

French National Project ReSeed

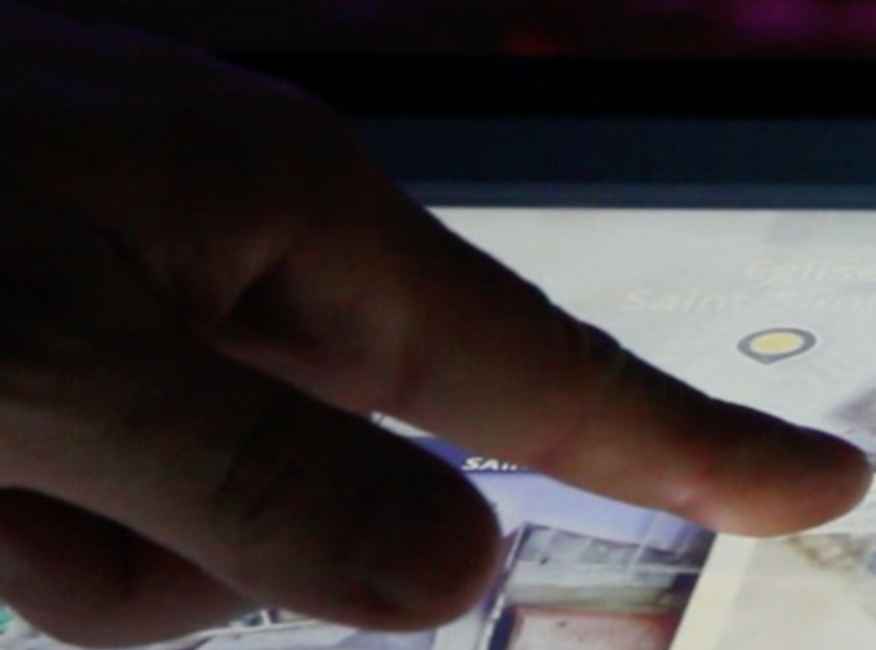
Semantic reverse-engineering of digital heritage objects

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Let's imagine you 'touch' history



