



Interim Conference

29th October
Sustainable Places 2020



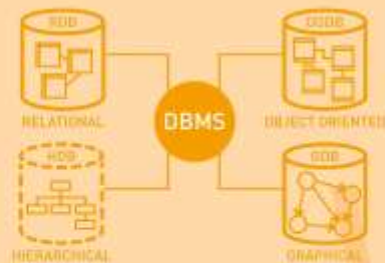
This project has received funding from European Union's H2020 research and innovation programme under grant agreement N. 820660

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Agenda

14:00 - 14:15	Introduction <i>Cecilia Maria Bolognesi, Bruno Daniotti (PoliMi)</i>
14:15 - 14:45	BIM-based toolkit for Efficient rEnovation in Buildings <i>Bruno Daniotti (PoliMi)</i>
14:45 - 15:05	The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings <i>Alessandro Valra, Davide Madeddu (One team)</i>
15:05 – 15:15	Poll and Questions and Answers session
15:15 - 15:35	Fast Mapping for Buildings AR-toolkit <i>Birgitta Andersson (RISE), Per Andersson (CGI)</i>
15:35 – 15:45	Poll and Questions and Answers session
15:45 - 16:00	Coffee break (15 minutes)
16:00 - 16:30	BIMcpd: A combined toolkit for constraint checking, performance evaluation and data management in building renovation projects <i>Andriy Hryshchenko (UCC), Brian O'Regan (IERC)</i>
16:20 – 16:30	Poll and Questions and Answers session
16:30 - 16:50	Towards BIM-enhanced renovation management tools with support to stakeholder interaction <i>Seppo Törmä (VisuaLynk), Markku Kiviniemi (VTT), Kostas Tsatsakis (Suite5)</i>
16:50 – 17:00	Poll and Questions and Answers session
17:00 - 17:20	Early stage energy refurbishment assessment tool for buildings using high-end BIM data <i>Teemu Vesanen (VTT)</i>
17:20 -17:30	Poll and Questions and Answers session
17:30 - 18:00	Closure <i>Cecilia Maria Bolognesi (PoliMi)</i>

Technical specifications for the design of a BIM management system



21 stakeholders
9 stage of renovation process



Users' profiles for accessing the BIM management system

CDE Database, Core DB functionalities, Ontological representation, BIM data translation engine to ontology

CDE Services, Interoperability Services, Exchange Layer Services, I/O Protocols and Data specification

Technical configuration of the platform

Guidelines for the implementation of the BIM management system

API, Master end user front end

Guidelines for the integration of new tools in the BIM management system

BIMMS

A platform to gather a set of digital tools to support BIM-based building renovation.

This Common Data Environment (CDE) allows you to collaborate and to store, share and visualise BIM and GIS models, manage data and link the data-streaming from sensors to the models.

BIMeaser tool

Fast Mapping of Buildings Toolkit

Auteras tool

BIM4 Occupants tool

BIMPlanner tool

BIMcpd tool

Agreed source of information for any given project or asset for collecting managing and disseminating each information container through a managed process.

EN ISO 19650 1:2019 CDEs

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www.bim4eeb-project.eu

BIM4EEB
BIM based fast toolkit for Efficient REnovation in Buildings

FAST MAPPING TOOLKIT

The tool incorporates a range of new tools developed to speed-up the scan-to-BIM process and to improve the data visualisation of an existing building by using Augmented Reality (AR).

Laser scan & sensor scan with the tool, are imported in an IFC-file in the HoloLens device and uploaded into a laptop and the

BIMMS

You will be able to map an existing building in an efficient and effective way using

sensorstick

Augmented Reality Tool:

- for finding electrical cables
- to find studs and humidity inside the walls
- for finding magnetic materials
- to detect differences in temperature



headset

The headset will be the user interface with the tool providing all features available.

Architects, engineers, construction workers will be able to use the 3D digital representation to visualise the building including hidden elements inside walls such as wall studs, water pipes, and electrical ducts.



Point clouds **generated** by digital mapping and scanning can be imported in the toolkit.



The IFC file can be automatically **selected** on the hololens device.



You can **visualize** the point cloud in the editor; you can **create** a new IFC file from it.



Then you start a **scanning** process with sensorstick and controller.

- inductance
- electricity
- capacitance



The scan-to-BIM **process** provides a 3D digital representation of the building including hidden elements inside walls.



BIM4EEB

BIM based fast toolkit for
Efficient rEnovation in Buildings

www.bim4eeb-project.eu



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29th October, SP2020 – Interim Conference
14:00 - 14:15 Introduction



BIMcpd

WILL ALLOW USERS TO

A combined toolkit for constraint checking, performance evaluation and data management in building renovation projects; it is a user-friendly self-intuitive software suite that provides users with the necessary tools to carry out tasks in these areas.

FIND recommended positions for HVAC Heating, Ventilation and Air Conditioning, lighting and other devices.

CONSTRAINT CHECKING TOOL



ANALYSE data from sensors, energy bills and other sources (weather for example).

PERFORMANCE ANALYSIS TOOL

- **Data viewer** for viewing data uploaded in the data management module and apply outlier detection methods to the data
- **Measurement and Verification** Measure and Verification devI mettere: for creating a baseline model of the building prior to the implementation of Energy Conservation Measures (ECM's) or building renovation



MANAGE the data that they have and create new data sets that they can share with other tools.

DATA MANAGEMENT TOOL



BIMCPD TOOLSET CONSISTS OF A RESPONSIVE WEB-BASED SOFTWARE



The tools developed in BIMcpd are designed to be used mostly by:

BIM Designer



Energy Auditor



M&V Practitioner

Administrator



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BIM4EEB

BIM based fast toolkit for Efficient Renovation in Buildings

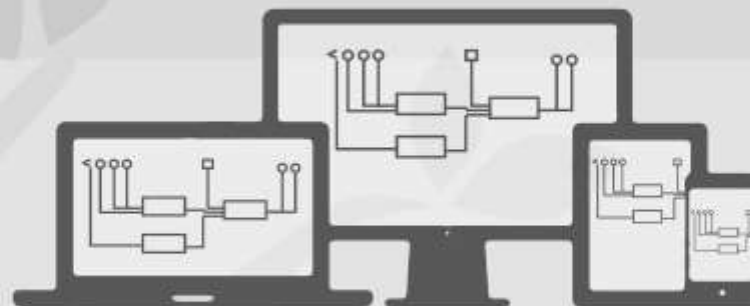


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29th October, SP2020 – Interim Conference
14:00 - 14:15 Introduction



Auteras supports building services designers to design **Room Automation Systems** (as part of Building Automation Control Systems-BACS) with a semi-automated process of a functional requirement survey and the generation of function block-based designs, which use standardised symbols to ensure a high comprehension from professionals in different trades.

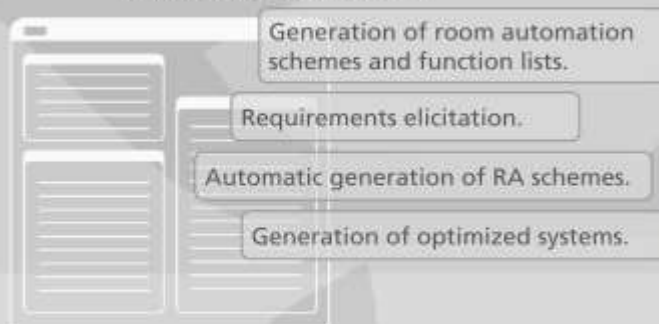


This tool is designed for building services designers. It will free the planner and system integrator from time-consuming, costly tasks of planning and designing room automation systems (RA systems).



These activities can now be transferred to the computer, which can solve them independently and with optimal quality within seconds. In the form of the new room automation design tool AUTERAS, the design approach will shortly be available to all interested planners, system integrators and device manufacturers.

Functions of AUTERAS®:



The resulting designs can be used directly to form bills of quantities for the procurement process. This tool imports and reads IFC information from existing buildings.

AUTERAS® suite:



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www.bim4eeb-project.eu
www.auteras.de



BIM based fast toolkit for
Efficient rEnovation in Buildings

THE BIM4OCCUPANTS

A web tool for building occupants

BIM4Occupants tool is a user friendly web based application that provides residents and/or owners with information related

- to their building renovation activities performed,
- to their indoor home conditions,
- to their comfort preferences and energy consumption.

Building occupants are supported to get insights about energy performance and environmental conditions.

They can get insights about the renovation tasks and activities running in premises and notified about security and safety conditions in premises.



The application has got two main features:
the Occupants 2.0 and the Building 2.0

Occupants 2.0

provides access to real time and historical information about indoor and outdoor environment parameters (such as temperature, humidity, illuminance, indoor air quality), as well as information regarding energy consumption.



Buildings 2.0

enables occupants to annotate information regarding building elements in their premises requested by contractors, contributing to the constant and collaborative updating of the BIM model and as-build documentation of their building.



Inhabitants receive information about on-site working planning and schedules, giving the contractors their needs and preferences



Building occupants, Inhabitants and Owners became part of the BIM4EEB project ecosystem and get insights about building performance in an intuitive way.

Occupants will be able to receive Health and Safety alerts and notification about the ongoing renovation processes within their building



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BIM4EEB
BIM based fast toolkit for
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29th October, SP2020 – Interim Conference
14:00 - 14:15 Introduction



The BIMeaser

BIM Early Stage Energy Scenario tool
A web tool

The tool is designed to support the decision-making process in the early design stage of the renovation process.

Linked Data can be used to enrich BIM models to enable decision making based on best possible models.

Scope of the BIMeaser-tool
Fill the gap between traditional process and sophisticated energy simulation needs.

Amount of design data in the traditional design

Sophisticated energy simulation needs

GAP

The tool allows architects and engineers to provide solutions that best fit to the client requirements



while optimising the energy use and the indoor comfort for the occupants.

Solar panel
New condensing gas boiler
Outside wall insulation
New windows (U1.1) and roller shutters

What are the main functionalities?

The BIMeaser tool enables the easy build-up of the "As-is" energy and indoor climate model of the building by using the BIM and linked data for accurate modelling in the early stage, where the most important design choices are made according to cost and performances.



The BIMeaser tool enables design teams to apply the renovation scenarios to the "As-is" building. It enhances the design team's collaborative work in the early design stage by providing an easy assessment of the multi-design domain alternatives.

BIMeaser tool presents the impact of each renovation scenario in terms of Owner Project Requirements (OPR). The design teams work collaboratively to validate the design selections against the OPR in each design stage. This is an important part of the performance-based building design process.



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BIM based fast toolkit for
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14:00 - 14:15 Introduction



BIM based fast toolkit for Efficient rEnovation in Buildings

Bruno Daniotti (PoliMi)

Introduction



A EU-funded project in a nutshell

BIM based fast toolkit **for** **E**fficient **rE**novation in **B**uildings

Duration:

- 42 months: 1 January 2019 – 30 June 2022

15 partners representing main stakeholders

- 3 Universities: PoliMi, UCC, TUD
- 2 Research Institutes: VTT, RISE,
- 2 Public administrations: Lombardy Region / ALER VCBM
- 4 SME/ Start-up: SOLINTEL, SUITE5, OneTeam, VisualLink
- 3 Large Enterprise: CAVERION, CGI Sverige, PROCHEM
- 1 EU Association ACE

The team: 15 Partners from 9 EU countries

Caverion



CGI

RI
SE
Research Institutes
of Sweden



Solintel



one team



Regione
Lombardia



ALER

Azienda Lombarda per l'Edilizia Residenziale
di Varese - Como - Monza Brianza - Busto Arsizio

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14:15 - 14:45 BIM based fast toolkit for Efficient rEnovation in Buildings



Partners' roles

Stakeholders' representatives

Building owner

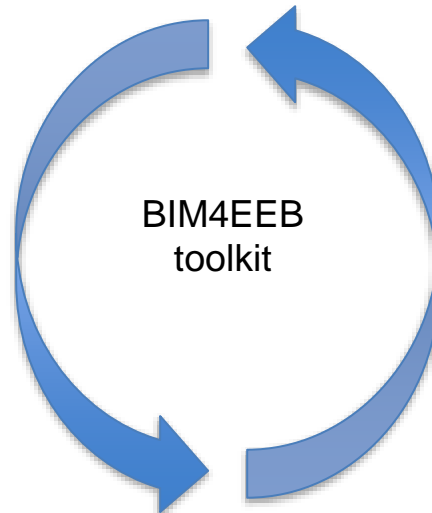
- Regione Lombardia
- SOLINTEL

Asset & facility manager

- ALER
- PROCHEM
- CAVERION

Architects' representative

- ACE



Tools developers

Industry

- One Team (SME)
- Suite5 (SME)
- Visualyink (SME)
- CGI

Research center

- VTT
- RI.SE
- IERC

University

- PoliMi
- TUD
- UCC



WHY BIM4EEB?

An EU-funded project supporting the renovation industry in retrofitting existing residential buildings with a complete **BIM-based toolkit to make the flow of information efficient and decrease intervention working time, while improving building performances, quality and comfort for inhabitants.**

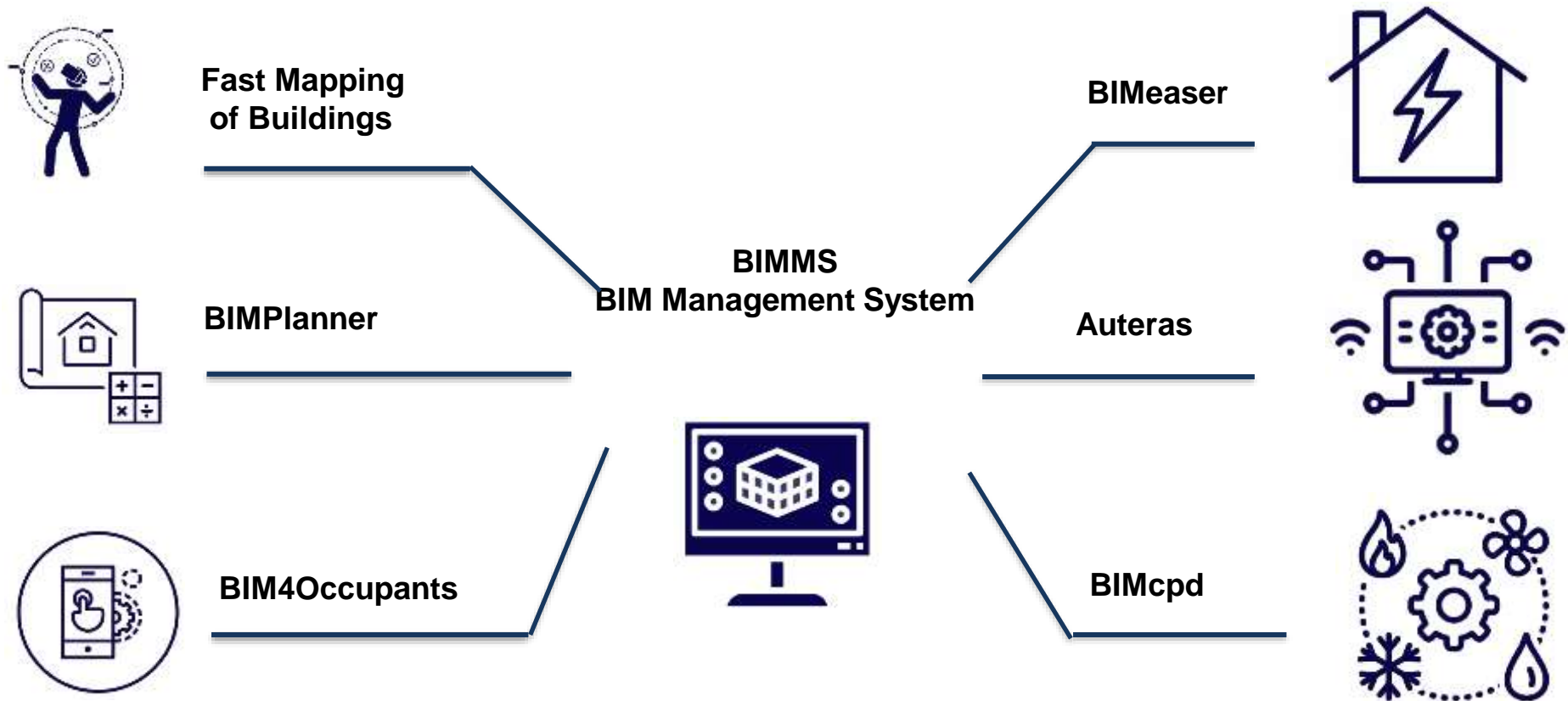
These tools will allow to **rapidly reconstruct 3D digital models of existing buildings** and to seamlessly integrate semantic data in order to perform advanced evaluations of design options for renovations.

Main results will include **guidelines for BIM implementation** and providing an easy, practical and operational platform as a central repository of information, namely **Common Data Environment (CDE)**, with different connected tools.

The BIM4EEB objectives

- 1. Maximise efficiency in building renovation:*
- 2. Accelerate the market uptake across Europe towards a digital built environment*
- 3. Speed-up data gathering and processing*
- 4. Interoperability of different stakeholders and tools, harmonising data exchange formats*

The BIM4EEB toolkit



Main phases

Phase 1



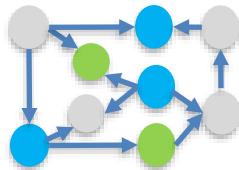
Construction & service companies



HVAC designers



owners & inhabitants



linked data & ontologies

**Requirements,
linked data & ontologies**

Phase 2



BIMMS



AR for fast mapping & survey



BIMplanner
BIM4Occupants

Auteras,
BIMcpd,
BIMeaser



Tools development

Phase 3



Monza demo site (IT)



Chorzow demo site (PL)



Tampere demo site (FI)

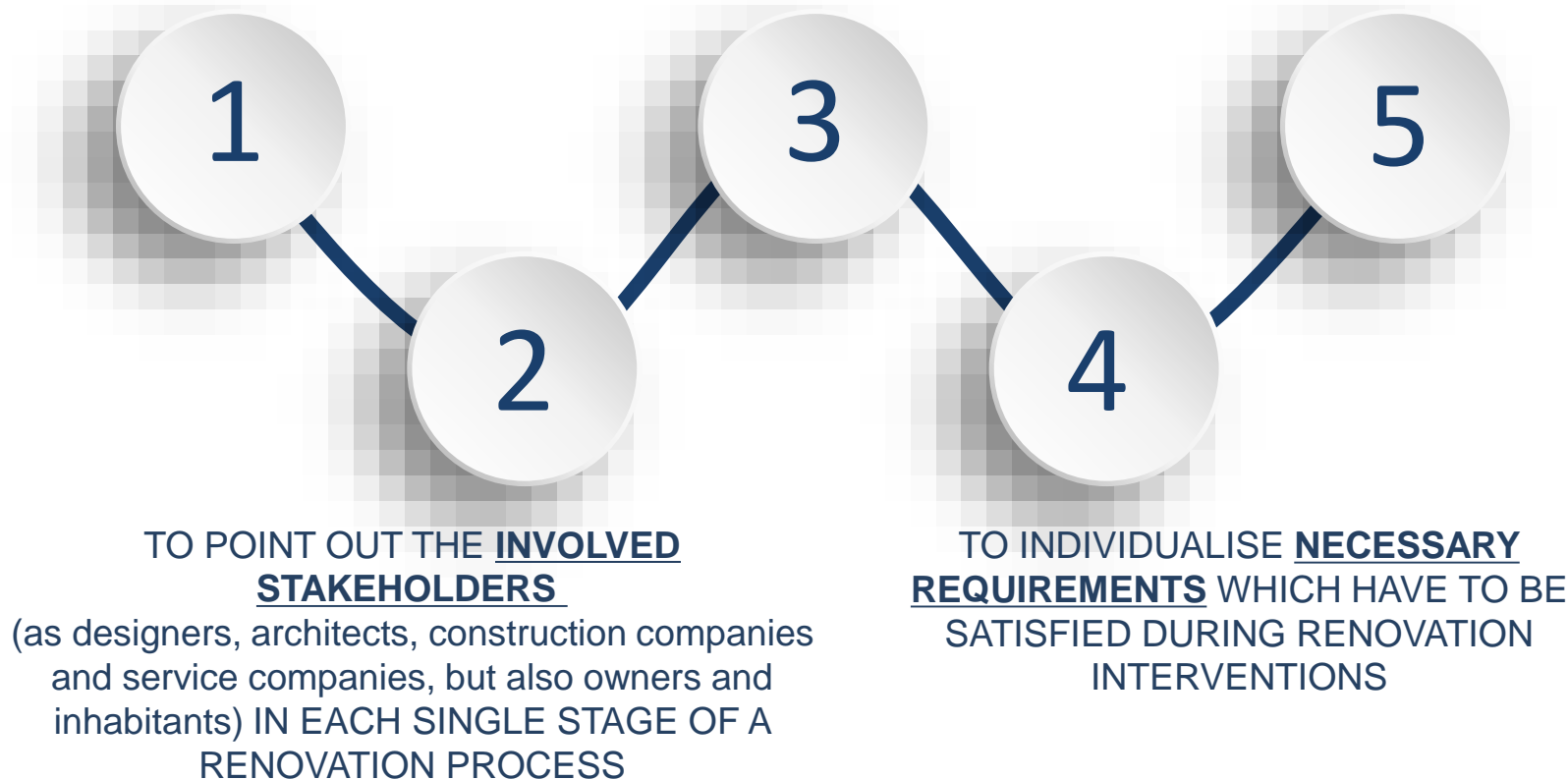
**Demonstration in
relevant environment**

Definition of requirements for an efficient renovation process

TO DEFINE PRECISELY EVERY **ACTIVITY** THAT IS REQUIRED IN EACH STAGE OF A RENOVATION PROCESS

TO DEFINE THE MOST PROPER **INFORMATION EXCHANGE/SHARE PROCESS AND WORKFLOW**

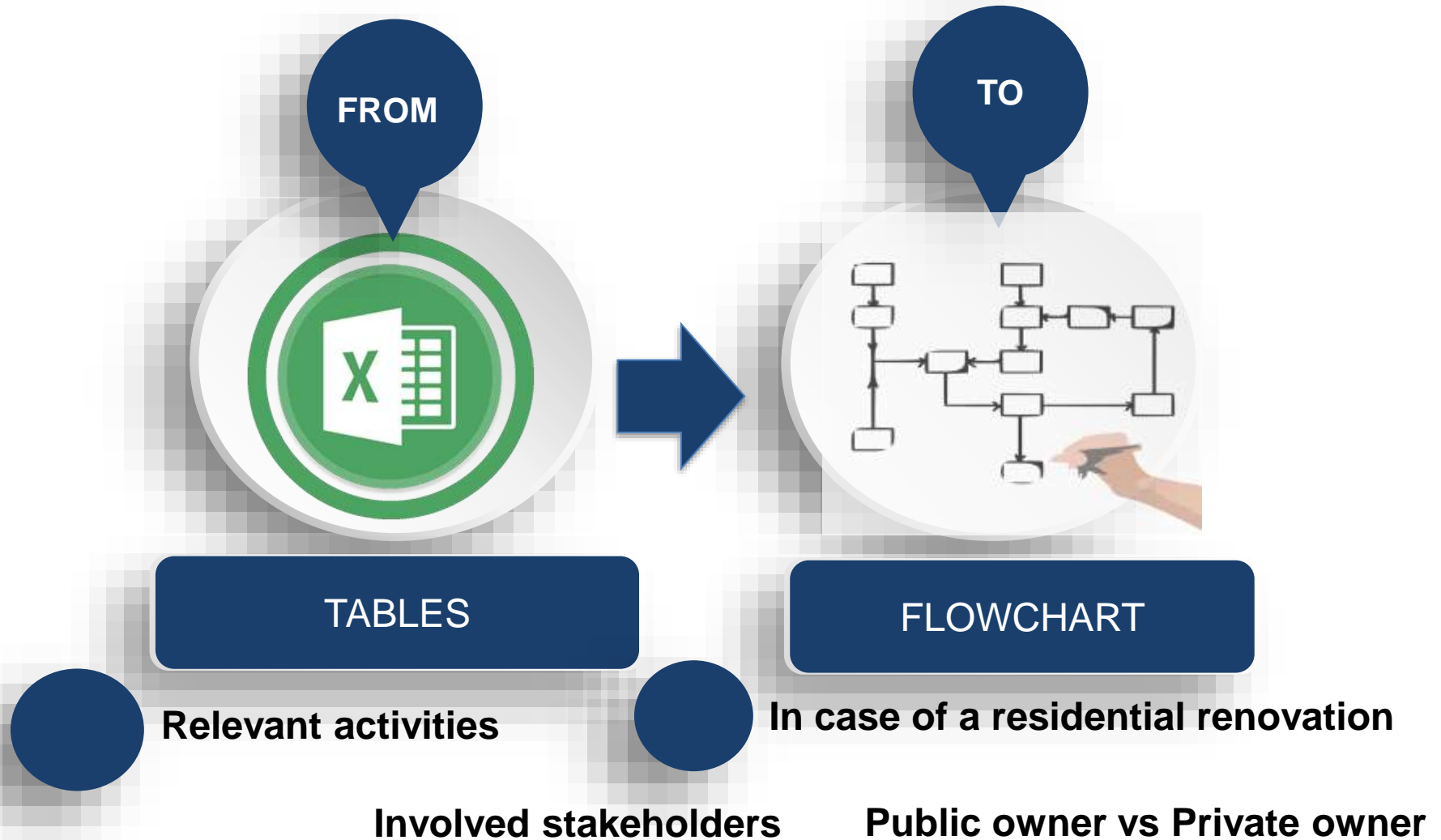
OPTIMISATION OF THE RENOVATION PROCESS (i.e. to limit inefficiencies due to incorrect or redundant exchange of information)



