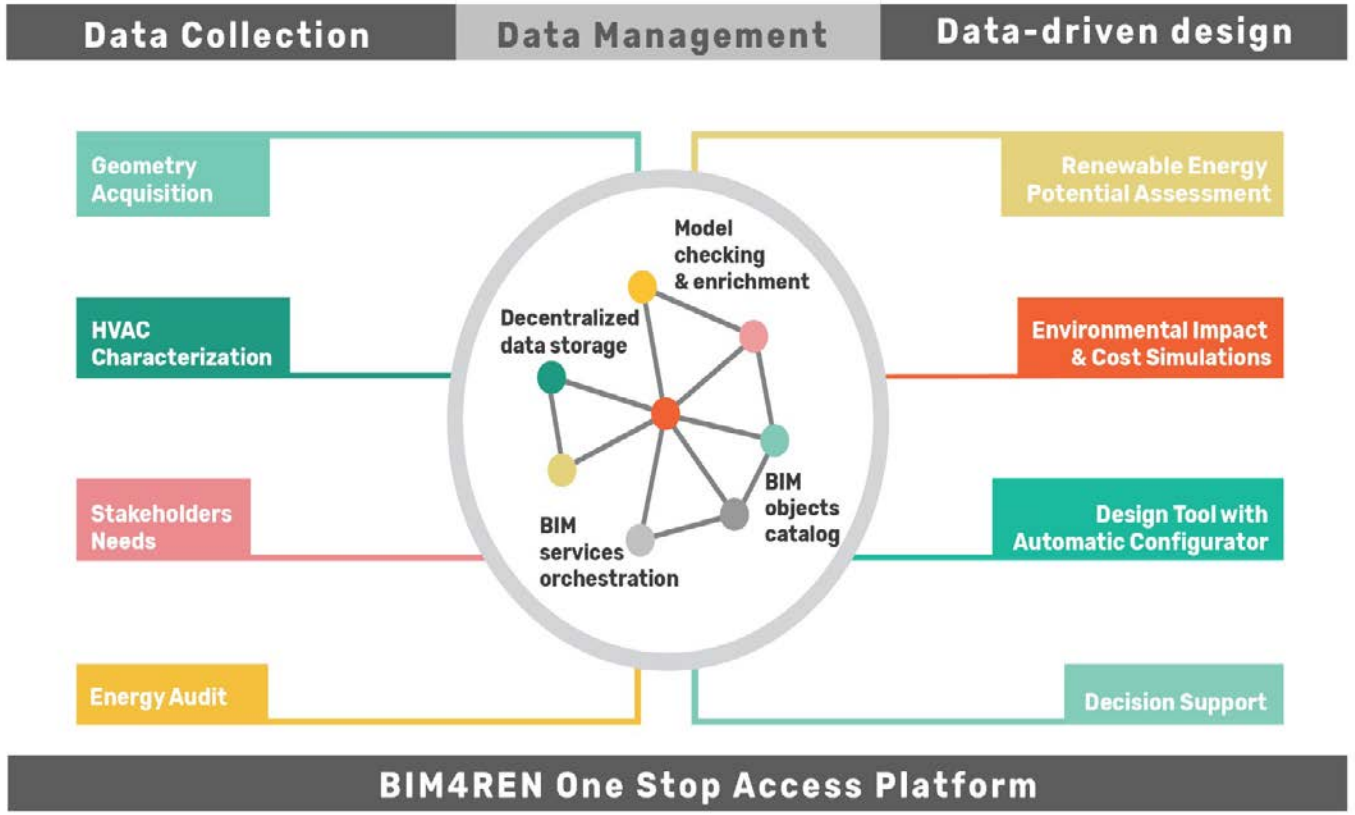
Conceptualizing Decentralized Information Containers for Common Data Environments using Linked Data

