

A Domain-driven Approach to Digital Curation and Preservation of 3D Architectural Data

- Stakeholder Identification and Alignment in the DURAARK project -

Archiving 2014
Berlin, May 13th - 16th 2014



Brief introduction to DURAARK

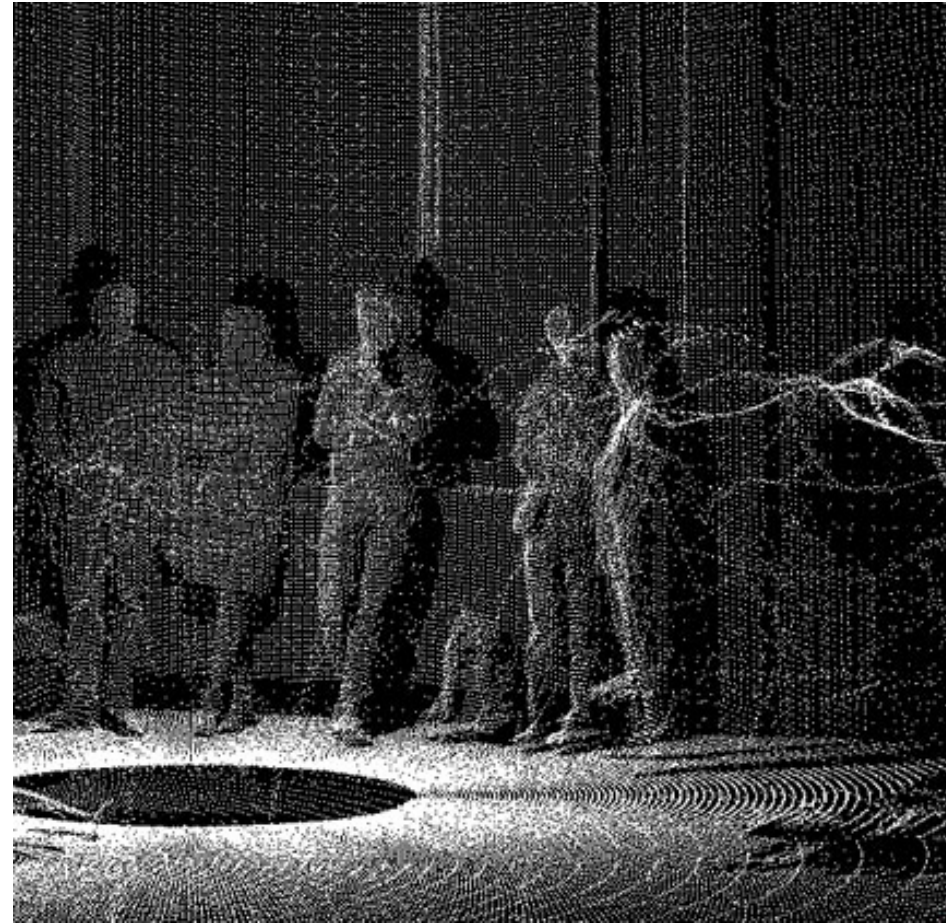
- to 3D scans
- to BIM

Stakeholder Identification

- why?
- different models used
- results for 6 stakeholder
- the „stakeholder preservation“

Use Cases

Outlook



DURAARK (DURABLE Architectural Knowledge)

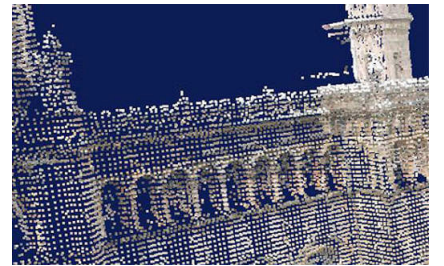
FP7 - ICT - Digital Preservation (STReP)

February 2013 - January 2016



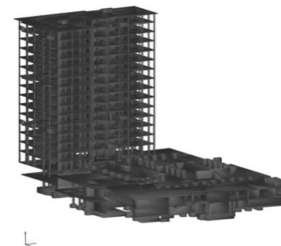
Goal

Develop methods and tools for **digital preservation** and **curation of 3D building data**, metadata, related knowledge & web data)



Scope

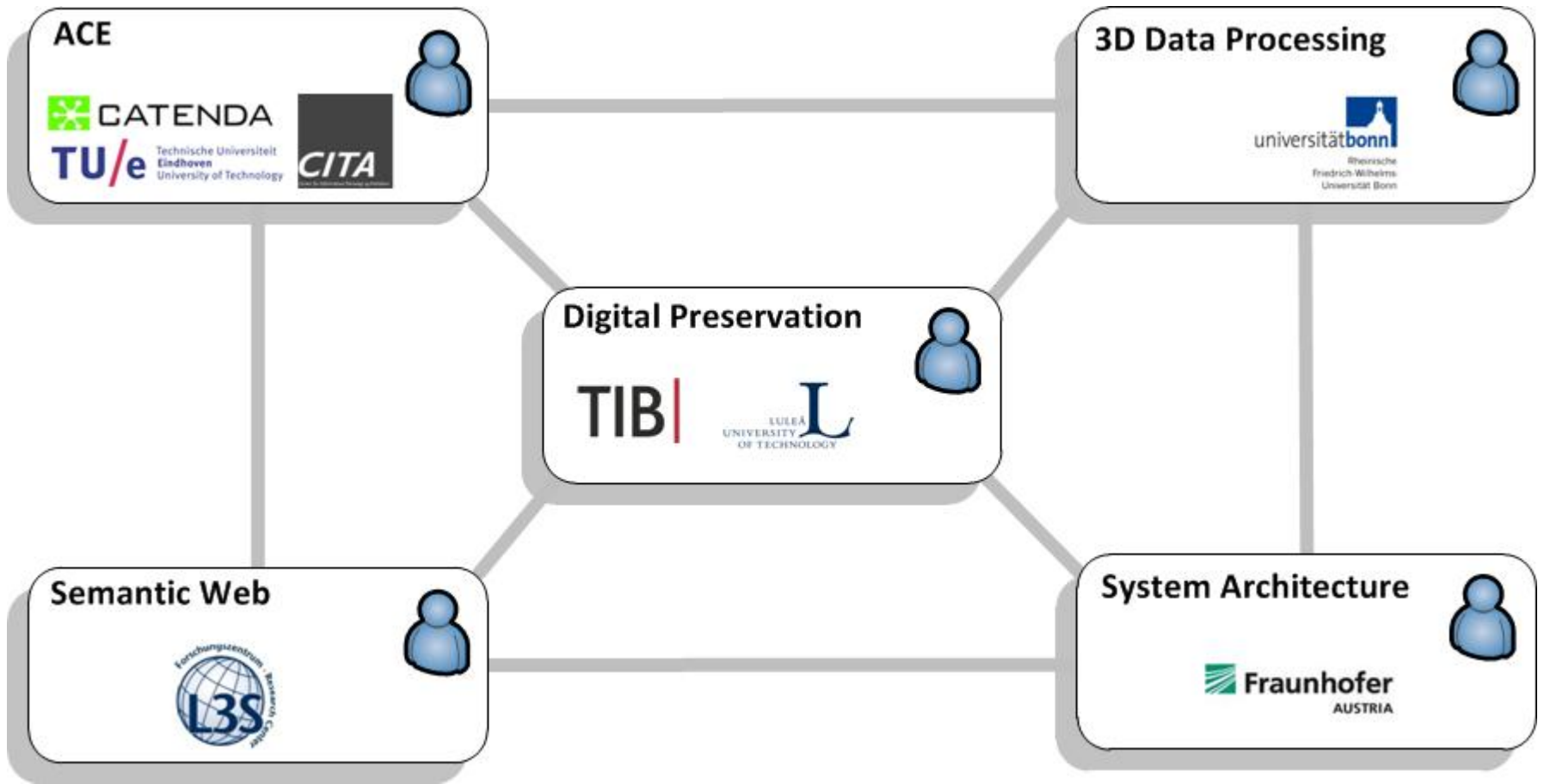
- interlinked curation and preservation workflows
- focus on two open file formats: IFC and E57
- incorporate existing OAIS compliant digital preservation system



