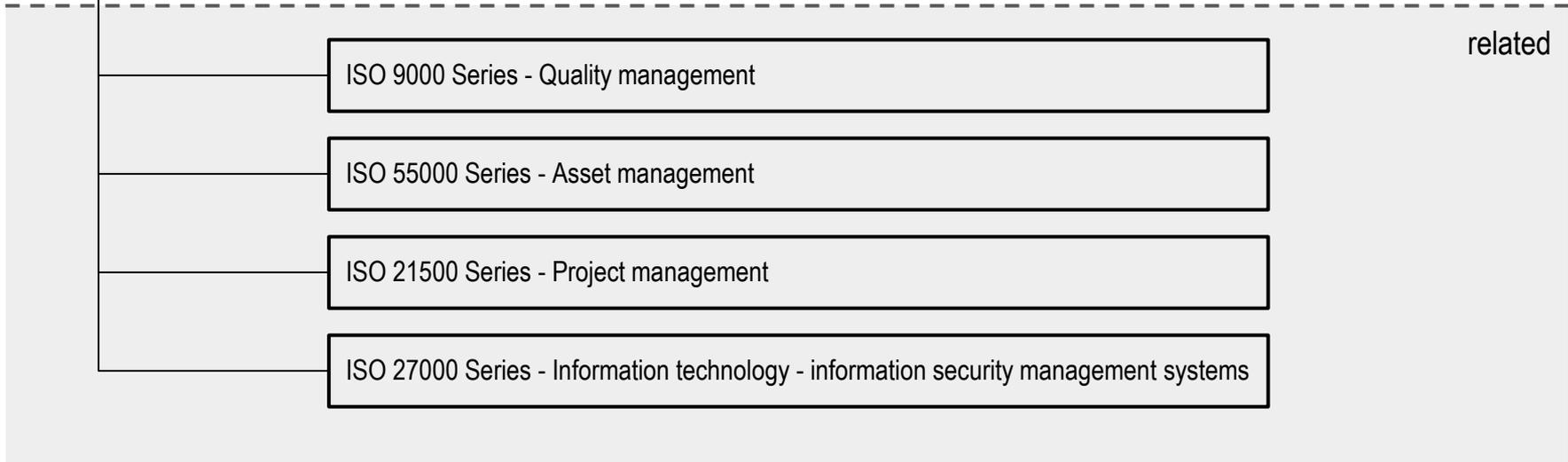


ISO 19650 parts	general ISO
1 - concept. principles, terms	ISO 9000 (Qual Mgmt)
2 - CAPEX phase	ISO 21500 (Proj Mgmt)
3 - OPEX phase	ISO 55000 (Asset Mgmt)
4 - information exchange	<i>(not COBie)</i>
5 - security minded BIM	ISO 27000 (IT Security)
6 - health and safety	ISO 45000 (Health & Safety)

the external ISO landscape

Information Management (BIM)

DIN EN ISO 19650 Series - Information Management using BIM
EN ISO 19650-1:2018 - Part 1 - Concepts and principles
EN ISO 19650-2:2018 - Part 2 - Delivery phase of the assets
EN ISO 19650-3:2020 - Part 3 - Operational phase of the assets
ISO/DIS 19650-4:2021 - Part 4: Information exchange
EN ISO 19650-5:2020 - Part 5 - Security-minded approach to information management
ISO/WD 19650-6:2023 - Part 6 - Health and Safety (WIP)



... the internal ISO landscape

Management

DIN EN ISO 19650 Series - Information Management using BIM

EN ISO 19650-1:2018 - Part 1 - Concepts and principles

EN ISO 19650-2:2018 - Part 2 - Delivery phase of the assets

EN ISO 19650-3:2020 - Part 3 - Operational phase of the assets

[ISO/DIS 19650-4:2021 - Part 4: Information exchange](#)

EN ISO 19650-5:2020 - Part 5 - Security-minded approach to information management

[ISO/WD 19650-6:2023 - Part 6 - Health and Safety \(WIP\)](#)

Technology

EN ISO 16739 Series - Industry Foundation Classes (IFC)

EN ISO 16739-1:2018 - Part 1: Data schema

EN ISO 29481 Series - Information Delivery Manual (IDM)

EN ISO 29481-1:2016 - Methodology and format Part 1

EN ISO 29481-2:2012 - Part 2: Interaction framework

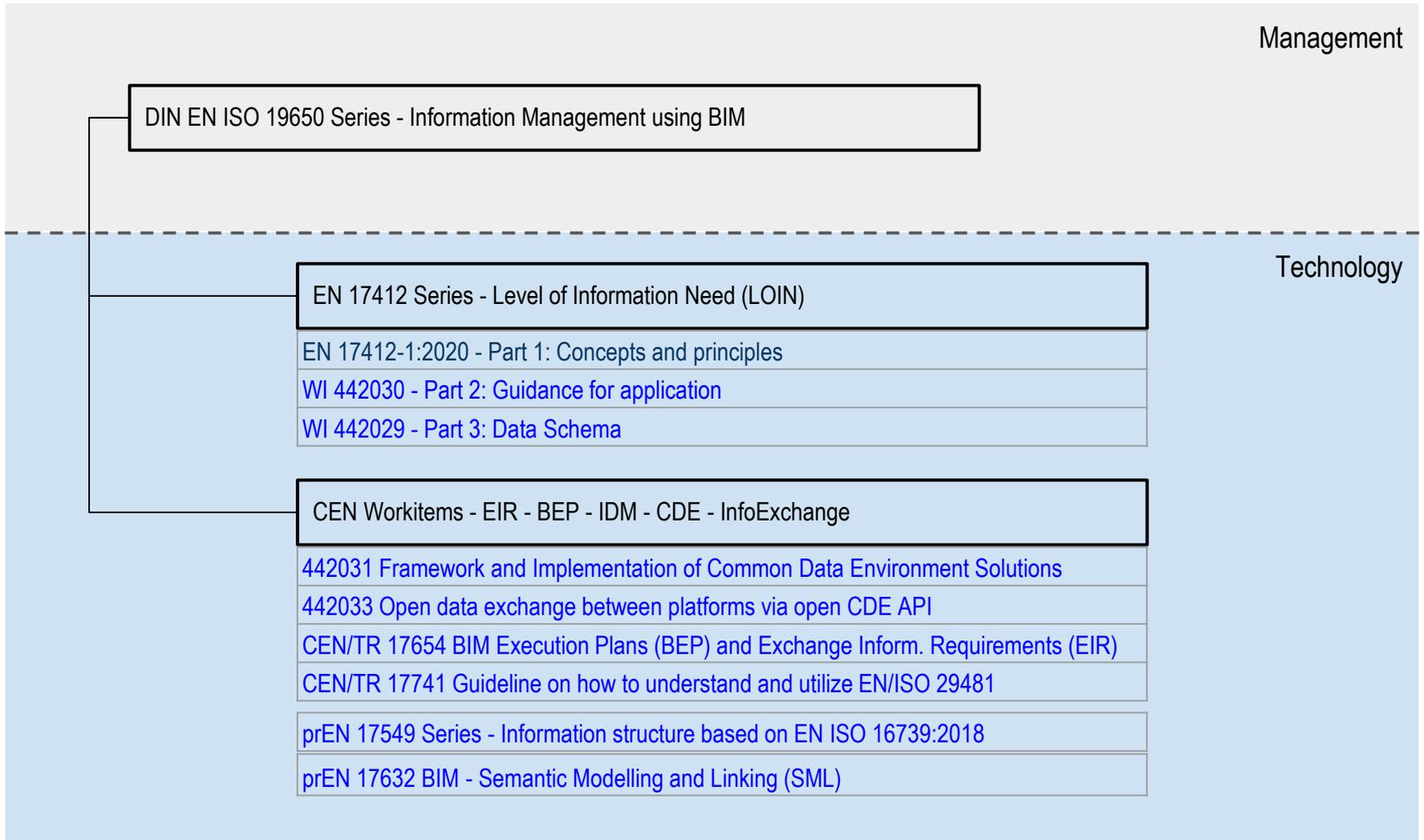
[ISO/DIS 29481-3 - Part 3: Data schema and classification](#)

EN ISO 16757 Series - Data structures for product catalogues for building services