Eglise
Saint-Similien



SAINT-SIMILIEN SUR LA MARQUE ET SAINT-SIMILIEN DE PIERRE-AUGUSTE

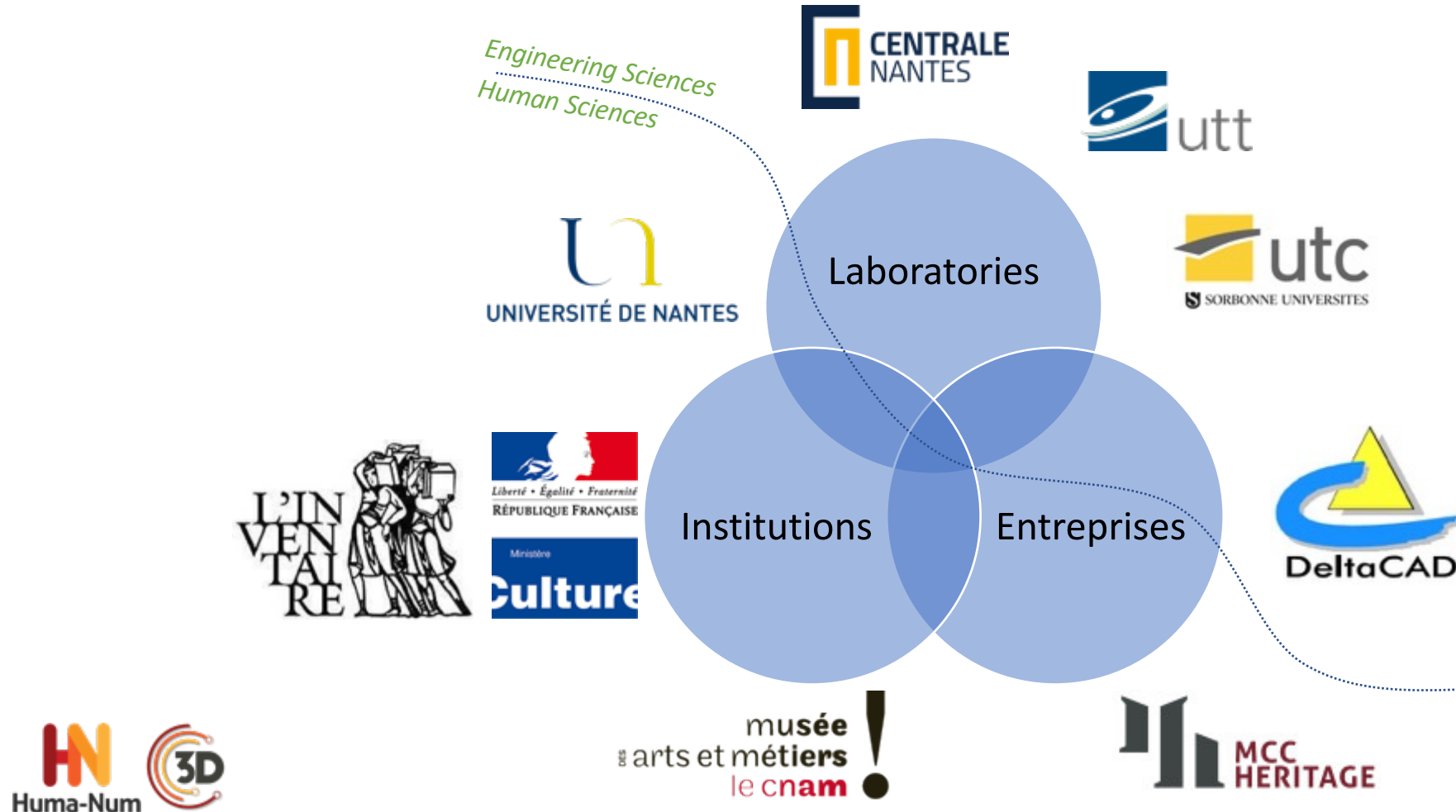


Project Identity

Acronym	<i>RéSeed</i>
Titre	<i>Rétro-conception Sémantique d'objets patrimoniaux Digitaux</i>
Title	<i>Semantic reverse-engineering of digital heritage objects</i>
Funding	<i>French National Research Agency (DEFI 7 - Axe 1)</i> <i>Information society and communication</i> <i>The Digital Revolution: link between Knowledge and Culture</i>
Time	<i>2016-2021 → 53 months</i>
Partners	<i>4 university labs, 2 private firms, the Ministry of Culture and one public museum</i>
Human Resources	20 researchers involved - 132 h.m
Budget	1 millions € global 650 k€ granted

Interdisciplinary consortium

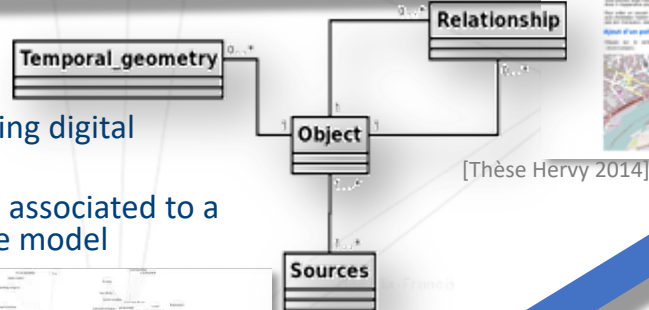
- 11 researchers inside the project
- + 9 specialized researchers when required



Semantical knowledge capture

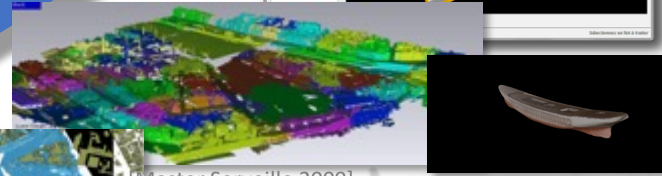
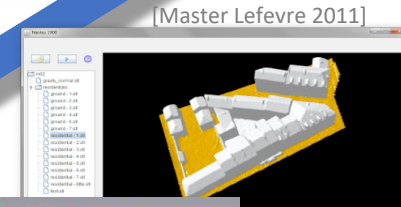
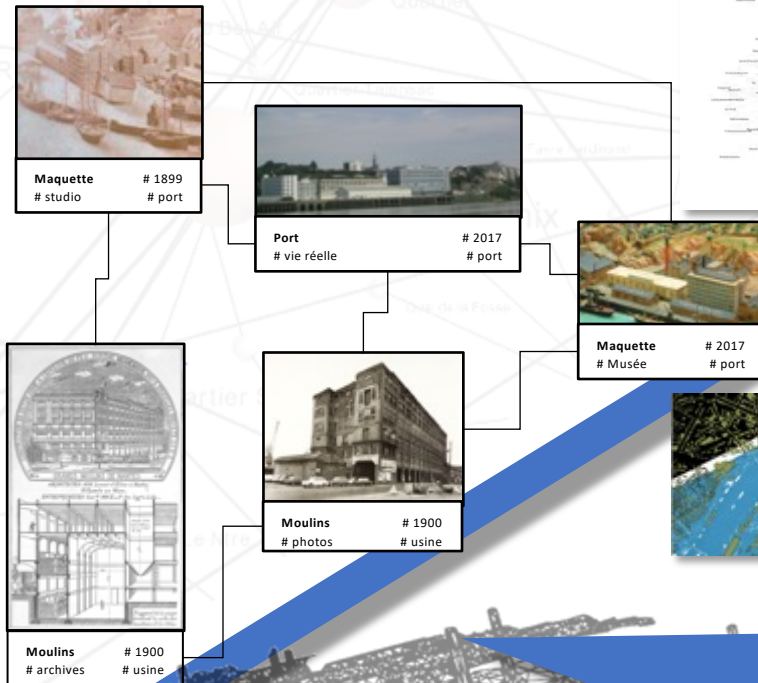
Contributions :