(a) 3D model.

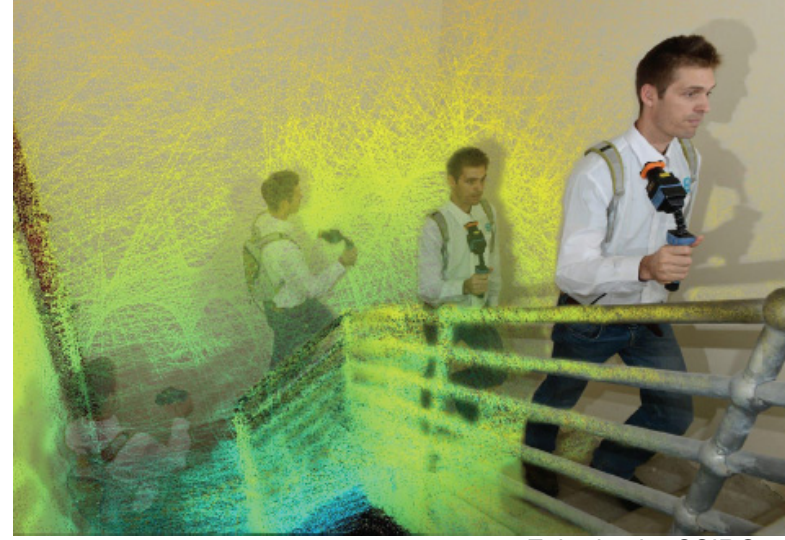
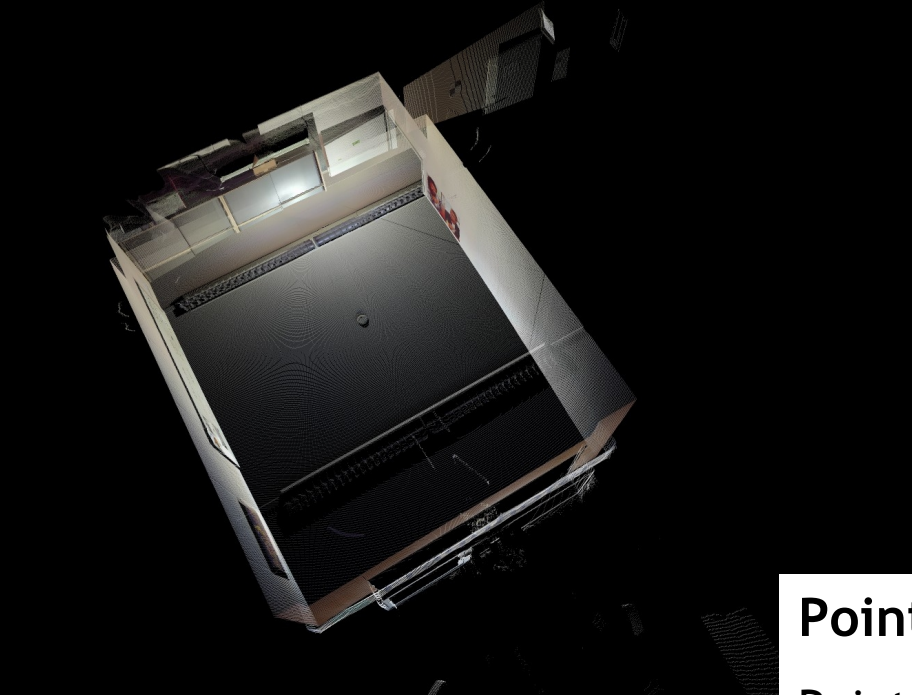


(b) Example laser scan.



DURAARK - an interdisciplinary project





Zebedee by CSIRO

Point clouds

Point clouds are a set of points in a 3D (X, Y, Z) coordinate system which describe the external surfaces of a scanned object.

While other domains may use post-processed NURBS models or 2D slices as the 3D scan reconstruction, the architectural and construction domains work directly with point clouds.