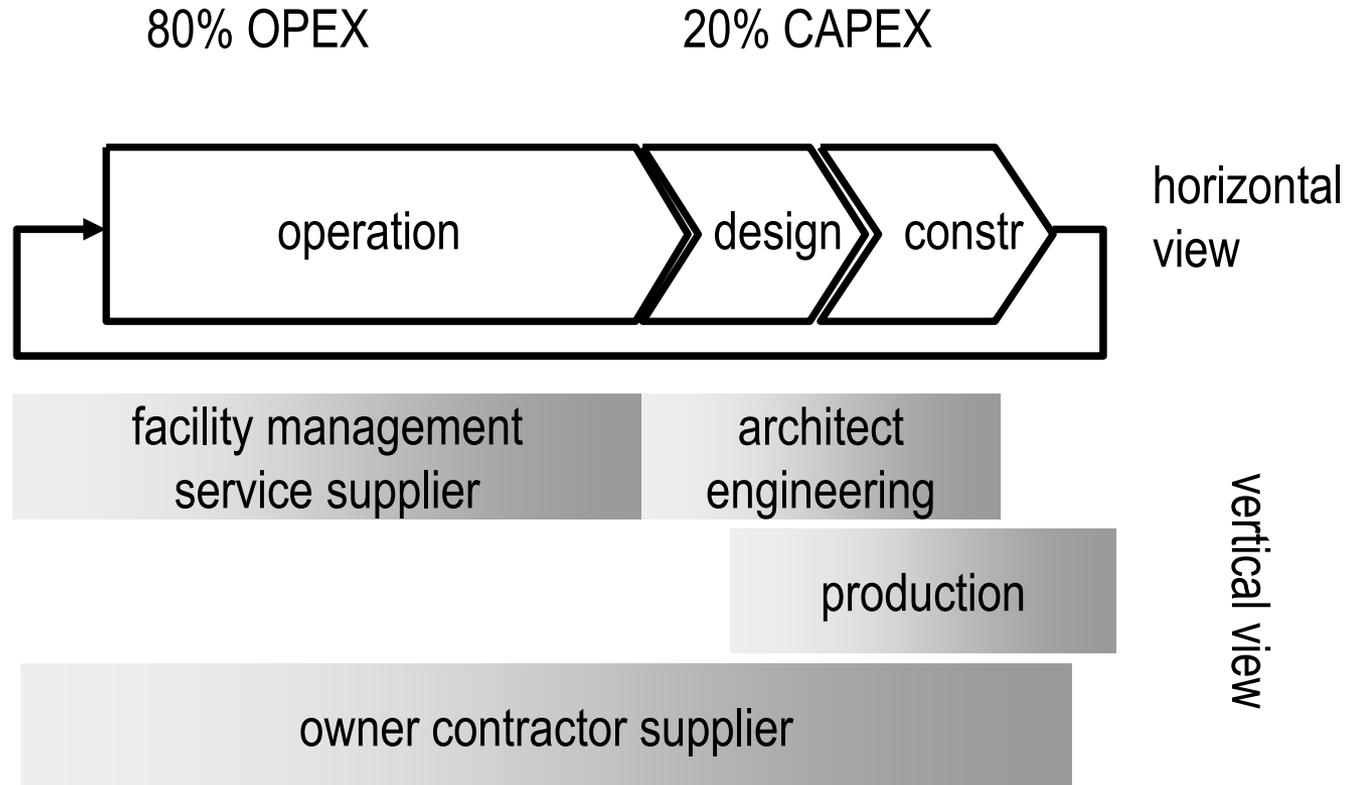
EN ISO 16757-1:2015 - Part 1: Concepts, architecture and model

