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Long-term Preservation of 3D Architectural Data

Ex Libris conference
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Berlin

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SEVENTH FRAMEWORK PROGRAMME

Plan

1. TIB
2. DuraArk Project
3. Digital preservation and 3D architectural data
    - Goal
    - Issue
    - Use Cases
    - Perspectives

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TECHNISCHE INFORMATIONSBIBLIOTHEK (TIB)

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The TIB

- German National Library for Architecture, Chemistry, Computer Science, Engineering, Mathematics, Physics, and Technology

  ➔Collection scope of a national library

- World‘s Largest Specialist Library for Science and Technology

- Customers in more than 60 countries

- Founded 1959 – on the basis of an existing university library (founded 1831)

Services

- GetInfo – Portal for Science and Technology

- Full Text Orders – print and digital
  - National and Alliance Licenses
  - Pay-per-View
  - Customized Solutions

- DOI-Service
  - DOIs assignment in cooperation with data centers for research data, grey literature, reports etc.

- Competence Center for non-textual materials

Services

- Collect, curate and preserve materials related to the history and practice of architecture and design
- Expand the scientific information to be archived to audio-visual media and 3D models.
- Build up expertise in the area of non-textual materials in conjunction with establishing a Competence Center for non-textual materials.
- Systematic acquisition of scientific objects, object specific search and presentation, long-term archiving, development of standards…

Services

- Mostly analog records like building design drawings, Blueprints, specifications, etc., were archived
- Current challenge : Long-term Preservation systems for novel digital data types often aggregating different data entities into one object.
- Mainly for 3D architectural data

PROBADO

- Content based retrieval methods for an architectural archiving system were developed.
- Funded by the German Research Foundation (DFG) that took place from 2006 to 2011.
- Amongst others, its goal was to integrate 3D architectural models into the librarian process chain.

A step toward the Long-term Preservation of 3D architectural data

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EU Project (Grant no. 600908).

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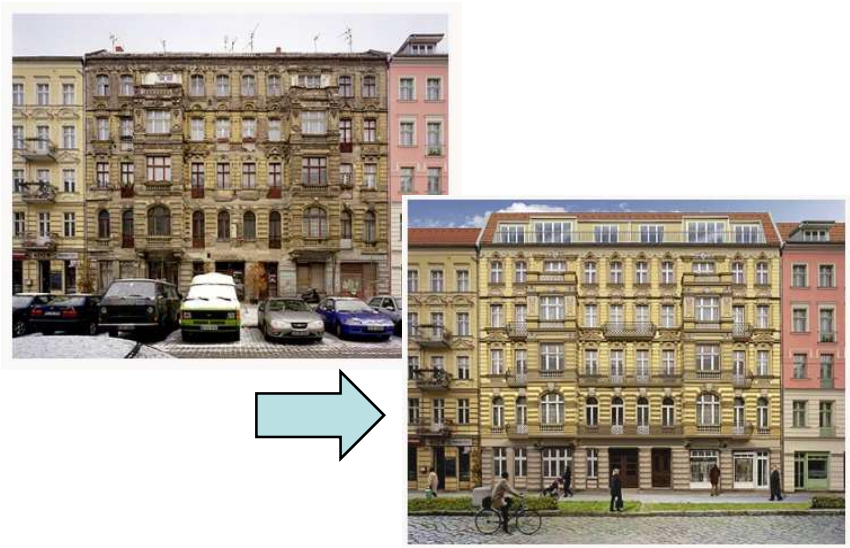
Goals & challenges (1/2)

Goal

- Development of methods and tools for **sustainable** long-term **preservation** of **architectural 3D models**

Challenges

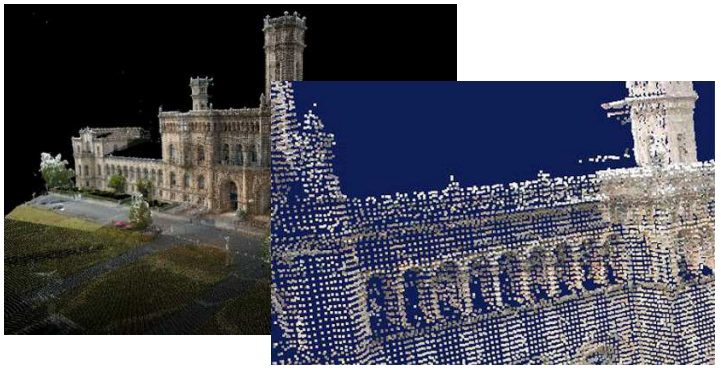
- **Building evolution**: documentation to prevent information loss and enable repair
- **Long-term readability /renderability of 3D architectural models:** addressing digital decay due to deprecated file formats
- **Inconsistent naming conventions**: improving architectural metadata schemes & vocabularies towards long-term sustainability



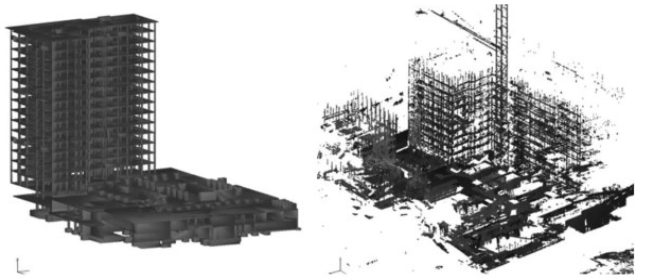
Goals & challenges (2/2)

Challenges

- **Interoperability and consistency:** bridging between diverse formats and abstraction levels (point clouds & legacy 3D models => enriched Building Information Models, BIM…)