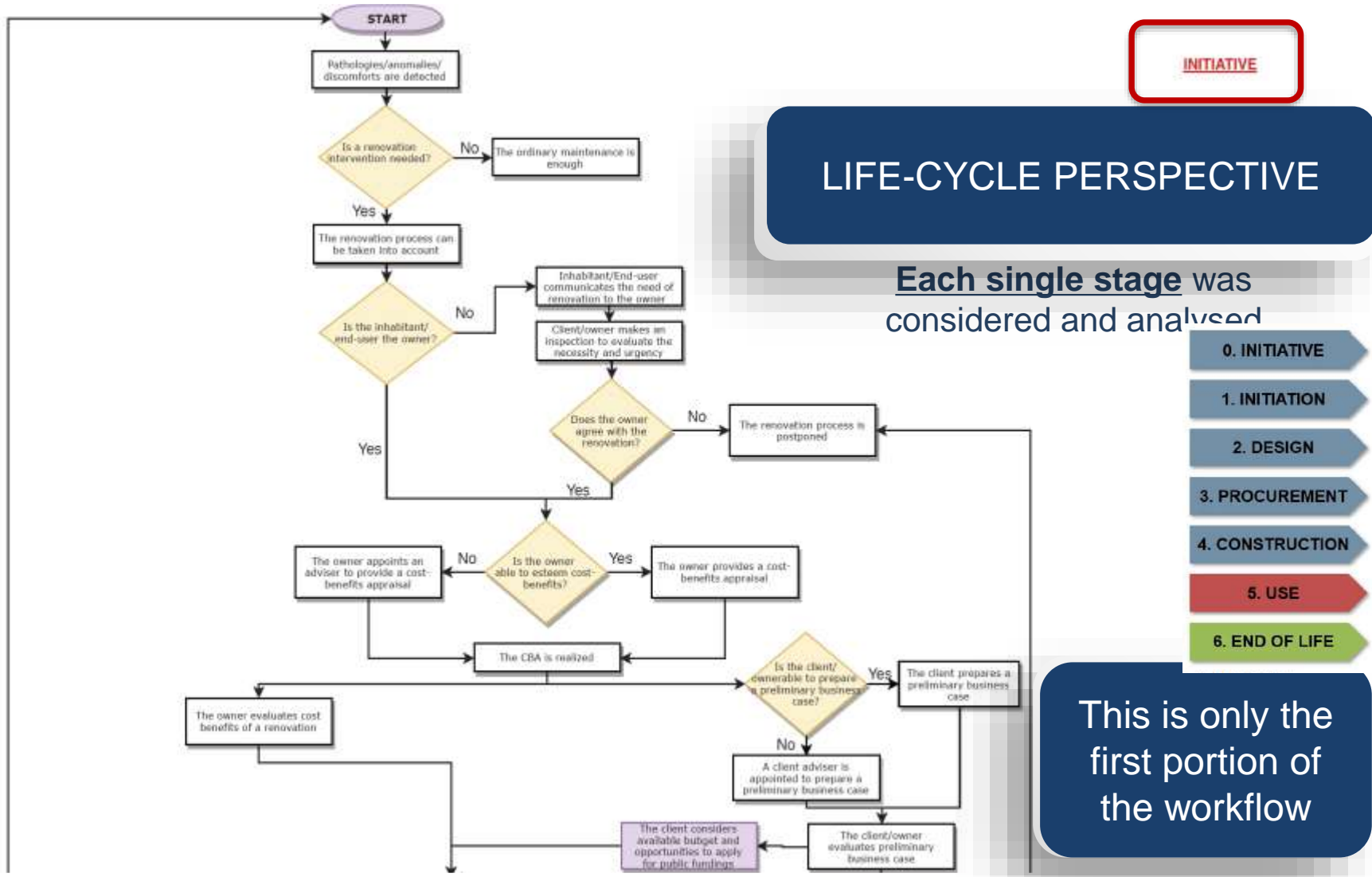
Process analysis and definition of relevant activities and involved stakeholders (public vs private sectors)



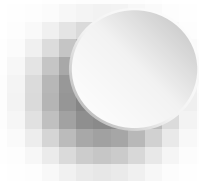
Definition of relevant activities and involved stakeholders in actual and efficient renovation processes



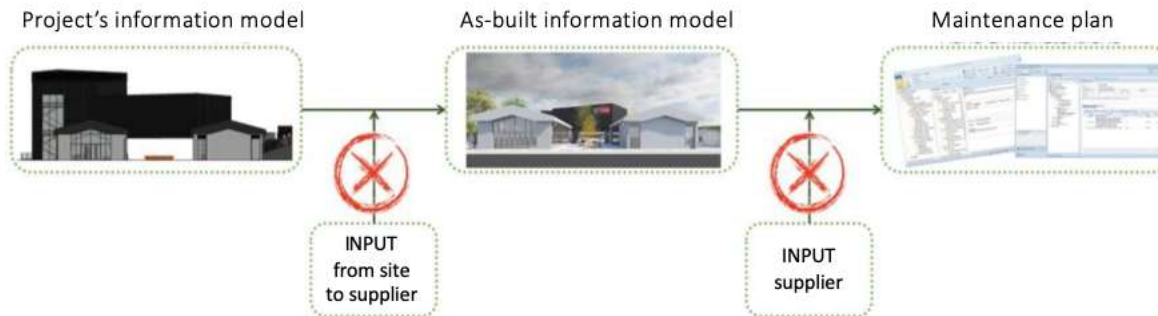
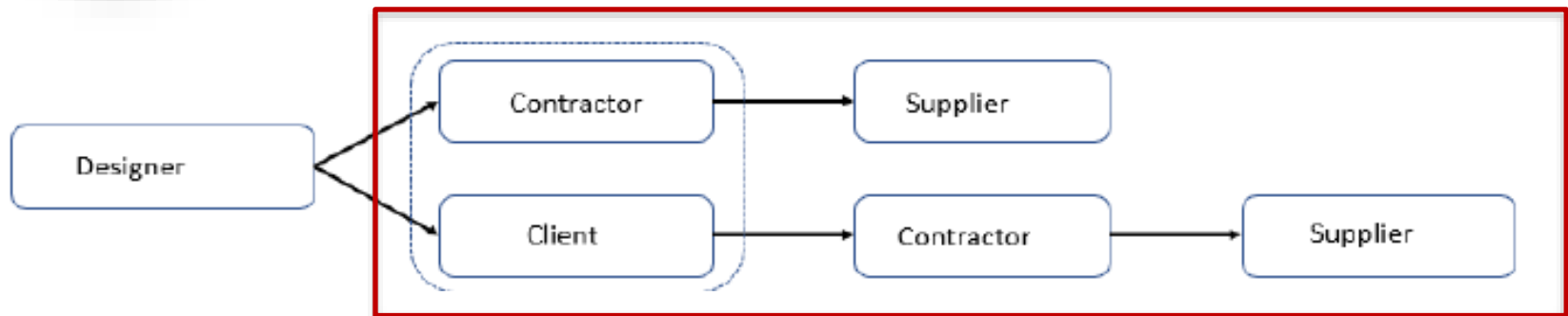
Main output: Workflow in a renovation process



Definition of **construction companies'** needs and requirements in renovation interventions

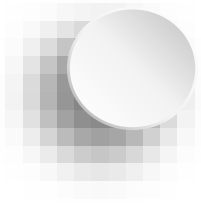


A SURVEY WAS DEVELOPED AND SHARED IN ORDER TO INDIVIDUALIZE INFORMATION REQUIREMENTS ALONG THIS INFORMATION WORKFLOW:



Example: lost of information in different stages due to a not digitized supplier

Definition of construction companies' needs and requirements in renovation interventions



INVOLVEMENT OF DIFFERENT ORGANISATIONS, ASSOCIATIONS, CONSTRUCTION COMPANIES in the 28 Member States, SUCH AS:

- | | |
|----------------|--------------------------|
| 1. Bam | 10. Ectp |
| 2. BSI | 11. Efca |
| 3. Bsint | 12. Fiec |
| 4. Cece Aisbl | 13. Indra |
| 5. Cpe | 14. LIST |
| 6. Cstb | 15. Ljubljana University |
| 7. Cstc (BBRI) | 16. NTNU |
| 8. CU/BRE | 17. Tecnalia |
| 9. Ebc | 18. TNO |

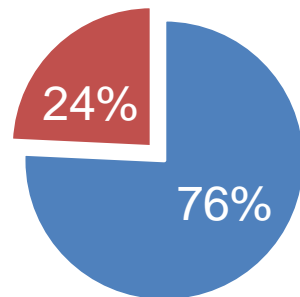
OUTPUT:

Report a list of needs and requirements of construction companies to be satisfied and to be taken into account for the definition of ontologies and the development of the BIM management system.

Definition of construction companies' needs and requirements in renovation interventions

Essential information for BIM-based renovation processes

Percentage of enterprises that define specific information for renovation processes vs percentage of enterprises that do not define any



- Not specific information provided
- Specific information for renovation processes

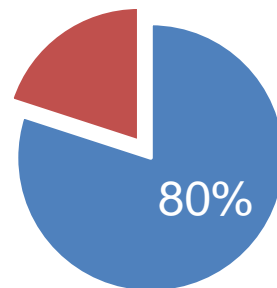
List of specific essential information

- Location
- Function
- Shape
- Material
- Cost
- Element ID
- Interdependencies with other elements
- Safety ratings
- Performance
- Installation date
- Estimated life expectancy
- Current capacity/utilization
- Warranty
- Contract documents
- Scope of the work

Definition of construction companies' needs and requirements in renovation interventions

Specific information containers for BIM-based renovation processes

Percentage of enterprises that indicate specific containers vs percentage of enterprises that do not indicate specific containers



■ Not specific containers ■ Specific containers

List of specific containers

- O&M manuals
- As built drawings

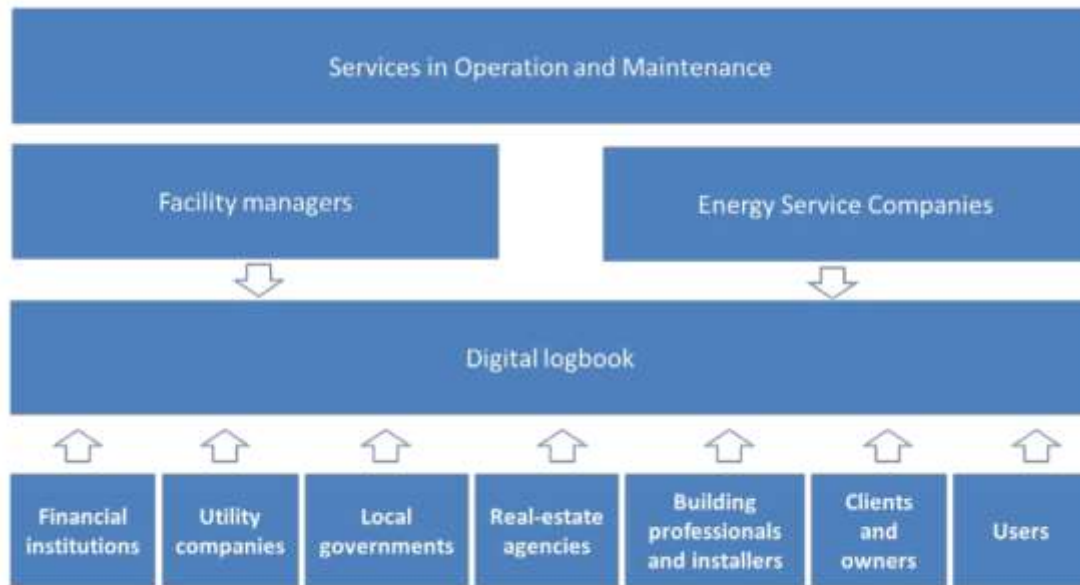
Definition of **service companies'** needs and requirements in renovation interventions

- Analysis of provided services by service companies, mainly with reference to Operation and Maintenance
- Literature review about existing logbooks (e.g. CIBSE, BPIE, Cornwall Council)
- Definition of information requirements related to **buildings** and **equipment/appliances** → information retrieved from drawings, O&M manuals, BMS functional information, warranty documents

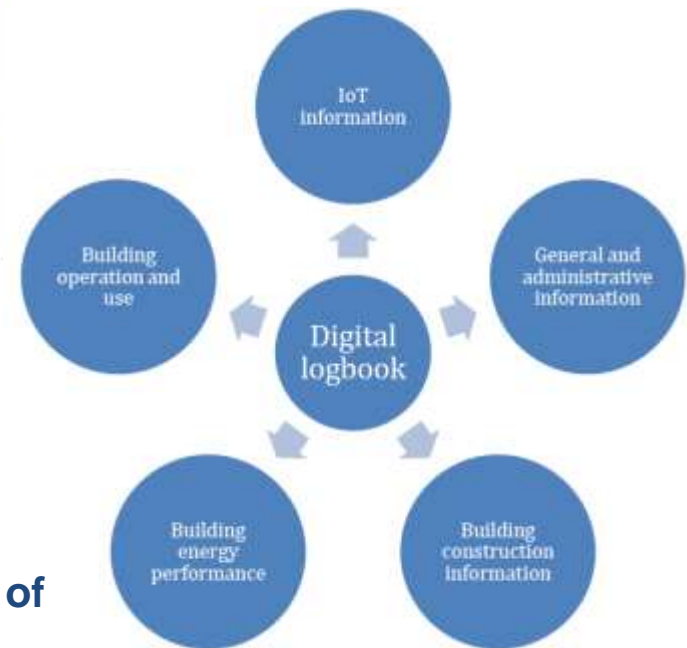
Figure 4 - List of performance indicators that could potentially be included in the Building Renovation Passport (Source: BPIE)

Energy consumption
<ul style="list-style-type: none">• Primary energy consumption kWh/m²year (heating, DHW, cooling, fans, pumps, control)• Final energy consumption kWh/m²year (heating, DHW, cooling, fans, pumps, control)• Net energy consumption kWh/m²year (heating, DHW, cooling)• Energy need for heating & cooling kWh/m²year• Energy consumption of lighting system kWh/m²year• Building heat transfer coefficient (U value)
Indoor climate
<ul style="list-style-type: none">• Indoor air temperature °C• Indoor air relative humidity %
Airtightness and ventilation
<ul style="list-style-type: none">• Type of ventilation system• Air exchanges rate (ACH)• Efficiency of heat recovery (if available OR applicable)• Building airtightness by 50Pa (ventilation)• Building airtightness by 50Pa 1/h (infiltration)
Indoor air quality
<ul style="list-style-type: none">• Indoor air quality (IAQ) indicator: ACH or CO₂ concentration in indoor air above outdoor concentration in PPM, for different categories in accordance with EN 15251 "Indoor environmental input parameters for design and assessment of energy performance of buildings- addressing indoor air quality, thermal environment, lighting and acoustics"• CO₂ concentration in indoor air in PPM• PM and TVOC content in indoor air
Noise insulation
<ul style="list-style-type: none">• Sound pressure level dB(A) in living room and bed room
Artificial lighting
<ul style="list-style-type: none">• Type of lighting• Power of lighting W/m²• Spatial light distribution
Daylight
<ul style="list-style-type: none">• Daylight factor• Daylight autonomy• Useful daylight illuminance
CO₂ emissions
<ul style="list-style-type: none">• Equivalent CO₂ emission in kg per year per m², kg CO₂/m²year (heating, DHW, cooling, fans, pumps, controls)
Thermal comfort - Qualitative
<ul style="list-style-type: none">• Use of scale/colour code to express: Cold - extremely uncomfortable, Cool - uncomfortable, Slightly cool- slightly uncomfortable, Neutral - Comfortable, Slightly warm - slightly uncomfortable, Warm - uncomfortable, Hot - extremely uncomfortable
Thermal comfort - Quantitative
<ul style="list-style-type: none">• With the use of PPD and PMV (EN ISO 7730) for four different categories of comfort levels in accordance with EN 15251 standard

Definition of **service companies'** needs and requirements in renovation interventions

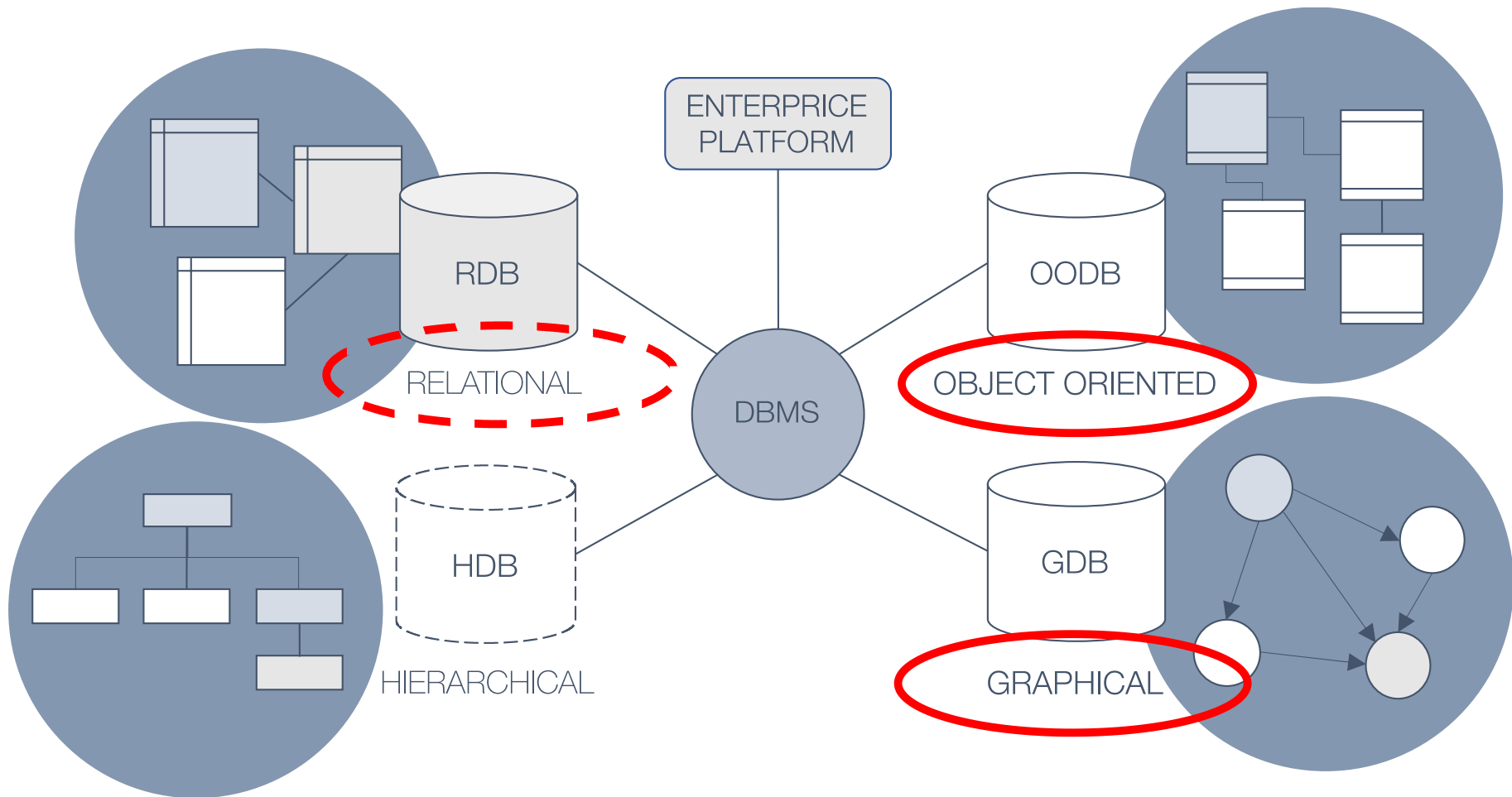


Main stakeholders considered in the definition of the information to be stored in a digital logbook



