DURAARK

Long-term Preservation of 3D Architectural Data

Ex Libris conference
April 29-30th, 2013
Berlin
Plan

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

EU Project (Grant no. 600908).
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

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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.

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

DuraArk
Consortium

Scientific excellence in three strategic areas:

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

DuraArk
**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

**TU/e, 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

- **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

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

- **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

DuraArk Durable Architectural Knowledge

PRODUCER

PROBAD3D

Generate SIP
Change Documentation BIM <-> Point Cloud
Semantic Enrichment and Structuring
Generate IFC

Semantic Digital Archive

SIP Submission Information Packages

OAIS compliant Digital Archiving System

Ingest
Quality Assurance
Generate AIP
Generate Descriptive Info

Archival Storage
Point Cloud Compression

Access
Retrieval and DIP generation

CONSUMER

PROBAD3D

Further Consumers

DIP Dissemination Information Packages
Query

Dr. Helmi Ben Hmida (Leibniz University Hanover, DE)
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...)
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

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

### Technical criterion

### Preservation risk criterion

### Issue

- 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
The 3D architectural Metadata

- 3D File Knowledge
- 3D Manipulation Knowledge
- 3D Description Knowledge
- 3D Technical Knowledge
- 3D Administrative knowledge
- 3D Preservation Knowledge

File type, Mime type, Extension, size, creation data, modification data, Signature
How to manipulate, access and use the objects...

The 3D architectural Metadata

- 3D File Knowledge
- 3D Manipulation Knowledge
- 3D Description Knowledge
- 3D Technical Knowledge
- 3D Administrative Knowledge
- 3D Preservation Knowledge

How to manipulate, access and use the objects...
The 3D architectural Metadata

- 3D File Knowledge
- 3D Manipulation Knowledge
- 3D Description Knowledge
- 3D Technical Knowledge
- 3D Preservation Knowledge
- 3D Administrative knowledge

Detailed Knowledge

Generic knowledge
3D objects Geometries, 3D object Characteristics (features), 3D objects Relations, material, dimension, description, location, related Point clouds, Semantic...

The 3D architectural Metadata

Detailed Knowledge

3D File Knowledge

3D Manipulation Knowledge

3D Preservation Knowledge

3D Description Knowledge

3D Technical Knowledge

Generic knowledge

Detailed Knowledge

3D File Knowledge

3D Manipulation Knowledge

3D Preservation Knowledge

3D Description Knowledge

3D Technical Knowledge

Generic knowledge
The **3D architectural Metadata**

- 3D File Knowledge
- 3D Manipulation Knowledge
- 3D Description Knowledge
- 3D Technical Knowledge
- 3D Administrative Knowledge
- Detailed Knowledge
- Generic Knowledge

Scene_Id, name (title), size, Description...
The 3D architectural Metadata

- 3D File Knowledge
- 3D Manipulation Knowledge
- 3D Description Knowledge
- 3D Technical Knowledge
- 3D Administrative knowledge

Title, right, type, Version, features, plugins, creator…

used device, software, Acquisition environment
The 3D architectural Metadata

- 3D File Knowledge
- 3D Manipulation Knowledge
- 3D Description Knowledge
- 3D Technical Knowledge
- 3D Administrative Knowledge
- 3D Preservation Knowledge

Creator, Access, Modification, Maintenance, Acquisition…
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).