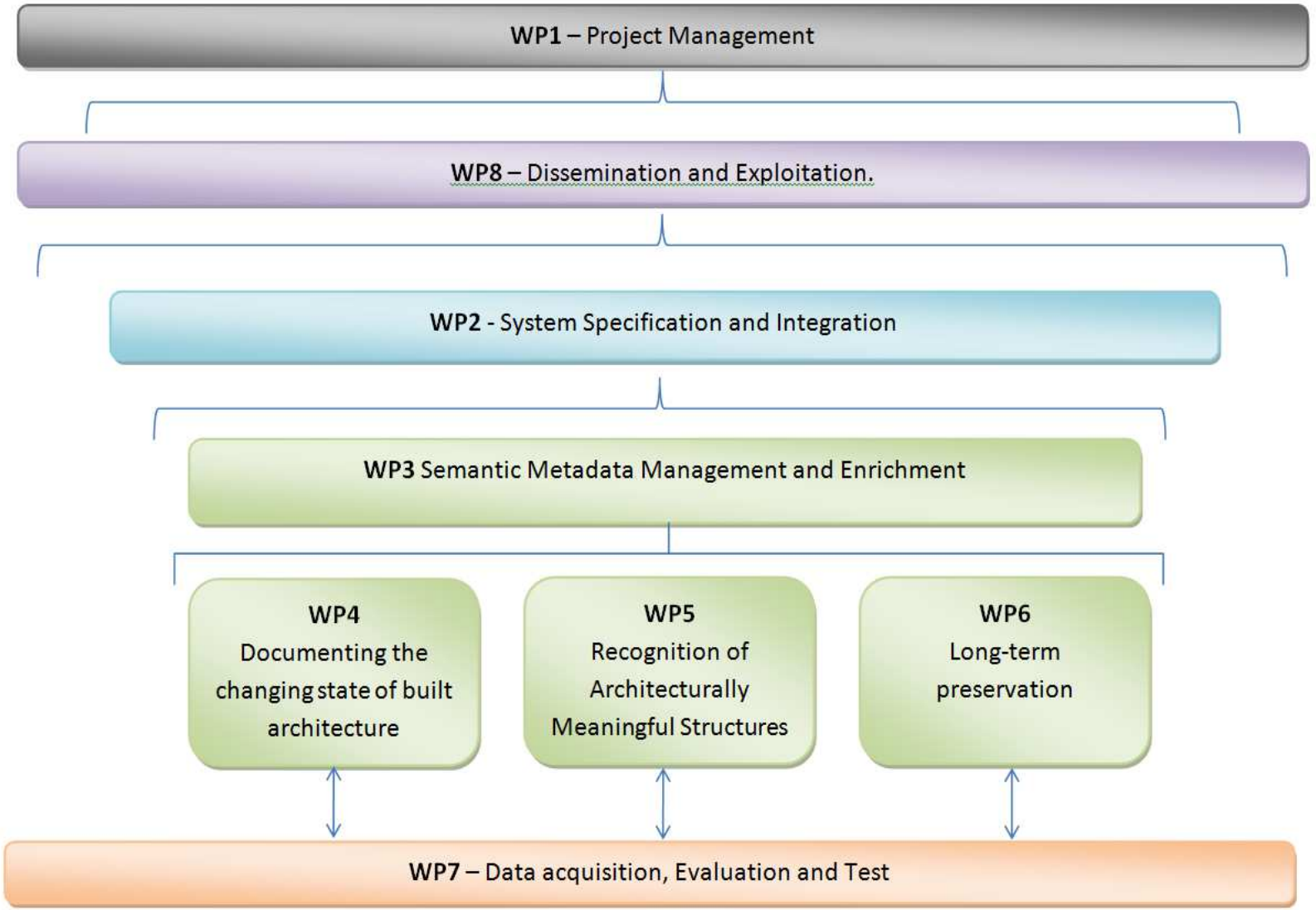
- **Enrichment of point clouds**: using semantics to efficiently store and discover point cloud and 3D models for targeted retrieval.



(a) 3D model. (b) Example laser scan.

- **Diversity of stakeholders**: taking into account requirements of libraries/archives, building constructors/architects, building operators, etc. on long-term archiving.

Work Packages



Consortium

Scientific excellence in three strategic areas:

- Long-term preservation & archiving
- Architectural & 3D models
- Data & system integration & management

universitätbonn
Rheinische Friedrich-Wilhelms-Universität Bonn

LULEÅ UNIVERSITY OF TECHNOLOGY

CITA

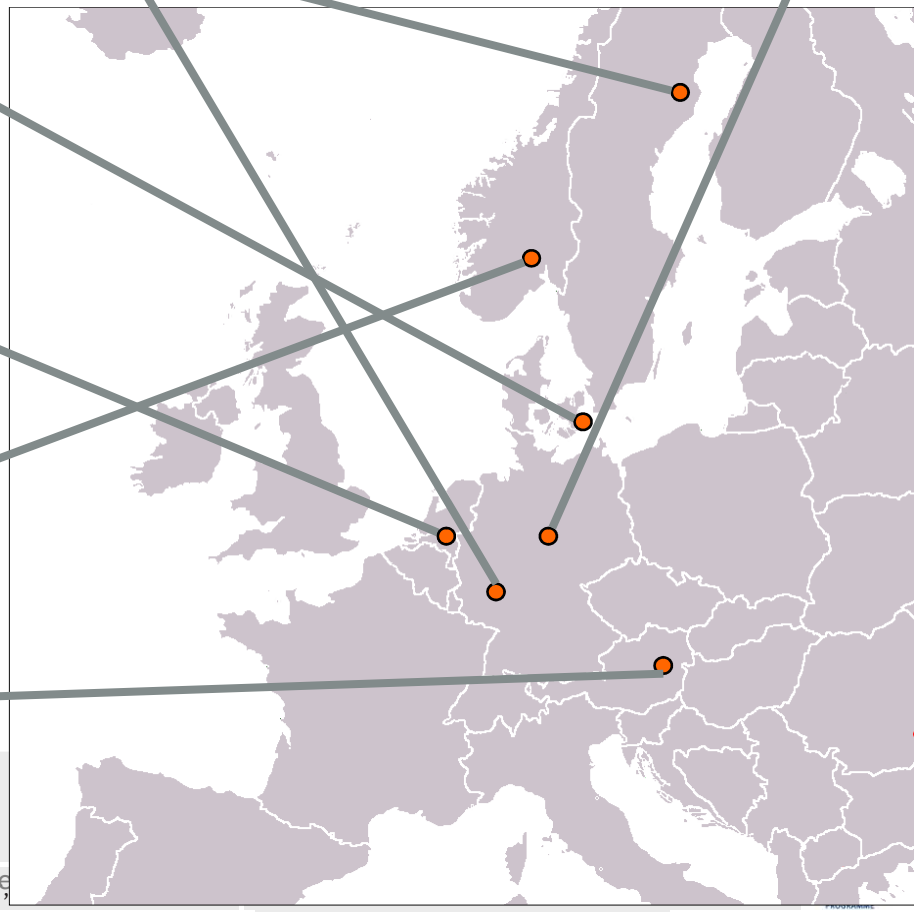
TU/e Technische Universiteit Eindhoven University of Technology

CATENDA

Fraunhofer AUSTRIA

Forschungszentrum L3S Research Center

TIB



UBO: Universität Bonn
- Technical Director
- WP4/WP5: change management, shape recognition