EN ISO 16757-2:2016 - Part 2: Geometry

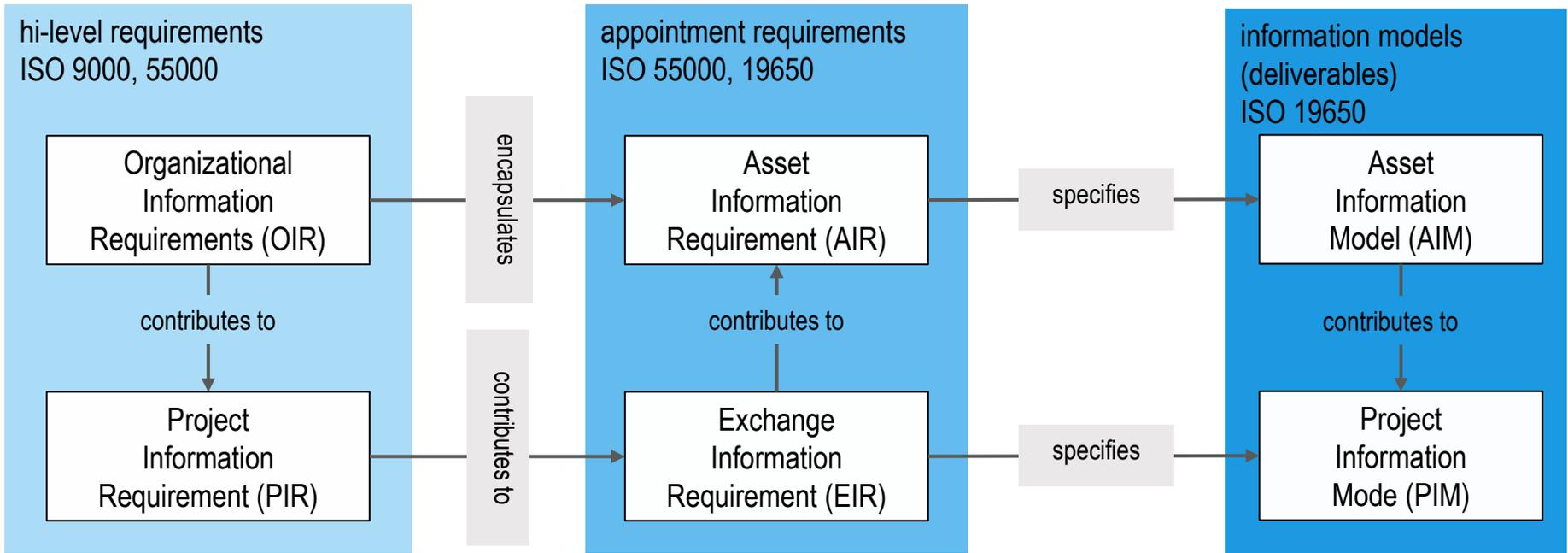
... the companionship of CEN



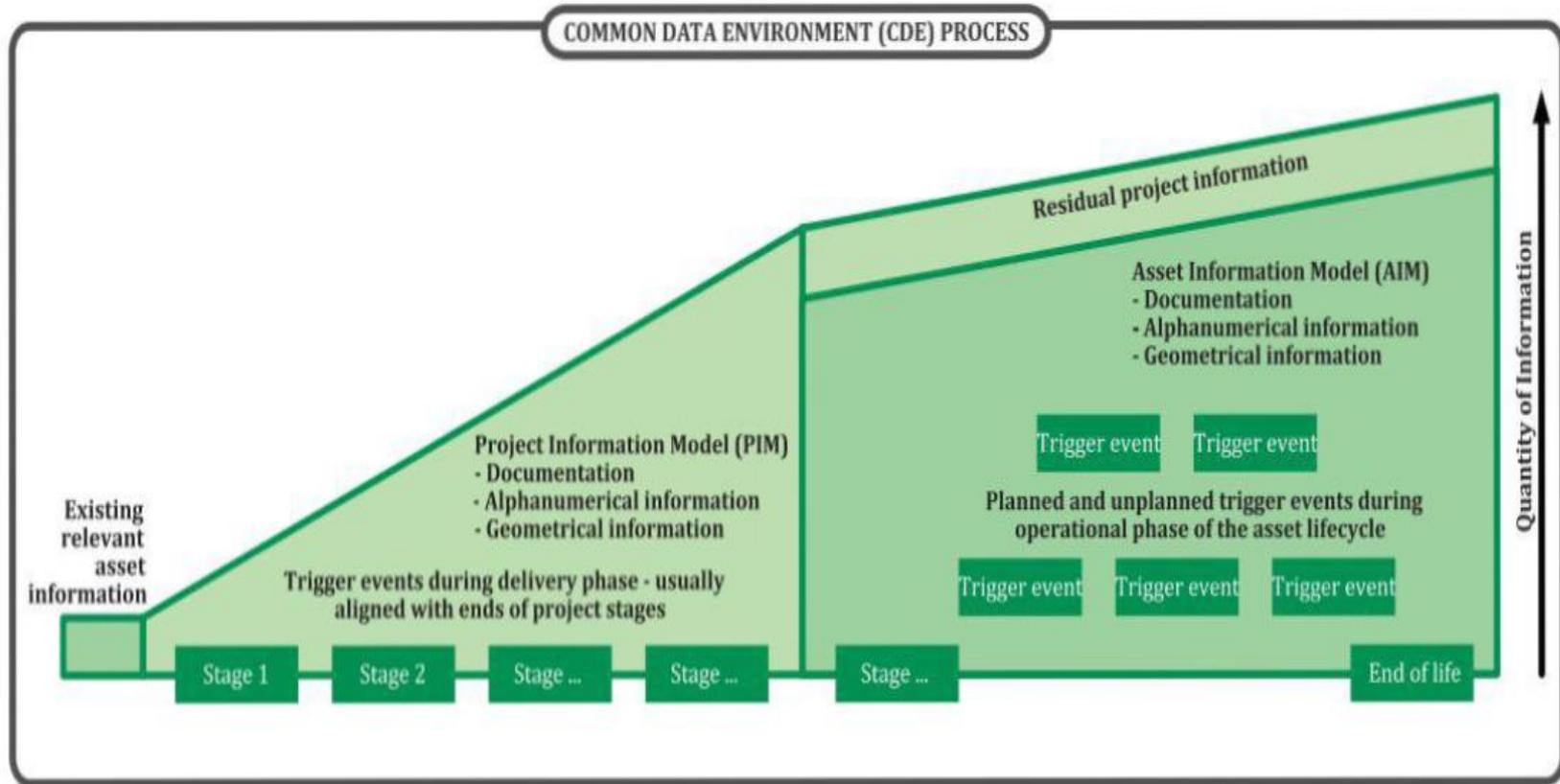
the life cycle view



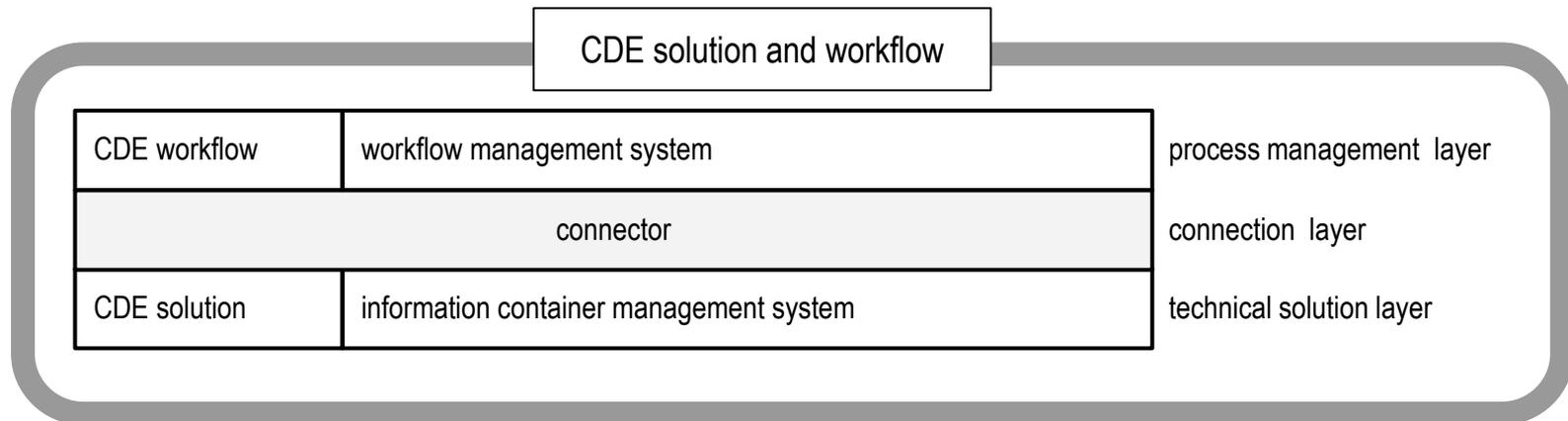
collaborative information management (19650-1 Fig2)



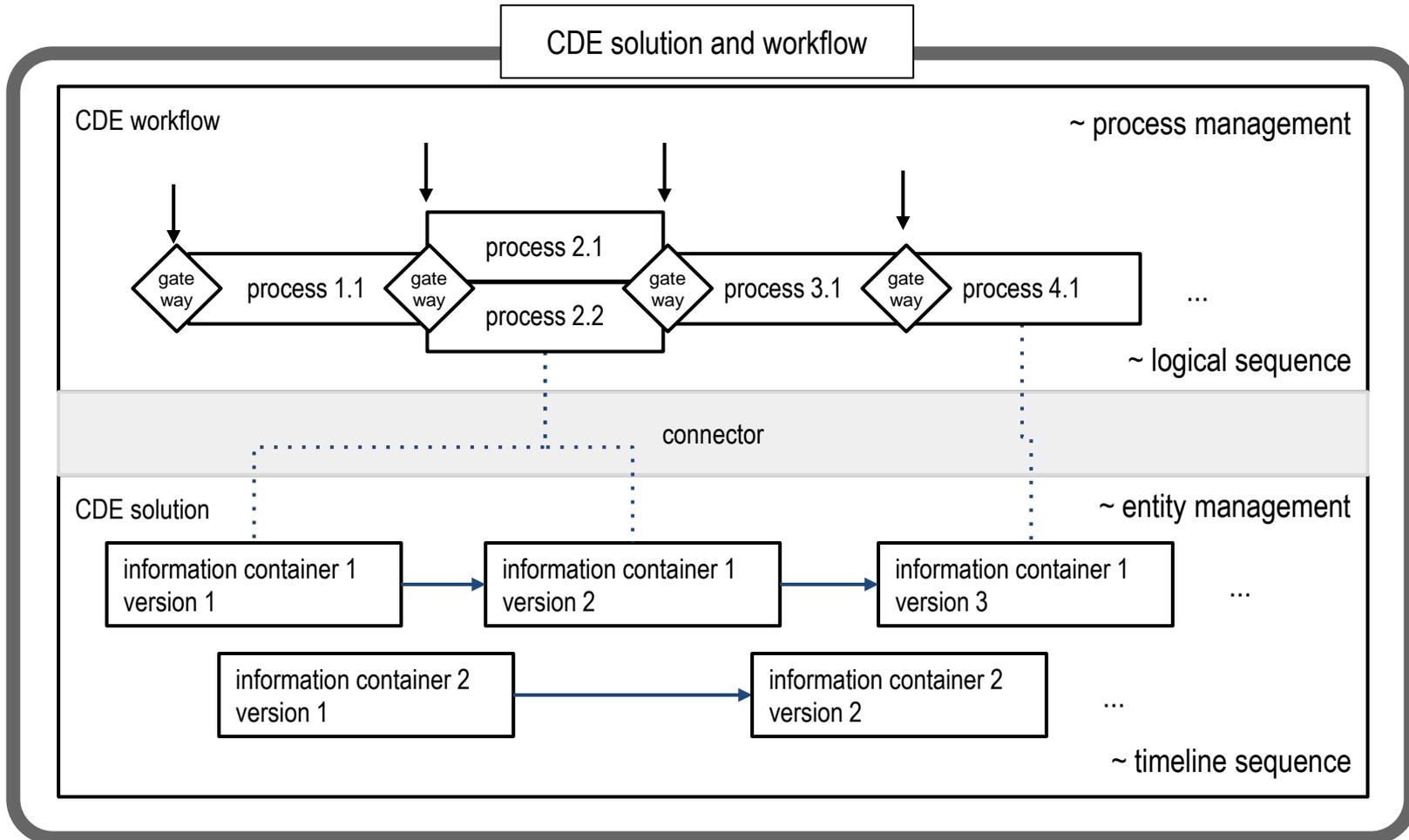
Common Data Environment (CDE) - Summary 19650-1



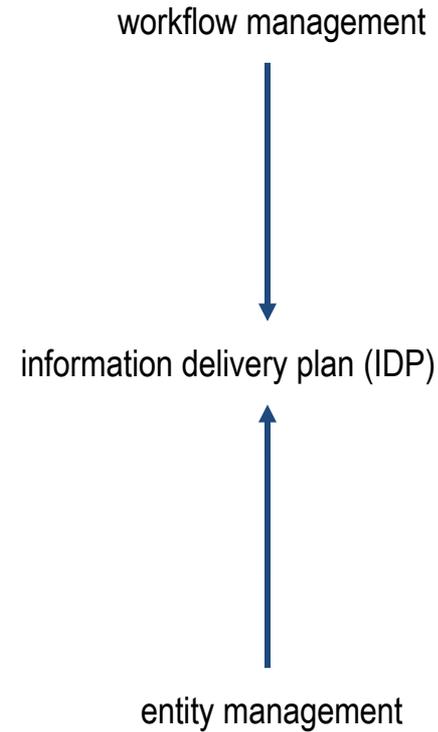
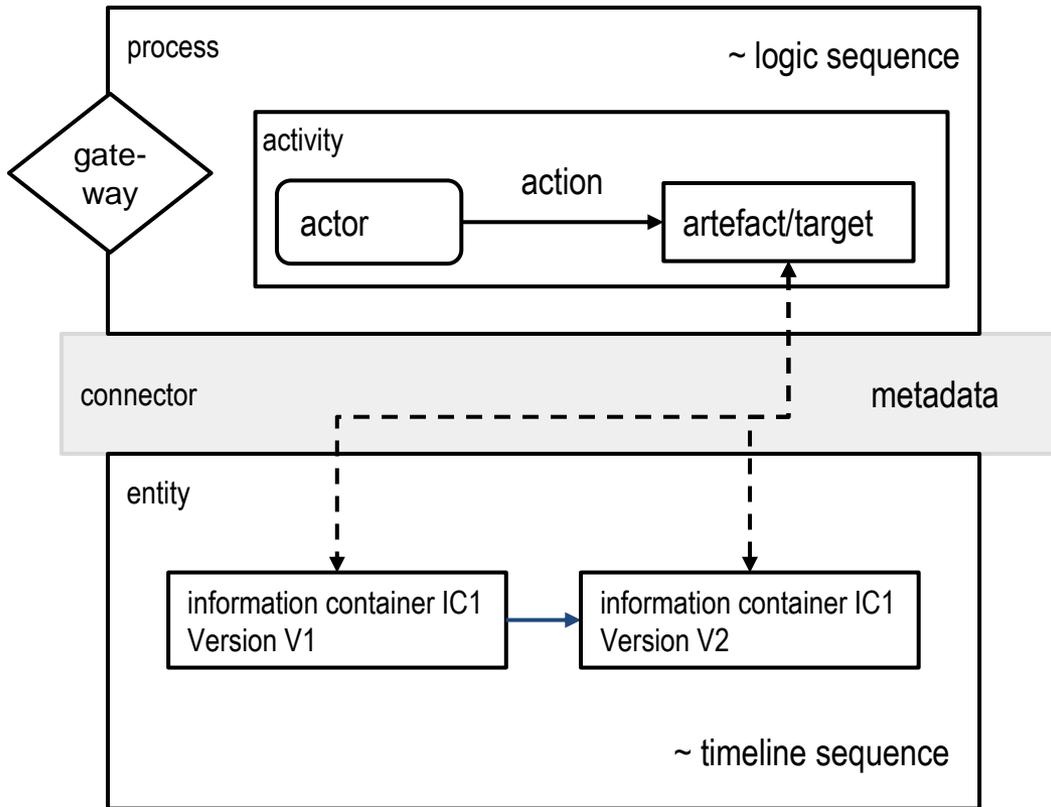
Common Data Environment (CDE) solution and workflow - layer concept