- ✓ Required to change historical practices using digital ways/thinking's
- ✓ Definition of a PLM dedicated to museum associated to a model for supporting historical knowledge model



Results:

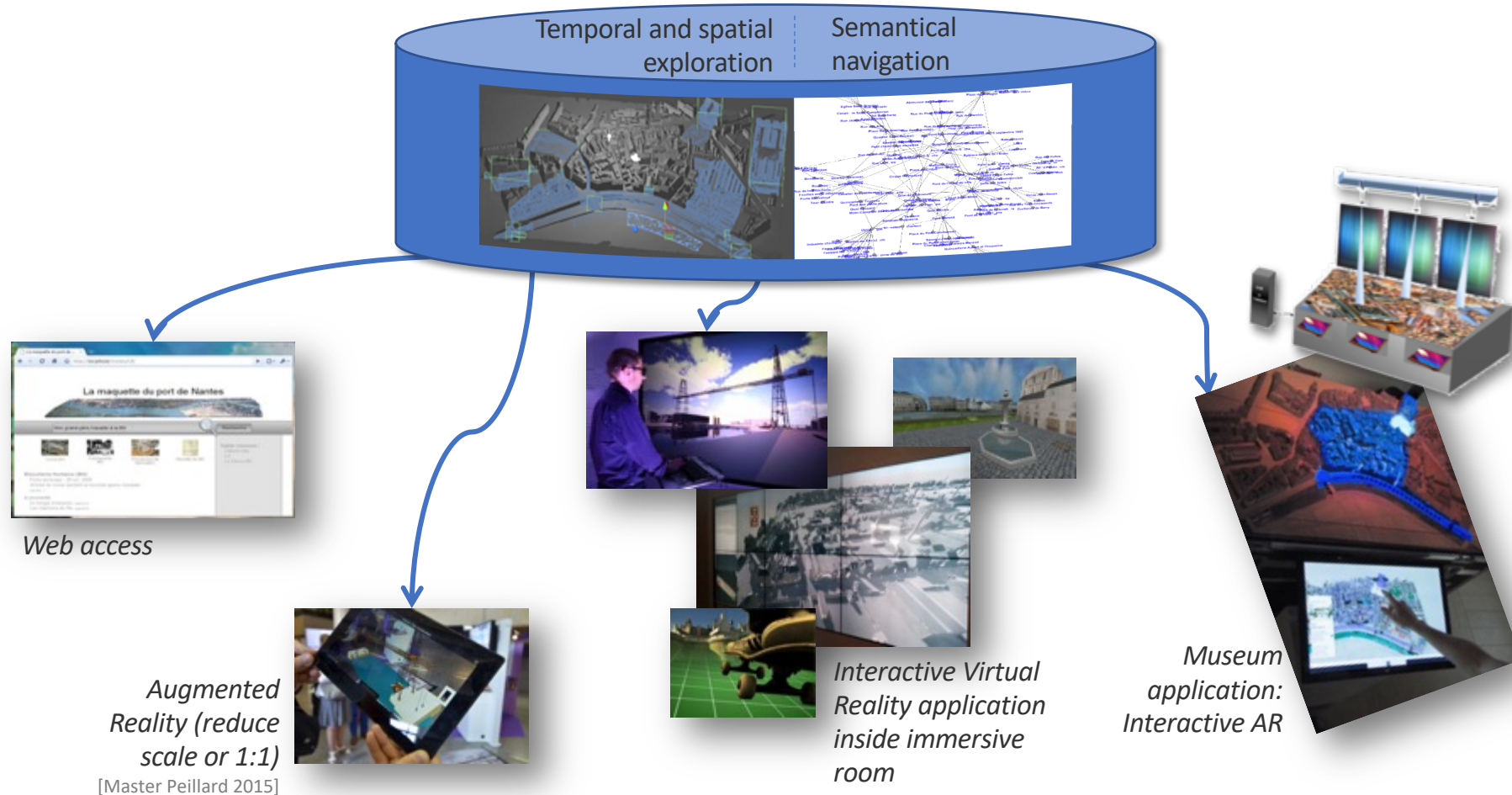
- ✓ 3D digitization of large scale mock-up (120 million points)
- ✓ Automatic reverse-engineering issues
- ✓ Create a link between real object and virtual object
- ✓ Using 3D in an in-situ museographic device