Group of information considered for the development of BIM4EEB digital logbook

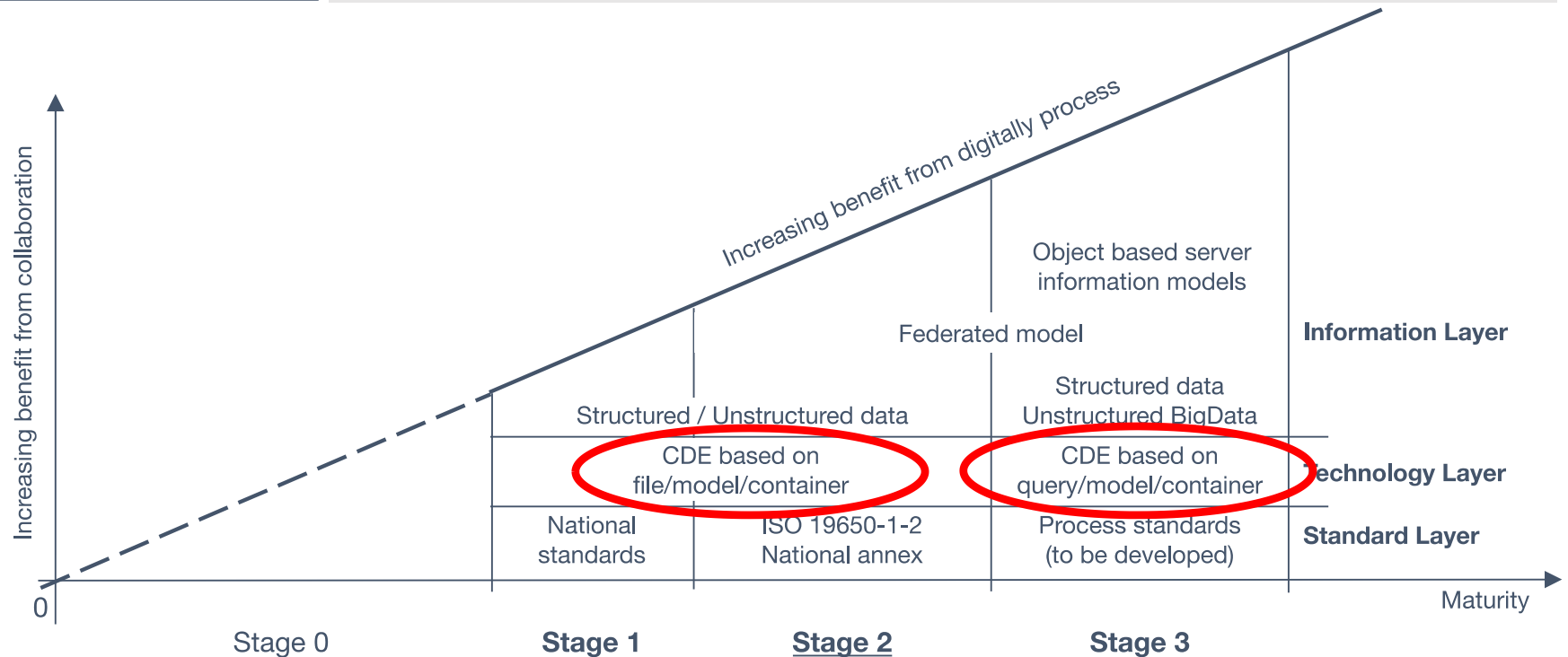
New CDE to BIMMS architecture



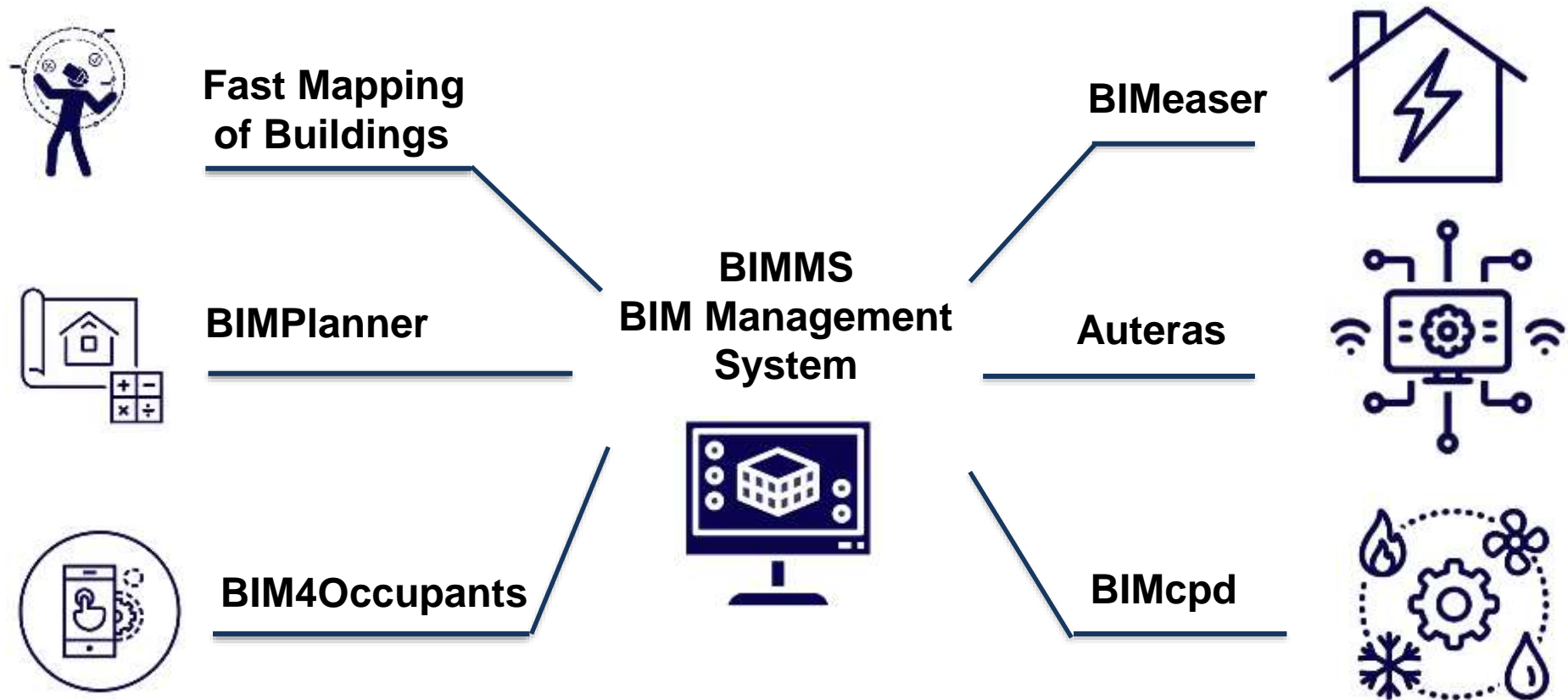
EN ISO 19650-1:2019 - CDE

CDE

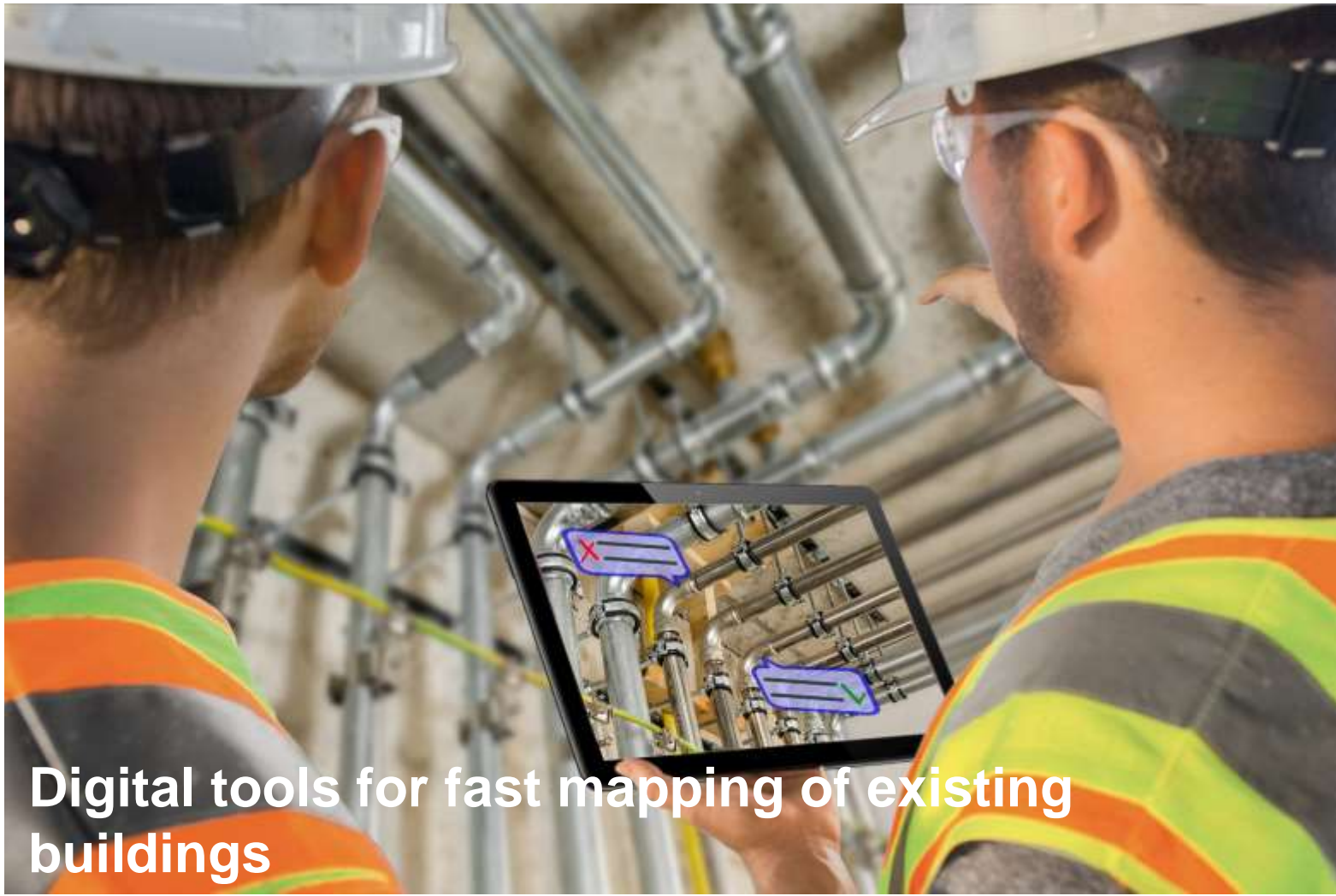
«common data environment: agreed source of information for any given project or asset, for collecting, managing and disseminating each information container through a managed process»



The BIM4EEB toolkit



The BIM Tools



Digital tools for fast mapping of existing buildings

The BIM Tools



Tools for managing BACS and HVAC with BIM
Tools for BEM analysis
Tool for inhabitants involvement

The BIM Tools



**Tools for construction planning and tracking
AR and VR implemented**

3 demonstration projects in IT, FI, PL



The Italian pilot in Monza



The Polish pilot in Chorzow



The Finnish pilot in Tampere

Any questions?

The coordinator:
Prof. BRUNO DANIOTTI
Politecnico di Milano
ABC dept

Project Email: infobim4eeb@polimi.it

Project Website: www.bim4eeb-project.eu

Twitter: @Bim4Eeb

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

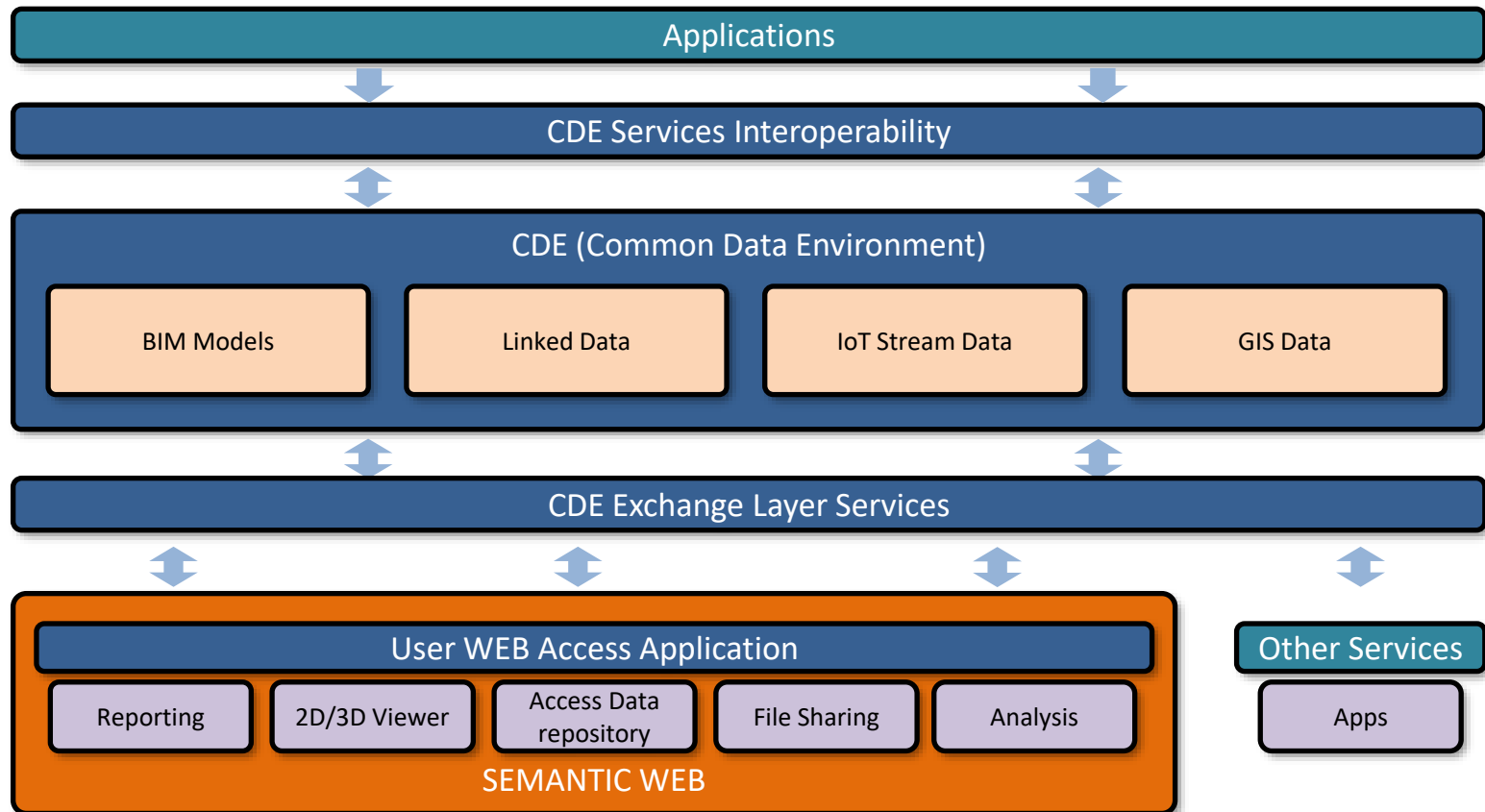
Alessandro Valra, Davide Madeddu (OneTeam)

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

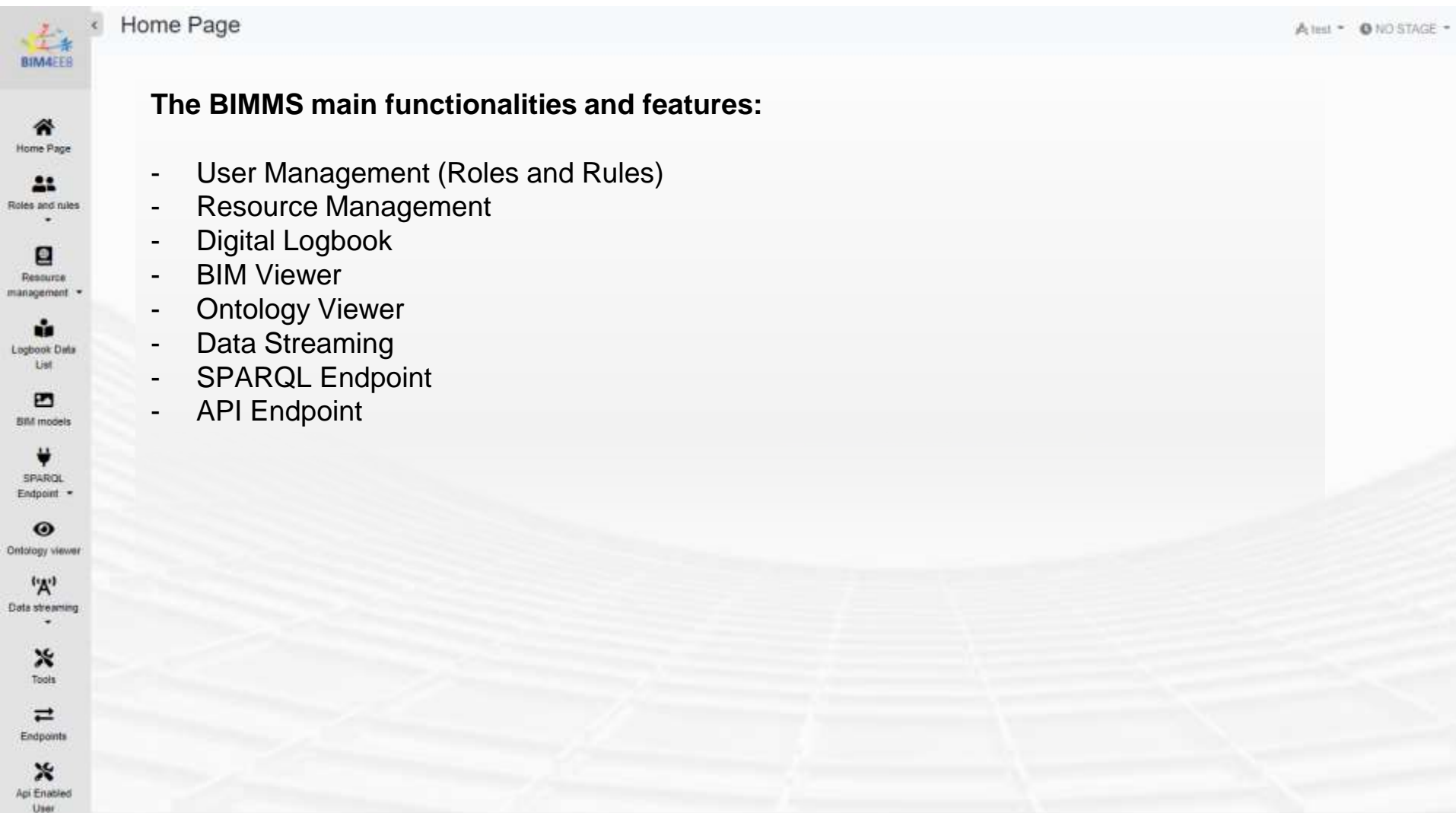
The BIM Management System (BIMMS) is a platform built around a Common Data Environment (CDE) that store all the data and information gathered through different sources and along the whole building life-cycle, acting a single source of truth (SSOT).

The BIMMS and its CDE allows to collaborate and to store, share and visualise BIM and GIS (Geographic Information System) models, manage documents, energy performance data and link the data-streaming from sensors devices to the models to evaluate the comfort preferences of inhabitants.

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



The screenshot shows the BIM4EEB Home Page. The top navigation bar includes the BIM4EEB logo, a 'Home Page' tab, and user status indicators 'A test' and 'NO STAGE'. A left sidebar contains icons for various functions: Home Page, Roles and rules, Resource management, Logbook Data List, BIM models, SPARQL Endpoint, Ontology viewer, Data streaming, Tools, Endpoints, and Api Enabled User. The main content area displays the title 'The BIMMS main functionalities and features:' followed by a list of features.

The BIMMS main functionalities and features:

- User Management (Roles and Rules)
- Resource Management
- Digital Logbook
- BIM Viewer
- Ontology Viewer
- Data Streaming
- SPARQL Endpoint
- API Endpoint

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- User Management (Roles and Rules)

User	Email	Project	Roles active	Roles Pending	Project Admin	IFC Zones
martinop	pietfrancesco.martino2@oneteam.it	test	Information/End-user	<input type="checkbox"/>	<input type="checkbox"/>	Zones
farinatd	diego.farina@oneteam.it	test	ClientOwner Health and safety adviser	<input type="checkbox"/>	<input type="checkbox"/>	
moriggip	pietfrancesco.martino3@oneteam.it	test	Information/End-user Client adviser Project leader ClientOwner	<input type="checkbox"/>	<input type="checkbox"/>	Zones
martinop3	pietfrancesco.martino@oneteam.it	test	Project administrator Client adviser ClientOwner Guest Local authority Project leader Technical adviser	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
valiaa	alessandro.valia@oneteam.it	test	Information/End-user Project leader Access consultant Project administrator	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Zones
madeddud	devide.madeddu@oneteam.it	test	Project administrator Access consultant Acoustic consultant Architectural designer Bank or third party financial BRECAM assessor Building services designer Cladding specialist Client adviser ClientOwner Construction lead Contract administrator Contractor Cost consultant/quantity surveyor Developer Electrical Designer Facilities management (FM) adviser Fire safety designer Guest Health and safety adviser HVAC Designer Information manager Information/End-user Interior designer Landscape architect Landscape designer Load designer Lighting designer Local authority Maintenance planner Machinery/plant Operational lead Party wall surveyor Planning consultants Project leader Security adviser Site surveyor Structural designer Sub-contractor Supplier Sustainability adviser Technical adviser Tenderer Trader Trust Water and Waste Designer Work supervisor	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Zones
chiappeti	giacopo.chiappetti@oneteam.it	test	ClientOwner Information/End-user Local authority	<input type="checkbox"/>	<input type="checkbox"/>	Zones
nam.vuhoang	nam.vuhoang@vtt.fi	test	Architectural designer ClientOwner Developer Information/End-user	<input type="checkbox"/>	<input type="checkbox"/>	Zones
vtmark	markku.kiviniemi@vtt.fi	test	Architectural designer ClientOwner Developer Information/End-user	<input type="checkbox"/>	<input type="checkbox"/>	Zones
BRMS User	ingegneria.oneteam@gmail.com	test	Access consultant Acoustic consultant Architectural designer Bank or third party financial BRECAM assessor Building services designer Cladding specialist Client adviser ClientOwner Construction lead Contract administrator Contractor Cost consultant/quantity surveyor Electrical Designer Facilities management (FM) adviser Fire safety designer Guest Health and safety adviser HVAC Designer Information manager Information/End-user Interior designer Landscape architect Landscape designer Load designer Lighting designer Local authority	<input type="checkbox"/>	<input type="checkbox"/>	Zones

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- Resource Management

Home Page

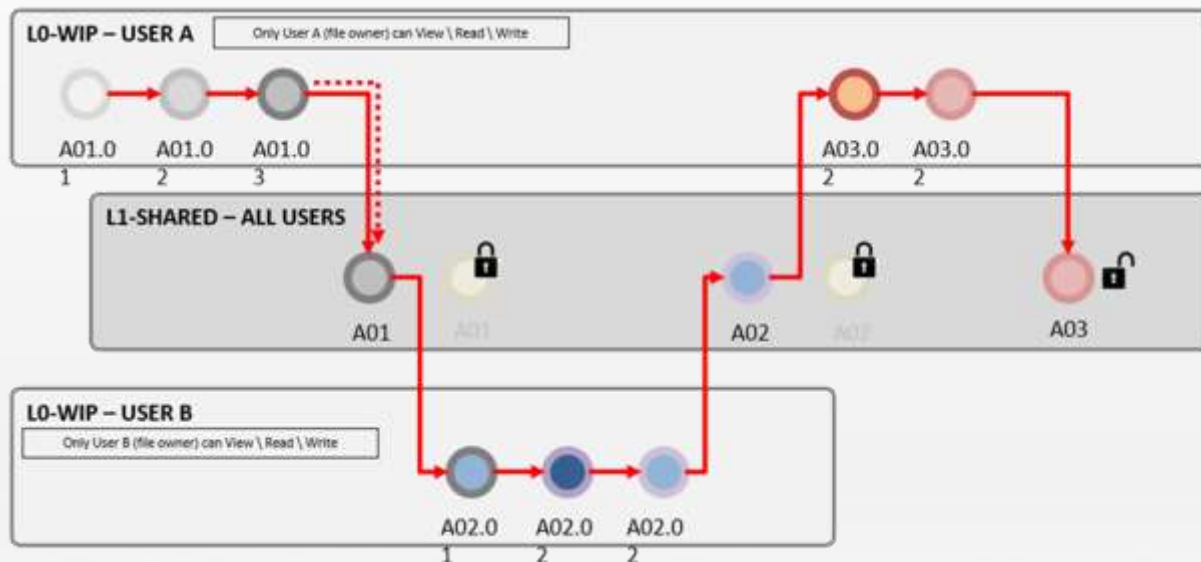
Show 50 entries

Search

File Name	Title	Description	Keywords	Synonyms	Creator User	Creation Date	Note				
	POLAND P&I				Davide Madeddu	2/19/2020 2:35:28 PM			IFC	RDF	
ABC_r0.ifc	Test ABC				Jacopo Chiappelli	7/30/2019 4:48:59 PM			IFC	RDF	BOT
ABC_r0_watParts_A.ifc					Davide Madeddu	4/20/2020 5:27:49 PM			IFC	RDF	BOT
ABC_r0_watParts_C.ifc					Davide Madeddu	4/2/2020 6:58:03 PM			IFC	RDF	
ABC_r0_watParts_F.ifc					Davide Madeddu	4/2/2020 7:55:04 PM			IFC	RDF	
ABC_r0_watParts_r03.ifc					Davide Madeddu	4/1/2020 11:40:16 AM			IFC	RDF	
ABC_r0_watParts_r04.ifc					Davide Madeddu	4/2/2020 9:46:09 AM			IFC	RDF	
ABC_r0_watParts_r05.ifc					Davide Madeddu	4/2/2020 5:27:46 PM			IFC	RDF	
ABC_watParts_r0.ifc	ABC_Model_Parts				Davide Madeddu	2/19/2020 2:31:08 PM			IFC	RDF	
COO_MNZ_r2020.ifc	Monza Pilot Model				Davide Madeddu	2/10/2020 4:10:01 PM			IFC	RDF	
Demonstration_Model_Rev0 2019_25_01_IFC4.ifc	TUD Demonstration Model				Davide Madeddu	2/24/2020 2:40:54 PM			IFC	RDF	
Demonstration_Model_V1_DTV_4.ifc	TUD Demo Building Model	G+2 Building Model for demonstration purpose			Prathap Vaituru	5/5/2020 3:09:59 PM			IFC	RDF	BOT
FAB2BLVH31570188122.ifc	Prova.ifc	Model to be deleted			Sonia Lupica Spagnolo	6/19/2020 11:26:38 AM			IFC		
IFCMeformPSCOMC20200211.ifc	WP5FastMapping.ifc				Alessandro Vitra	2/13/2020 9:06:48 AM			IFC	RDF	
P6.ifc	P6	OTRMA			Perfrancesco Marino	7/31/2019 12:04:51 PM			IFC	RDF	