Madhumitha Senthilvel, Prof. Jakob Beetz | RWTH Aachen University

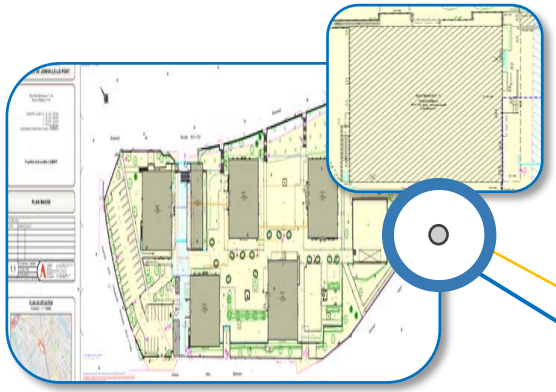
BIM4Ren : An EU-funded Project

- **Online framework for renovation-oriented BIM (H2020)**
- **Interconnecting heterogeneous information sources and tools represented as services**
- **Toolchains for real-world renovation scenarios**
- **23 partners across Europe**
- **Practitioners, Developers, Researchers**
- **One Stop Access Platform (Common Data Environment)**



BIM4Ren H2020 Project Grant No. 820773

Data Management in BIM4Ren

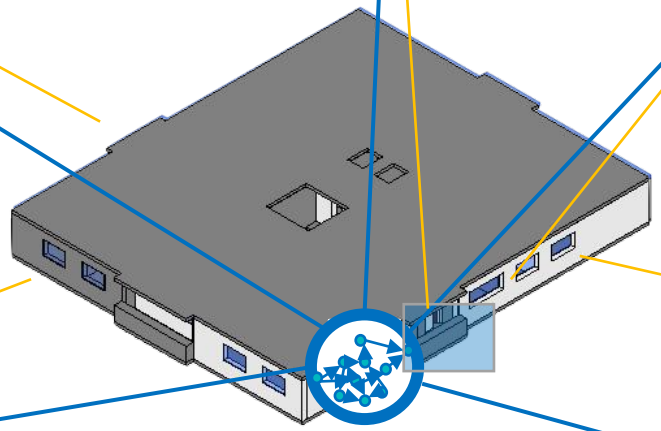


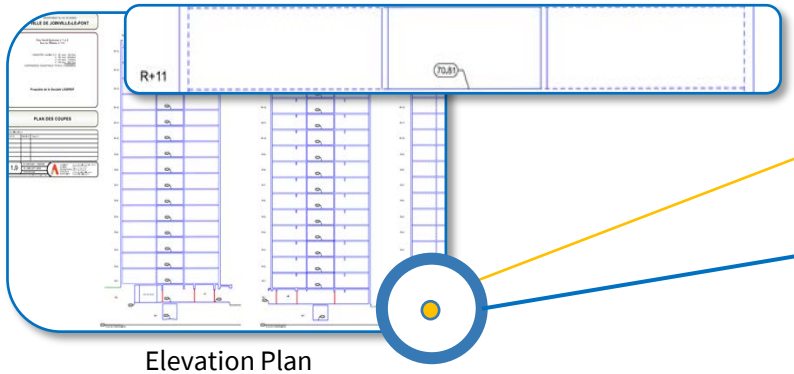
Overall Ground Plan

Energy Audit

PVC Double Glazing with Thermal Performance = 2.8 W/m² K

Material Identification report

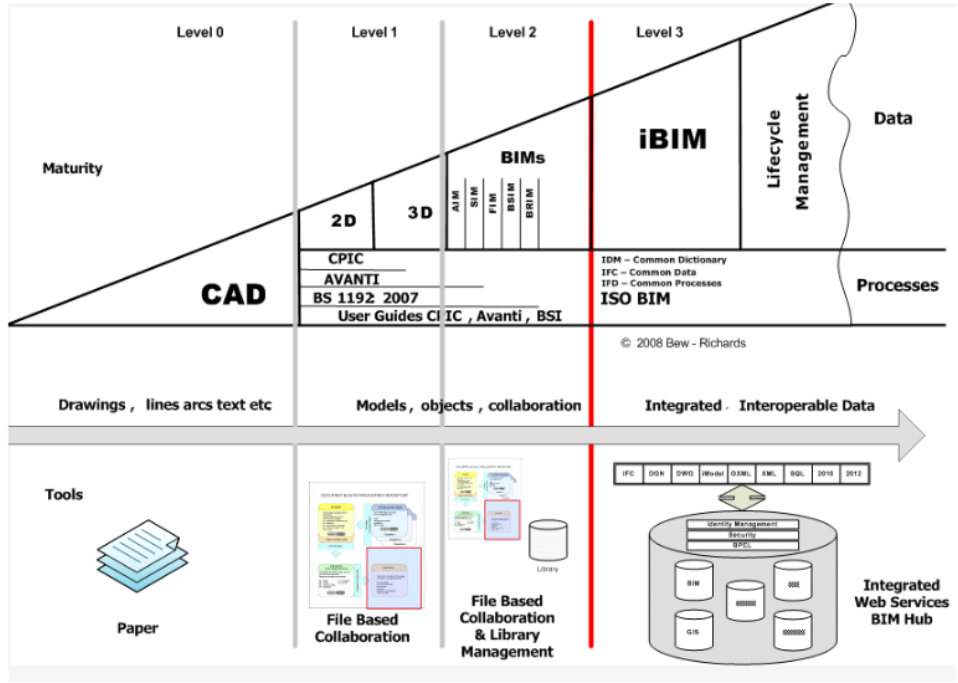


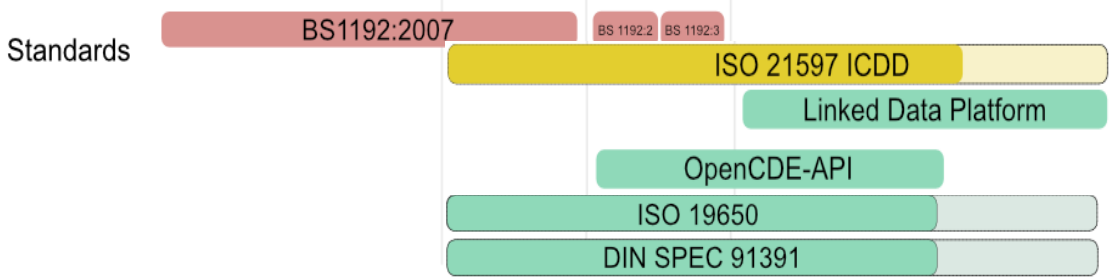


Elevation Plan

Photograph

BIM Maturity Levels





- CDE - essential step in BIM implementation
- Collect, manage and share information

Individual models produced by different stakeholders do not interact, they have clear authorship and remain separate.

BIMPLUS planBIM ORACLE Aconex
Trimble Connect ProjectWise CONNECT Edition AUTODESK CONSTRUCTION CLOUD

BIM4Ren Design Computation RWTH AACHEN UNIVERSITY

The best of both worlds?

- What are the requirements for Information Containers?
- What are the requirements for process architecture of Containers in CDEs?
- How to build a functional Information Container, supporting Linked Data for a CDE?

ISO 19650

Defines requirements for containers

- Collaborative, federated models

- How federated models should be implemented
- Linking of such information
- Breakdown structures of such containers

DIN SPEC 91391

Functionalities and specifications for meta-data (states, history, access control)

- Data integrity
- Nested containers
- Structured approach
- Decentralized information linking