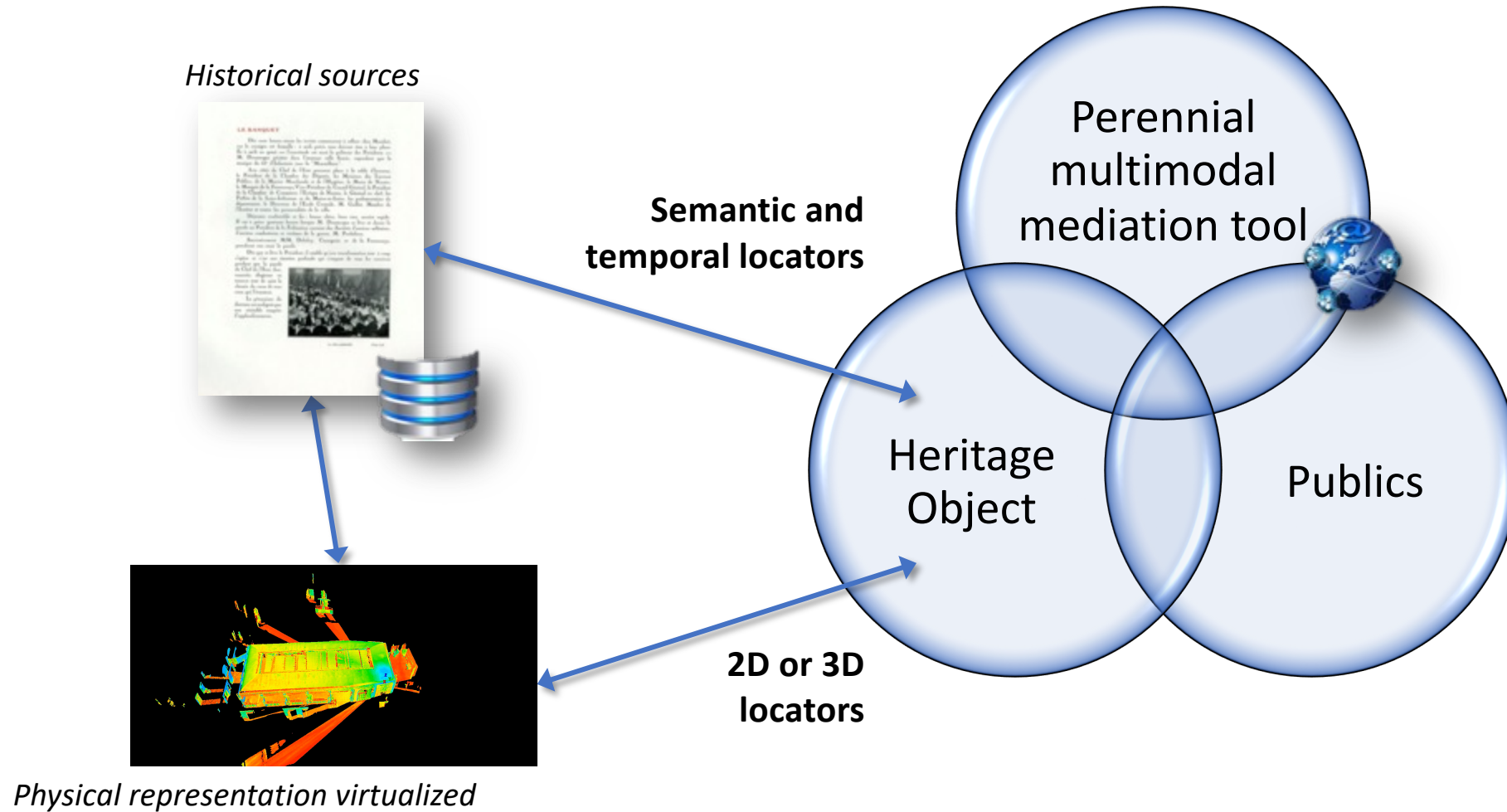
[Master Serveille 2009]