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- Resource Management

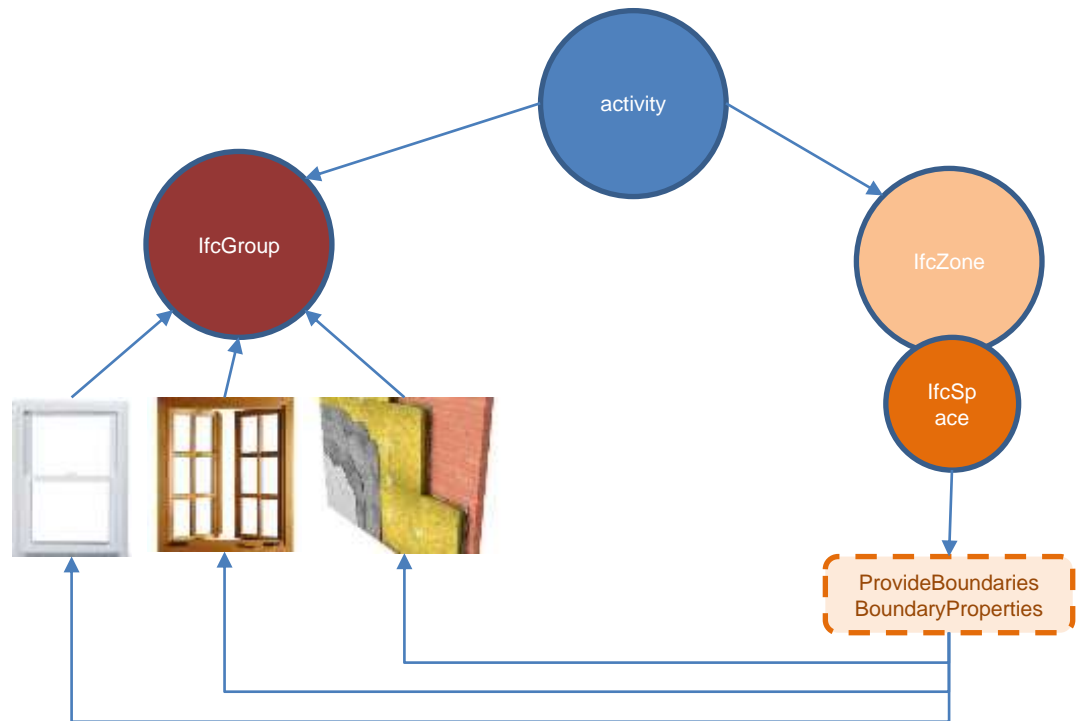


The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- BIM Viewer

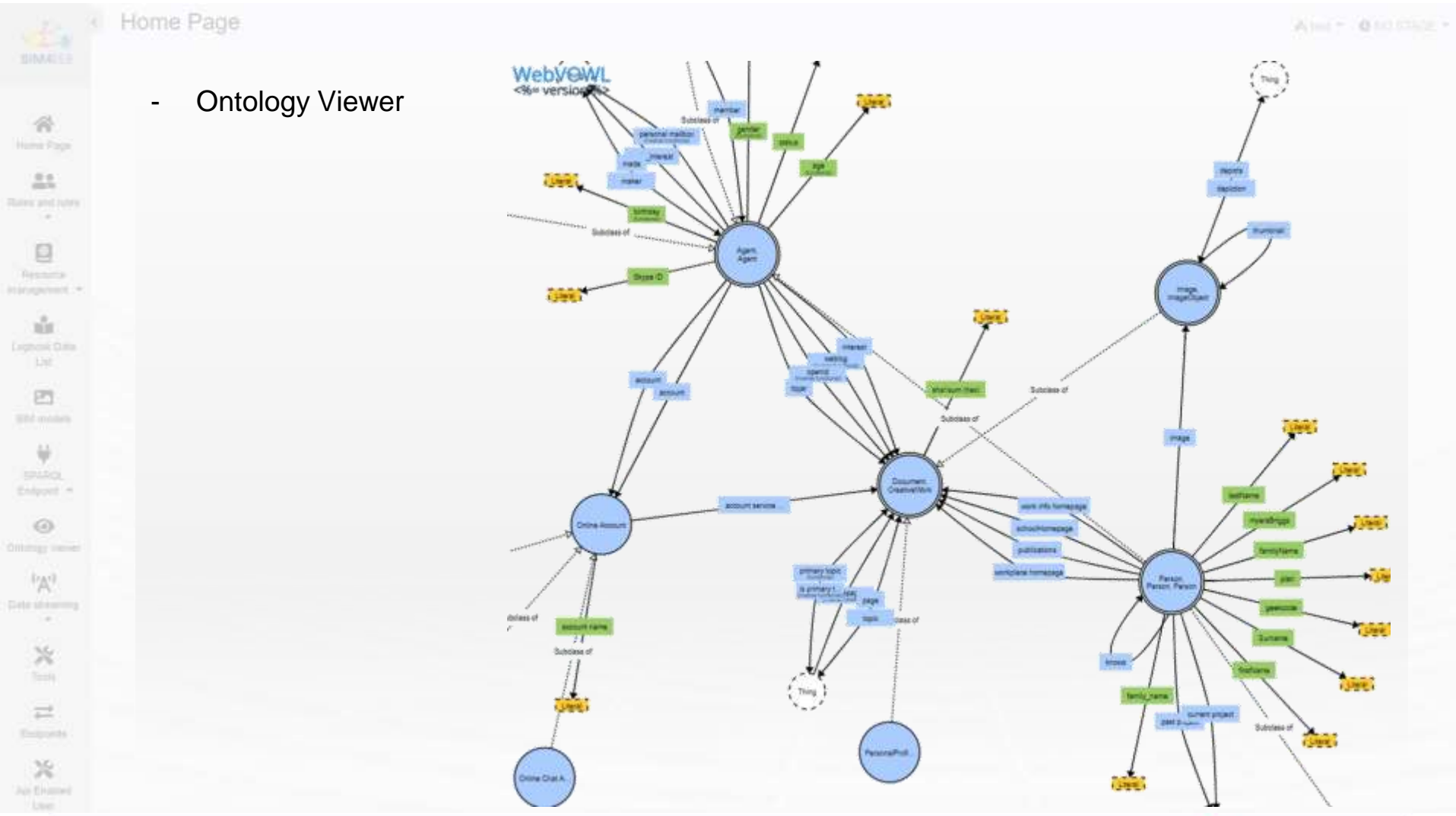


The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- Ontology Viewer



The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- Data streaming

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- SPARQL Endpoint

SPARQL Endpoint

SPARQL Query

```

PREFIX rdf:type <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX foaf: <http://xmlns.foaf.org/2000/01/01/foaf#>
PREFIX schema: <http://schema.org/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

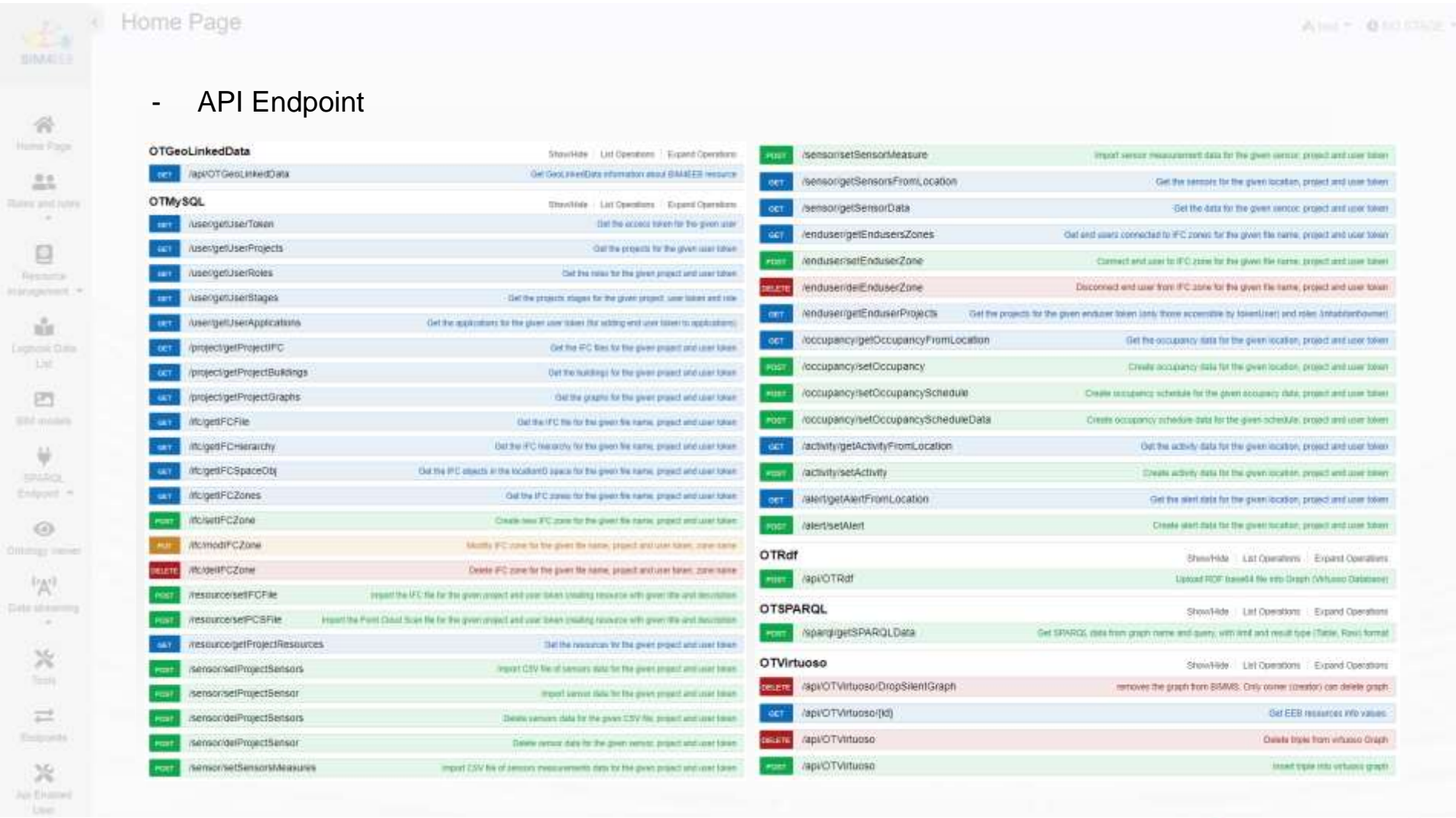
SELECT ?id ?name ?type
WHERE {
  ?id rdfs:label ?name .
  ?id rdfs:type ?type .
}
    
```

Limit: 100 Graph URI: <http://bim4eeb.onelab.it/SPARQL/endpoint>

s	story	building/story	a1
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"1 - Piano Terra"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"2 - Piano Terra"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"3 - Piano 1"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"4 - Piano 2"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"5 - Piano 3"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"6 - Piano 4"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"7 - Piano 5"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"8 - Piano 6"	http://bim4eeb.onelab.it/SPARQL/endpoint
http://bim4eeb.onelab.it/SPARQL/endpoint	http://bim4eeb.onelab.it/SPARQL/endpoint	"9 - Piano 7"	http://bim4eeb.onelab.it/SPARQL/endpoint

The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- API Endpoint

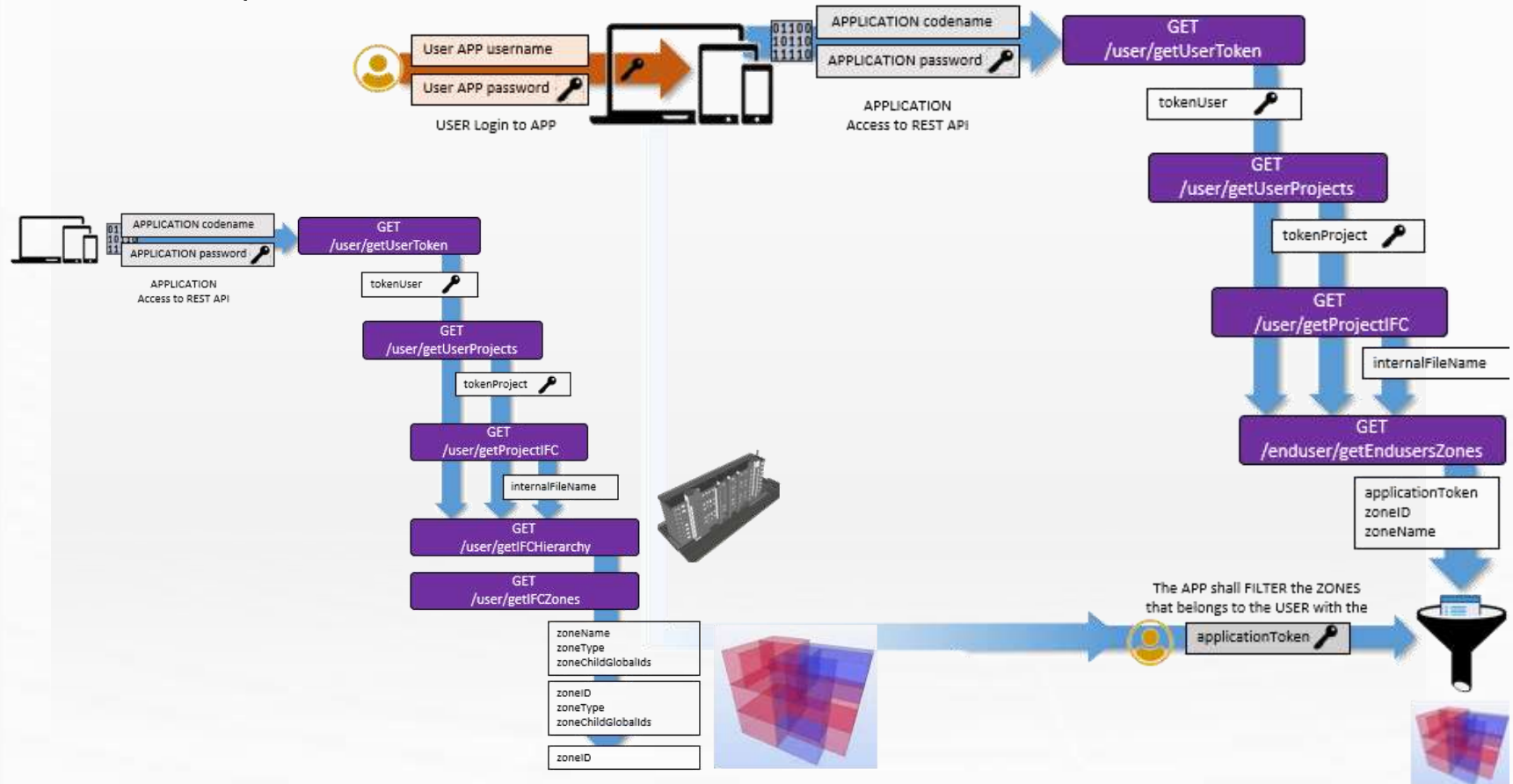


The screenshot displays the API Endpoint page of the BIM Management System. The page is organized into several sections, each representing a different data source or service. The left sidebar contains navigation icons for Home Page, Users and roles, Resource management, Logout Data List, BIM models, SPARQL Endpoint, Ontology viewer, Data streaming, Tools, Endpoints, and API Endpoint (selected). The main content area is divided into five sections: OTGeoLinkedData, OTMySQL, OTRdf, OTSPARQL, and OTVirtuoso. Each section contains a table of API endpoints with columns for Method, Endpoint, and Description.

Method	Endpoint	Description
GET	/api/OTGeoLinkedData	Get GeoLinkedData information about BIM4EB resource
GET	/user/getUserToken	Get the access token for the given user
GET	/user/getUserProjects	Get the projects for the given user token
GET	/user/getUserRoles	Get the roles for the given project and user token
GET	/user/getUserStages	Get the projects stages for the given project, user token and role
GET	/user/getUserApplications	Get the applications for the given user token (for setting user token to applications)
GET	/project/getProjectIFC	Get the IFC files for the given project and user token
GET	/project/getProjectBuildings	Get the buildings for the given project and user token
GET	/project/getProjectGraphs	Get the graphs for the given project and user token
GET	/ifc/getIFCFile	Get the IFC file for the given file name, project and user token
GET	/ifc/getIFCHierarchy	Get the IFC hierarchy for the given file name, project and user token
GET	/ifc/getIFCSpaceQty	Get the IFC objects in the localized space for the given file name, project and user token
GET	/ifc/getIFCZones	Get the IFC zones for the given file name, project and user token
POST	/ifc/setIFCZone	Create new IFC zone for the given file name, project and user token
PUT	/ifc/modifyIFCZone	Modify IFC zone for the given file name, project and user token, zone name
DELETE	/ifc/deleteIFCZone	Delete IFC zone for the given file name, project and user token, zone name
POST	/resource/setIFCFile	Insert the IFC file for the given project and user token creating resource with given file and description
POST	/resource/setPCFile	Insert the Point Cloud Scan file for the given project and user token creating resource with given file and description
GET	/resource/getProjectResources	Get the resources for the given project and user token
POST	/sensor/setProjectSensors	Import CSV file of sensors data for the given project and user token
POST	/sensor/setProjectSensor	Import sensor data for the given project and user token
POST	/sensor/delProjectSensors	Delete sensors data for the given CSV file, project and user token
POST	/sensor/delProjectSensor	Delete sensor data for the given sensor, project and user token
POST	/sensor/setSensorMeasure	Import CSV file of sensors measurements data for the given project and user token
POST	/sensor/setSensorMeasure	Import sensor measurement data for the given sensor, project and user token
GET	/sensor/getSensorsFromLocation	Get the sensors for the given location, project and user token
GET	/sensor/getSensorData	Get the data for the given sensor, project and user token
GET	/enduser/getEnduserZones	Get end users connected to IFC zones for the given file name, project and user token
POST	/enduser/setEnduserZone	Connect end user to IFC zone for the given file name, project and user token
DELETE	/enduser/delEnduserZone	Disconnect end user from IFC zone for the given file name, project and user token
GET	/enduser/getEnduserProjects	Get the projects for the given enduser token (only those accessible by token/user) and roles (initial/default)
GET	/occupancy/getOccupancyFromLocation	Get the occupancy data for the given location, project and user token
POST	/occupancy/setOccupancy	Create occupancy data for the given location, project and user token
POST	/occupancy/setOccupancySchedule	Create occupancy schedule for the given occupancy data, project and user token
POST	/occupancy/setOccupancyScheduleData	Create occupancy schedule data for the given schedule, project and user token
GET	/activity/getActivityFromLocation	Get the activity data for the given location, project and user token
POST	/activity/setActivity	Create activity data for the given location, project and user token
GET	/alert/getAlertFromLocation	Get the alert data for the given location, project and user token
POST	/alert/setAlert	Create alert data for the given location, project and user token
POST	/api/OTrdf	Upload RDF based file into Graph (Virtuoso Database)
GET	/api/OTsparql	Get SPARQL data from graph name and query, with limit and result type (Table, Rows) format
DELETE	/api/OTVirtuoso/DropSlientGraph	removes the graph from B2BWS. Only owner (creator) can delete graph.
GET	/api/OTVirtuoso/{id}	Get EEB resources info values
DELETE	/api/OTVirtuoso	Deletes links from virtuoso Graph
POST	/api/OTVirtuoso	Insert triple into virtuoso graph

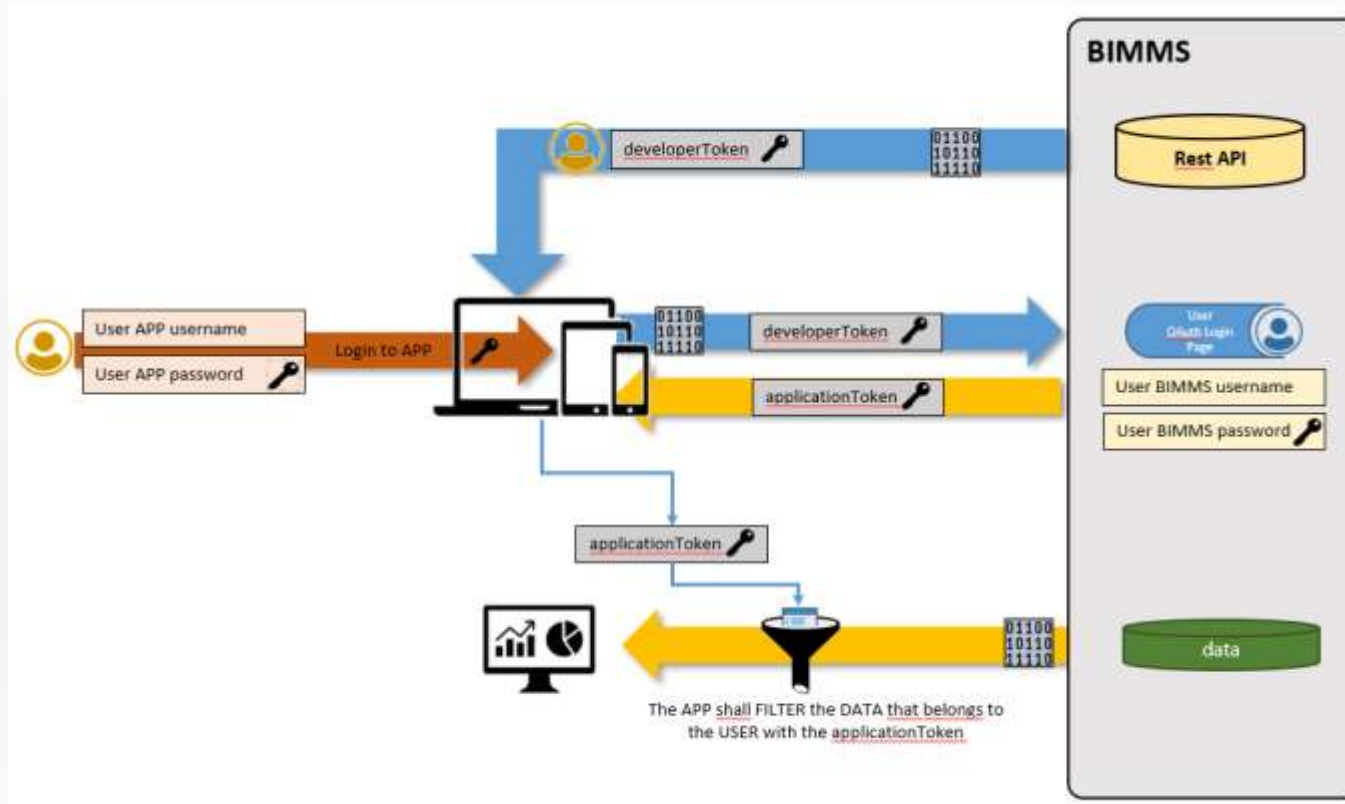
The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