E57 - ASTM E2907-11 Standard



ScanCopter by FaroLabs

3D building data - scans

3D CAD

Geometry along X-Y-Z axes



4D CAD

Schedule time



5D CAD

Cost-related information



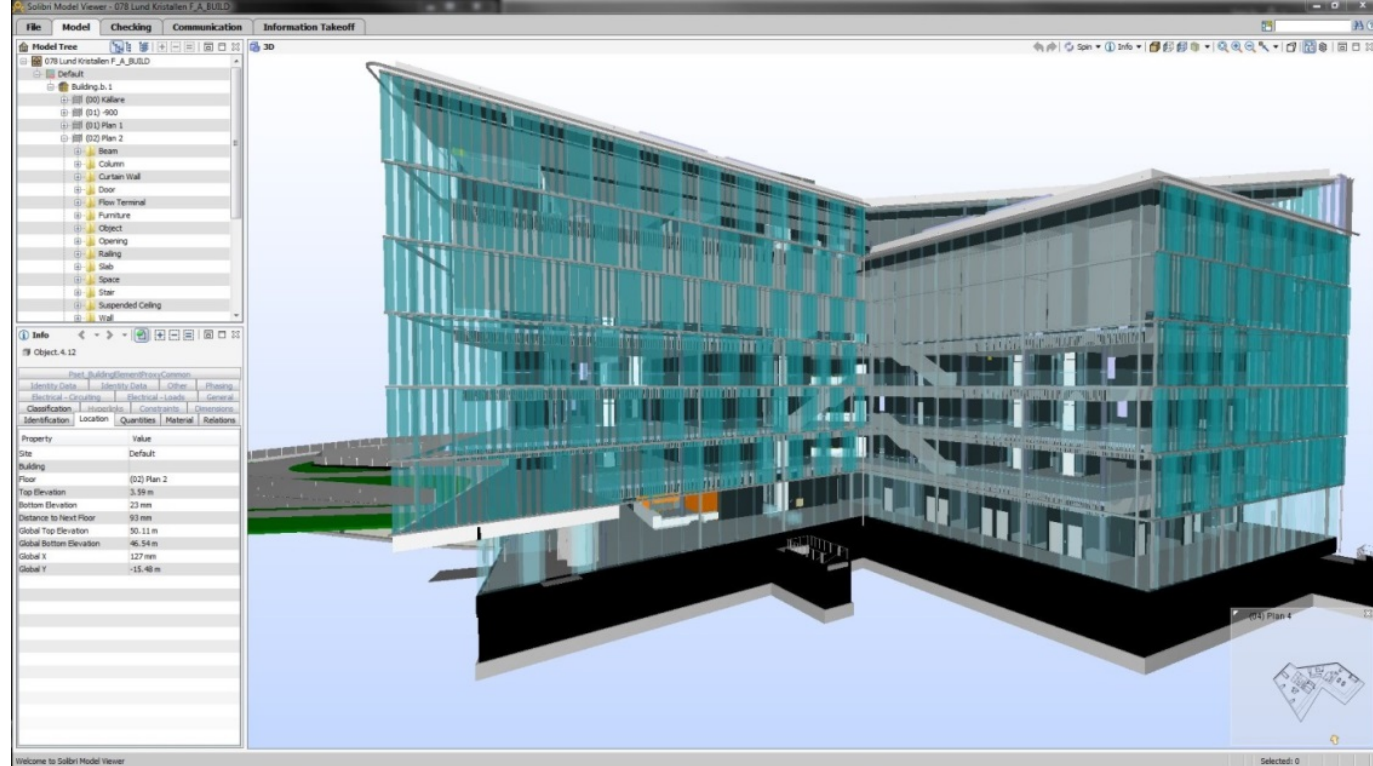
6D CAD

Energy and sustainability



7D CAD

Facility management



Building Information Modelling (BIM)

Lund Cristallen by DURAARK partner CCO architects

Moves beyond CAD by covering the entire design-to-construction process (including: project planning, cost, part specifications, construction time, ...)

IFC - based on STEP standards (ISO 10303), ISO16739:2013

3D building data - models

Why? Stakeholder need to be identified to understand ...

... how data is created, processed and used

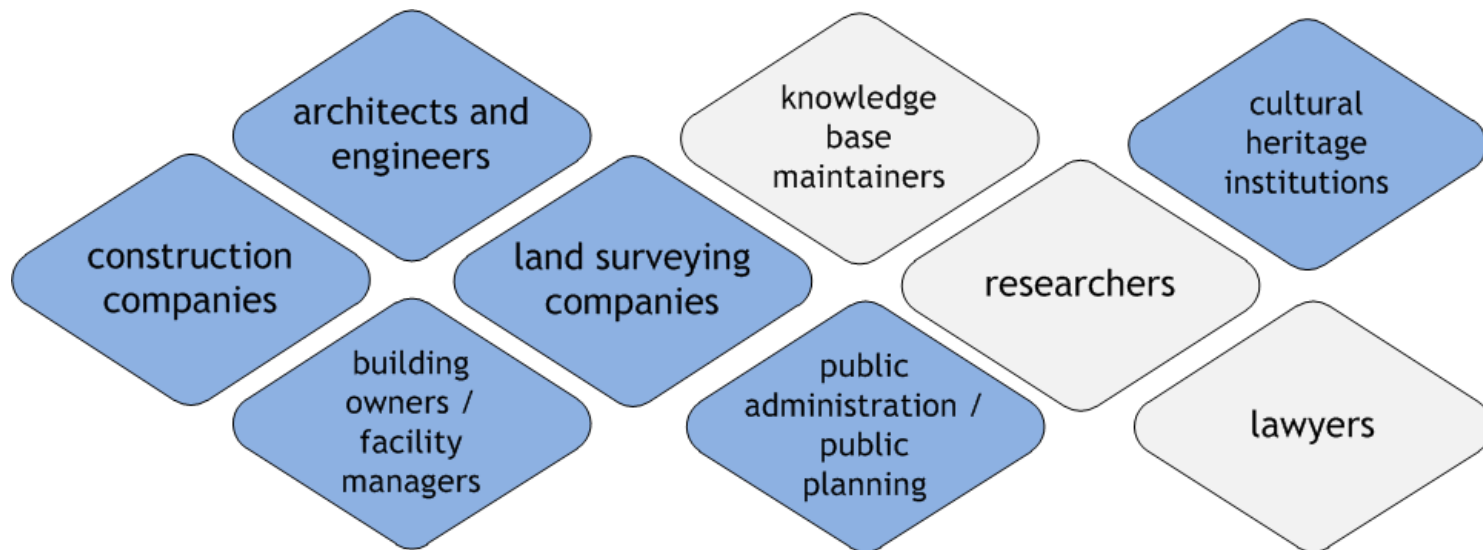
... where data is already being stored / archived