Luleå University of Technology
- WP8 leader, dissemination/exploitation

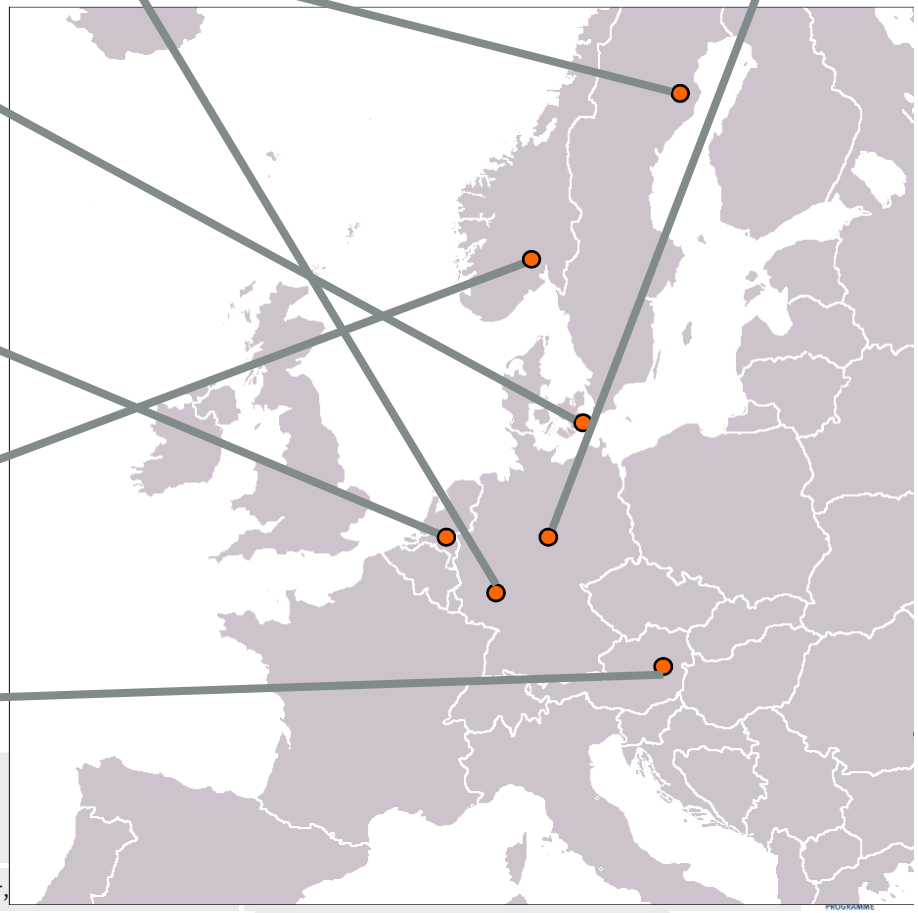
CITA, Center for Information Technology and Architecture Copenhagen
- WP7 leader, evaluation, test

TUE, Department of the Built Environment, Eindhoven University of Technology
- WP3 leader, semantics & metadata

Catenda, SME
- User perspective, market requirements, evaluation

Fraunhofer Austria
- WP2 leader, system specification & integration

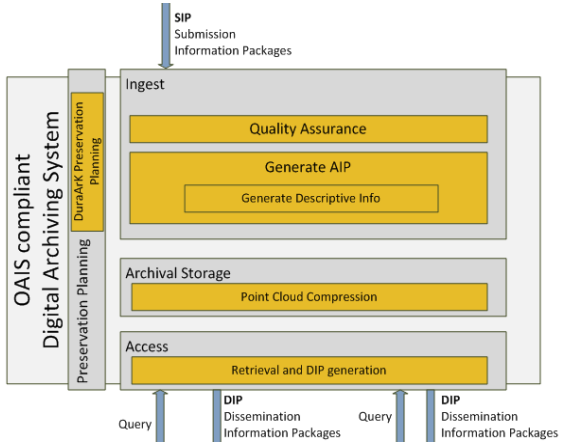
LUH: German National Library of Science and Technology (TIB) & L3S Research Center Hannover
-Coordinator
-WP6 leader, long-term preservation



Tangible outcomes

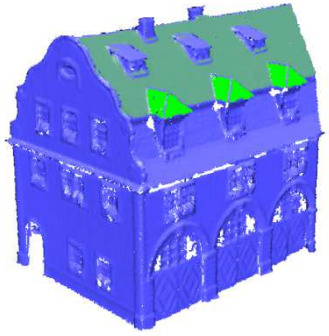
Tangible outcomes

- **Workflows and tools for OAIS compliant ingest:** Management, preservation and delivery of the various types of architectural data



- **Semantic enrichment:** Vocabularies for description of built structures and enrichment techniques based on a unified and sustainable naming scheme

- **Tools for structuring of point clouds and legacy 3D data:** Enable targeted retrieval by detecting high-level semantic structures in the data



Tangible outcomes

Tangible outcomes

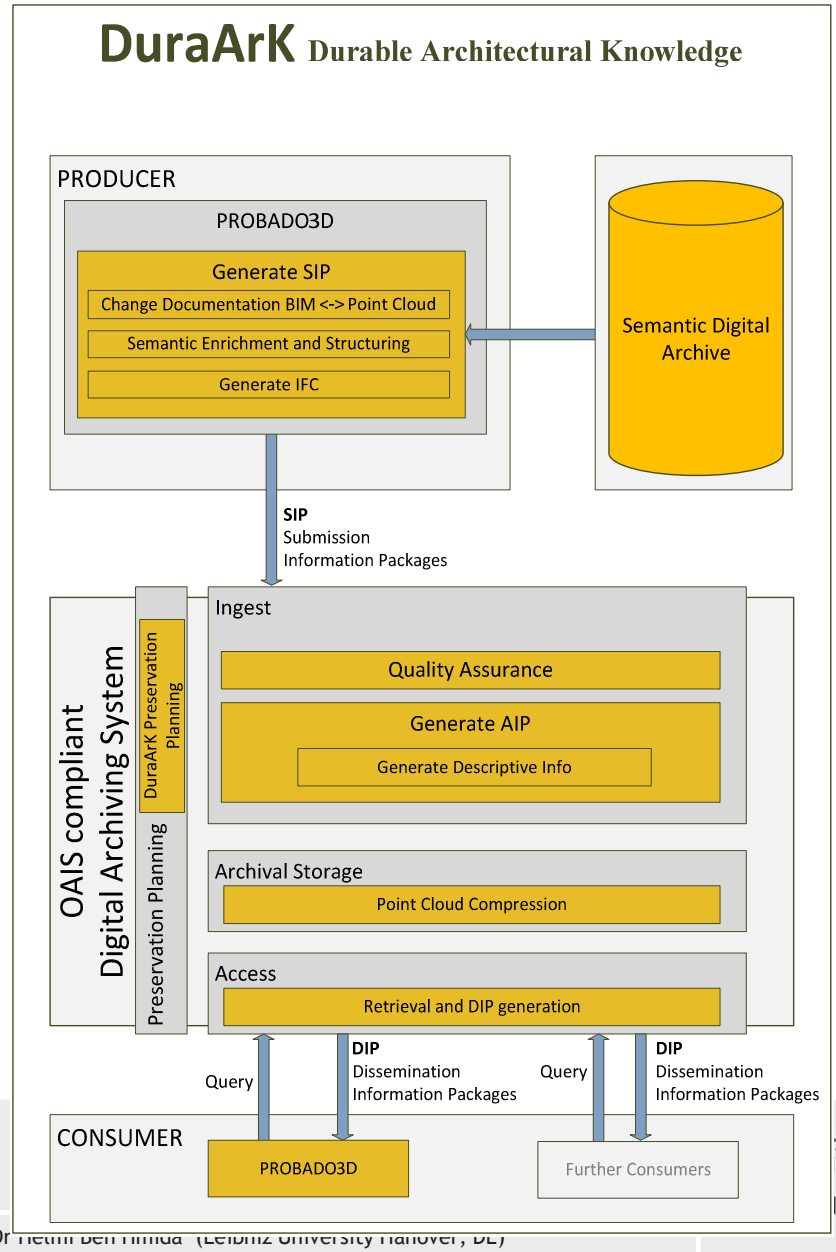
- **Tools for detection of changes in the building:** Avoic information loss by detecting differences in original building plans and point clouds documenting the as-is building state to enable guided repair

Aligned 3D model and laser scan

- **OAIS compliant storage:** Face problem of digital decay by using Industry Foundation Classes (IFC) as an open and already well-established file format suited for long-term preservation. Use point cloud compression techniques that are self-documenting and robust towards bit rot.