Common Data Environment (CDE) solution and workflow



Common Data Environment (CDE) solution and workflow - activity



- 1 ISO
- 2 IFC4Lab

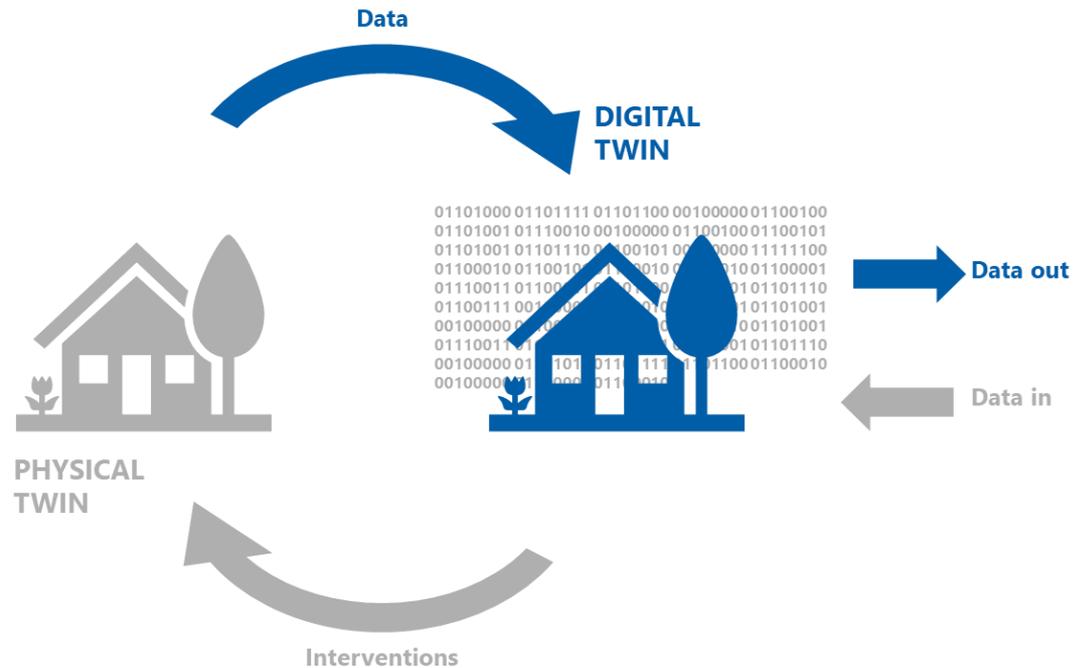
ACHEMA 2022

departure now

Digital Twin \

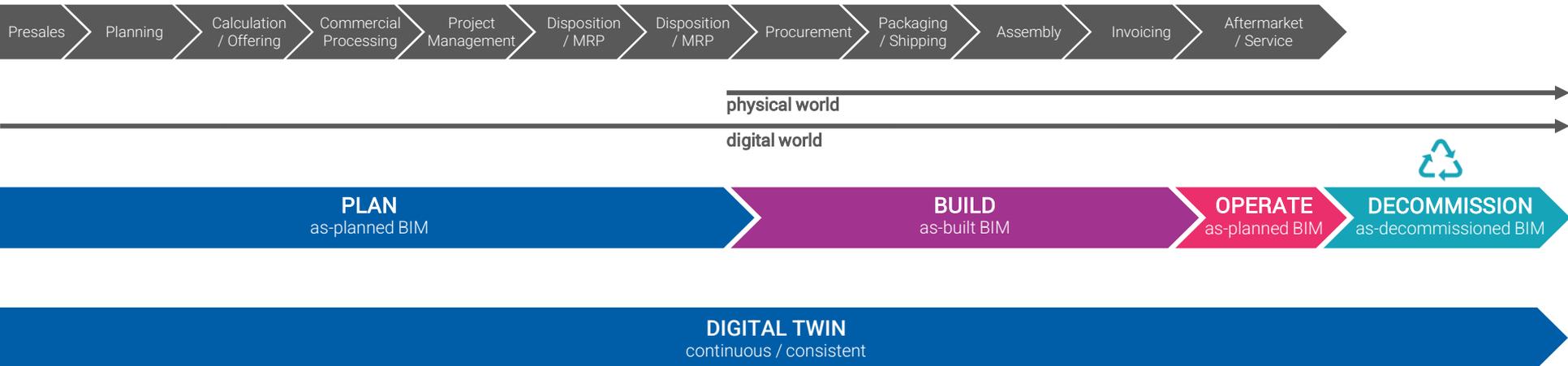
*“A **digital twin (DT)** - also referred to as **digital shadow, digital replica or digital mirror** - is a **digital representation of a physical asset**. Linked to each other, the physical and digital twin regularly exchange data **throughout the PBOD lifecycle and use phase**. Technology like AI, machine learning, sensors and IoT allow for dynamic data gathering and right-time data exchange to take place”*

[source: buildingSMART International]



Digital Twin \ “PBOD lifecycle”

LABORATORY





010000100100100101001101001011010100110101001111
010001000100010101001100010011000010000001000001
010011000101001100100000010101100100100101010011
010101010100000101001100010010010101001101001001
010001010101001001010100010001010101001000100000
010001000100000101010100010001010100111001000011

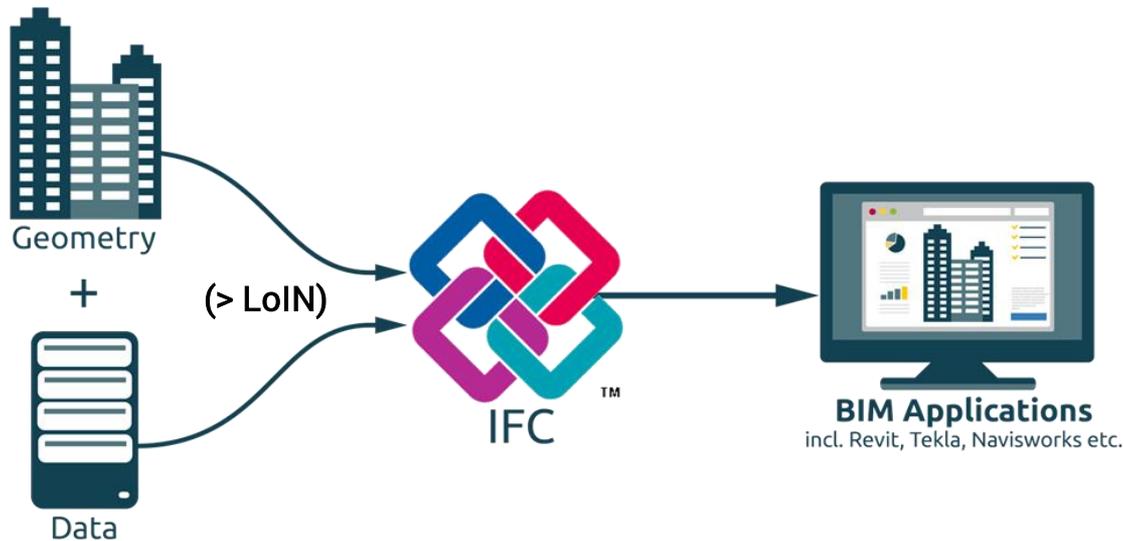
BIM MODEL / DIGITAL TWIN AS A VISUALIZED DATA CONTAINER

010000100100100101001101001011010100110101001111
010001000100010101001100010011000010000001000001
010011000101001100100000010101100100100101010011
010101010100000101001100010010010101001101001001
010001010101001001010100010001010101001000100000
010001000100000101010100010001010100111001000011



IFC

buildingSMART \ IFC \



"(...) Industry Foundation Classes (IFC)

The buildingSMART data model, also known as Industry Foundation Classes (IFC), represents a general data schema that enables the exchange of data between different proprietary software applications.