... where data (long-term) availability would be beneficial, but is not in place

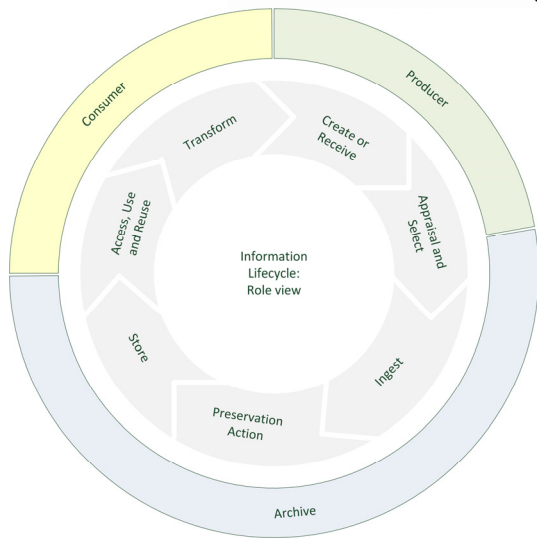
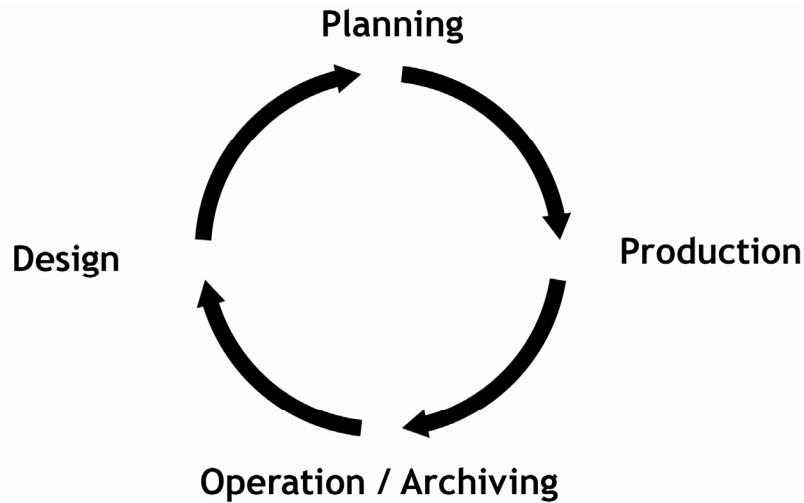
... what level of digital preservation knowledge / risk awareness can be assumed




→ To identify gaps which need to be closed in curation & preservation practises for the respective data

→ (... and the OAI says so ...)



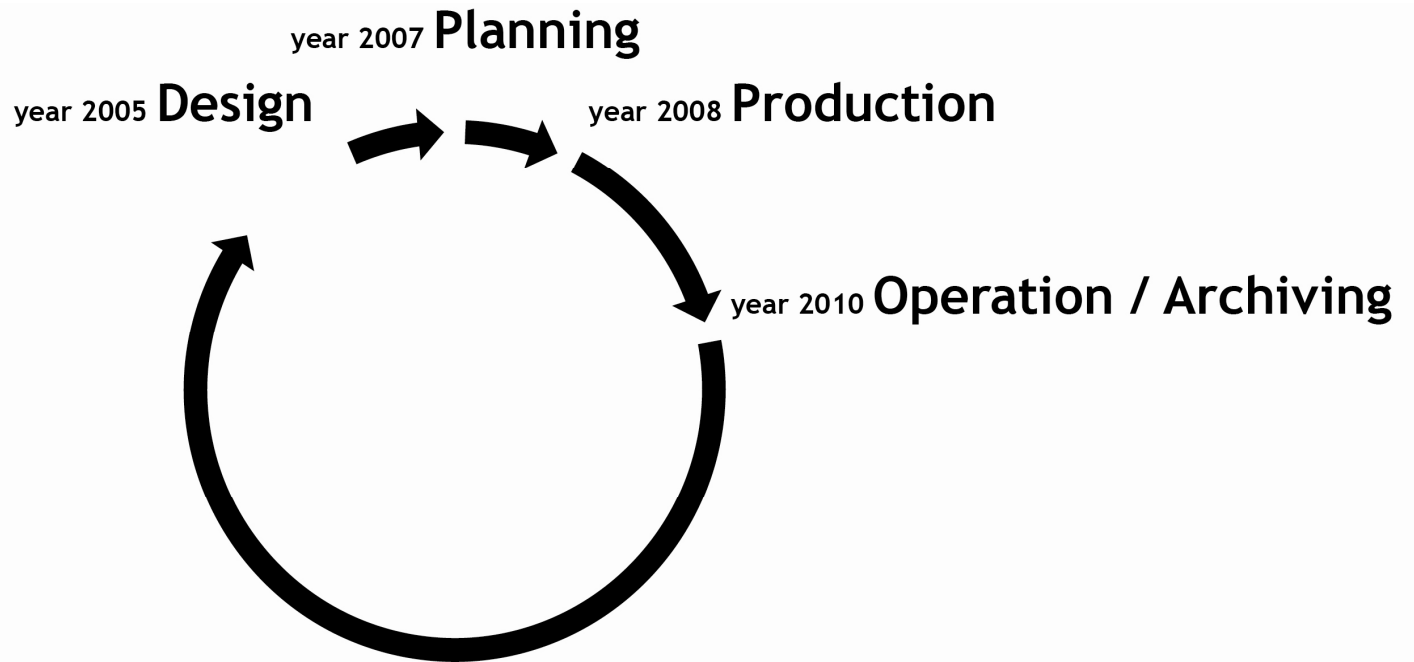
How do you explain digital preservation to your stakeholders ?



	digital object	
semantic preservation	conceptual object	authenticity, interpretability "How to understand/ interpret the data?"
		
logical preservation	logical object	logical preservation "How to open/render the file?"
		
bit preservation	physical object	bit preservation "How to keep the 1s and 0s?"
		