- **Tailored Workflows**: Thoroughly investigate requirements of institutional stakeholders (libraries/archives) and SMEs on long-term archiving. Develop according workflows.

Architecture



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Digital preservation and 3D architectural data

Goals

- Creating technology solutions and innovative methods for keeping 3D architectural data available and useable over time

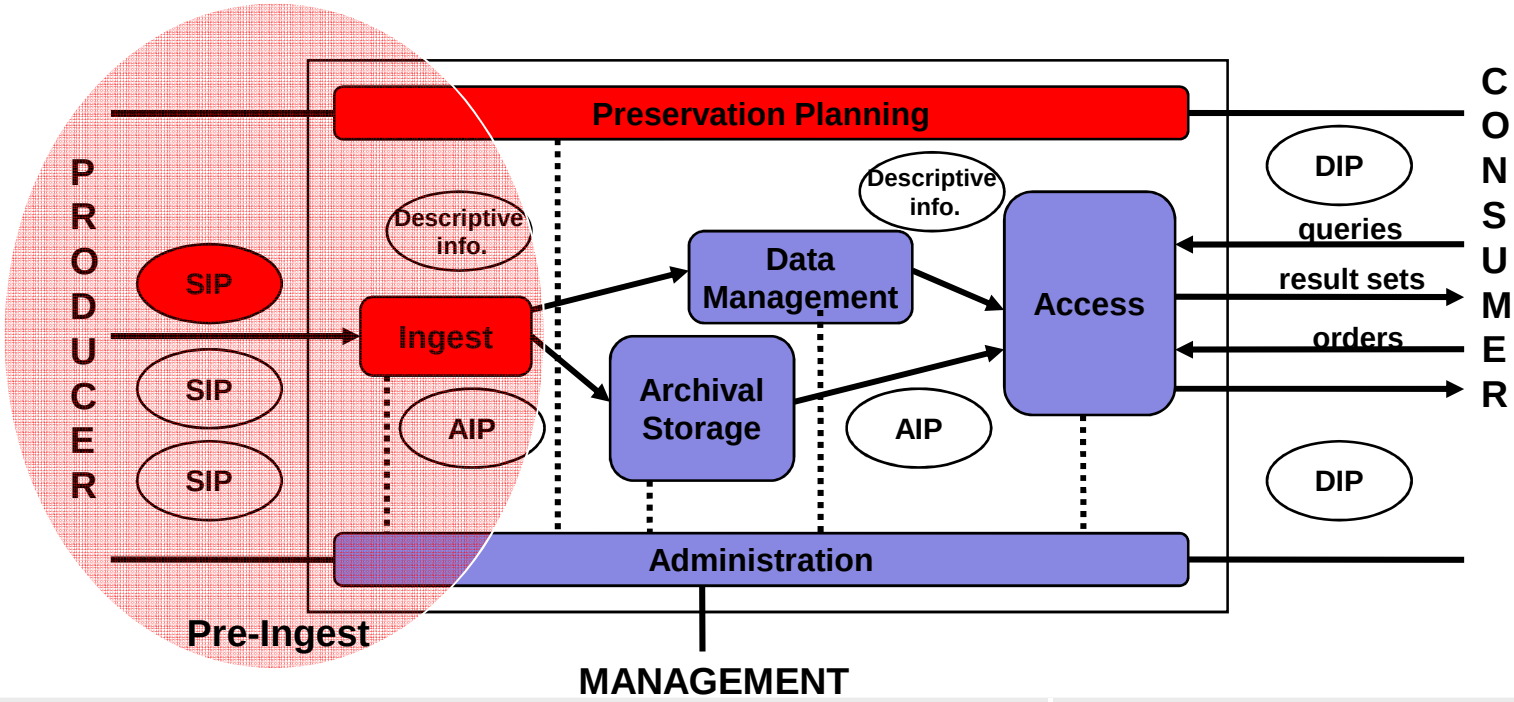
- Implement approach based on the OAIS model to support the 3D architectural data

- OAIS

  - Archive consisting of organization, people and systems
  - The primary goal of an OAIS is to preserve information for a designated community over an indefinite period of time.
  - OAIS must store significant information about the object and its contents.

The Pre-Ingest \ Ingest Process

- Prepare the contents of a SIP for storage and management comprises
  - The 3D architectural data
  - Its accompanying metadata



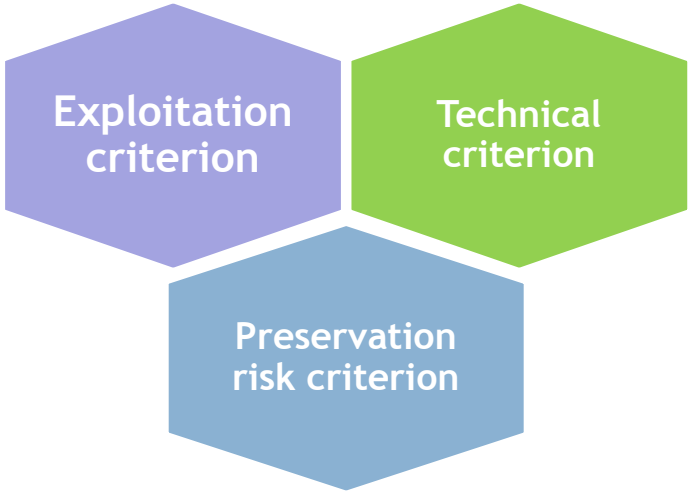
The 3D architectural data

- Be based on the Industry Foundation Classes (IFC)
- Study and suggest different criterion to evaluate 3D data structure and their related risk for preservation purpose.
- Study several kinds of 3D data structure add to the IFC and evaluate it based on the selected criterions (CAD, IFD, WRL…)

AutoCAD

The 3D architectural data

- End user able to access, visualize, manipulate the content
- Future user should be able to interact with the data (3D)
- Simplicity: understand, manipulation