This data schema includes information from all disciplines involved in the construction project throughout its lifecycle.

IFC is the primary data model for buildingSMART construction models.

IFC has been an official ISO standard since the IFC4 release - ISO 16739:2013. (...)"

buildingSMART \ IFC \



IFC PROJECT

Project

IFC SITE

Property

IFC BUILDING

Building

IFC BUILDINGSTOREY

Floor

IFC BUILDING ELEMENTS

Objects according to IFC classes

For each model element, each building object and each annotation element, there is an assigned counterpart in the IFC structure (IFCBuildingElement).



Version	Name (HTML Documentation)	ISO publication	Published (yyyy-mm)	Current Status	HTML	EXPRESS	XSD	pSet XSD	OWL HTML	RDF	TTL
4.4.0.dev	IFC 4.4.0 development	not started		<p>Extension of 4.3.0. Adding additional functionality (mainly for Tunnels).</p> <p>Currently under development in the Standards & Solutions program</p>							
4.3.0.1.dev	IFC4.3.1 dev	n.a.	Continuous updates of documentation. Minor changes to the specification & schema.	Under development.	Latest HTML	GitHub output		PSD output			
4.3.0.0	IFC4.3 (zip)	Under ISO voting	2022-03-07	bSI Production Standard	HTML	IFC 4.3 exp		PSD (zip)			
4.2.0.0	IFC4.2	-	2019-04	Withdrawn	ZIP	EXP	IFC4x2.xsd	-			
4.1.0.0	IFC4.1	-	2018-06	Withdrawn	ZIP	EXP	IFC4x1.xsd	-	ifcOWL IFC4.1	RDF	TTL
4.0.2.1	IFC4 ADD2 TC1	ISO 16739-1:2018	2017-10	<u>Official</u>	ZIP	EXP	IFC4.xsd	-	ifcOWL IFC4 ADD2 TC1	RDF	TTL
4.0.2.0	IFC4 ADD2	-	2016-07	Retired	ZIP	EXP	IFC4_ADD2.xsd	-	ifcOWL IFC4 ADD2	RDF	TTL
4.0.1.0	IFC4 ADD1	-	2015-06	Retired	ZIP	EXP	IFC4_ADD1.xsd	-	ifcOWL IFC4 ADD1	RDF	TTL
4.0.0.0	IFC4	ISO 16739:2013	2013-02	Retired	ZIP	EXP	ifcXML4.xsd	PSD_IFC4.xsd	ifcOWL IFC4	RDF	TTL
2.3.0.1	IFC2x3 TC1	ISO/PAS 16739:2005	2007-07	Official	ZIP	EXP	IFC2X3.xsd	PSD_R2x3.xsl	ifcOWL IFC2x3 TC1	RDF	TTL
2.3.0.0	IFC2x3	-	2005-12	Retired	ZIP	EXP	-	-	ifcOWL IFC2x3	RDF	TTL

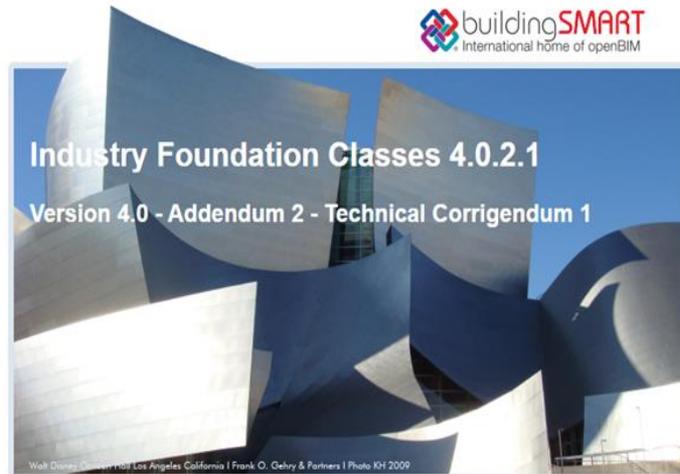


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IFC4_ADD2_TC1 - 4.0.2.1 [Official]

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- 7. Domain specific data schemas
 - 7.1 IfcArchitectureDomain
 - 7.1.1 Schema Definition
 - 7.1.2 Types
 - 7.1.2.1 IfcDoorPanelOperationEnum
 - 7.1.2.2 IfcDoorPanelPositionEnum
 - 7.1.2.3 IfcDoorStyleConstructionEnum
 - 7.1.2.4 IfcDoorStyleOperationEnum
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 - 7.1.2.6 IfcWindowPanelOperationEnum
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 - 7.1.2.9 IfcWindowStyleOperationEnum
 - 7.1.3 Entities
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 - 7.1.3.2 IfcDoorPanelProperties
 - 7.1.3.3 IfcDoorStyle
 - 7.1.3.4 IfcPermeableCoveringProperties
 - 7.1.3.5 IfcWindowLiningProperties
 - 7.1.3.6 IfcWindowPanelProperties
 - 7.1.3.7 IfcWindowStyle
 - 7.2 IfcBuildingControlsDomain
 - 7.2.1 Schema Definition
 - 7.2.2 Types
 - 7.2.2.1 IfcActuatorTypeEnum
 - 7.2.2.2 IfcAlarmTypeEnum
 - 7.2.2.3 IfcControllerTypeEnum
 - 7.2.2.4 IfcFlowInstrumentTypeEnum
 - 7.2.2.5 IfcSensorTypeEnum
 - 7.2.2.6 IfcUnitaryControlElementTypeEnum
 - 7.2.3 Entities
 - 7.2.3.1 IfcActuator
 - 7.2.3.2 IfcActuatorType
 - 7.2.3.3 IfcAlarm
 - 7.2.3.4 IfcAlarmType
 - 7.2.3.5 IfcController
 - 7.2.3.6 IfcControllerType
 - 7.2.3.7 IfcFlowInstrument
 - 7.2.3.8 IfcFlowInstrumentType
 - 7.2.3.9 IfcSensor

7 Domain specific data schemas

The domain specific data schemas contain final specializations of entities as shown highlighted in blue. Entities defined in this layer are self-contained and cannot be referenced by any other layer. The domain specific layer organizes definitions according to industry discipline.

- 7.1 IfcArchitectureDomain
- 7.2 IfcBuildingControlsDomain
- 7.3 IfcConstructionMgmtDomain
- 7.4 IfcElectricalDomain
- 7.5 IfcHvacDomain
- 7.6 IfcPlumbingFireProtectionDomain
- 7.7 IfcStructuralAnalysisDomain
- 7.8 IfcStructuralElementsDomain
- [Link to this page](#)

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 - 7.1.2.5 IfcPermeableCoveringOperationEnum
 - 7.1.2.6 IfcWindowPanelOperationEnum
 - 7.1.2.7 IfcWindowPanelPositionEnum
 - 7.1.2.8 IfcWindowStyleConstructionEnum
 - 7.1.2.9 IfcWindowStyleOperationEnum
 - 7.1.3 Entities
 - 7.1.3.1 IfcDoorLiningProperties
 - 7.1.3.2 IfcDoorPanelProperties
 - 7.1.3.3 IfcDoorStyle
 - 7.1.3.4 IfcPermeableCoveringProperties
 - 7.1.3.5 IfcWindowLiningProperties
 - 7.1.3.6 IfcWindowPanelProperties
 - 7.1.3.7 IfcWindowStyle
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 - 7.2.2.4 IfcFlowInstrumentTypeEnum
 - 7.2.2.5 IfcSensorTypeEnum
 - 7.2.2.6 IfcUnitaryControlElementTypeEnum
 - 7.2.3 Entities
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 - 7.2.3.2 IfcActuatorType
 - 7.2.3.3 IfcAlarm
 - 7.2.3.4 IfcAlarmType
 - 7.2.3.5 IfcController
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 - 7.5 IfcHvacDomain
 - 7.6 IfcPlumbingFireProtectionDomain
 - 7.7 IfcStructuralAnalysisDomain
 - 7.8 IfcStructuralElementsDomain
- [Link to this page](#)