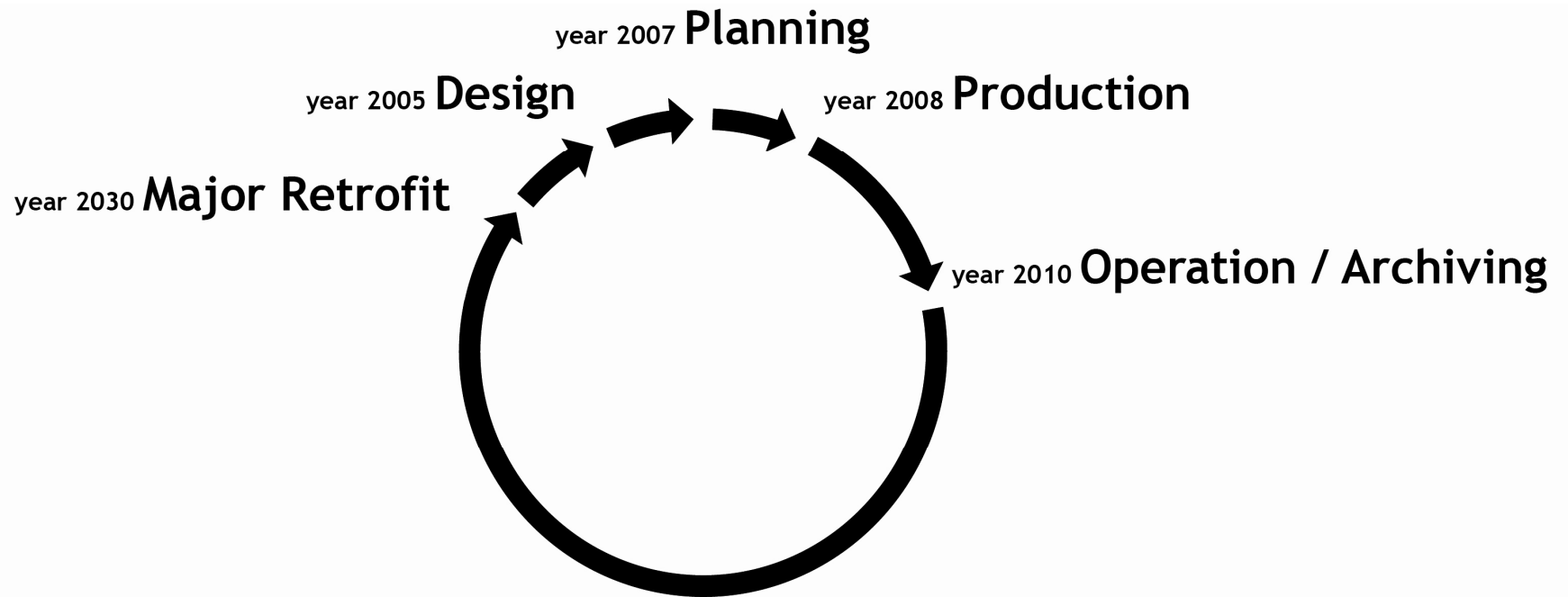
Different models





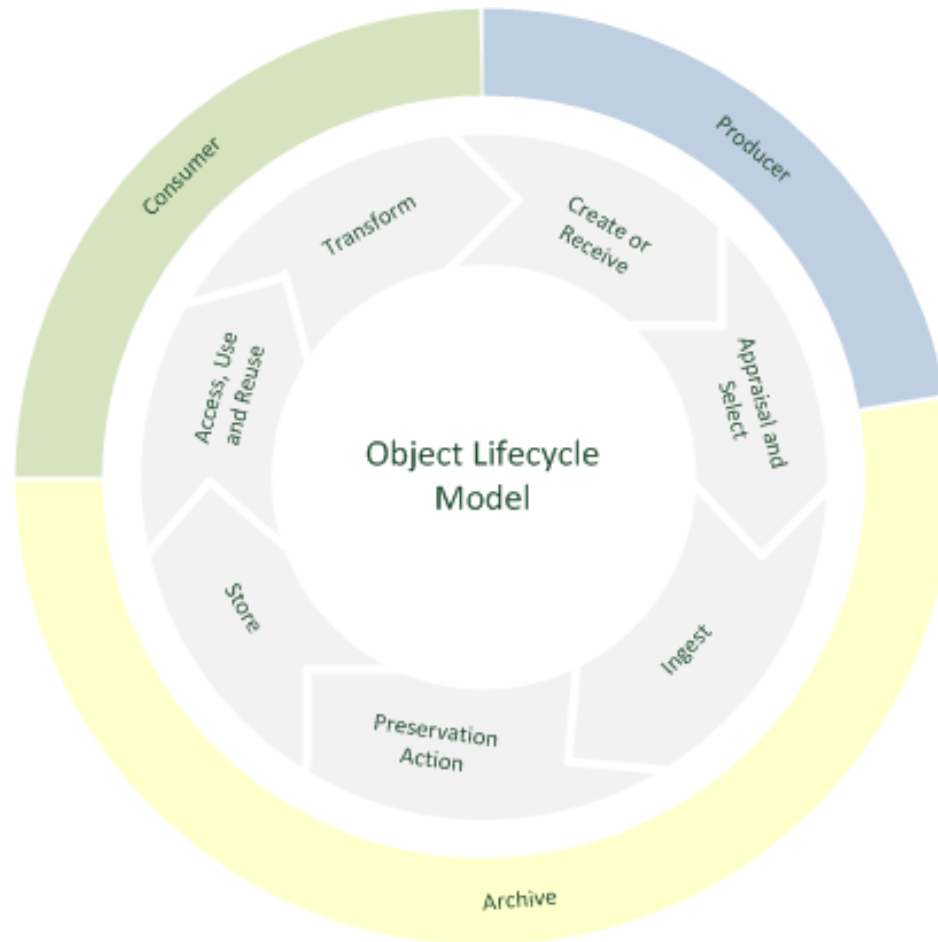
Design-to-Construction-to-Retrofit Model





Design-to-Construction-to-Retrofit Model





Based on DCC Digital Curation Lifecycle Model

Digital Object Lifecycle Model



Land surveyors and 3D scanning companies



The screenshot shows the website for LE34, a company specializing in 3D scanning and surveying. The page features a navigation menu with categories like 'Nyheder', 'Om os', 'Ydelse', 'IT&GIS', 'Projekter', and 'Kontakt'. Below the menu, there are sub-categories: 'Kommuner', 'Infrastruktur', 'Forsyning', 'Byggeri', and 'Privat'. The main content area displays an article titled 'Scanning som As-Built dokumentation' (Scanning as As-Built documentation). The article includes a photograph of two people using a 3D scanner on a tripod. The text discusses the benefits of 3D scanning for documentation and quality control in construction projects.

LE34

Nyheder Om os **Ydelse** IT&GIS Projekter Kontakt

Kommuner Infrastruktur Forsyning **Byggeri** Privat

Tradition for innovation

3D Projektgrundlag

3D As-Built dokumentation

Scanning til renovering

Maskinstyring

Udstykning af løjgheder

Find...

Scanning som As-Built dokumentation

Flere og flere byggeherre stiller krav til arkitekter og entreprenører om at dokumentere den endelige levering af et bygge- og anlægsprojekt.

3D Scanning er oplagt at benytte til dette formål, da målingerne automatisk inkluderer alle eksisterende fysiske forhold. Ved en sammenligning af to scanninger, der er foretaget fra samme lokalitet, vil man nemt kunne registrere og dokumentere alle ændringer.

Kvalitetssikring

Ved opmåling under byggeprocessens tidlige faser, kan man sikre, at der er overensstemmelse mellem design og virkelighed.

Opdag unøjagtigheder

3D scanning bruges derfor også til kvalitetssikring løbende, da selv små unøjagtigheder i byggeriet på denne måde kan opdages i tide ved gennemgang af opmålingerne. Derved kan mulige problemer tilrettes, så projektet færdiggøres til tiden og til budgettet.