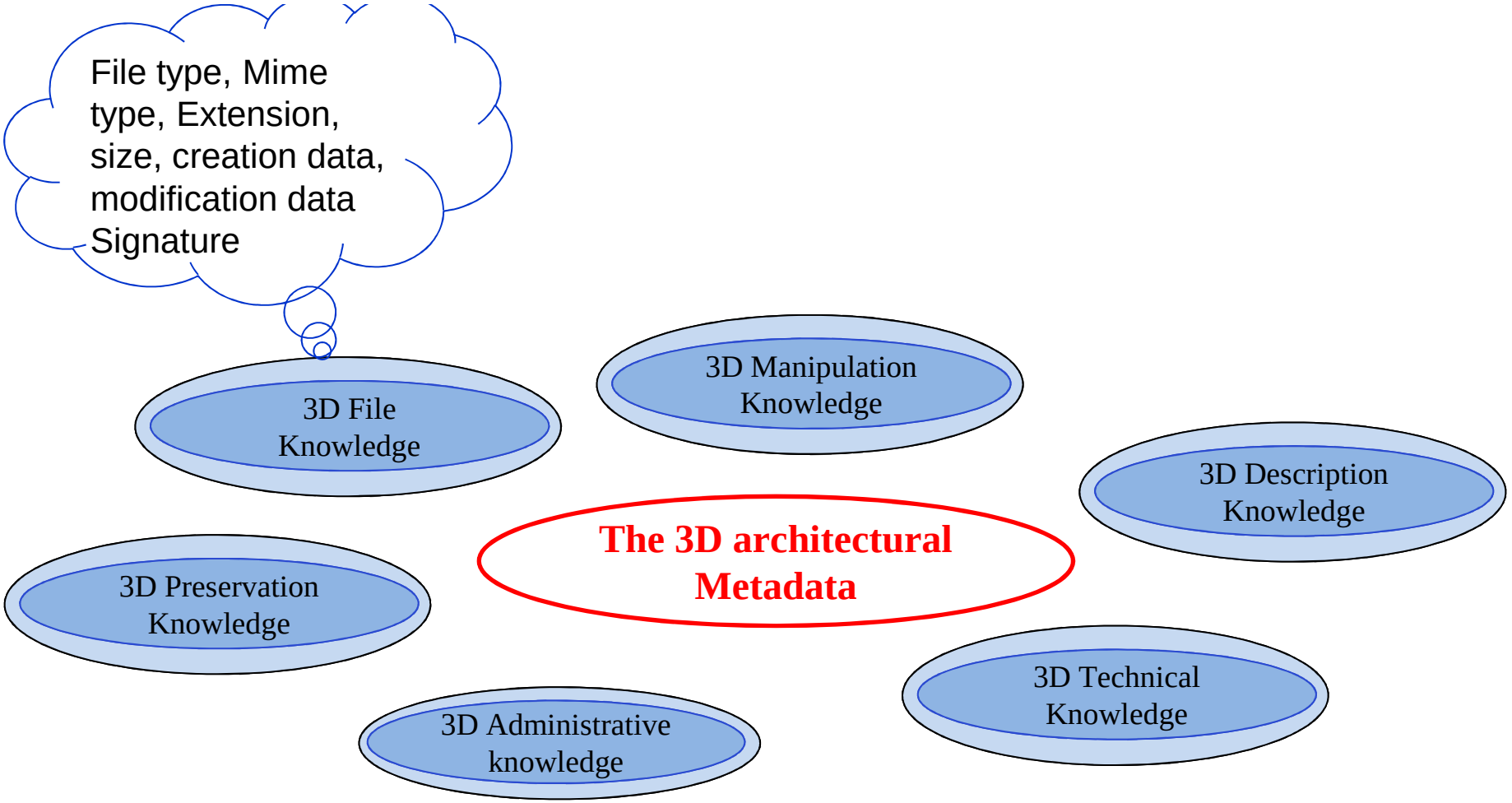


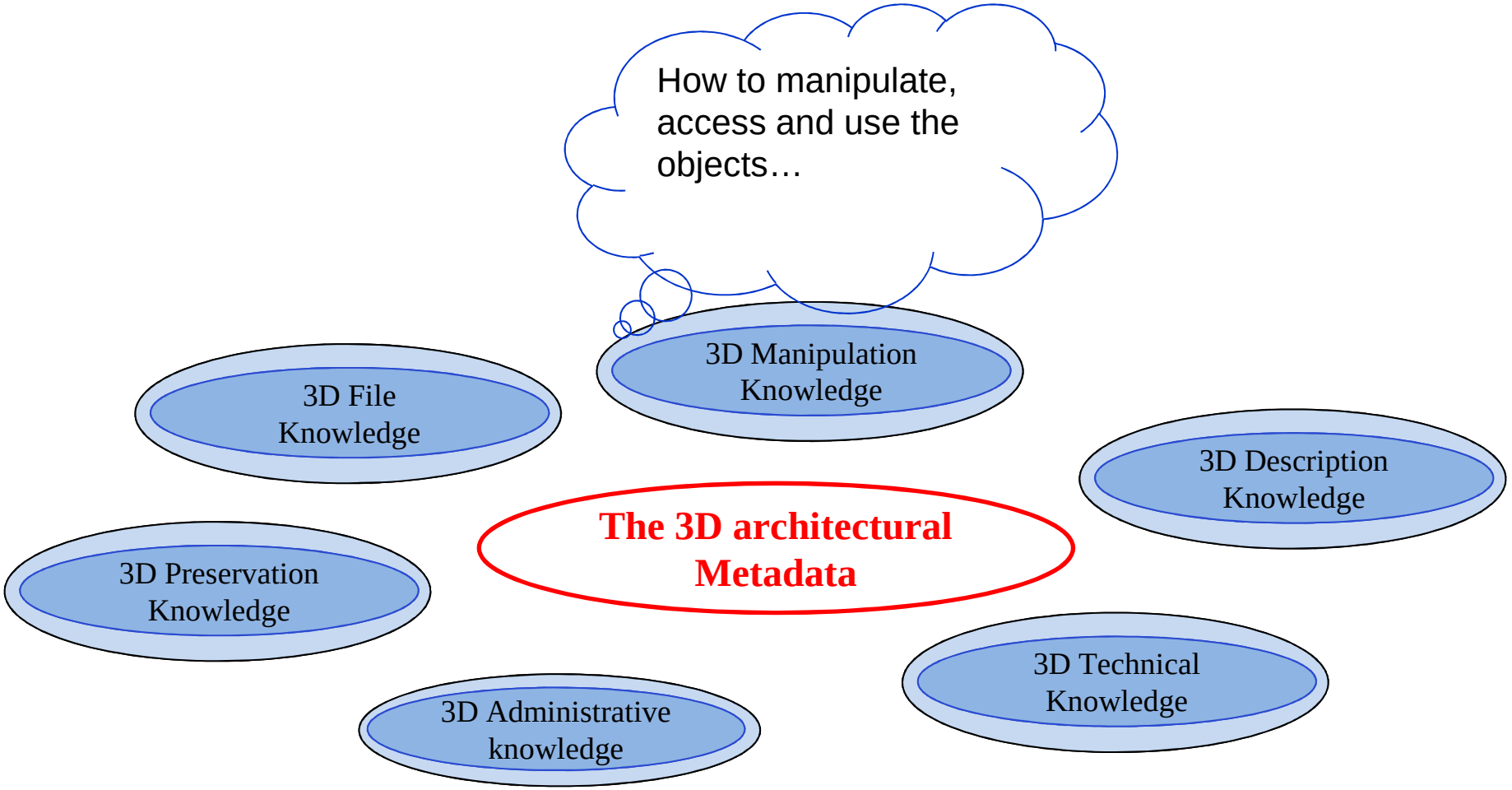
- Open File Format
- Compatible with software and plugins
- Independent from software
- Standardisation
- Display speed