- API Endpoint

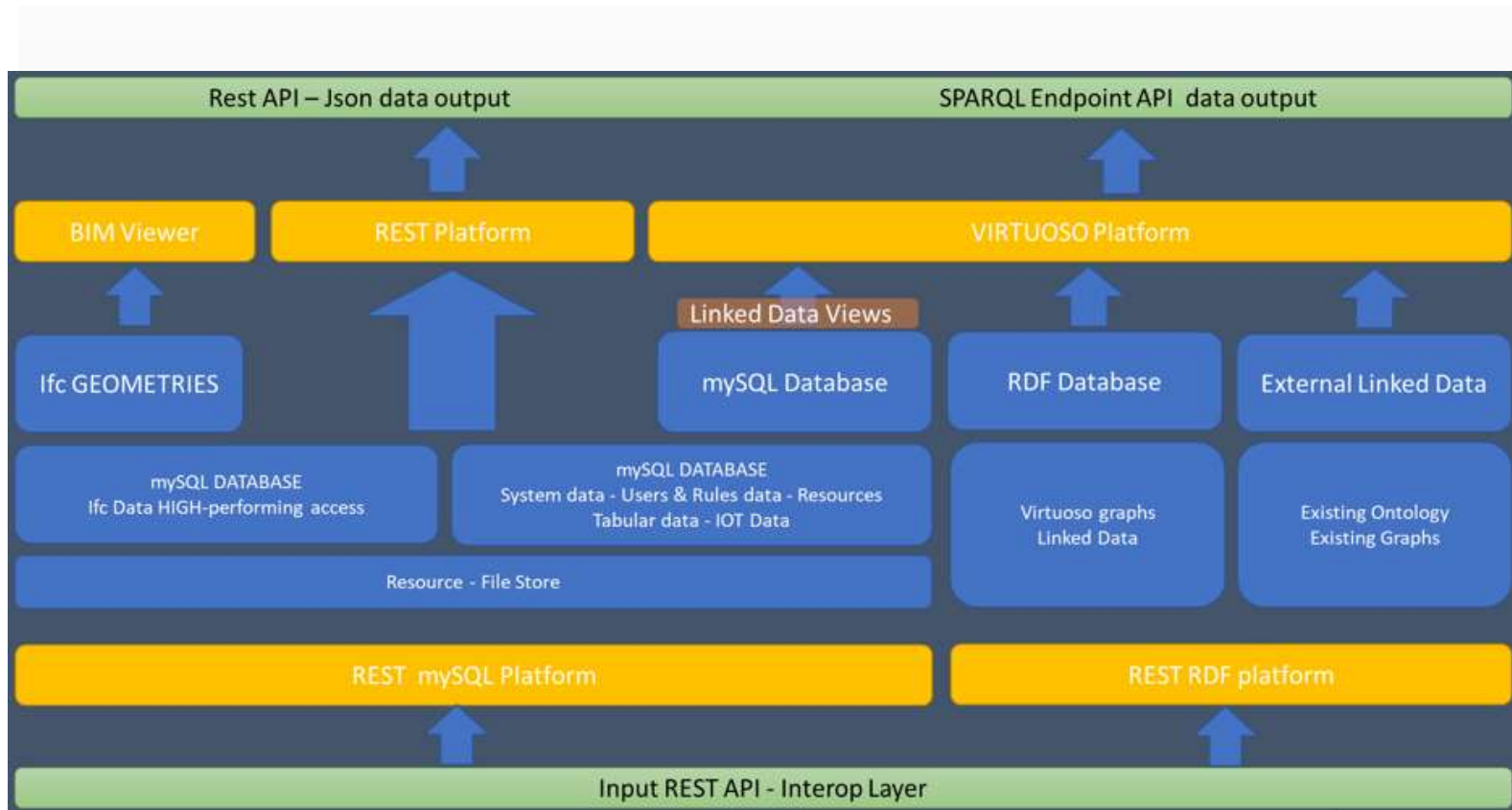


The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

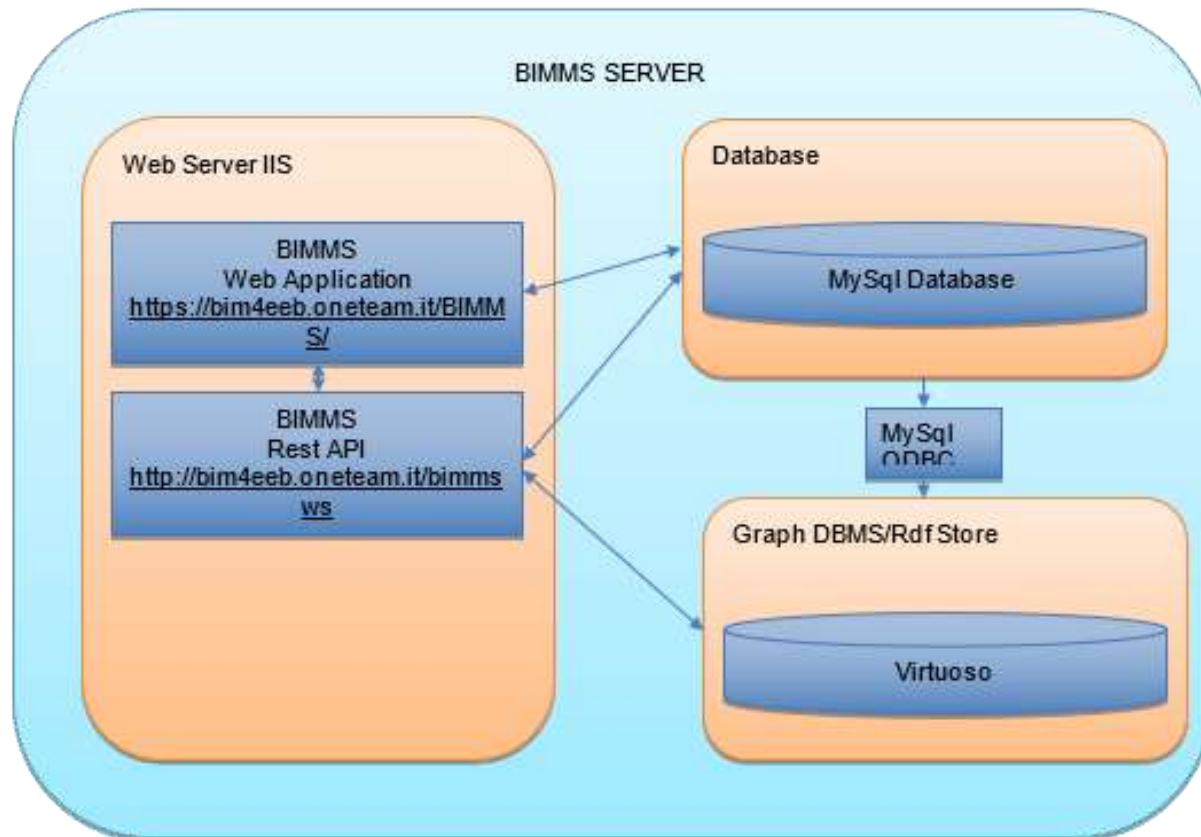
- Privacy and Pseudonymization



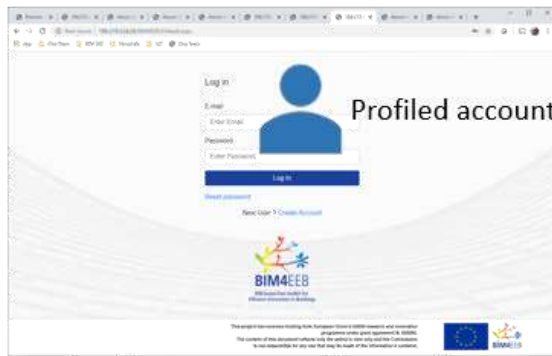
The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings

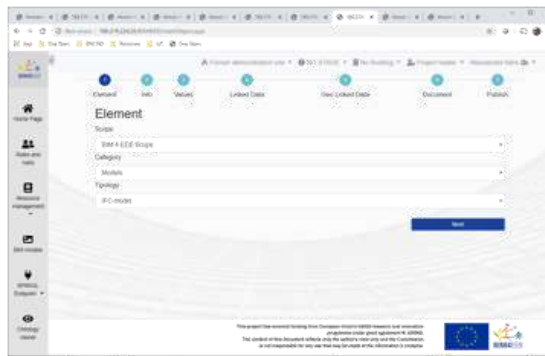


The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



1

Log In



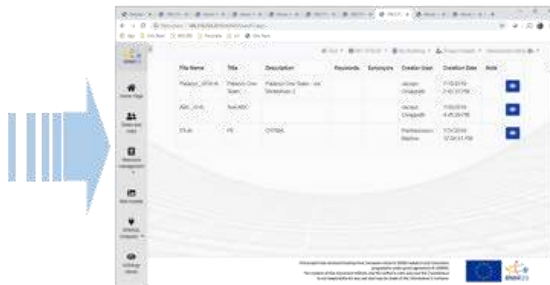
2

Create new resource
Upload BIM Ifc Model

3

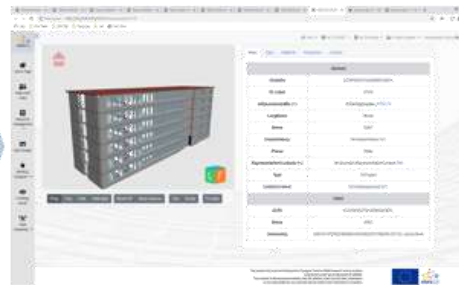
Batch process

BIM4EEB IFC engine
Model parsing
MySQL DB storage



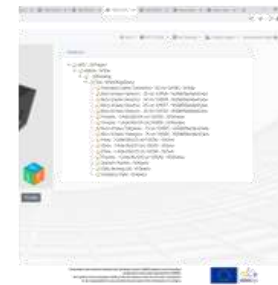
4

Processed BIM model list

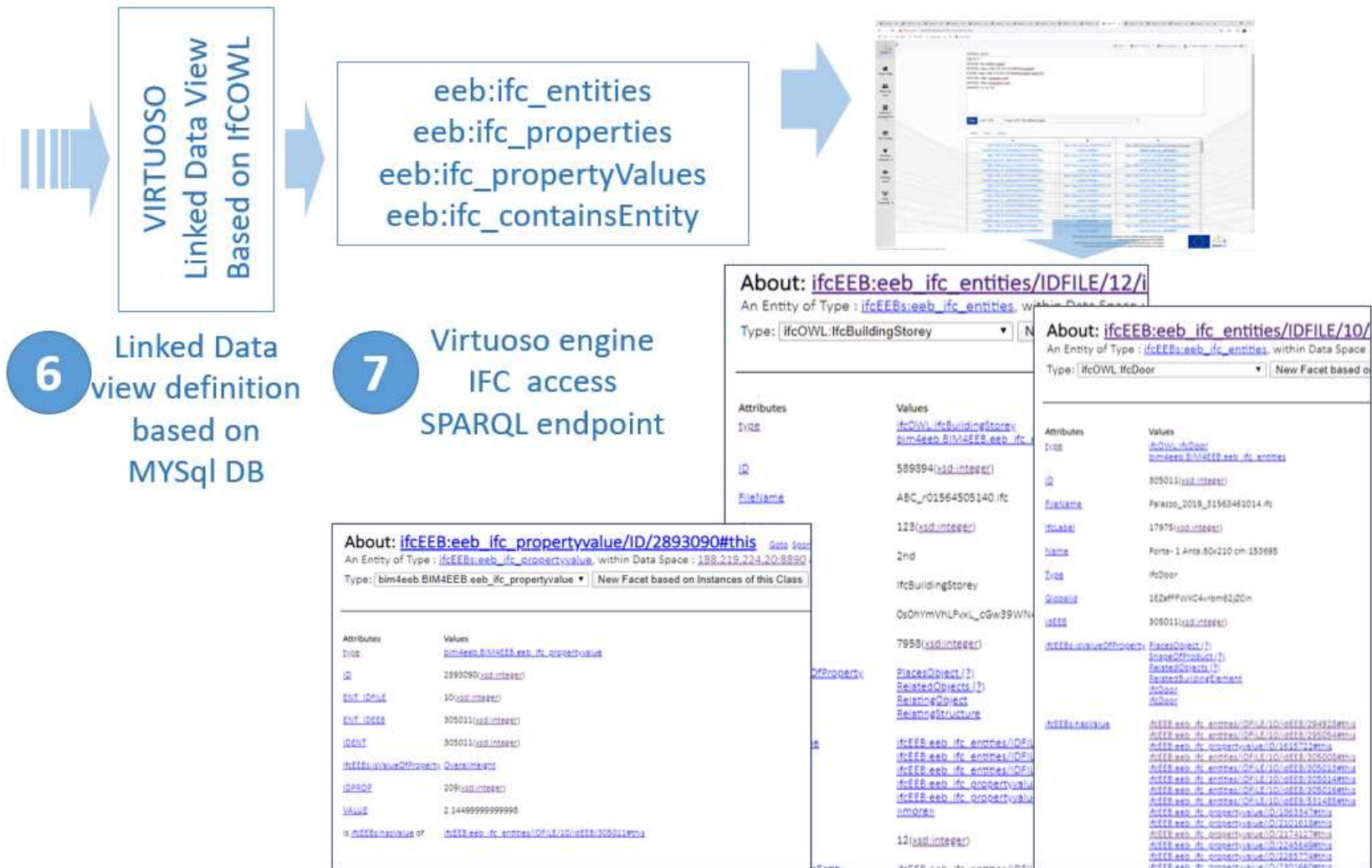


5

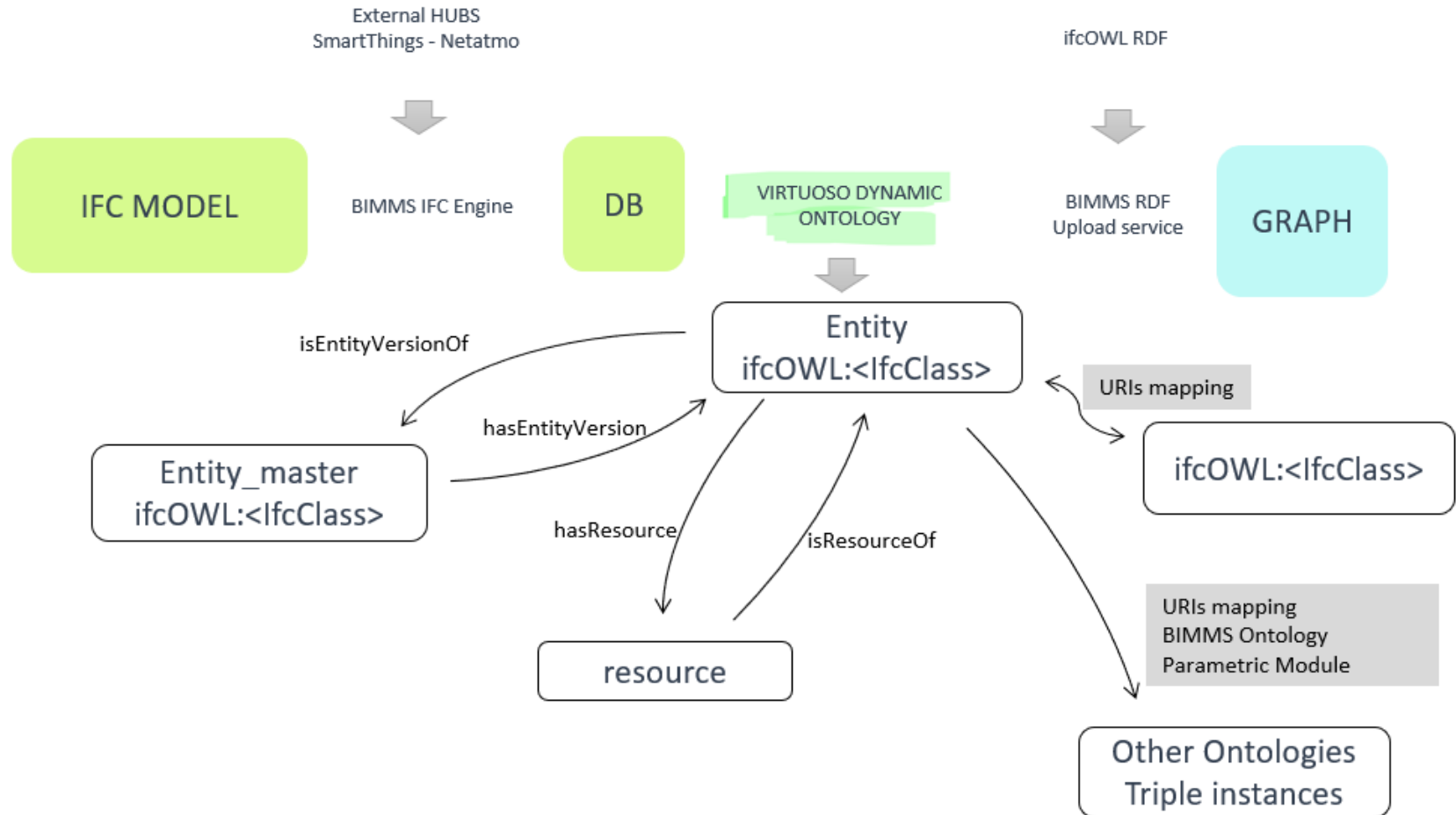
DB Based Access to:
3D Model View
Ifc Data and structure



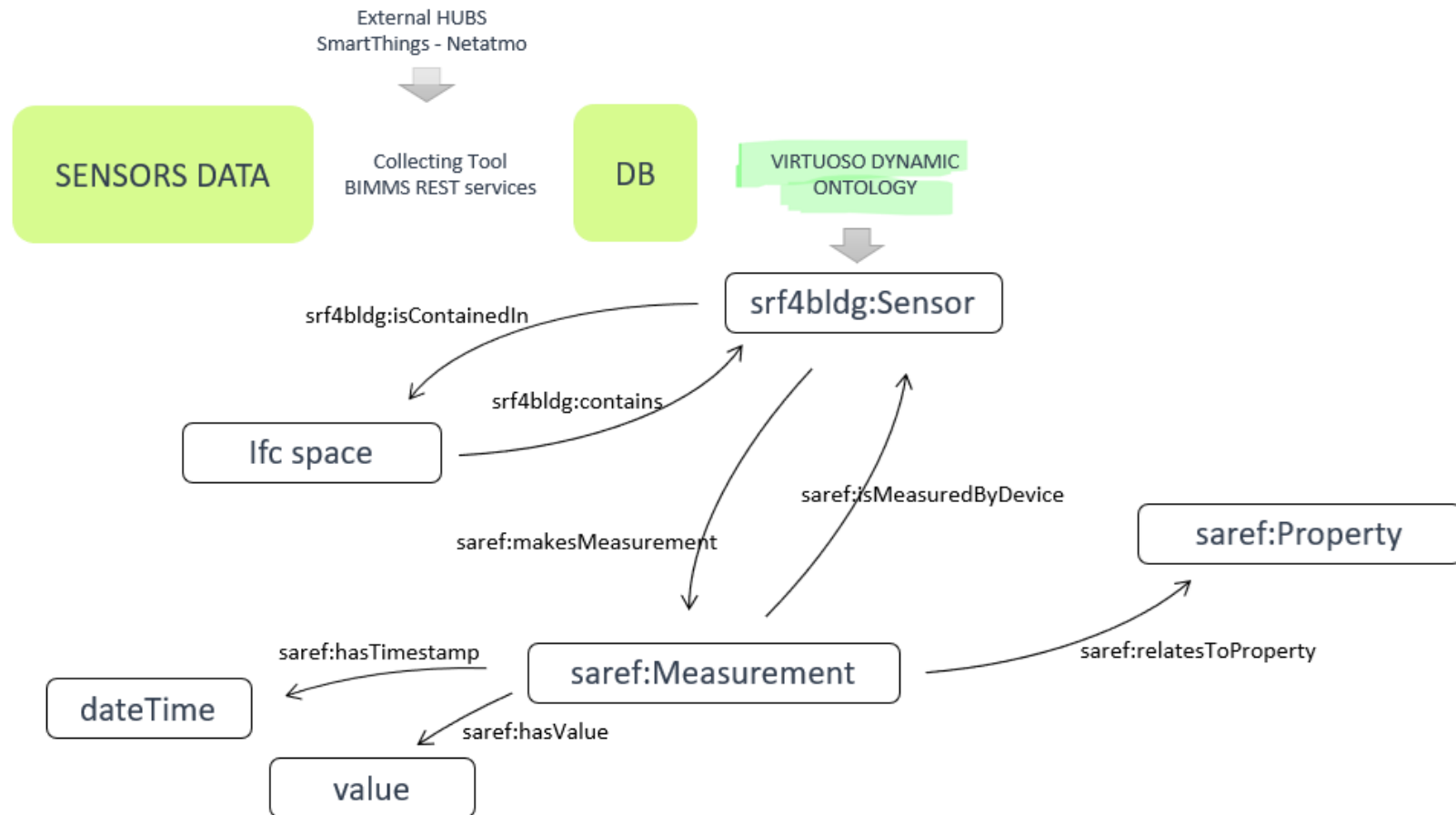
The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



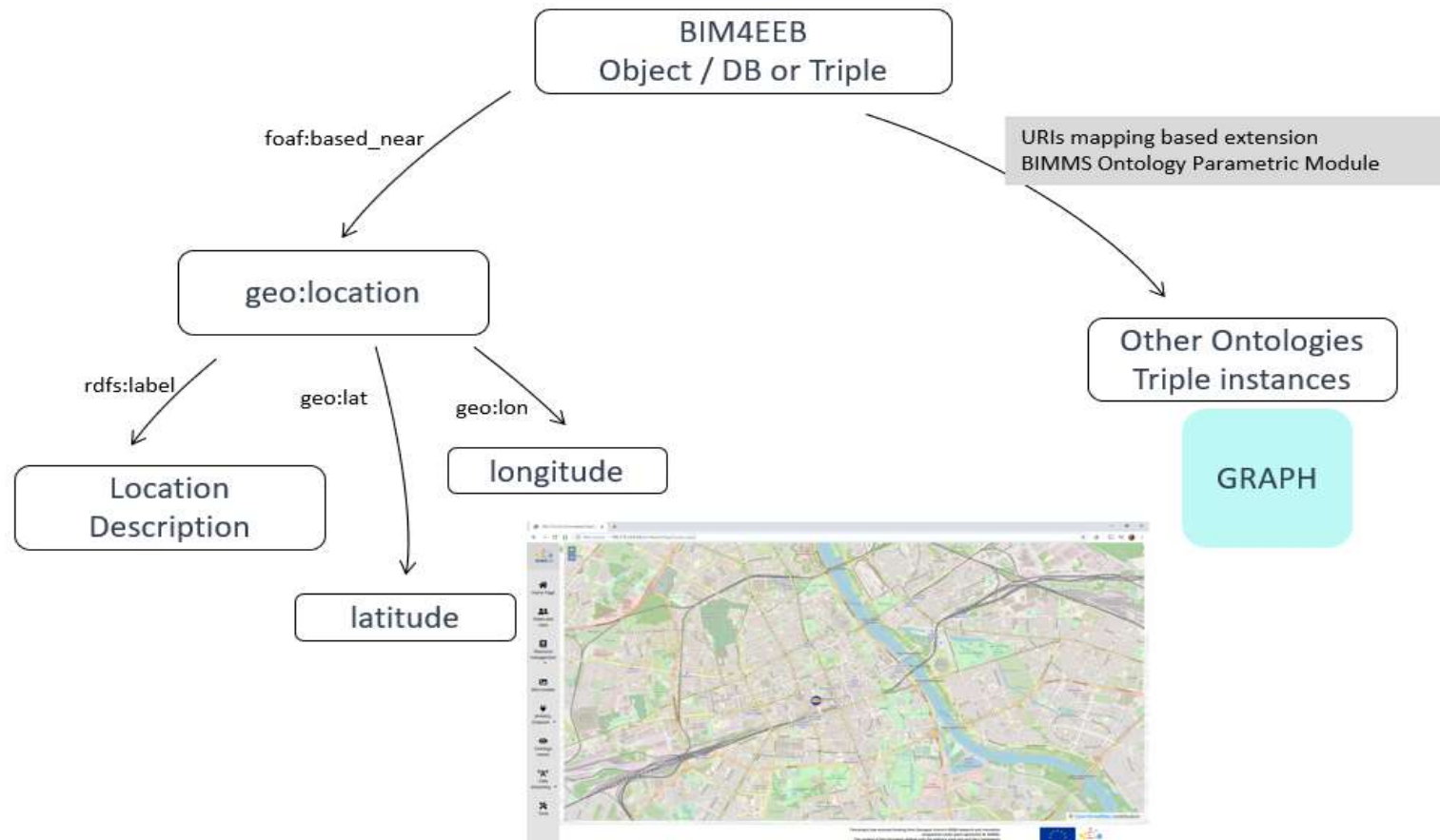
The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