LE34 +45 7733 2222 info@le34.dk DS/EN ISO 9001

- Interface with all other parties in the building industry and at all points of a building process
- Exclusive user of 3D scanners in AEC
- Challenged by BIM → need to adapt their practice to provide project and client specific data
- Little incentive for long-term archiving

Typical software:

Faro Scene, Bentley Pointools, Trimble RealWorks, AutoCAD, Revit

Stakeholder results (1)

Architects and engineers

ERIK MOLLER



CATEGORY
EDUCATION
CHURCHES
CULTURE
BUSINESS AND INDUSTRY

TYPE

Erik Møller Arkitekter Flæsketorvet 75 D

NYHEDER PROJEKTER PROFIL FILM KONTAKT ENGLISH



NY BOG OM #
16-10-2013

Vi er med i den ny
projekter, Green Li
Det er anden gang
arkitekter, bogen e



ERHVERVSSK
08-10-2013

CCO dellager i et v
På initiativ af Leif F
provins Limpopo. E
hjælper derefter m
også tilbyde mad, i
har indtil videre sik
dagen. Skolen byg



E. PIHL & SØN
07-10-2013

Efter nogle uger m
er vi rigtig glade fo
byggerierne igen k

NAVITAS i Århus e
Glostrup P-Hus. Vi

- Interface with all other parties in the building industry
- Embrace BIM
- BIM is hard to integrate in retrofitting
- Flexible business processes
- Little incentive for long-term archiving

Typical software

Revit, Navisworks, Velux Daylight Visualizer, Bentley Microstation CAD and BIMAutoCAD, SketchUp, Revit, NavisWorks, Dalux Model Checker, Ecotect Analysis, Vasari, Flow Design, AutoCAD, Revit, Solibri

Stakeholder results (2)

Construction companies

Danish ▾ Mine sider Søg projekt, service, person 🔍

PROJEKTER JOB OG UDDANNELSE BÆREDYGTIGHED

NCC

LEDIGE STILLINGER

NCC byder på mange job- og karrieremuligheder. Uanset om du ønsker et job som projektleder, entreprenør, håndværker eller noget helt andet, eller er på jagt efter en praktik- eller læreplads.

[Ledige job](#) [At arbejde i NCC](#)

KONTAKT OS

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info@ncc.dk

[Kontakter](#) [Nyheder og presse](#)

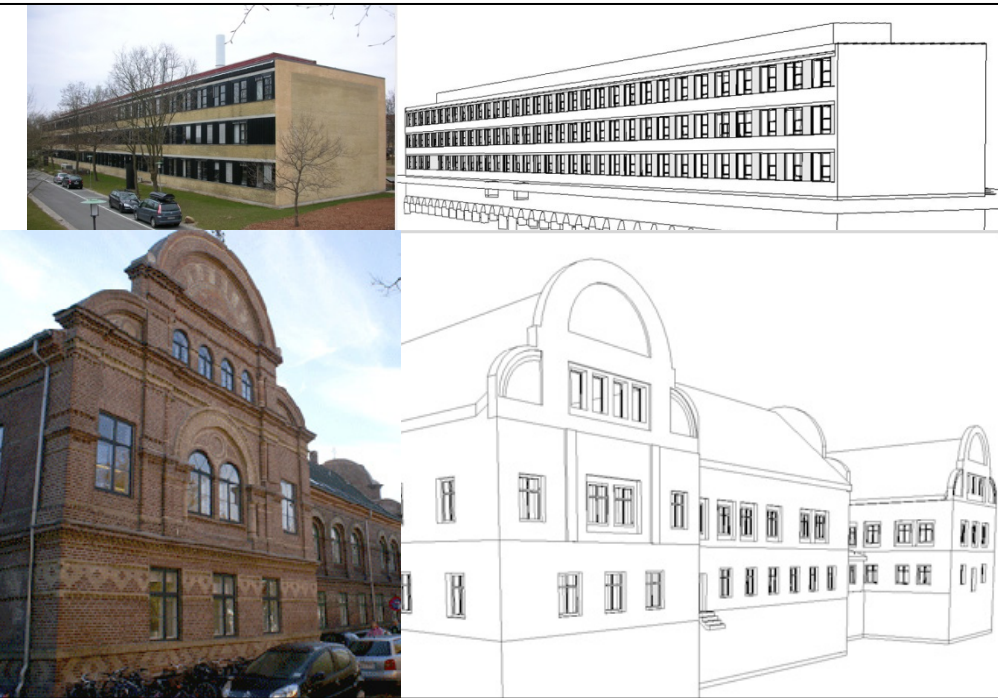
- Interface with all other parties in the building industry
- Enforce BIM on partners and demand enriched data
- Data quality is major concern
- Fixed business processes
- Incentive for long-term archiving until 5 year building review

Typical software

ArchiCad, Revit, Tekla, NavisWorks, Solibri

Stakeholder results (3)

Building owners / facility managers



- Interface with all other parties in the building industry
- Major driver for BIM
- Enforce BIM on partners and demand enriched data
- Data diverge from building data
- Establish currently 3D based facility management systems
- Strong incentive for long-term archiving

Typical software

Revit, Da Rufus, Da Tia, Dalux FM, Dalux BIM Checker, Solibri, Caretaker FM, AutoCad

Stakeholder results (4)

Cultural Heritage Institutions

Work

Search Cammors Type Here Search

Scotland's national collection of buildings, archaeology and industry

Home

Resources

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Digital Archive Developments

RCAHMS, like a growing number of heritage organisations, is increasingly moving towards digital recording methods and now regularly receives archives containing digital files from external depositors. The aim is to build our own secure digital archive that will meet with emerging international standards.

Digital Archiving Issues

Digital files bring a range of new problems for us to face if they are to be preserved in the long term. These issues include:

- Security
- Obsolete formats, software and storage devices
- Hardware failures

Our Digital Archive

At RCAHMS we are developing the digital archive with best practice in mind. Some of the areas in which we are carrying out work are listed below:

- Ongoing investigation of international best practice and consultation with organisations such as the Digital Curation Centre
- Production of robust standards for the digital component of our recording activities
- Creation of policies and procedures for the deposit of digital material with us
- Development of technological solutions for the preservation of digital files

Links

- [Digital Curation Centre](#)

- Preservation of current state of building in focus
- Preservation of records of older stages for historical value (but with what selection & appraisal criteria?)
- Hardly operate with 3d objects or BIM
- Strong incentive for long-term archiving

Stakeholder results (5)

Public Administration / Public Planning

Erhvervs- og Byggestyrelsen og Realdania
Forankring af Det Digitale Byggeri
Rapport
Juni 2009

bips

Handlingsplan 2003

Handlingsplanen har 5 hovedoverskrifter – foreløbige og **uprioriterede**. Fuldt uddybet skal handlingsplanen afspejle den samlede proces: Projekttering – produktion – drift.