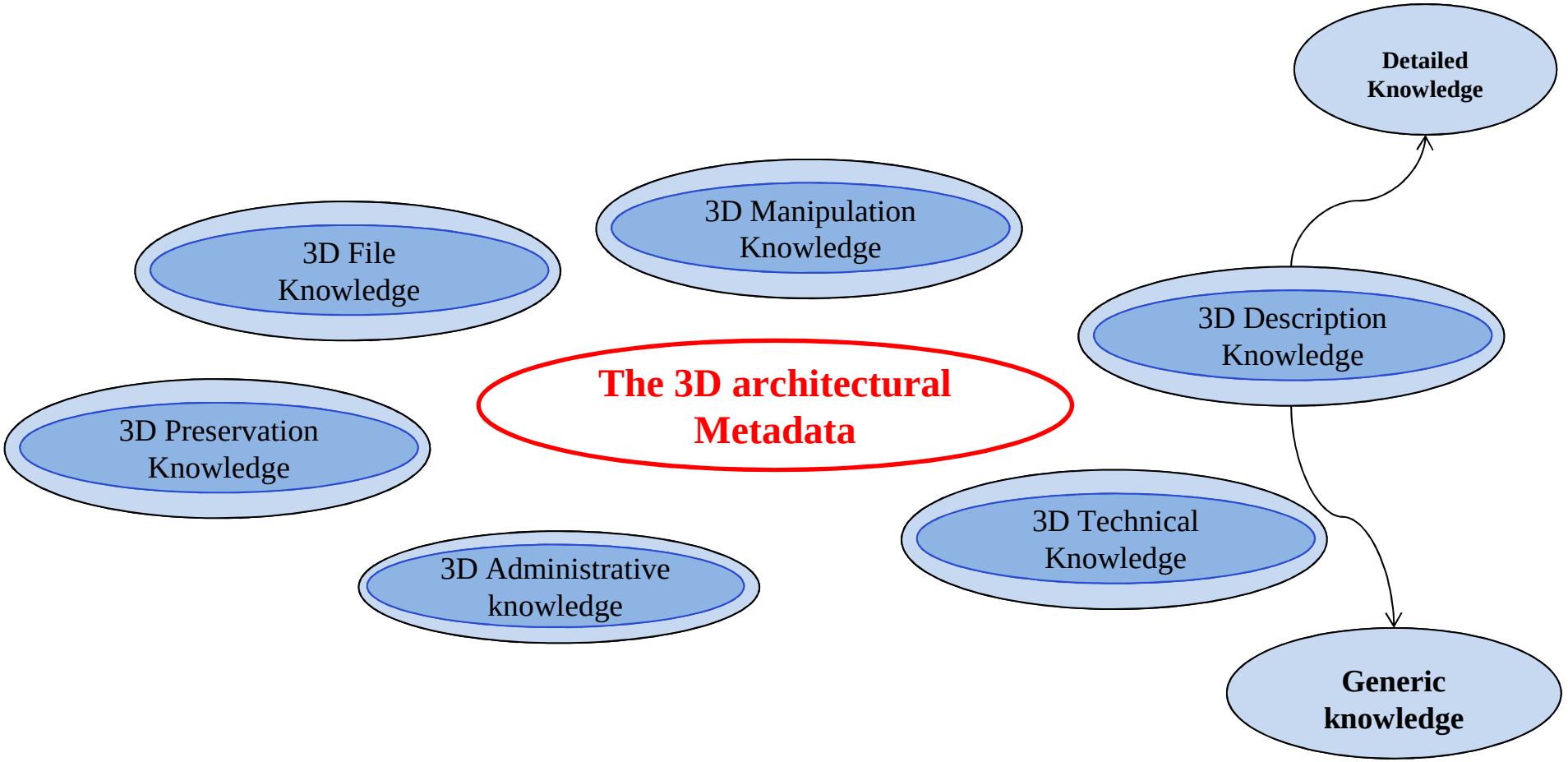
- Duration of support
- Open specification
- Able to access on future computer