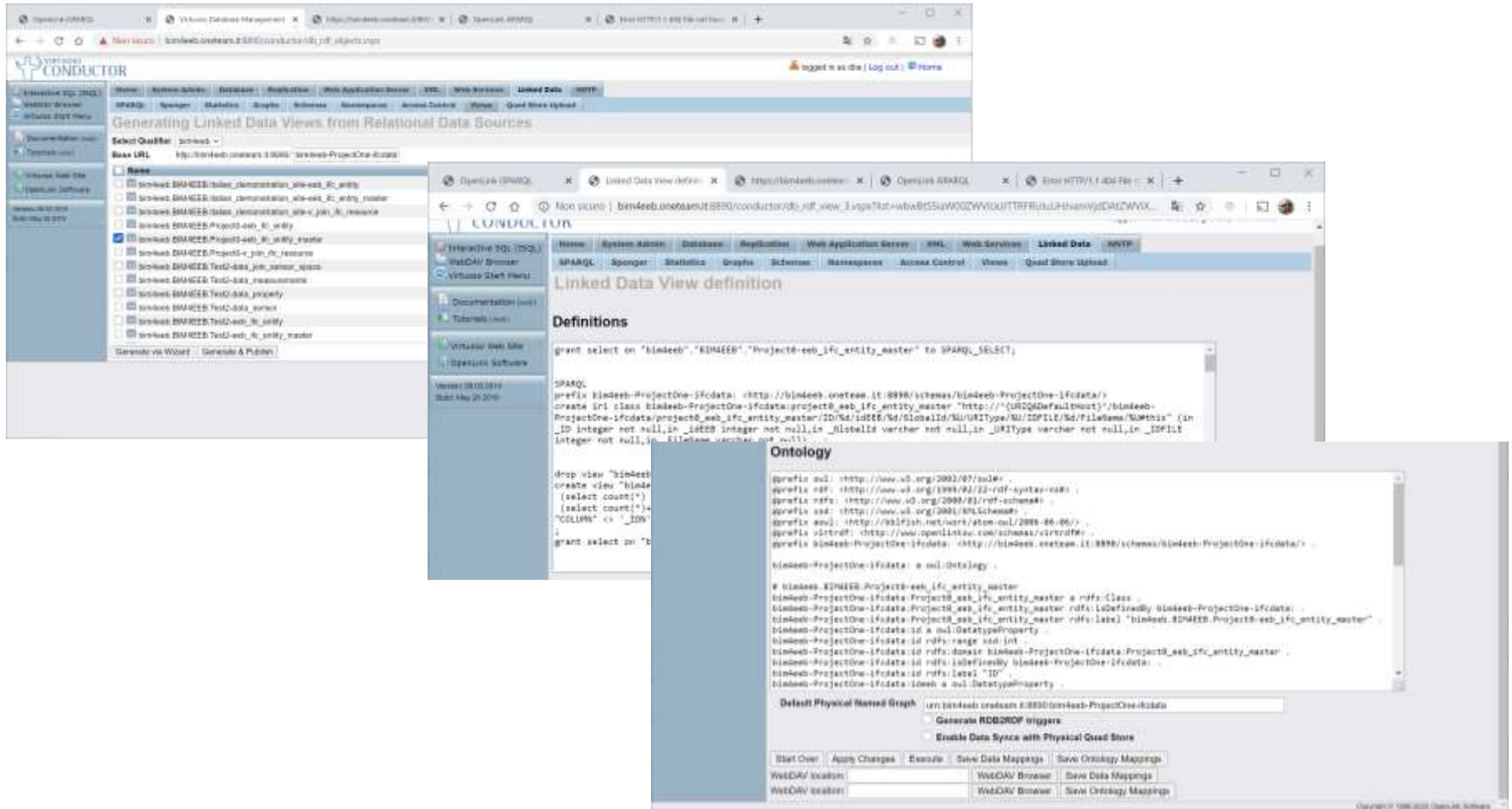
The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



The BIM Management System: an open Common Data Environment using Linked Data to support the efficient renovation in buildings



BIM Management System



Which feature should have the actual commercial CDEs to improve the collaboration?

Interactive Poll

What are the most valued BIMMS feature?

How do you rate the BIMMS?

Any questions?

Fast Mapping for Buildings AR-toolkit

Speaker:

Birgitta Andersson (RISE)

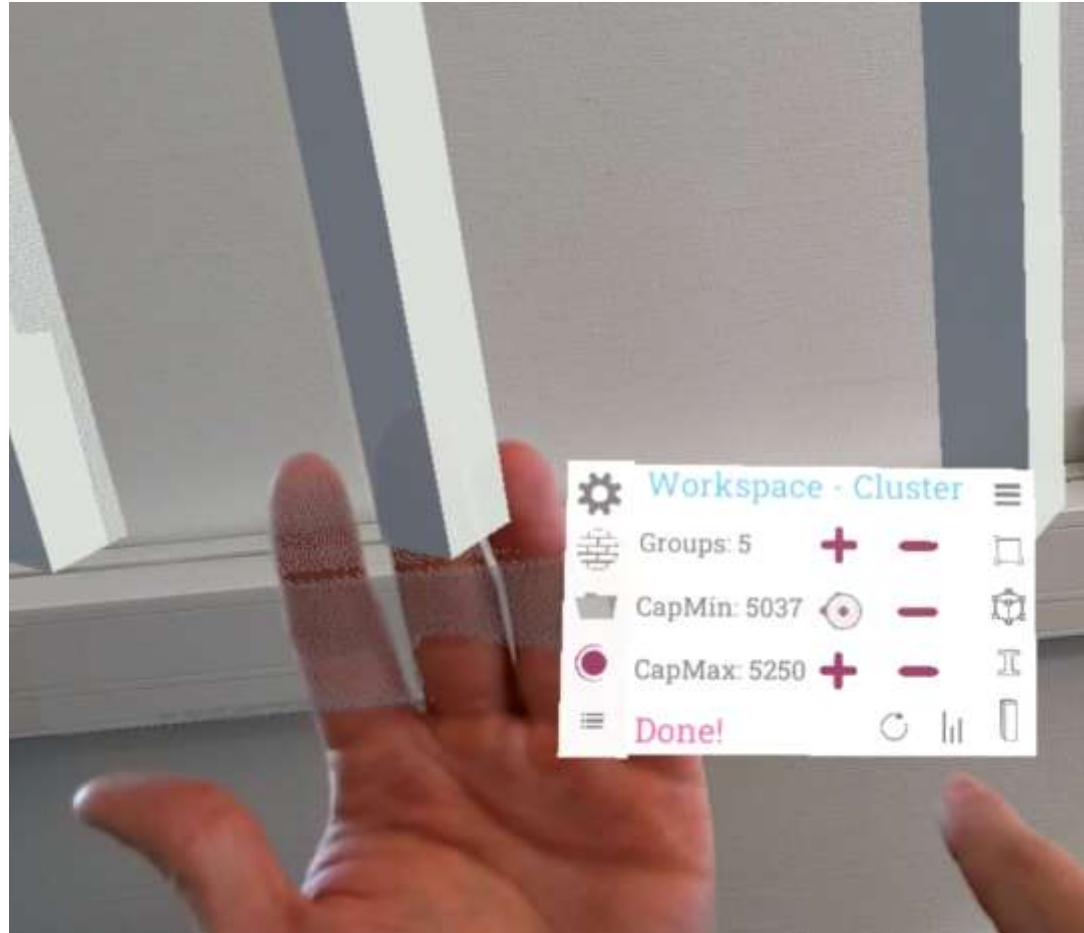
Per Andersson (CGI)

Fast Mapping for Buildings AR-toolkit

View from AR-tool.

New drawings can be created if those are missing in a renovation building.

By using our AR-tool a 3D-view is visualized.



Fast Mapping for Buildings AR-toolkit

The Fast Mapping Toolkit aims to develop a tool for fast mapping of buildings regarding geometric parameters, heating- and waterpipes, ventilation systems, electrical cables and materials.

To cover the needs of installation schemes and drawings in renovations we develop a fast and precise tool.

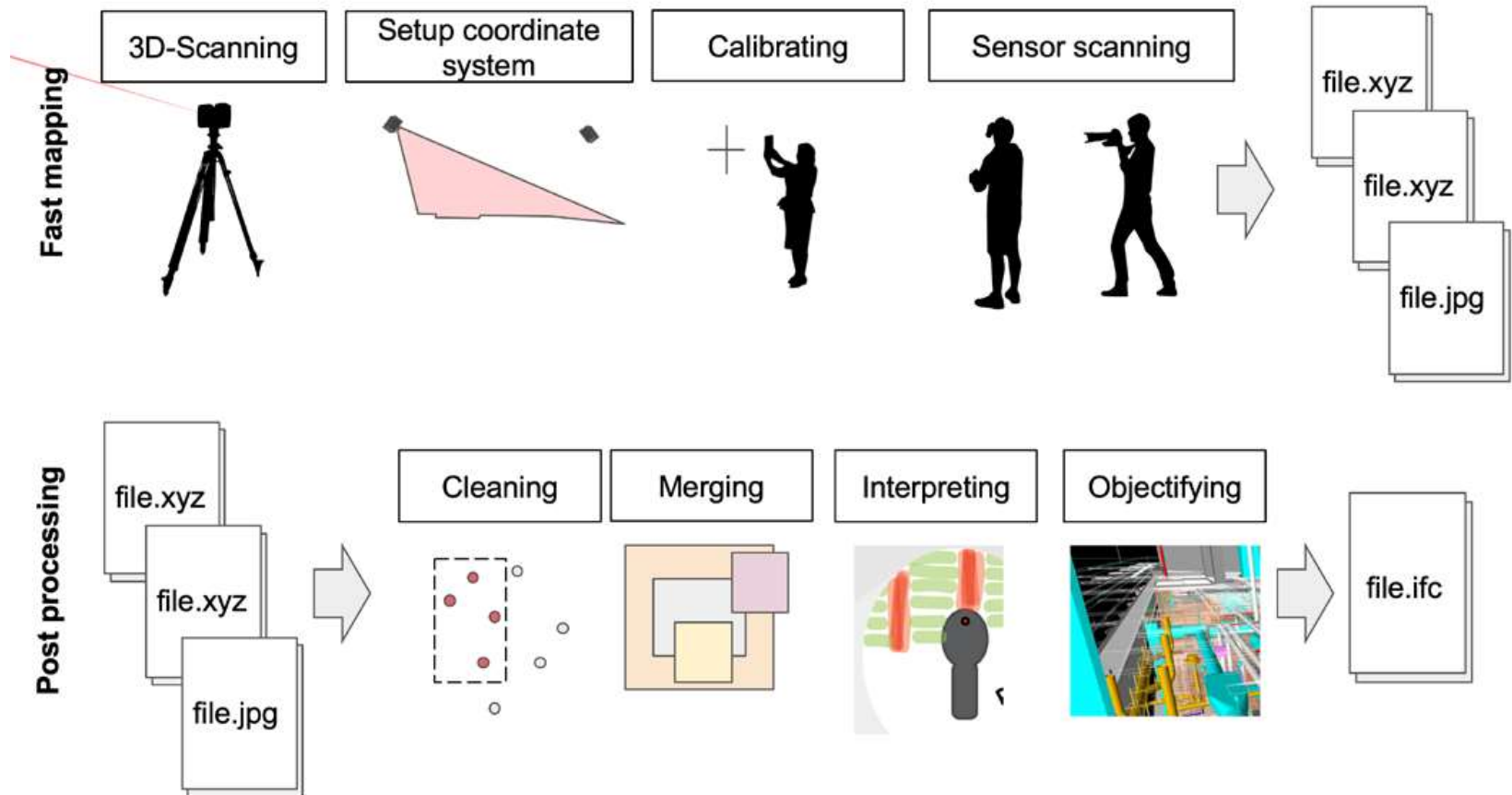
- It is a user-friendly light-weight sensorstick for mapping walls together with the scanning.
- A headset will visualize the collected data by an interface module to view installations inside walls.

Fast Mapping for Buildings AR-toolkit

The Fast Mapping Toolkit will be useful for the following target groups:

- Renovation companies
- Architects
- Technical designers
- Building owners
- Installation workers

Fast Mapping for Buildings AR-toolkit



Fast Mapping for Buildings AR-toolkit

Set up for mapping walls by laserscanning, sensor stick and AR-tool headset.



- The laser scanner measures the geometry of the room and transfer data into a point cloud.
- Sensor stick detects the materials and installations inside the wall
- The AR-tool visualize a 3D-map of the scanned and mapped areas.

Fast Mapping for Buildings AR-toolkit



Most important functionalities in Sensor stick are:

- Electricity sensor for finding electrical cables in walls
- Positioning function for tracking sensor stick in real time
- Temperature sensor to detect differences in temperature
- Sensors for inductivity and capacitance to find studs and humidity inside the walls
- Metal sensor for finding magnetic materials

Fast Mapping for Buildings AR-toolkit

Scanning with sensor stick to find installations inside the wall.

Sweep the sensor stick to detect materials and electricity.



Fast Mapping for Buildings AR-toolkit

Scanning with
sensor stick
to find installations
inside
the wall

If you do not know
where cables are
located, this tool will
help you to find
them.



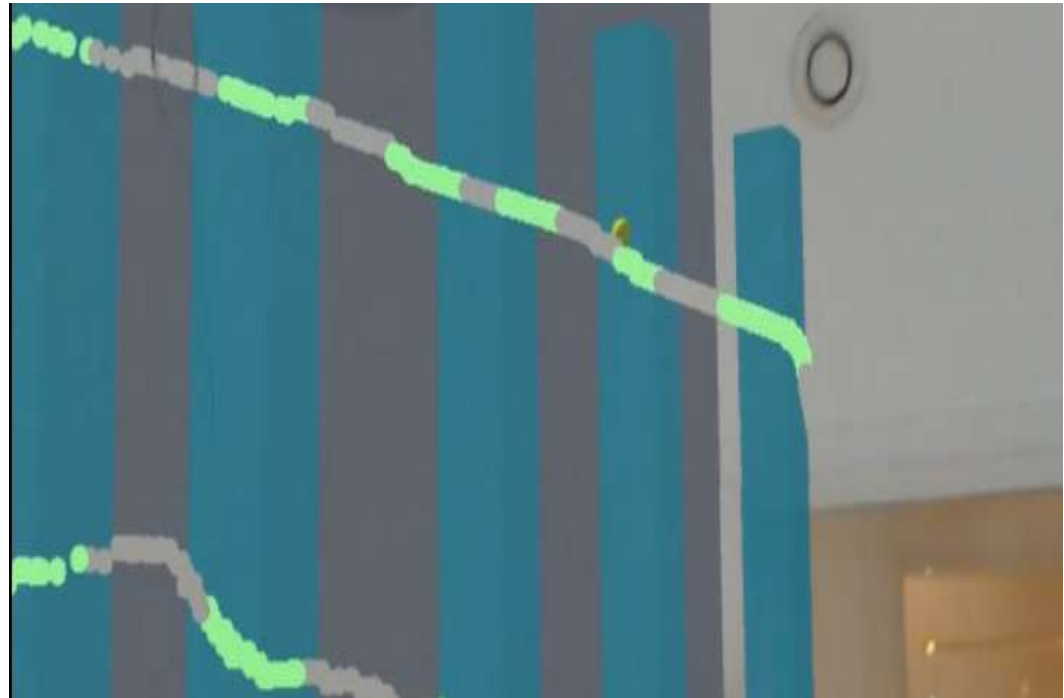
Fast Mapping for Buildings AR-toolkit

Creation of autogenerated beams by scanning with sensor stick.



Fast Mapping for Buildings AR-toolkit

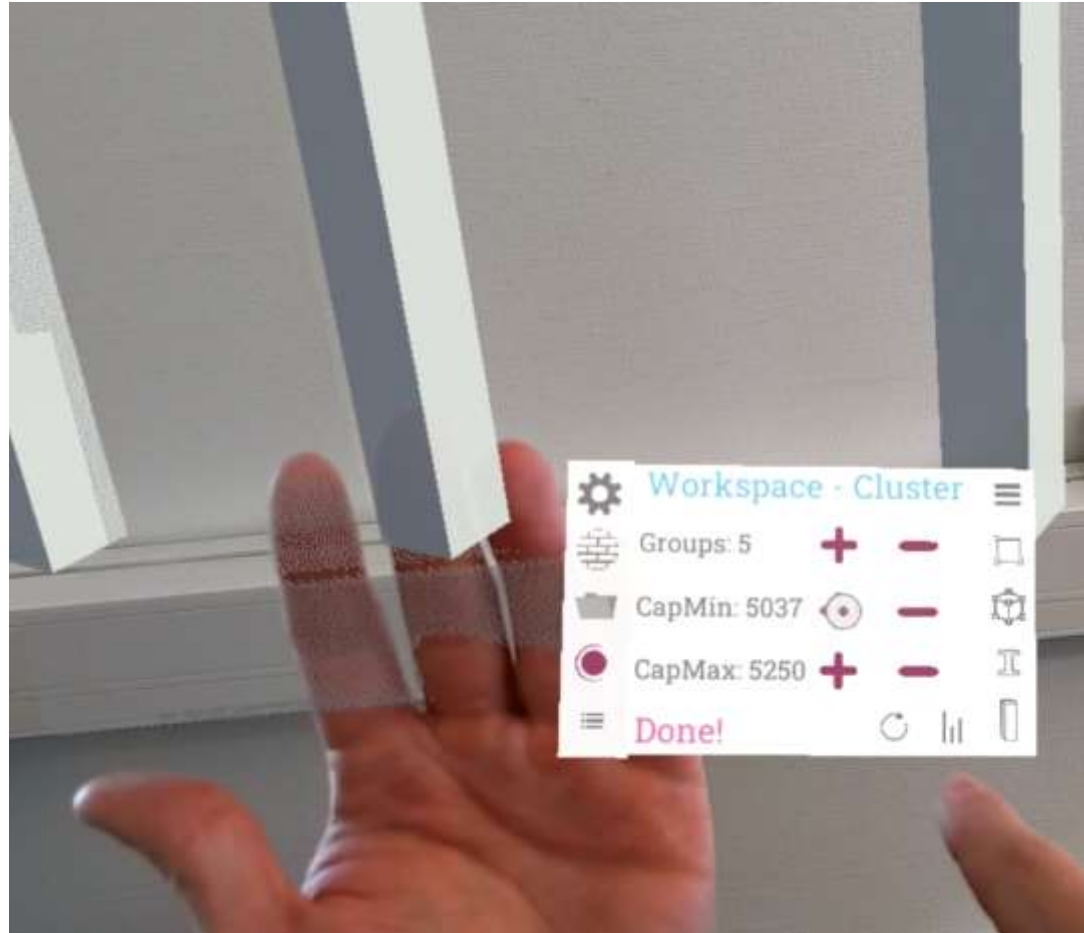
Generated studs
from AR-tool
after scanning walls.



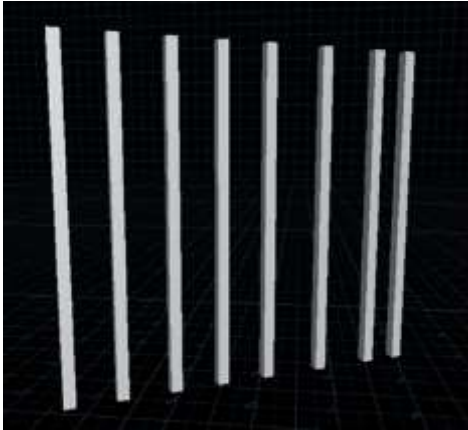
Fast Mapping for Buildings AR-toolkit

View from AR-tool.

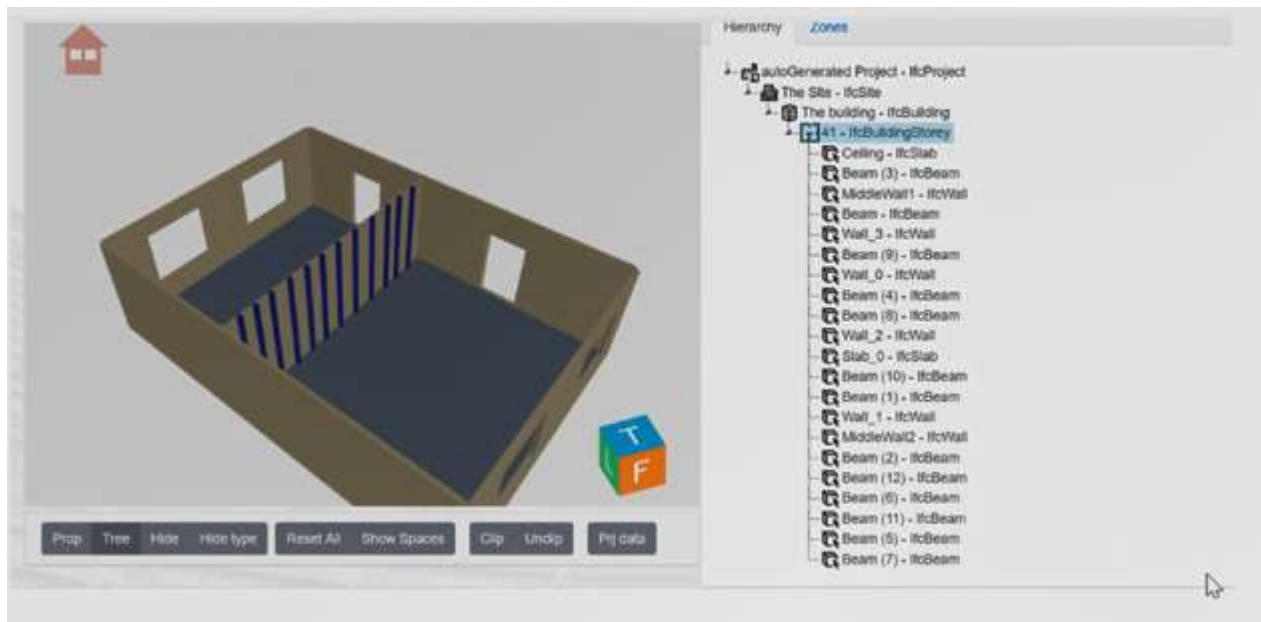
3D-map of studs from mapping with sensor stick inside a wall.



Fast Mapping for Buildings AR-toolkit



After scanning and making a 3D view of room in a building, an IFC-file will be created in the headset device and uploaded it into the BIM Management System, BIMMS.





Interactive Poll

What impact do you think the AR-Fast Mapping Tool will have on renovation industry?

Interactive Poll

When will the tool be most useful?

Any questions?