7.XX IfcLabDomain

- still missing ...
- ... because not standardized yet
- bS PG IFC4Lab is fixing this 🙌

buildingSMART \ IFC \



buildingSMART \ IFC \



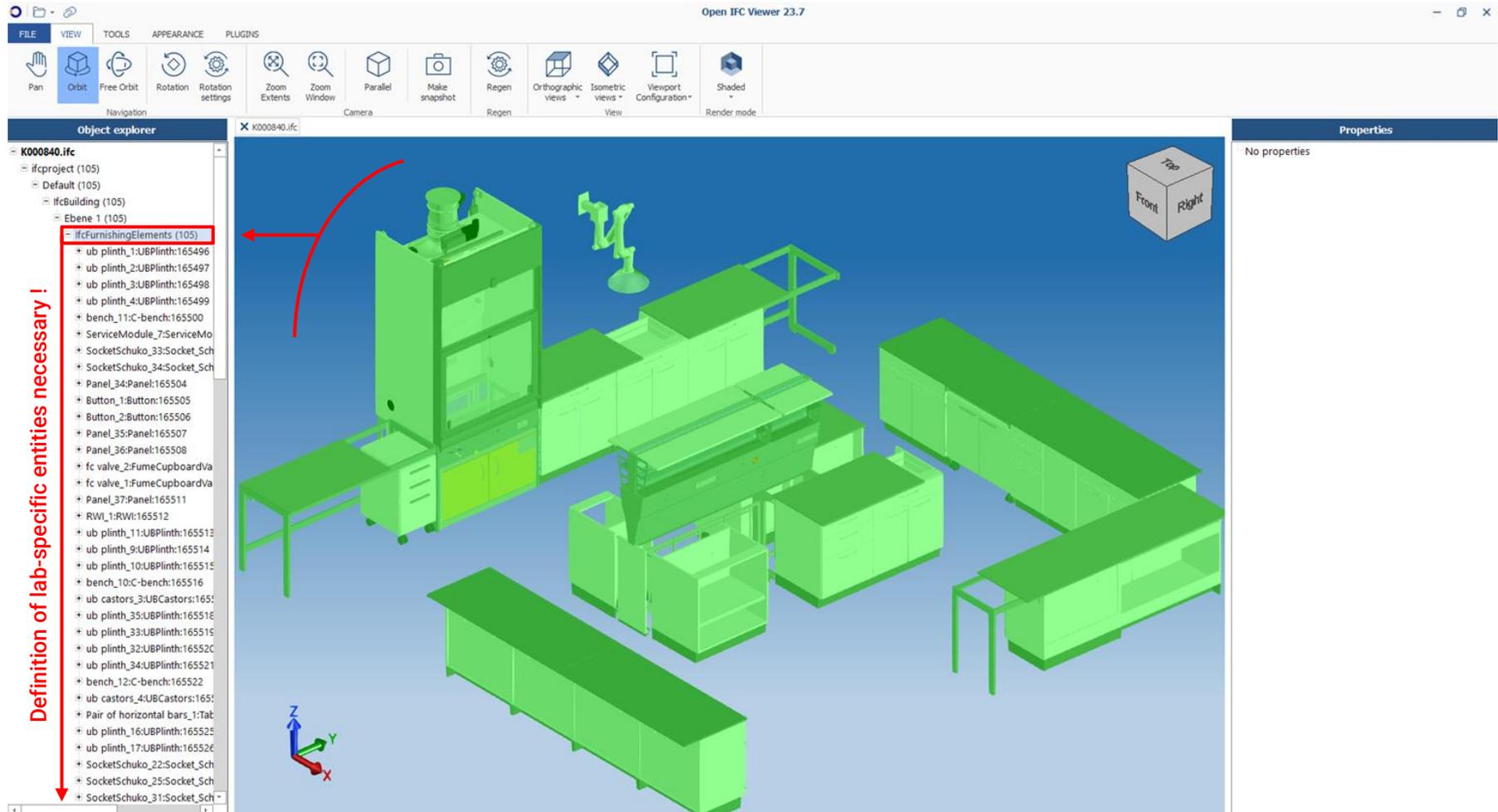
~~IfcFumehood (?)~~



~~IfcFumeCupboard (?)~~ - need for a unified "IFC lab language"



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Open IFC Viewer 23.7

FILE VIEW TOOLS APPEARANCE PLUGINS

Pan Orbit Free Orbit Rotation Rotation settings Zoom Extents Zoom Window Parallel Make snapshot Regen Orthographic views Isometric views Viewport Configuration Shaded

Navigation Camera Regen View Render mode

Object explorer

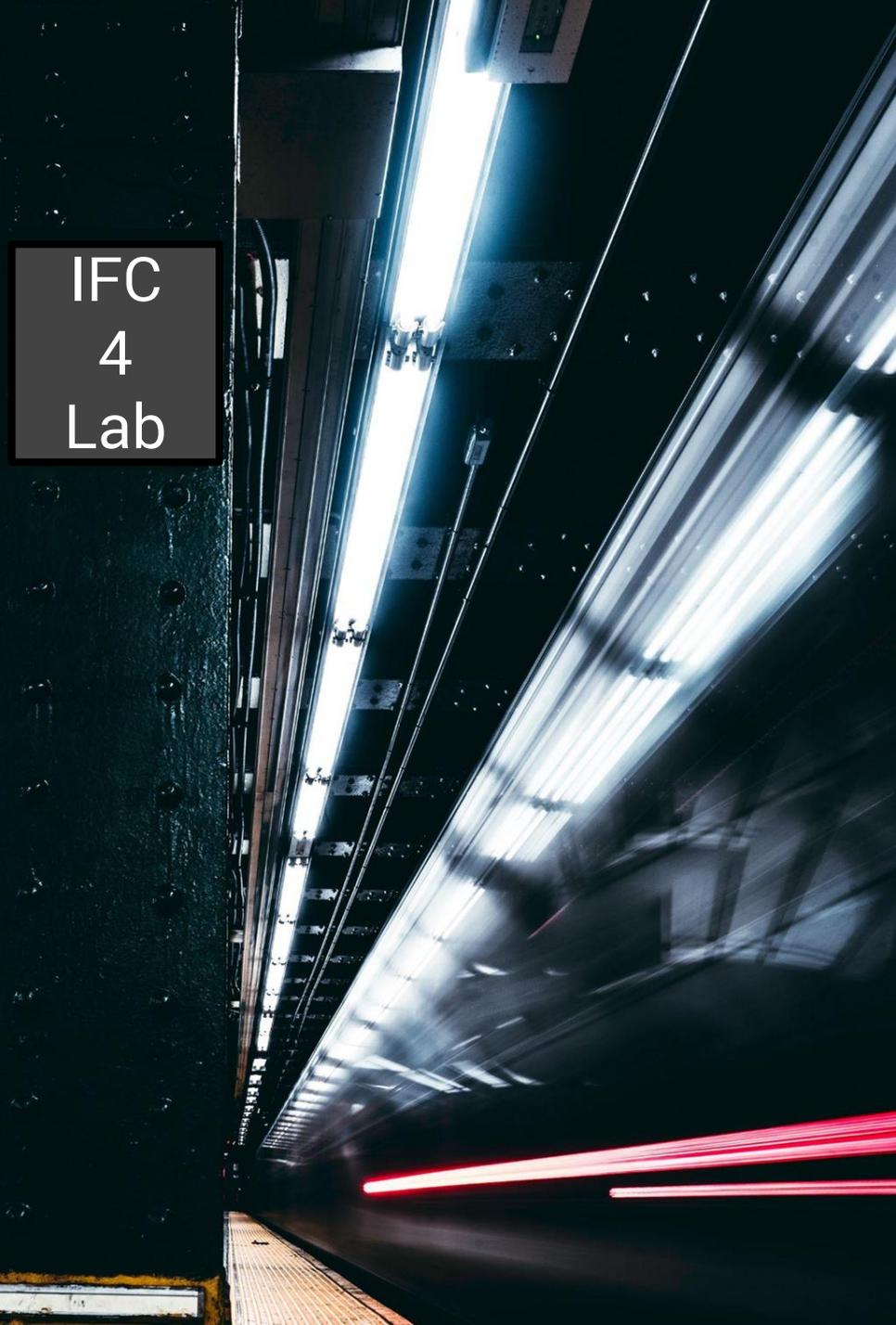
- K000840.ifc
 - ifcproject (105)
 - Default (105)
 - ifcBuilding (105)
 - Ebene 1 (105)
 - ifcFurnishingElements (105)
 - + ub plinth_1-UBPlinth:165496
 - + ub plinth_2-UBPlinth:165497
 - + ub plinth_3-UBPlinth:165498
 - + ub plinth_4-UBPlinth:165499
 - + bench_11:C-bench:165500
 - + ServiceModule_7:ServiceMo
 - + SocketSchuko_33:Socket_Sch
 - + SocketSchuko_34:Socket_Sch
 - + Panel_34:Panel:165504
 - + Button_1:Button:165505
 - + Button_2:Button:165506
 - + Panel_35:Panel:165507
 - + Panel_36:Panel:165508
 - + fc valve_2:FumeCupboardVa
 - + fc valve_1:FumeCupboardVa
 - + Panel_37:Panel:165511
 - RWL_1:RWL:165512
 - + Group_1
 - + Group_2
 - + Group_3
 - + Group_4
 - + Group_5
 - + Group_6
 - + Group_7
 - + Group_8
 - + Group_9
 - + Group_10
 - + Group_11
 - + Group_12
 - + Group_13
 - + Group_14
 - + Group_15
 - + Group_16
 - + Group_17

Properties

- **Abhängigkeiten**
 - Verschieben mit umliegenden Elementen F
 - Höhe von Ebene 0
 - Versatz von Host 0
 - Basisbauteil Keine
- **Abmessungen**
 - Fläche 13.5072
- **IfcElement**
 - ProvidesBoundaries
 - ReferencedInStructures
 - ConnectedTo
 - Tag 165512
 - HasStructuralMember
 - FillsVoids
 - HasCoverings
 - HasProjections
 - HasPorts
 - HasOpenings
 - IsConnectionRealization
 - ConnectedFrom
 - ContainedInStructure 1932451
- **IfcObject**
 - ObjectType RWL_1:F
 - IsDefinedBy 376378.
- **IfcObjectDefinition**
 - HasAssignments
 - HasAssociations 1932727
 - Decomposes
- **IfcProduct**
 - ObjectPlacement 376369
 - Representation 376364
 - ReferencedBy
- **IfcRoot**
 - GlobalId 2AN1uHr
 - OwnerHistory 41
 - Name RWL_1:F
 - Description y
- **Phasen**
 - Phase erstellt Neue Ko
- **Pset_QuantityTakeOff**

Definition of specific property sets necessary!