* Individual model elements/attributes linking

LDP

Defines a standard set of techniques - creating clients and servers

Container definition, link types, and HTTP protocols for such containers

* Immense flexibility in meta-data for container and its contents

ISO 21597

Bridges Linked Data research and industry “document-based” practice

Breakdown structure of containers with linking mechanisms

Combine multiple exchange standards in a coherent way

* No guidelines for CDE integration

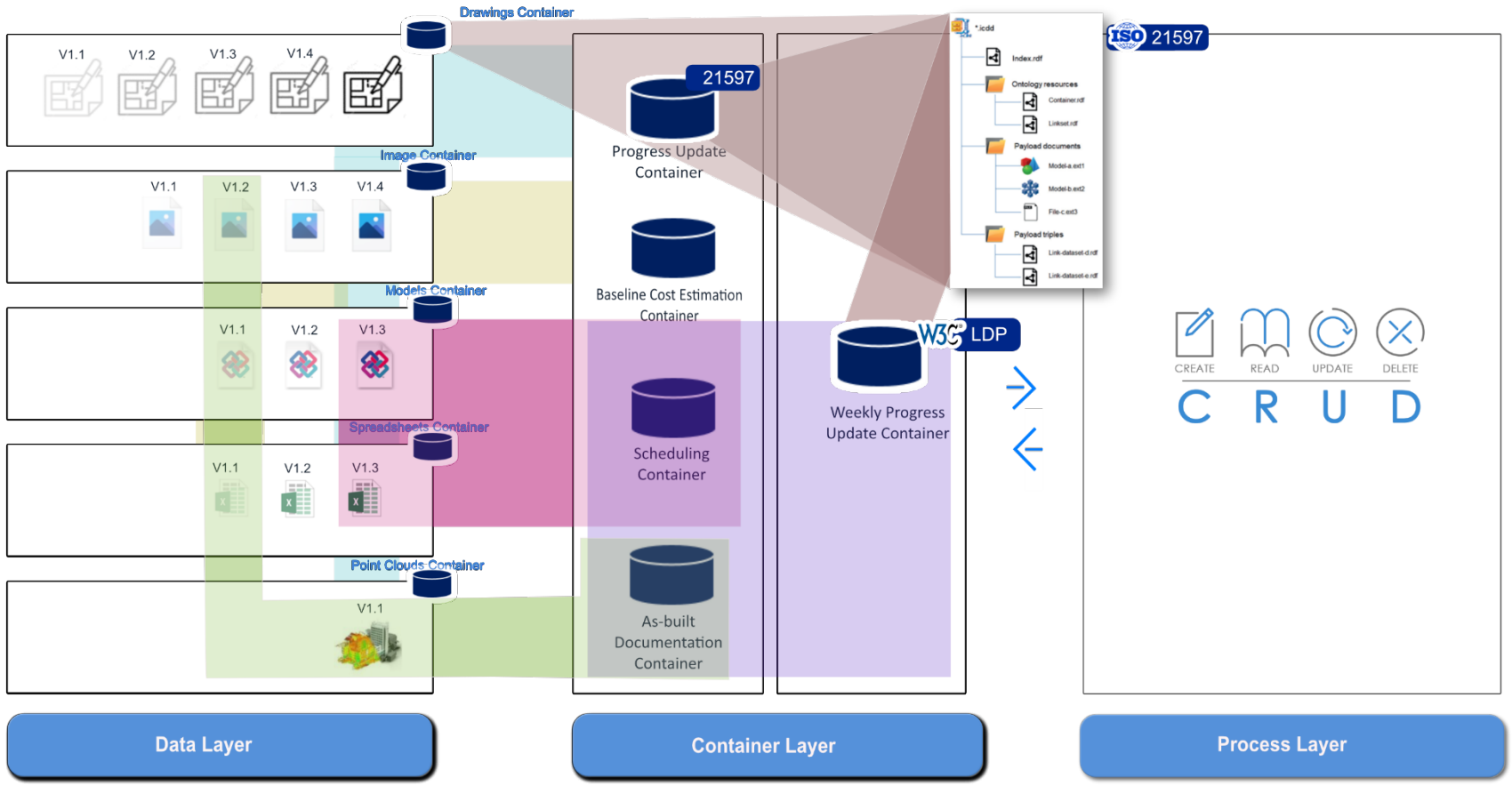
Building on Previous Work

- What are the requirements for Information Containers?
- What are the requirements for process architecture of Containers in CDEs?
- How to build a functional Information Container, supporting Linked Data for a CDE?