Coffee break 15 minutes



BIMcpd: A combined toolkit for constraint checking, performance evaluation and data management in building renovation projects

Speakers:

Andriy Hryshchenko (UCC), Brian O'Regan (IERC)

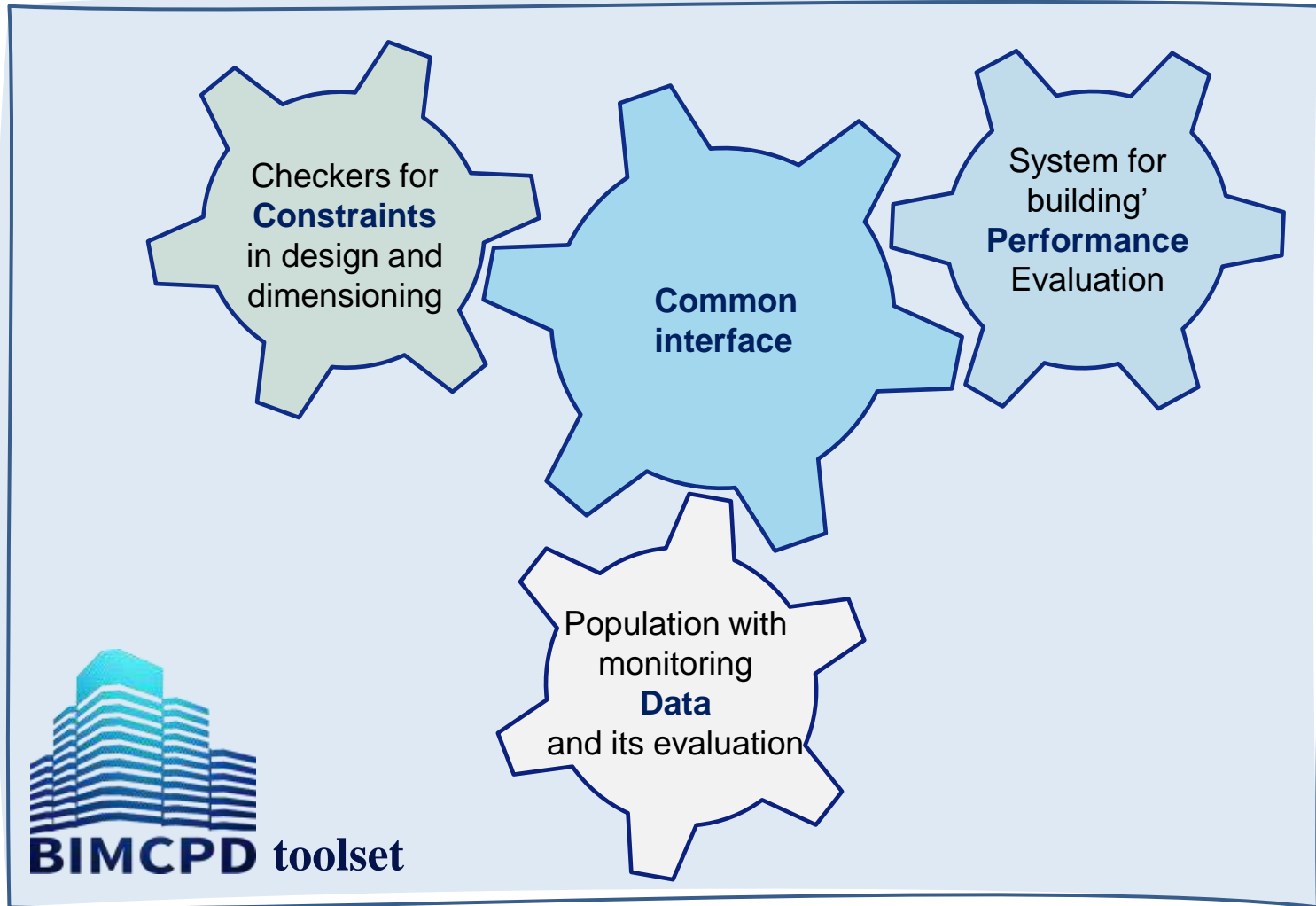
University College Cork – BIM4EEB WP6 Leader

Our aim is to develop digital tools to support the design, procurement, installation, post-renovation operation, user feedback and profiling of building automation systems during and after buildings' renovation processes.

For UCC there are two groups contributing together to different tasks and other internal peer-reviews:

- The Intelligent Efficiency Research Group (IERG) are responsible for overall work package activities;
- The International Energy Research Centre (IERC) is leading predominantly software tasks. They have created a web-based BIMcpd toolset.

UCC: BIMcpd Introduction



Constraint Checking Tool

Aims to:

- find possible positions for ducts and cable runs,
- take into consideration of fire zones, or
- find the position of switches, e.g. for elderly living.
- Further non-functional requirements are install-zones for devices.



Constraint Checking Tool

- Configuration
- Libraries
- Processing
- Dijkstra's algorithm
- Multiple Iterations



Ducting and Diffusors



Cable Runs and Lamps

Constraint Checking Tool

Report

- Heatmap
- Layers

Future work:

- More accurate airflow representation based on BSRIA Rules of Thumb
- BIM Level of Detail
- Building Code Compliance Report



Data Performance Tool

Goals

- Quality assessment for building operators,
- User feedback,
- Compliance check between “design intent” and “as built operation”.

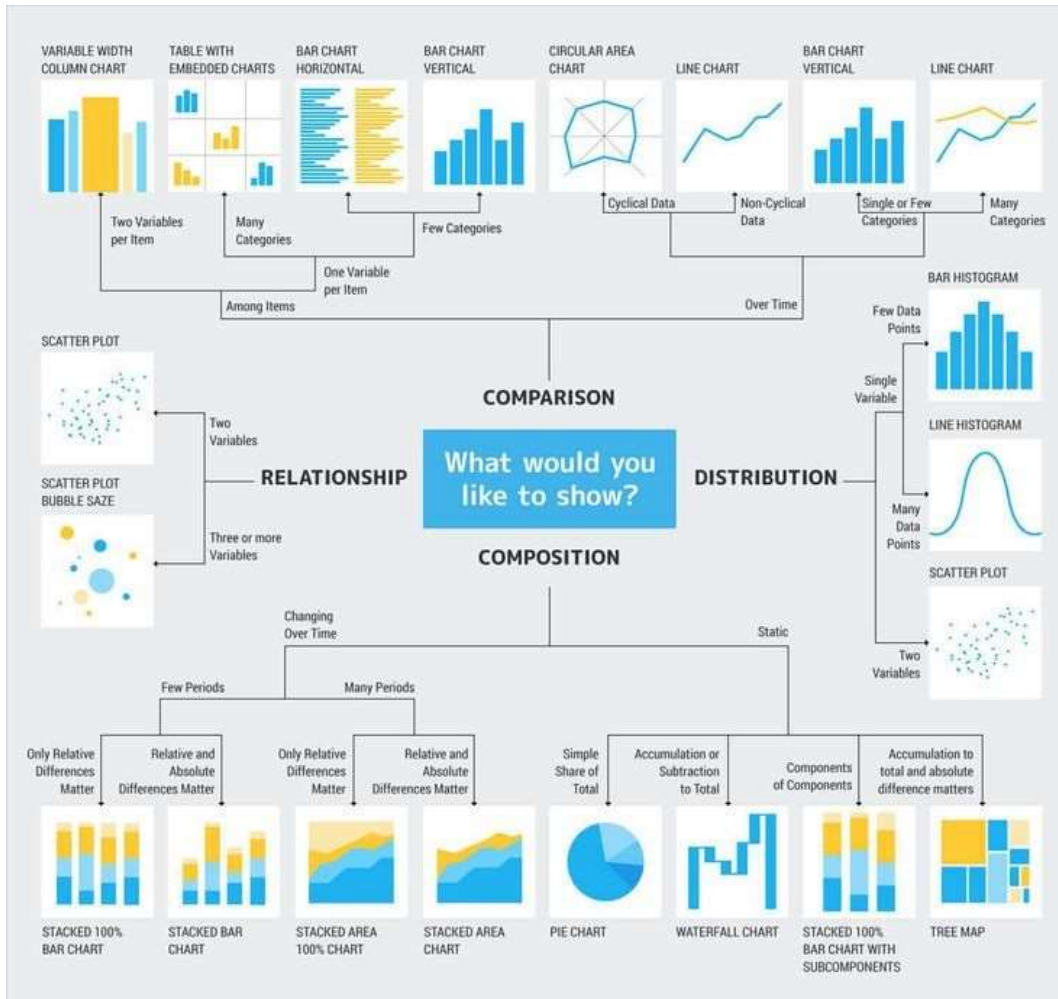
The Data Performance Tool aims to:

- develop a BIM-based performance evaluation tool
- related BIM-compatible meta-data schema.
- allow the seamless performance evaluation before and after the renovation case.
- Increase accuracy (Outlier Detection)



Data Represented with and without outliers

Data Performance Tool



Uses the chart selection diagram that was developed by Dr. Andrew Abela for his book Advanced Presentation by Design. The diagram, titled "Chart Suggestion—A Thought Starter,"

BIMcpd automatically displays the data in the most appropriate chart type based on the options selected by the user

Data Performance Tool – M&V

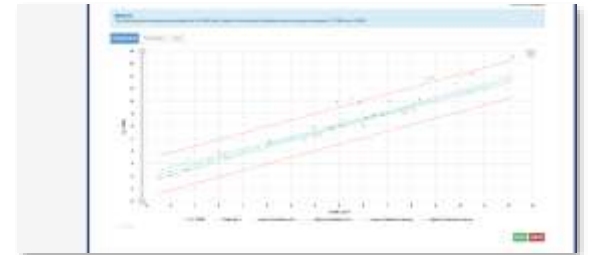
The Measurement and Verification Tool applies the International Performance Measurement and Verification Protocol (IPMVP)

Allows the user to:

- Create a baseline
- Select the reporting period
- Apply Non-Routine Adjustments
- Identify savings

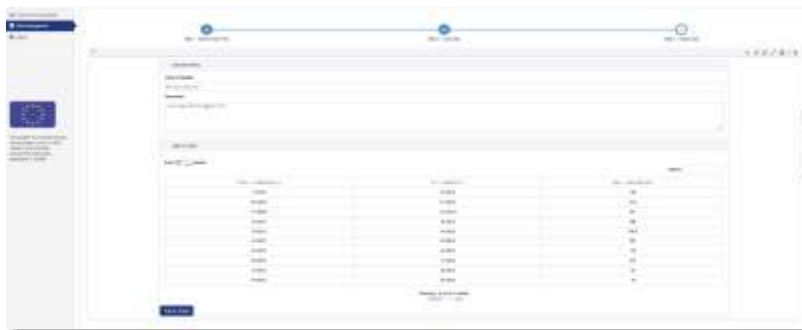
$$\text{Savings} = (\text{Baseline Period Energy} - \text{Reporting Period Energy}) \pm \text{Adjustments}$$

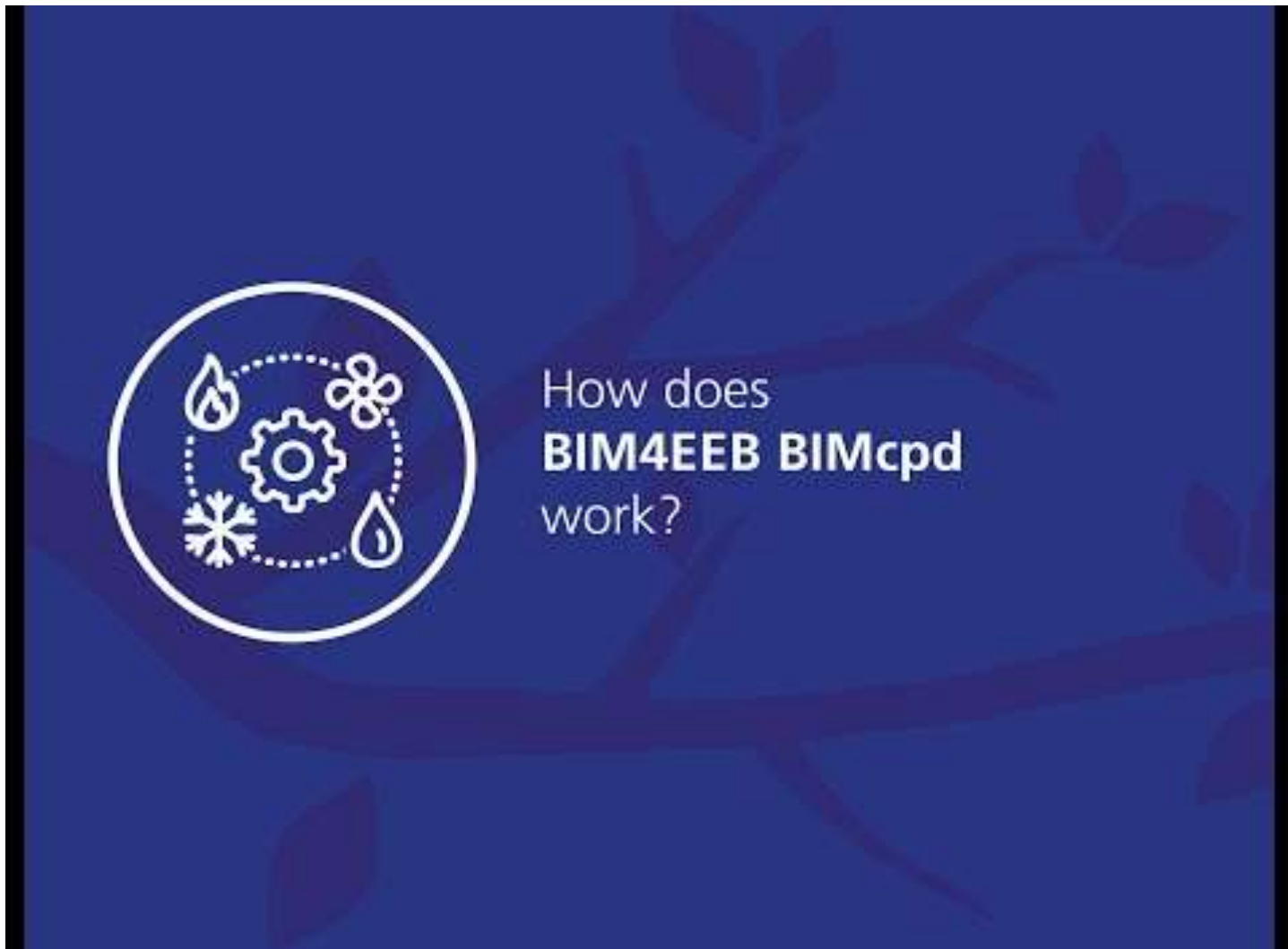
The baseline and reporting periods display data as scatter plot, timeseries and data tables



Data Management Tool

- Import building/energy/environmental/people data
- Map to the BIMcpd Data Schema (Project Haystack, amongst others)
- Use data in the Performance Analysis Tool





Audience feedback - Interactive Pool

Which of the following do you think that the Constraint Checking Tool would be most useful for?

Audience feedback - Interactive Pool

Would you be more or less likely to apply outlier detection algorithms to your data?

Thanks for your attention.

Any questions?

Towards BIM-enhanced renovation management tools with support to stakeholder interaction

Speakers:
Seppo Törmä (VisuaLynk)
Markku Kiviniemi (VTT)
Kostas Tsatsakis (Suite5)



29th October, SP2020 – Interim Conference
16:30 - 17:00 Towards BIM-enhanced renovation
management tools with support to stakeholder interaction



Towards BIM-enhanced renovation management tools with support to stakeholder interaction

Problem

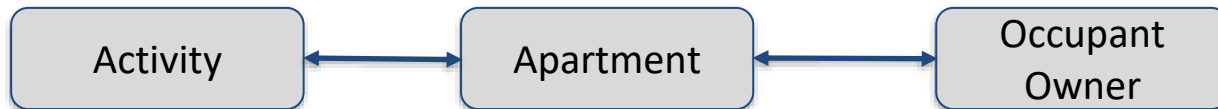
- Renovation projects
 - often take place in buildings where occupants live during the works
 - contain additional uncertainty caused by surprises when structures are opened
- Communication is needed
 - to prevent conflicting activities of contractors and occupants/owners
 - to ensure proper health and safety procedures
- Since uncertainty causes changes, communication needs to be dynamic and flexible

Goal

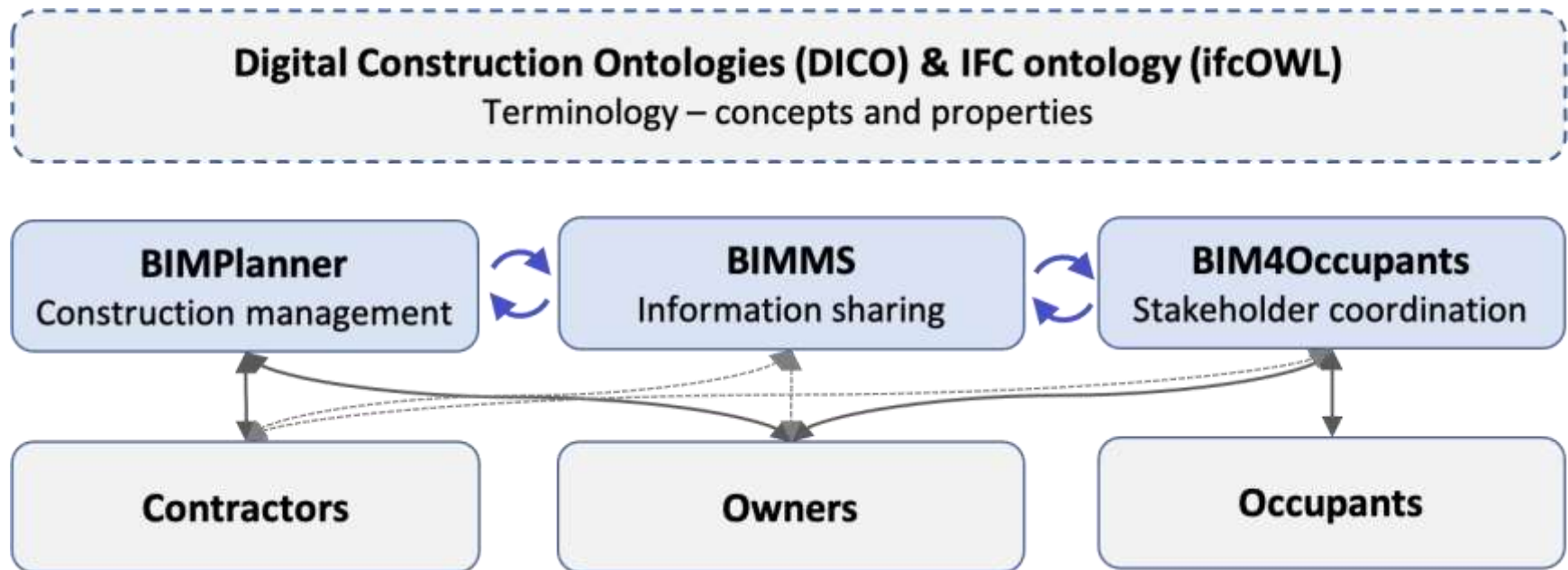
- Smooth coordination between owners, contractors and occupants

Approach

- BIM-enhanced renovation management based on linked data and ontologies to support interaction among stakeholders



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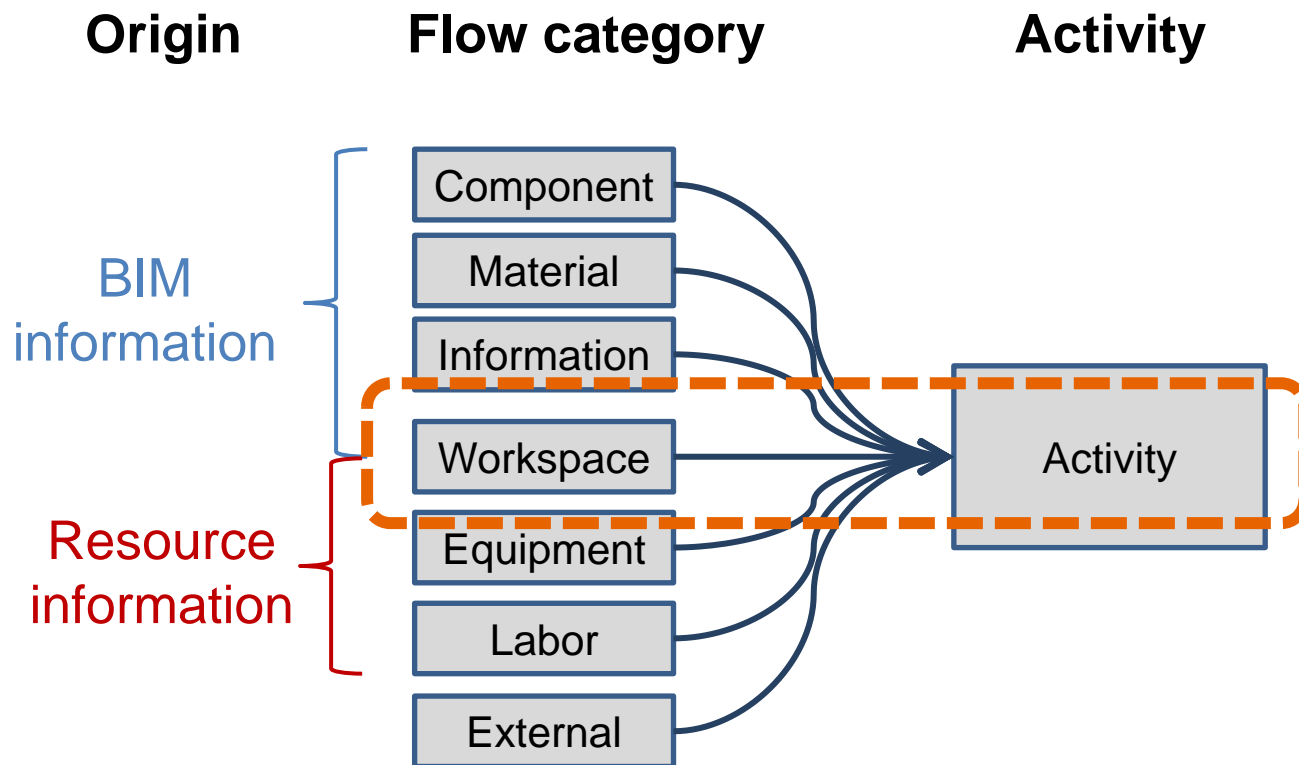
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BIMPlanner

- Project management software for renovation site operations
- Work location based management with BIM
- Sharing site planning and progress information as Linked Data according to DICO ontologies

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Approach: Lean construction – Activity-flow modeling