IFC
4
Lab



buildingSMART \ IFC4Lab \



DE EN

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buildingSMART-Project Groups (PG)

"Project groups" pursue **specific standardisation** tasks on the initiative and under the responsibility of a number of member companies (including, where appropriate, associations and university partners). These have a pre-defined goal and are limited in time. The results of the work should be documented in a standardised form, shared with other bodies if necessary and followed up at international level (e.g. buildingSMART International).

Link to IFC4Lab: <https://www.bsde-tech.de/mitarbeiten/projektgruppen/pg-ifc4lab/>

buildingSMART \ IFC4Lab \ our roadmap

doc title: Roadmap <u>IFC4Lab</u>	doc type: living collaborative document	doc status: cf. version history
<p>Roadmap <u>IFC4Lab</u></p> <p>Version: V0.9</p>		
<p>Common Document of / Gemeinsames Dokument von <u>EGNATON</u> e.V. buildingSMART e.V.</p>		
<p>Contributing Editors / Beteiligte Verfasser Christian Kolb Volker Krieger Judith Buschbeck Peter Neurieder Bernd Gmeiner</p>		
doc owner: Egnaton e.V. - buildingSMART e.V.	doc license: CC-BY-NC-SA 3.0	1/38

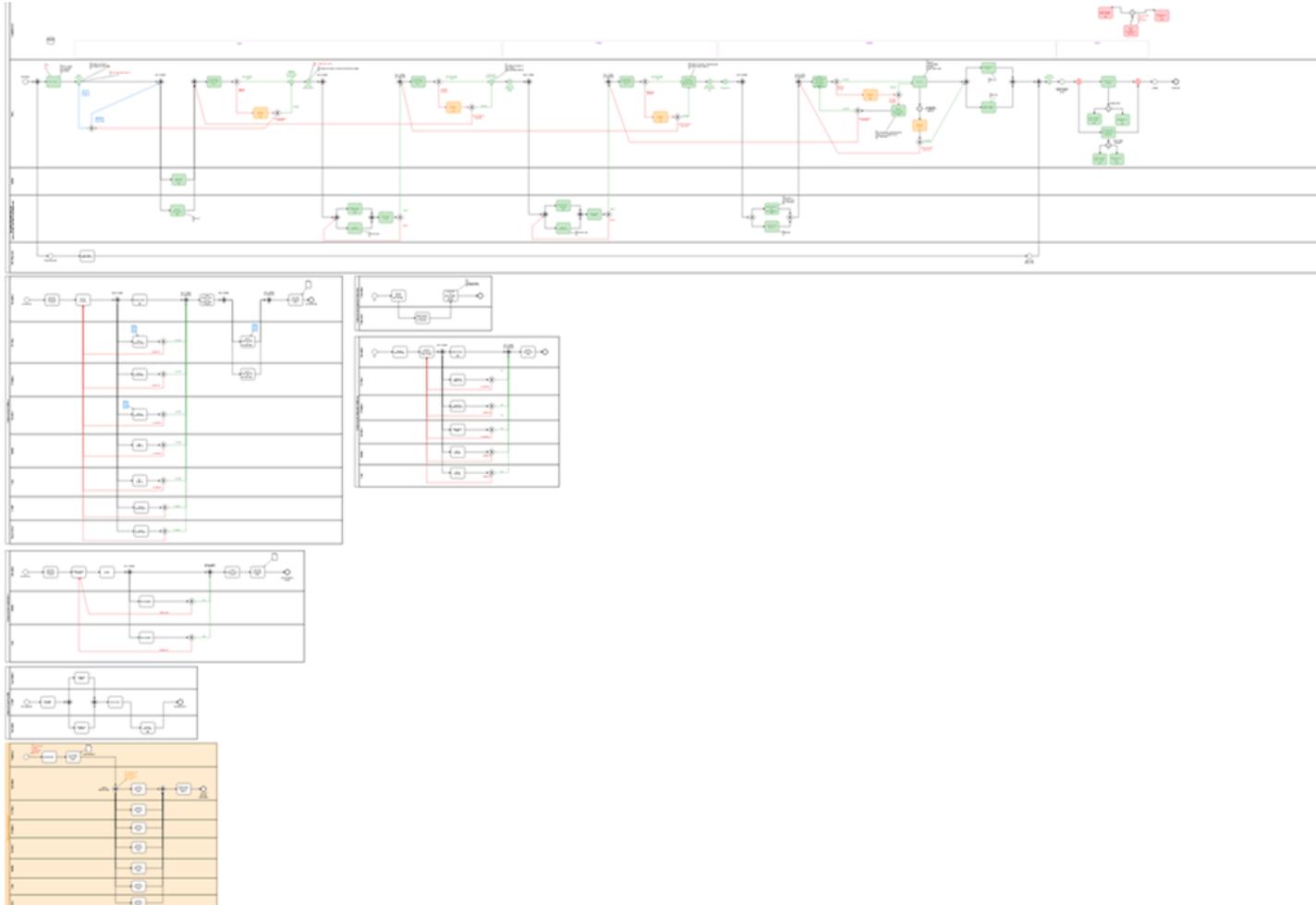
Goals:

- **Define classifications and entities within the IFC schema,** e.g. for laboratory equipment with fume hoods, media supply, safety cabinets, etc.
- **Standardization task in the overall process**
- **Clearly characterize the interfaces of the TecBoxes** to the building infrastructure with parameters and make them usable as a transfer, e.g. for design programs.
- **Create technical requirements**
- **Coordination with other specialist and project groups of bS** [e.g.: hospital / industrial kitchen / HVAC / factory planning]
- **Graphical process representation [process map]**

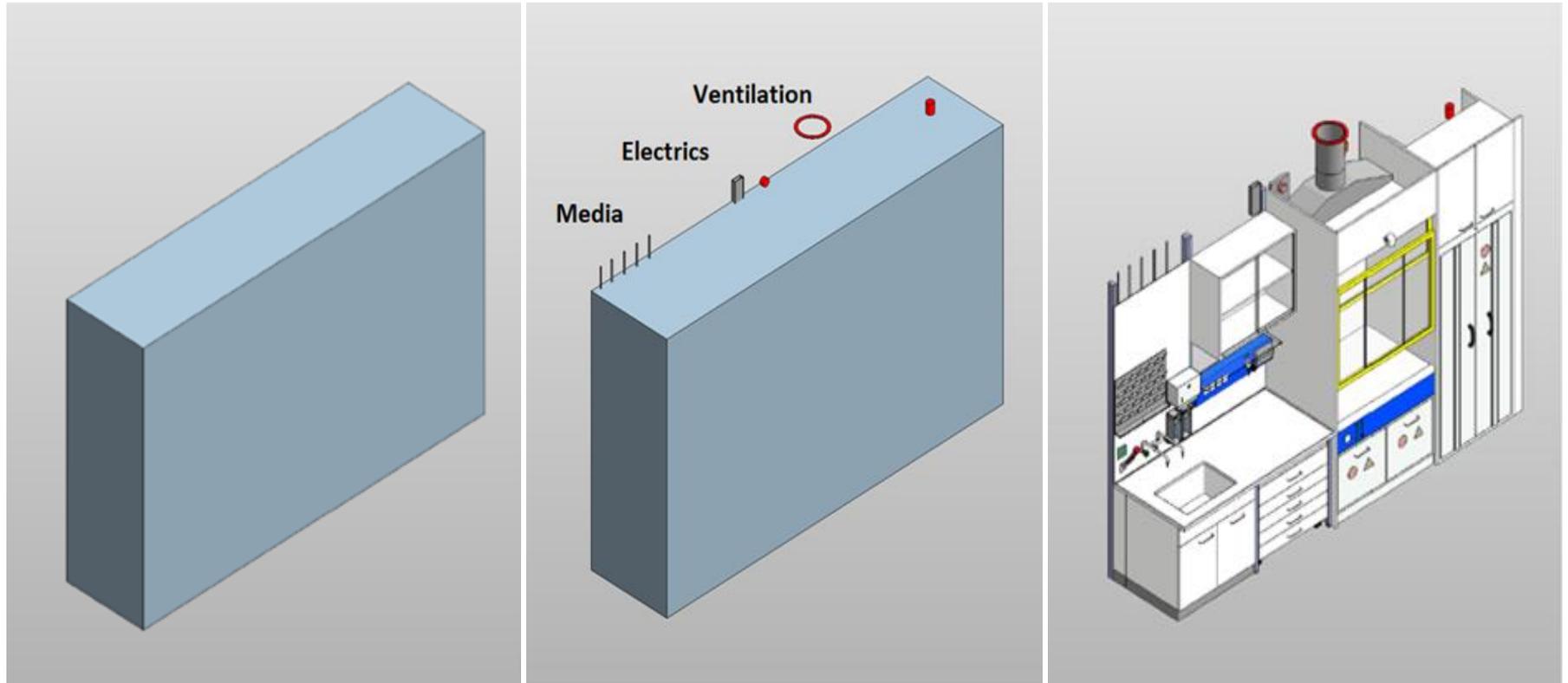
public link for comments

https://docs.google.com/document/d/1xMBCpz4x0YXMdqnmMQ-eIVfkDiGcFiaixIHZ9_uedEQ/edit?usp=sharing