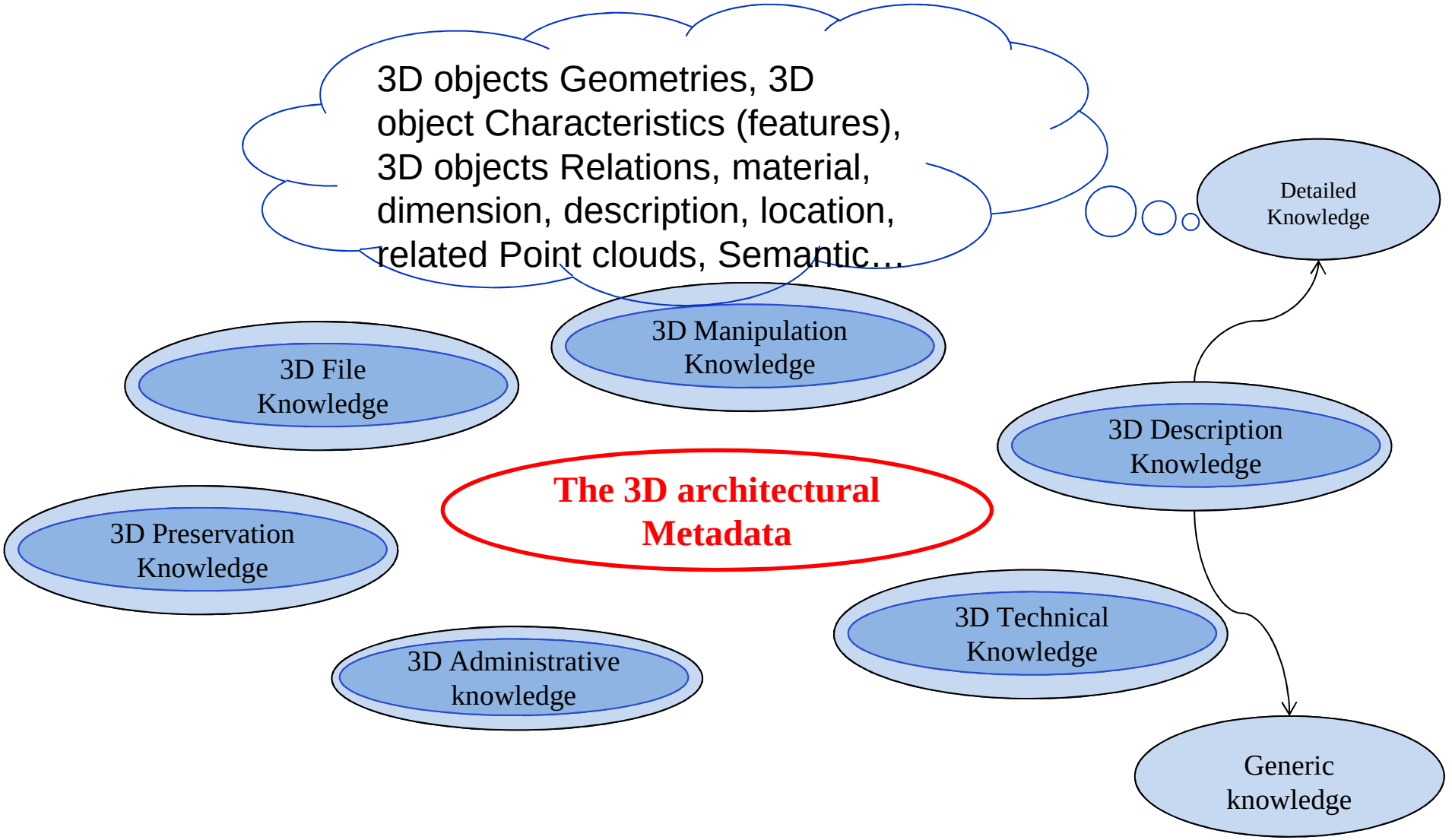
The 3D architectural Metadata

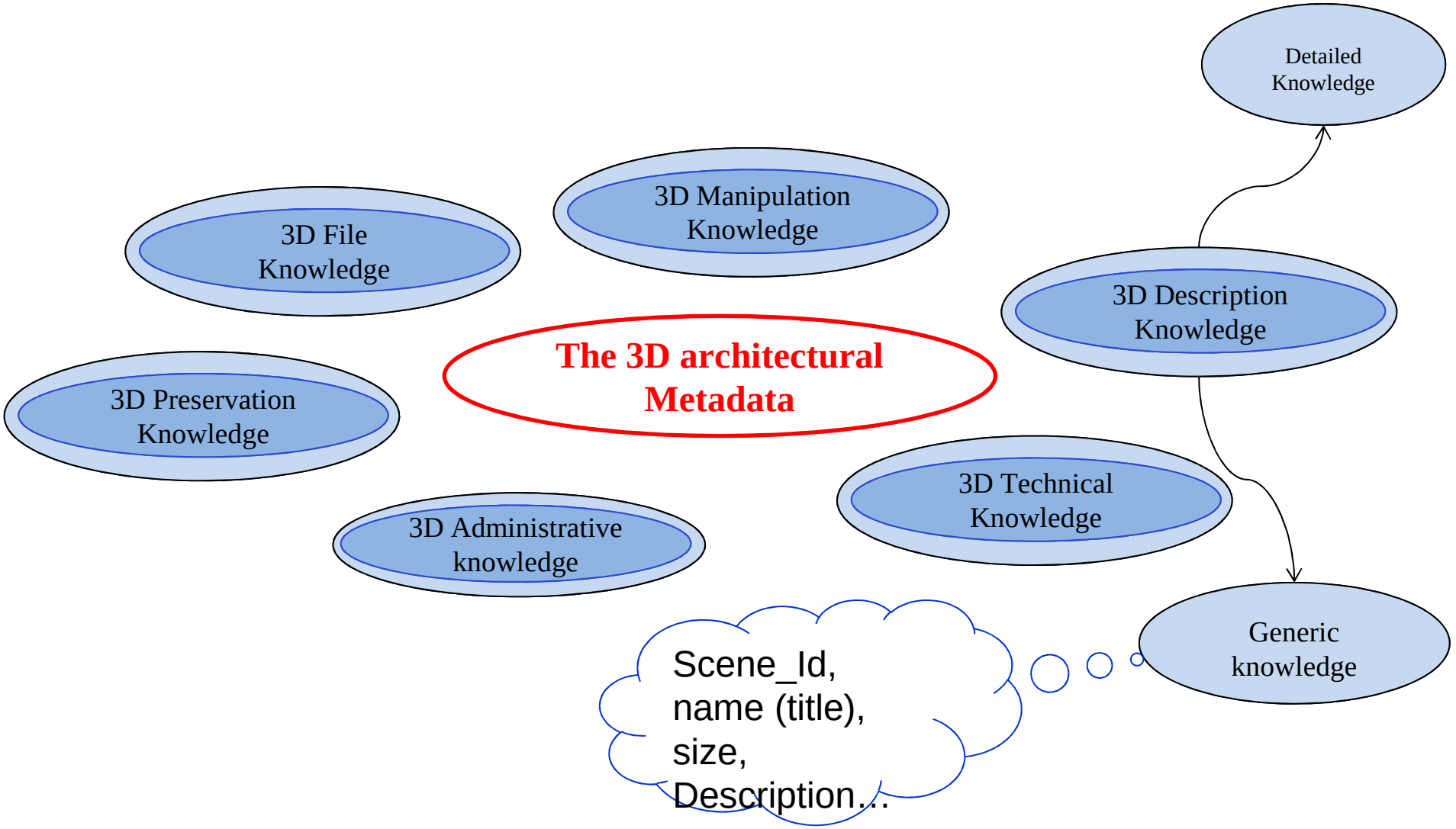
- Study which kind of information should we preserve for the 3D architectural data
- Study and evaluation of existing metadata schemas towards their feasibility for our purpose
- Try to adapt/update existing standards to support new 3D information