Handlingsplanen skal tilgodese:

- Der skal opnås produktivitetsgevinst for virksomhedene her-og-nu, som sigter mod en mere rationel arbejdsproces og bedre information, men tillige styres efter et langsiget perspektiv med sigte mod værditilvækst gennem dataintegration, datagenbrug og kvalitetsvækst
- Der skal opnås en mere effektiv proces

mest aktuelle projekter:
Ert af handlingsplanens fokusområder indeholder en række projekter. Som nogle af de højst prioriterede projekter at få sat i gang fremhæves:

Opgeklassifikation
Bygningsdelstavle er fundamentet for digital behandling af data. bips har mange projekter - a. de følgende 3 - der færdiggøres, når en ny bygningsdelstavle er færdig og har skabt grundlag for at klassificere bygningsdelene og tilknyttede data. Der er i byggebranchen et stort behov for at få færdigudviklet en tavle, der kan fremme kommunikationen på tværs mellem bygningens parter.

Titelt bygningsdelskort
Formning af tegninger og beskrivelser foregår i dag digitalt, men er stadig 2 adskilte processer i projekteringen. Der er ikke en optimal forbindelse mellem disse to indbyrdes afhængige elementer. Det grundlag, der skabes i tegningerne, når ikke altid med i beskrivelsen omvendt. Der skal udvikles et elektronisk bygningsdelskort, som kan danne link mellem grafik og BPS skriveværktøjer og mellem objektet på tegningen og objektets egenskaber i beskrivelsen. Et elektroniske bygningsdelskort skal give mulighed for at arbejde med tegning og beskrivelse på samme side. Resultatet vil blive bedre sammenhæng og færre konflikter mellem projektets tegningsdel og skriveafdeling, fordi uoverensstemmelser afdækkes og løses tidligere og dermed et sikrere grundlag for udførelse og produktion. Formålet er, at de digitale data videreføres til de følgende, der således får en bedre mulighed for at sammenkæde data fra tegninger og beskrivelser.

Titleret arbejdsmetode
af grundpillerne i tegningsproduktion er BPS publikation 21. Fælles tegningsprincipper, 89. Nu er tiden imidlertid løbet fra publikationen, som er skrevet under forudsætning af papirbaserede dokumenter. Der er behov for at reorganisere terminologi, tegningsstruktur og dokumentstruktur i lyset af, at al projektering nu sker i form af CAD-tegninger og digitale dokumenter. Den nye "bips tegningsstruktur" skal være fundamentet i en fælles og optimeret digital arbejdsmetode i byggenet, hvor både procedurer, roller, dokument- og it-struktur reorganiseres og optimeres.

Processkriterier
Gælder for alle bips projekter gælder, at de skal bruges af de involverede parter og på tværs i byggeprocessen.

COWI

- Major driver of BIM
- More for efficiency and cost reasons, than for long-term preservation reasons
- In the following countries BIM is mandatory for (some) publically funded buildings: Denmark, Finland, Hong Kong, Netherlands, Norway, Singapore, UK, USA
→ out of those only Hong Kong does not require BIM in IFC
- These objects will be reaching archives / libraries in a few years !

Stakeholder results (6)

We now know **who**, **what** and **why**.

But **how** can the objects be preserved ?



digital object

semantic preservation

conceptual object

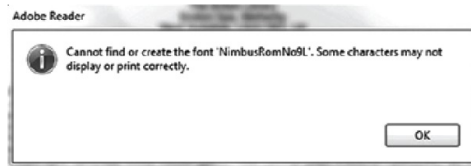
authenticity, interpretability
"How to understand/ interpret the data?"



logical preservation

logical object

logical preservation
"How to open/render the file?"



bit preservation

physical object

bit preservation
"How to keep the 1s and 0s?"



The 3 [preservation] layers of a digital object



Bit preservation

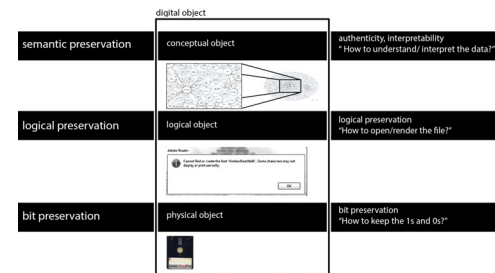
- integrity checks
- storage choice and location
- storage monitoring (including monitored redundancy) and disaster recovery planning
- organizational implementation of good IT practise

Logical preservation

- file format description, e.g. in registry
- Identification, technical metadata extraction, validation
- file format sustainability

Semantic preservation

- metadata capturing at all levels
- enrichment on ingest with additional information
- monitoring of sources
- Tracing and capturing changes in semantic information



The 3 [preservation] layers of a digital object



Bit preservation

„good information technology practise“ needs to be addressed at organizational level

Logical preservation

gaps relating to lack of tool support for identification, technical metadata extraction and validation; risk of dependency on external information

Semantic preservation

gaps relating to identification of knowledge bases, methods to monitor changes and to monitor the impact of entity changes within chosen graph; gaps relating to lack of methods to capture and preserve changing concepts