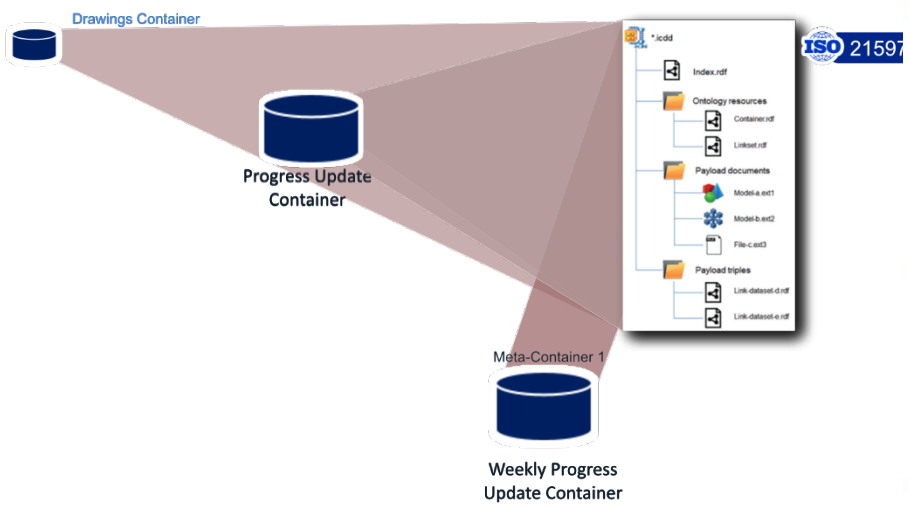
Meta-Classification	Requirement/CDE	ICDD DIN SPEC	ICDD - LDP
Container Structuring	Information Container Classification System	X	✓
	Nested Containers	X	✓
	Customisable folder structure with highly controlled access	X	✓
Versioning & History	Status Codes for Information in Container	X	X
	Container history log (status change for username, dates, revisions)	X	X
Access Control	Document Control and Document Actions via workflow engine	X	X
	Access control at Information Container level	X	✓
Meta Information	Customisable meta data	✓	X
Linking Containers	Document Level	X	✓
	Sub Document (model element) level	✓	✓
	Link Type specification for Document Level	✓	✓
	Link Type specification for Sub Document Level	✓	✓

Senthilvel, Oraskari, Beetz 2021 Implementing Information Container for Linked Document Delivery (ICDD) as a Micro-Service, EG-ICE 2021, July 2021