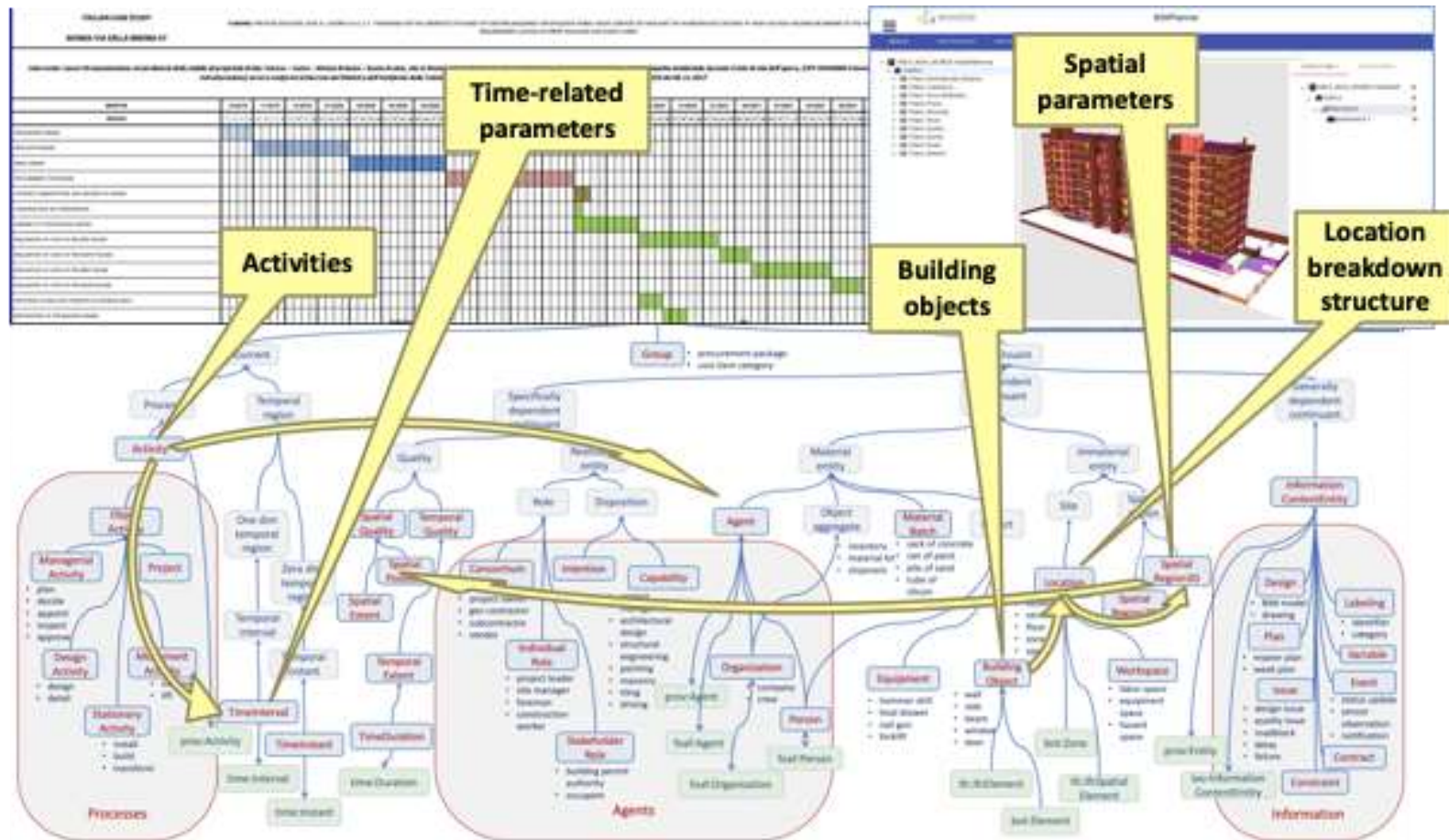


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Mapping to ontology

BimPlanner

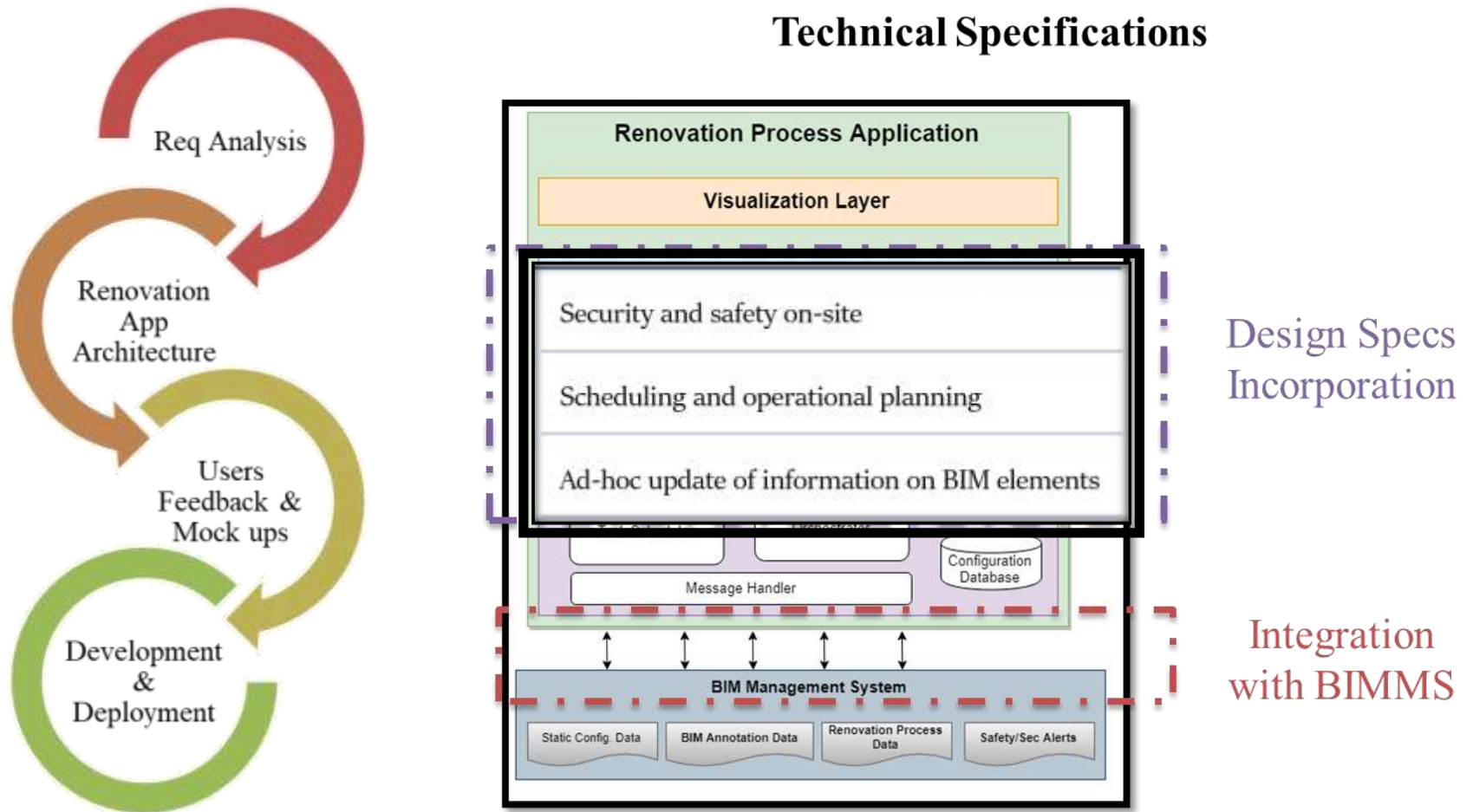
DICO



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Renovation Management Application for Building Occupants

Architecture Definition and Technical Specifications



Renovation Management Application Views



Towards BIM-enhanced building construction operations management tools

BIM - Based Framework Demonstration

BIM based framework validation is taking place, in 3 Best Practice Examples under different construction technologies, processes, different climatic, socio-economic, cultural and behavioural contexts.



- Country: Finland
- City: Tampere
- Pilot: Two 5-storey residential buildings built in 1998.



- Country: Poland
- City: Chorzow
- Pilot: 5-storey building with 12 residential apartments and 3 commercial areas.



- Country: Italy
- City: Monza
- Pilot: 8-storey building, with 65 residential apartments

Towards BIM-enhanced renovation management tools with support to stakeholder interaction

BIM - Based Framework Validation Action Plan



Towards BIM-enhanced renovation management tools with support to stakeholder interaction

Conclusions

- There is ongoing development of two interlinked tools
 - BIMPlanner – renovation management
 - BIM4Occupants – stakeholder interaction
- Validation will happen at pilot sites in Finland and Italy
- Observations gathered so far
 - It is possible to express the required links in the ontologies (DICO and ifcOWL), and convert plans to linked data complying with the ontologies
 - Surrounding systems and practices need to support the planning methods; for example, BIM models should include spaces and zones
 - Proper user interaction methods to establish links and visualize complex linked networks are missing as of yet
 - Software development tools and skills regarding linked data and ontologies are still in early stages of development
- Linked data is a promising enabler to future renovation management systems



Interactive Poll

What is the main obstacle that hinder building occupants participation in the renovation process management activities?

Interactive Poll

Why is communication a bigger problem in renovation than in other construction?



29th October, SP2020 – Interim Conference
16:30 - 17:00 Towards BIM-enhanced renovation
management tools with support to stakeholder interaction



Any questions?



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Early stage energy refurbishment assessment tool for buildings using high-end BIM data

Teemu Vesanen (VTT)



29th October, SP2020 – Interim Conference
17:00 - 17:30 Early stage energy refurbishment
assessment tool for buildings using high-end BIM data

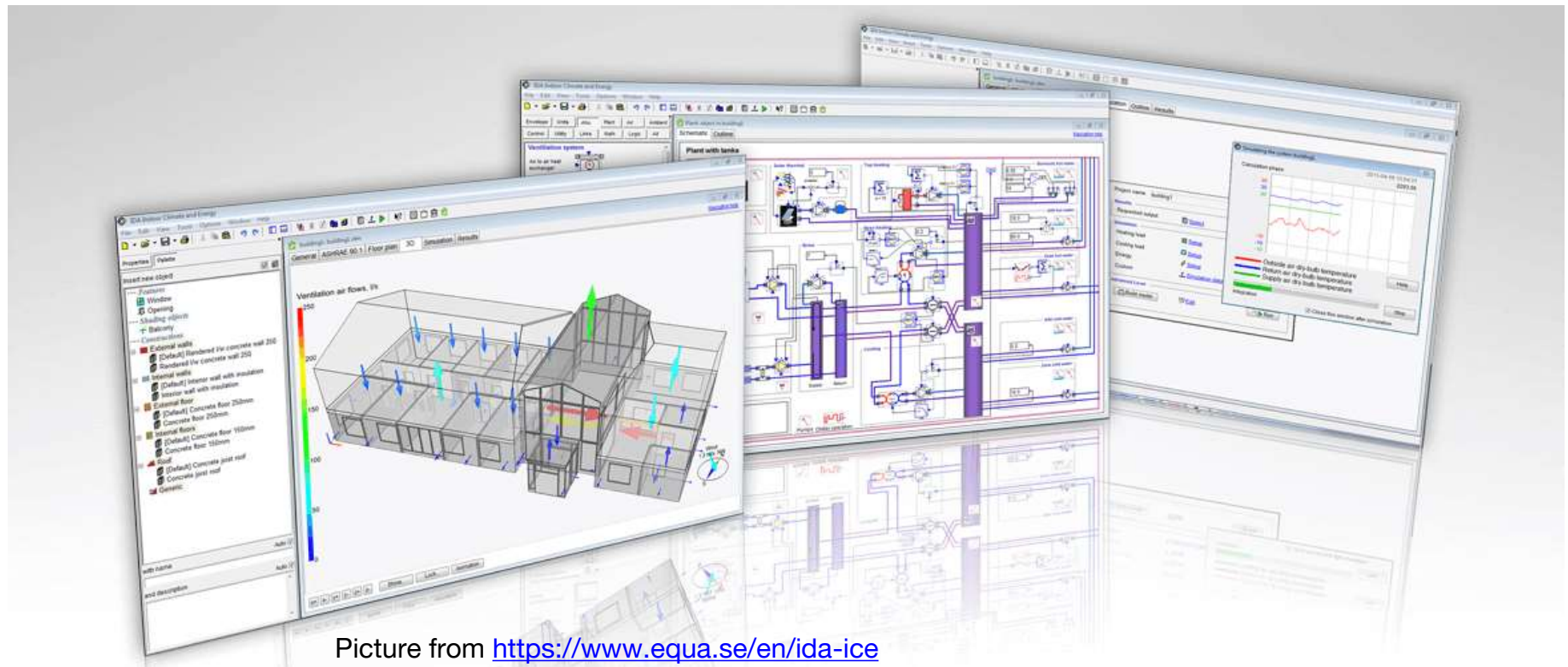


Early stage energy refurbishment assessment tool for buildings using high-end BIM data

- **BIM-assisted energy scenario tool, BIMeaser** was developed in the BIM4EEB project
- The novelty is not in the simulator, but in **a process and a tool** for managing the linked data enriched BIM data to assess the energy performance in a building refurbishment project.

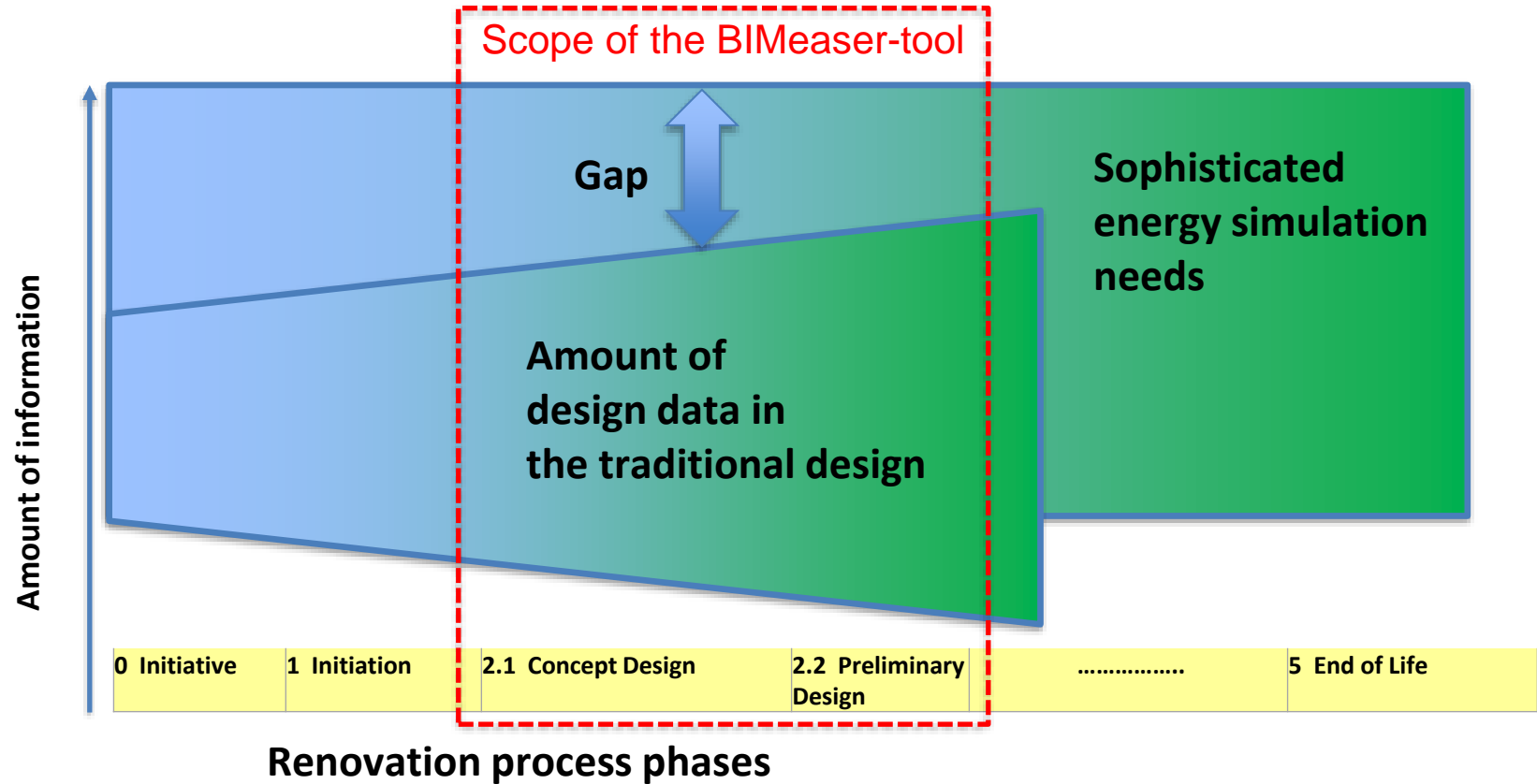
Simulation tools

Very sophisticated and well validated simulation tools for energy and indoor climate are commercially available such as IDA Indoor Climate and Energy by EQUA.



The early design stage information gap

The information gap between the early stage information need is filled with the enriched BIM content



BIM Early Stage Energy Scenario tool, BIMeaser

BIMeaser is used several times during the design process. The intended usage is **collaborative** and as automated as possible. Results should be available in an hour → decision making during the design meetings.

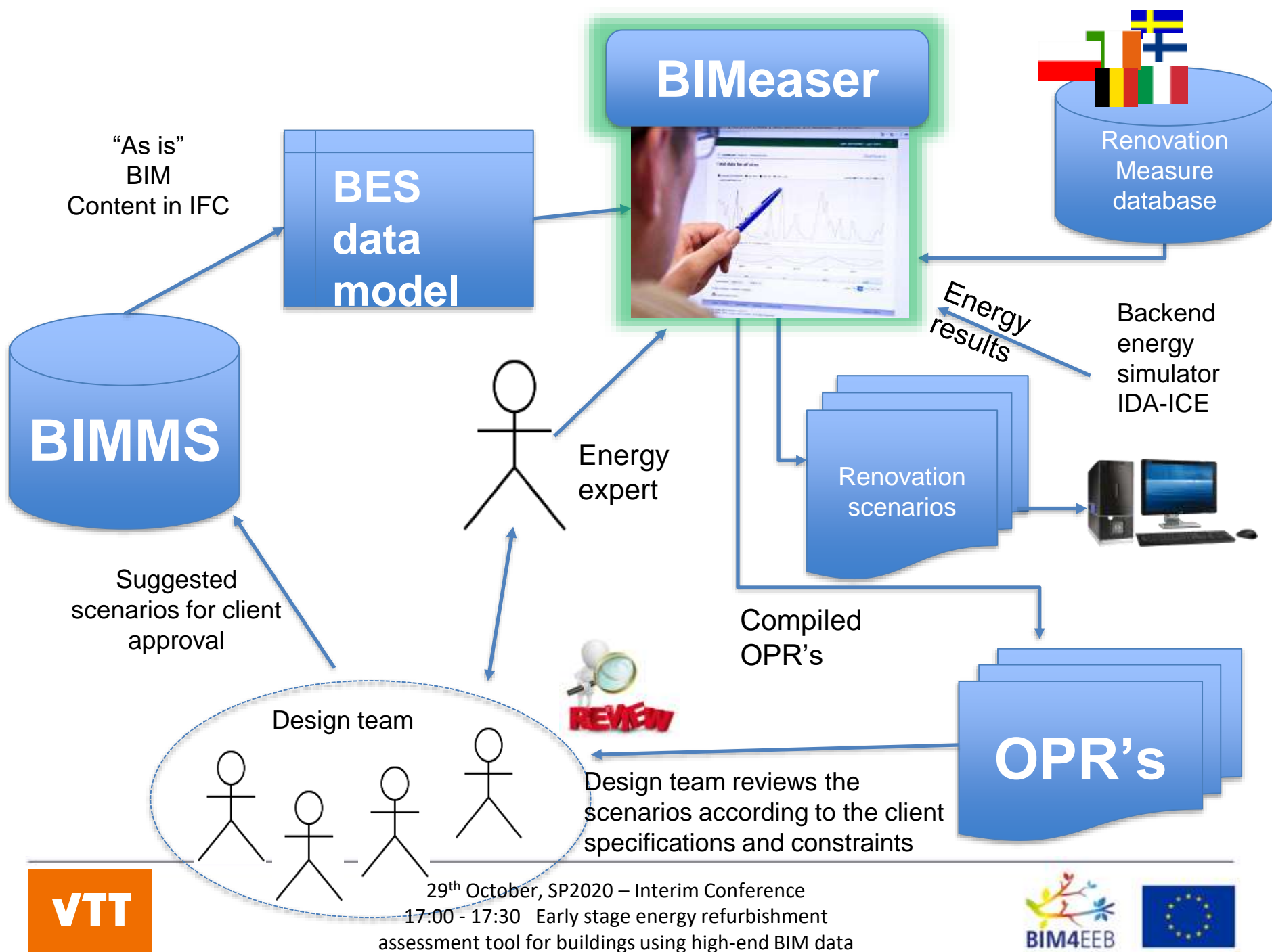
The **user** of the tool is an "*Energy expert*".

The targeted **design phases** are: (1) *Concept design* and (2) *Preliminary Design*

The main functionalities of the tool are:

1. To build an "**As is**" **energy and indoor climate model**
2. To apply the **renovation scenario, which is set of** renovation measures
3. To present the impact of each renovation measure in terms of **Owners Project Requirements (OPR)**





Currently calculated OPR

Impact criterion	Indicator	Unit
energy savings	Delivered energy (purchased) for heating, cooling and electricity	kWh/m ² ,a
	Primary energy	kWh-pr/m ² ,a
	Renewable energy share of solar PV, solar thermal and biofuels	%
comfort	Overheated hours (e.g., hours when operative temperature is over 27 °C or just cooling load)	(-) Number of hours according to criteria for the average zone in building
cost	Total investment cost	(€) Renovation cost of a one scenario, VAT excluded
	Operational energy cost	(€/a) Sum of all delivered energy cost items, VAT excluded
	Payback time of the energy investment	(Years) Payback time of the energy investment for an individual scenario

User interface

1. External connections

2. Renovation measure database view

3. Scenario view

4. OPR pop-up view for the result review

The screenshot displays the BIM4EEB BIMEASER tool interface. The top navigation bar includes File, Edit, View, History, Bookmarks, Tools, and Help. The browser address bar shows the URL: https://localhost:8443/planner/bes/main. The interface is divided into several sections:

- User:** LoggedIn: tuotmn
- Project:** Selected: Project Milano (a2d). Buttons: Create, Remove, Properties.
- Simulator:** Selected: IDA ICE. Buttons: Create, Remove, Connect, Disconnect, Properties.
- Base model:** Selected: IT Baseline. Buttons: Create, Remove, Load, IFC, Properties.
- Available measures:**
 - Air-to-air heat pump for the space cooling and heating
 - Air-to-air heat pump for each apartment
 - Balancing the radiator heating network control
 - Radiator network hydraulic balancing
 - Exhaust air-to-water heat pump for heating
 - Exhaust air-to-water heat pump, 3-6 floor building
 - Insulation in the wall cavity
 - Brick wall 650 mm cavity insulation
 - Insulation on the inside of the outside wall
- Properties:**
 - G-value: 0.49
 - U-value: 0.97
- Scenario:** Selected: Scenario: New windows (b60). Buttons: Create, Remove, Properties.
- Renovation measures (drop here):**
 - ☐ Replacing the windows - SOSTITUZIONE SERRAMENTI ESTERNI
 - ☐ Venetian blind - Sillekaihdin lasivalissa
- Log:** e4afa2 BIMEASER initialised a logger.
- Results (OPR pop-up view):**

Scenario	Cost			Energy					Comfort
	Operational energy cost €/floor-m²,a	Payback time Years	Investment €/floor-m²	Primary Energy kWhpr/m²,a	RES share %	Heating kWh/m²,a	Cooling kWh/m²,a	Electricity kWh/m²,a	Summer thermal comfort h/year when Tindoor > 27 °C
IT Baseline	15.7	0.0	0.0	243.5	0.0	165.3	3.0	28.2	103051.0
New windows U 1.1 200513b	14.1	0.0	9.5	214.1	0.0	137.1	3.9	28.2	102472.0
Scenario PV panels 5cf2	15.7	0.0	2.9	233.4	0.0	165.4	3.0	18.1	103051.0

Benefits

1. allows accurate build-up of **the As-is models using the BIM and linked data**
 - focus in the early design stage, where most important design decisions are made.
2. allows easy **application of renovation scenarios** to the As-is building
 - predefined renovation measures available in the national database
3. enhances **collaborative work** inside the design team
 - important for buildings' design, which is a multi-domain task that should always be a collective work of the design team members

Challenges

1. The accuracy of the BIMEaser tool relies on the availability of good quality BIM data of the renovated apartment building.
2. The required time for running detailed simulation of large multi-zone apartment buildings models can be long, which may hinder the intended fast collaborative teamwork



How does
BIM4EEB BIMeaser
work?

Interactive Poll

Is your work affiliated with a residential building renovation business?

Interactive Poll

Do you think BIM has a role in residential building renovation?

Interactive Poll

Do you think the concept demonstrated with the BIMeaser tool is feasible?

Any questions?

Closure



BIM4EEB

BIM-based toolkit for
Efficient rEnovation in Buildings

Thank you!



RI
SE

Suite5
We Deliver Intelligence

Caverion



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