→ *Within the project we are currently working on closing these gaps.*

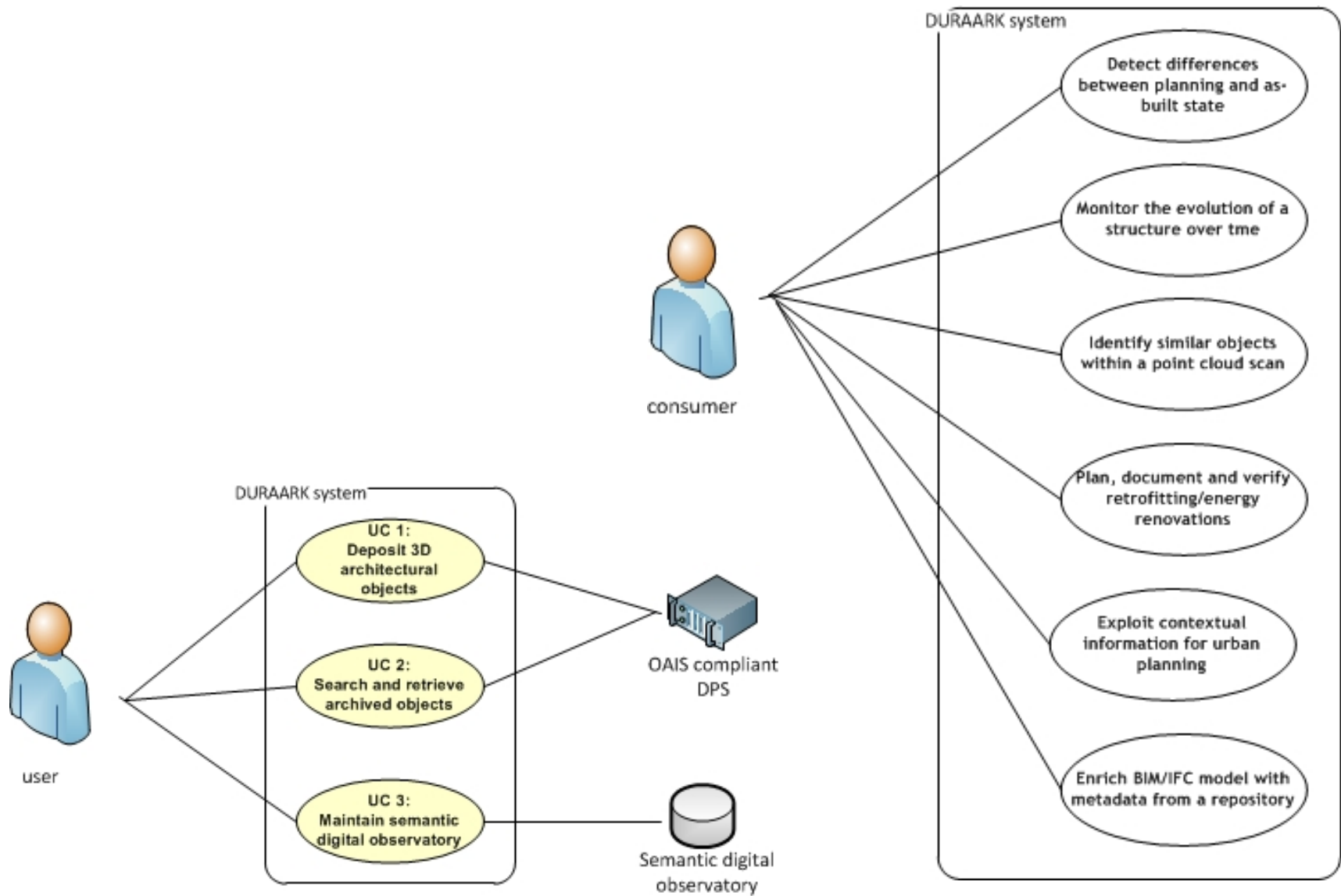


D6.6.1 Current state of 3D object digital preservation and gap-analysis report

DURAARK
FP7 - ICT - Digital Preservation
Grant agreement No.: 000000

Date: 2014-05-22
Version: 1.0
Document ID: Duraark/3DAD/04.1/1.0





DURAARK Use Cases

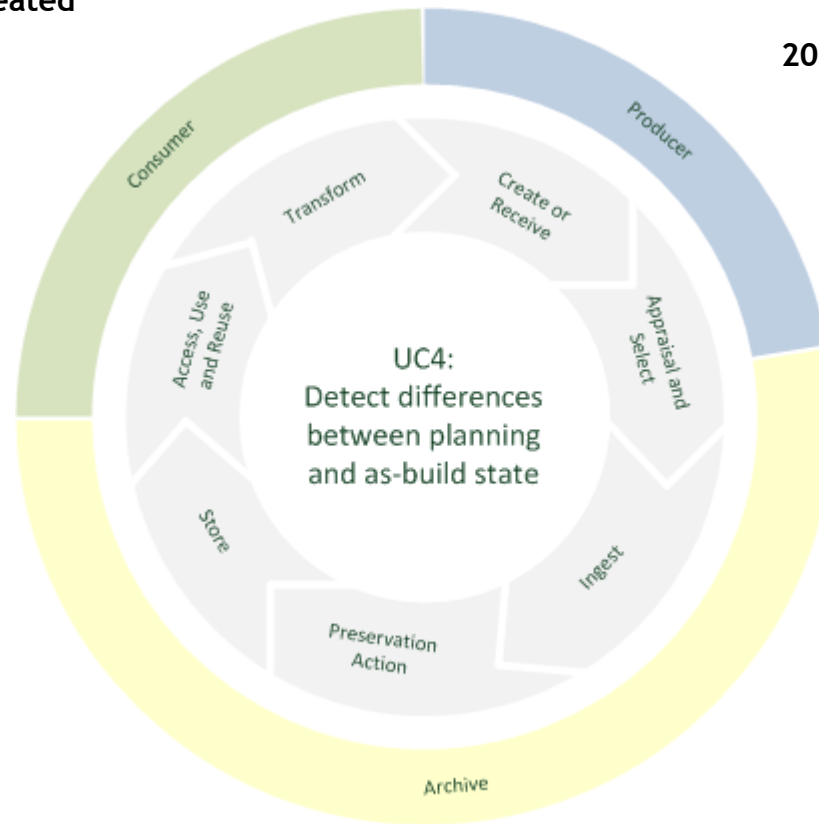


New object may be created

2013: Producer A creates plan

2016: Producer B creates scan

Consumer C accesses the objects → use case scenario (UC needs to be fulfillable, digital objects need to be accessible)



Information matching building in plan to building in scan needs to be available

Geometric enrichment needs to be conducted

Ingested objects can support the use case (needs to be documented)

Accessibility of digital object needs to be kept (and checked)

Executability of use case needs to be kept over the course of preservation action (needs to be checked)

Use case awareness in preservation processes



Fall workshops

- targeted at stakeholders with a long-term interest or mandate in 3D architectural data (as per stakeholder definition)
- includes demonstration of / feedback round on tools developed in the project so far (e.g. 3D-scan quality checker, registration tool of scan and plan, first draft of semantic digital observatory / semantic enrichment, metadata schema for descriptive metadata,...)
- proof-of-concept ingest into existing digital preservation system

Metadata work

- almost completed is „buildm“ schema for 3D-scans and plans
- technical metadata is currently ongoing

Tools

- technical metadata extraction
- quality checker for E57
- semantic digital observatory for pre-ingest enrichment



Outlook - the DURAARK vision



DURAARK
DURABLE
ARCHITECTURAL
KNOWLEDGE





Outlook - no more handovers like this !





DURAARK
DURABLE
ARCHITECTURAL
KNOWLEDGE

Do you have architectural
3D data? Contact us!

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Thank you. Questions? Suggestions?