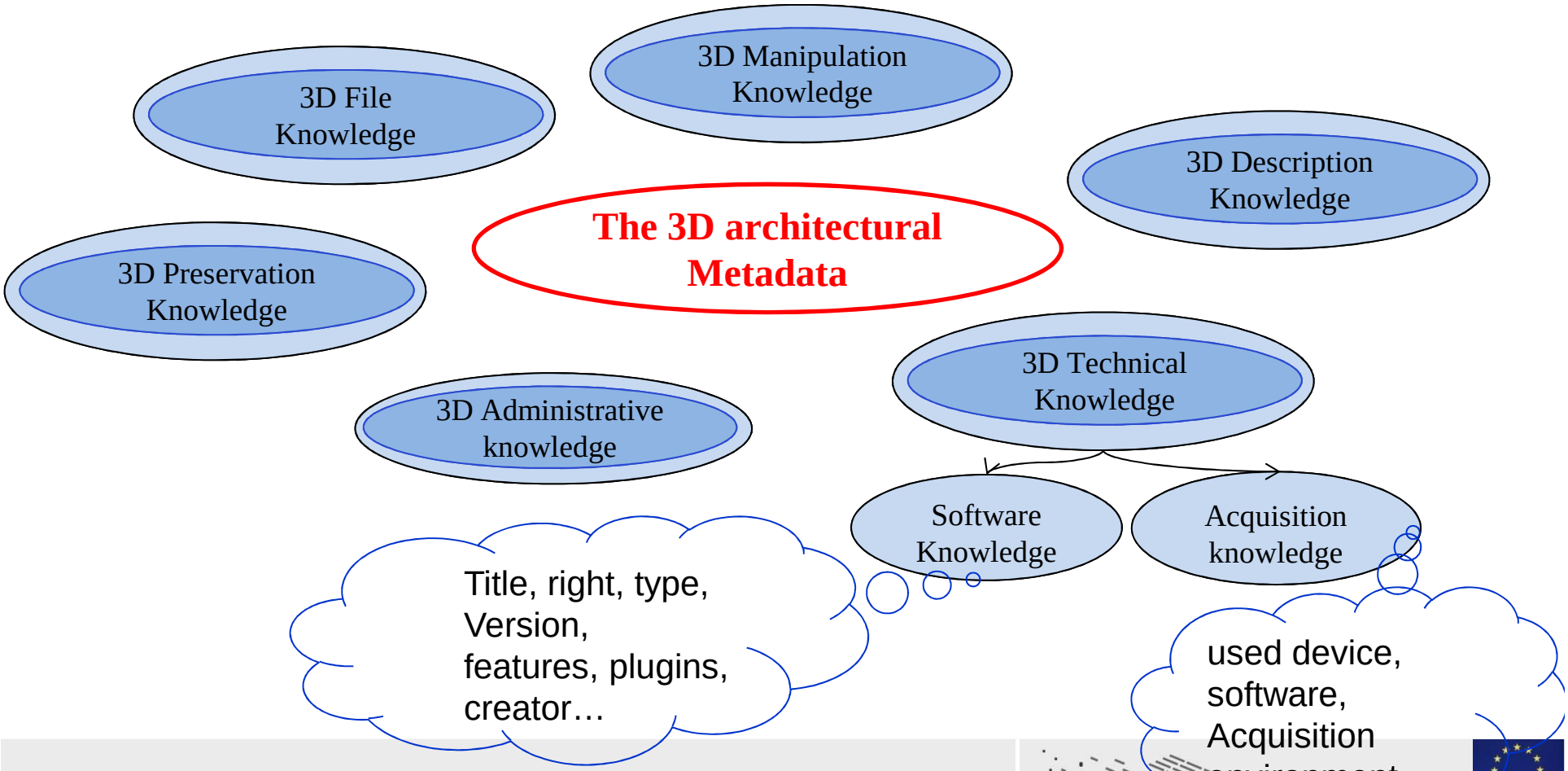

File type, Mime type, Extension, size, creation data, modification data Signature
3D File Knowledge
3D Manipulation Knowledge
3D Description Knowledge
The 3D architectural Metadata
3D Preservation Knowledge
3D Technical Knowledge
3D Administrative knowledge


How to manipulate, access and use the objects…
3D Manipulation Knowledge
3D File Knowledge
3D Description Knowledge
The 3D architectural Metadata
3D Preservation Knowledge
3D Technical Knowledge
3D Administrative knowledge

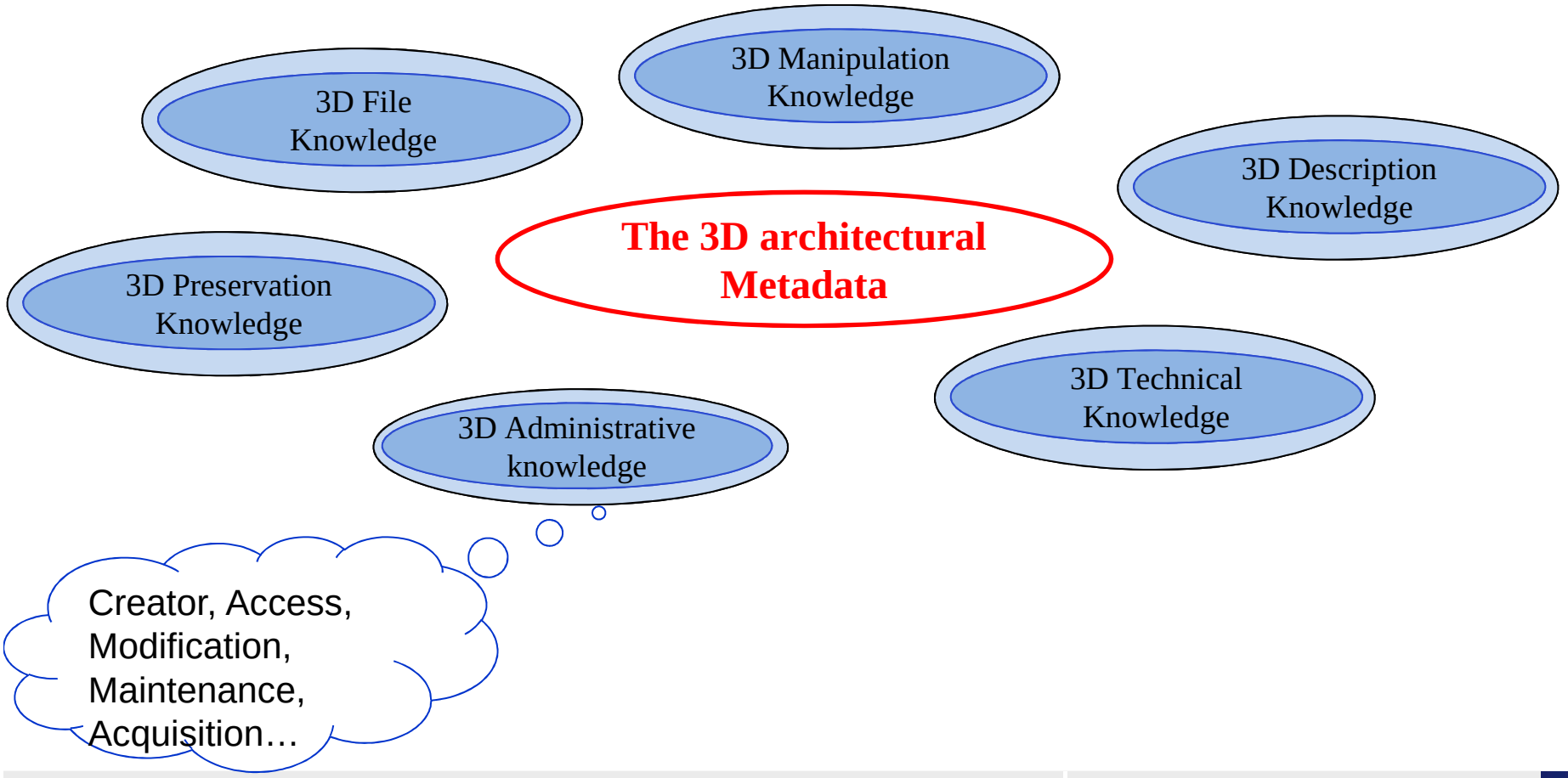

Detailed Knowledge
3D Manipulation Knowledge
3D File Knowledge
3D Description Knowledge
The 3D architectural Metadata
3D Preservation Knowledge
3D Technical Knowledge
3D Administrative knowledge
Generic knowledge


3D objects Geometries, 3D object Characteristics (features), 3D objects Relations, material, dimension, description, location, related Point clouds, Semantic…
Detailed Knowledge
3D File Knowledge
3D Manipulation Knowledge
3D Description Knowledge
The 3D architectural Metadata
3D Preservation Knowledge
3D Technical Knowledge
3D Administrative knowledge
Generic knowledge


Detailed Knowledge
3D File Knowledge
3D Manipulation Knowledge
3D Description Knowledge
The 3D architectural Metadata
3D Preservation Knowledge
3D Technical Knowledge
3D Administrative knowledge
Generic knowledge
Scene_Id, name (title), size, Description…


3D File Knowledge
3D Manipulation Knowledge
3D Description Knowledge
3D Preservation Knowledge
The 3D architectural Metadata
3D Technical Knowledge
3D Administrative knowledge
Software Knowledge
Acquisition knowledge
Title, right, type, Version, features, plugins, creator…
used device, software, Acquisition environment

Issue



Issue

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Use Cases

- **SME Use Case**
  - Fulfilling the needs of SME
  - Design Build and Retrofitting

- **Institutional Preservation Use Case**
  - Fulfilling the archival task of a research library
  - Provide better services for their academic and industrial customers.

Perspectives

- Integrate workflows for 3D data into TIB's productive digital preservation system based on the software Rosetta
- Support the ingest of architectural 3D data from the vast domains specific spectrum of semantic detail levels
  - Low-level point cloud scans over legacy 3D CAD models
  - highly enriched Building Information Modeling (BIM).

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