Data Architecture



Under The Hood

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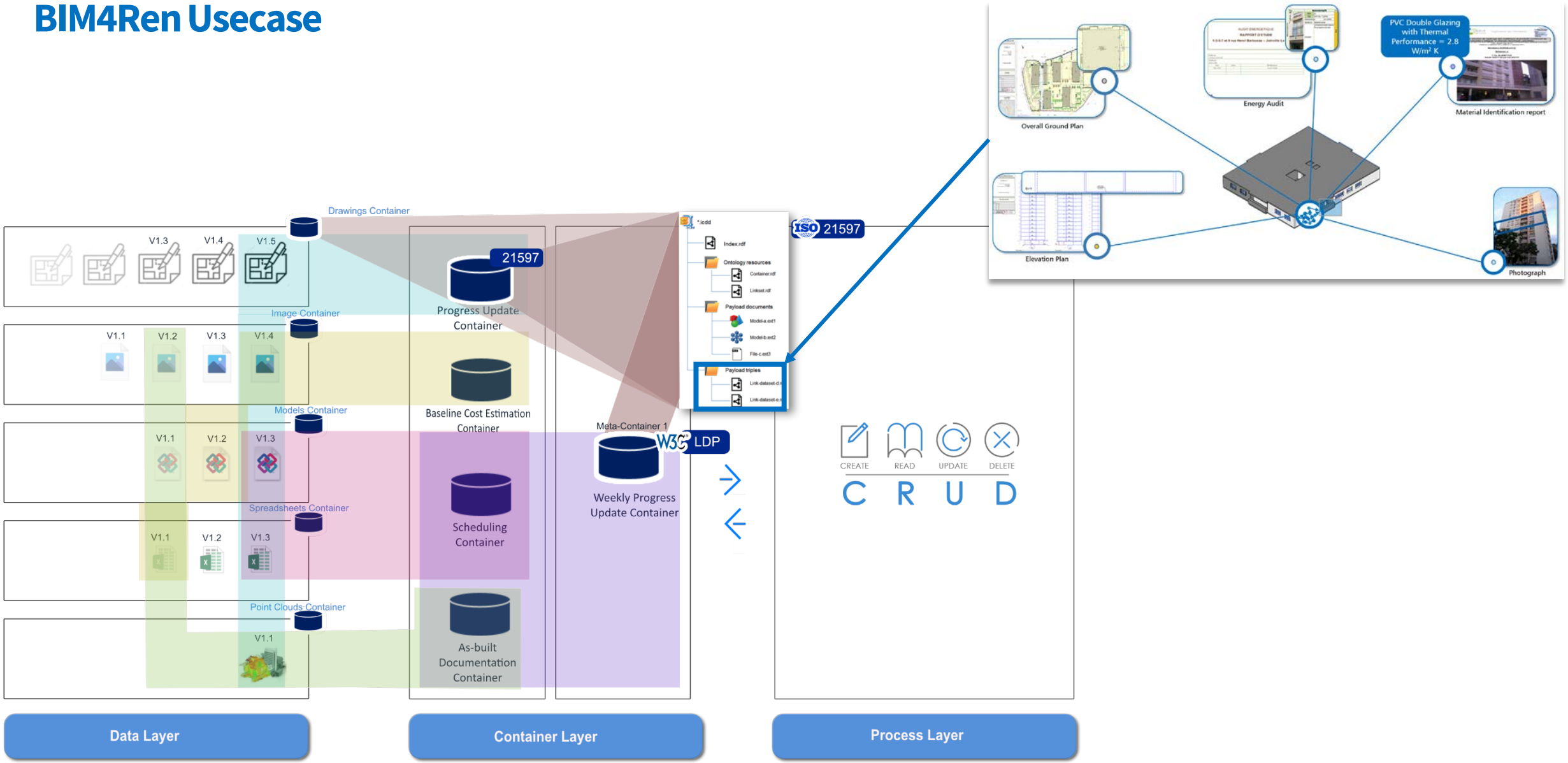
BIM4Ren Usecase



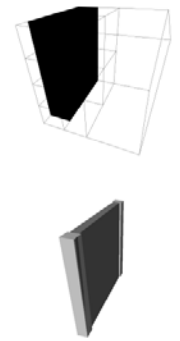
Conclusions & Future Work

- **Data blobs: smallest referable unit**
  - **No duplication of data**

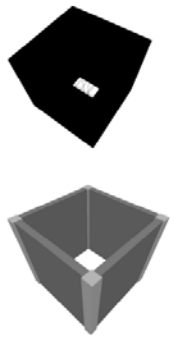
- proposed conceptualization using ICDD falls in-between level 2 and 3
  - supports both file based (stored locally)
  - web-based resources (stored in database)
  - federated model building

- Reusing terminologies for
  - Provenance of links
  - additional meta-data for defining delta changes between versions of files/resources

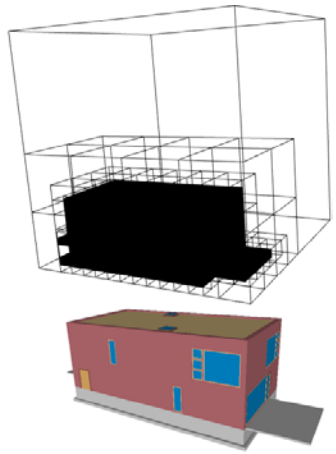
- Automating linking in such containers



One Wall, Two Columns



Four Walls, Four Columns



Duplex Model

Thanks for your attention!