buildingSMART \ IFC4Lab \ our processmap



buildingSMART \ IFC4Lab \ the TecBox

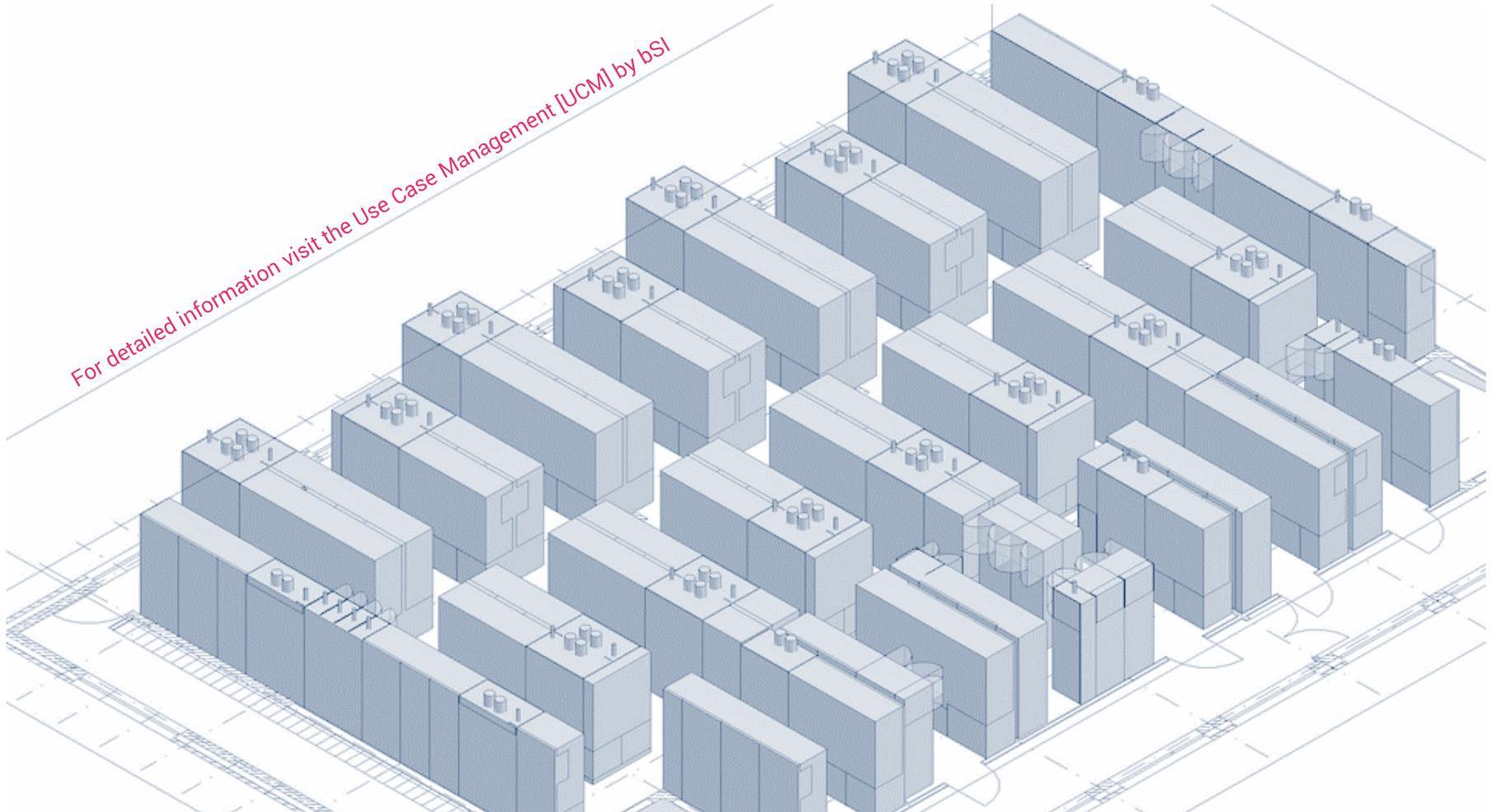


PHASE 1

PHASE 2

PHASE 3

buildingSMART \ IFC4Lab \ the TecBox

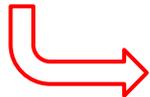
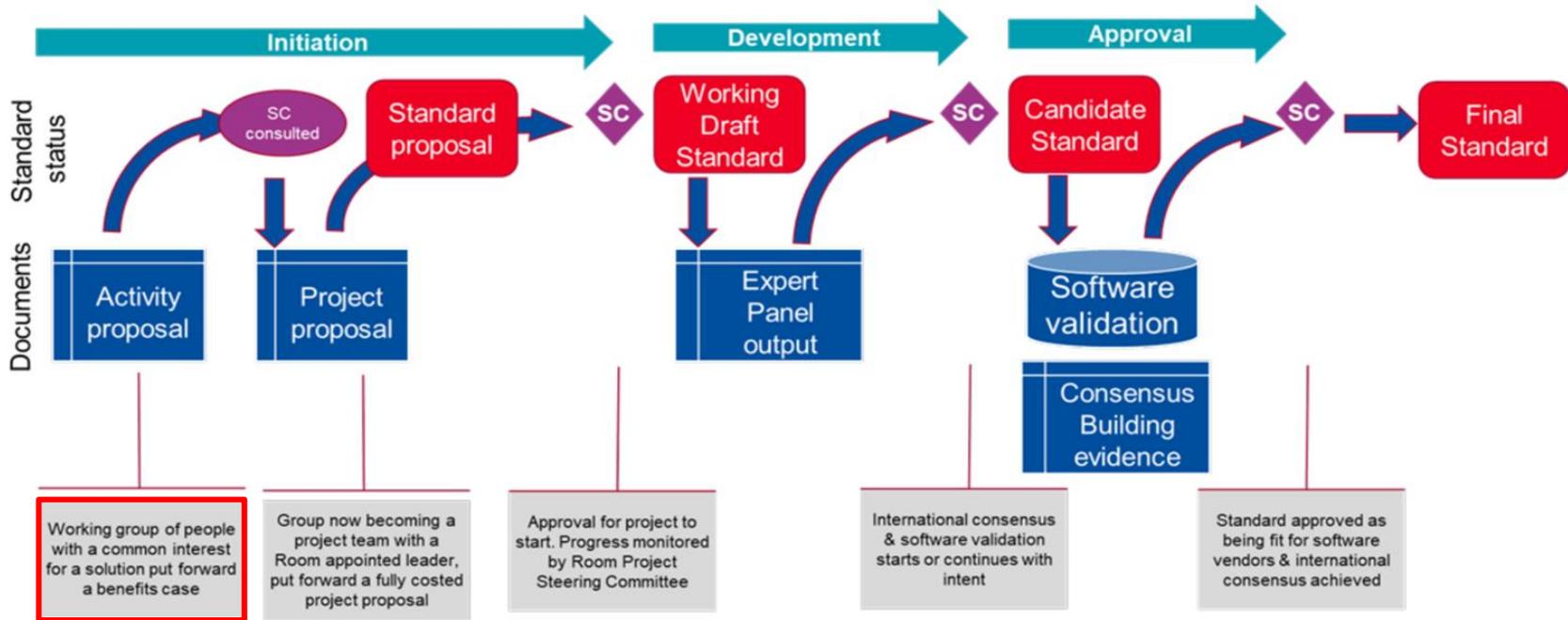


↑↑↑
Futur
e

Exit ↑
Pine St
Cedar St
William St



buildingSMART \ IFC4Lab \ where we [have to] go



Here we are:

The working group in the first instance will complete an Activity Proposal and submit it to buildingSMART International Management Office (bSI MO) to open the discussion about the proposal.

The Activity Proposal addresses the opportunities, needs and objectives of the activity.

QUESTIONS

*THANKS
FOR JOINING
OUR RIDE 🙌*