Geometrical knowledge capture

Creating interaction between real model and virtual model



Scientific hypothesis



Project objectives



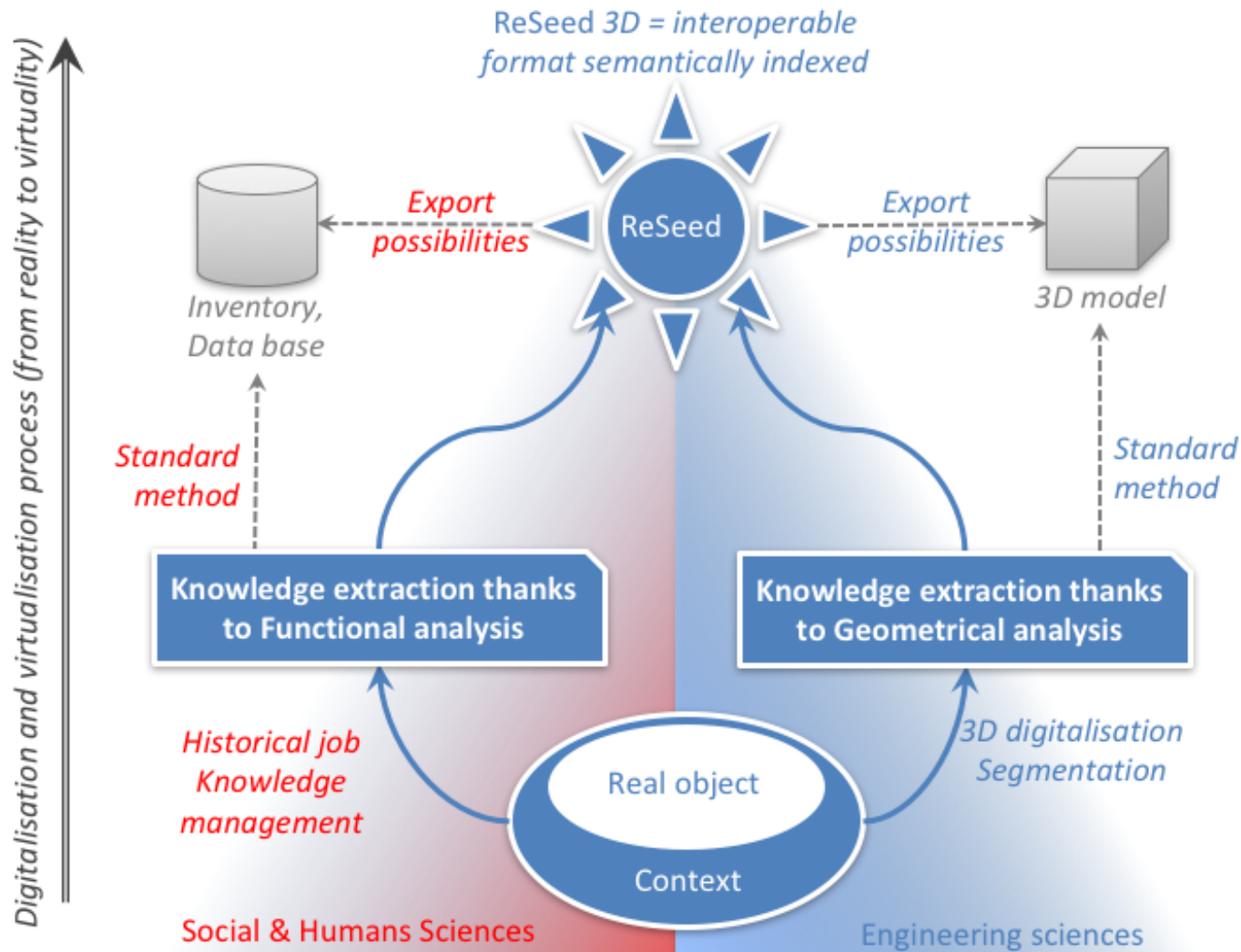
*How to open and deal with this
– big 3D file and only
focus on the information we
have on the cathedral?*



- ReSeed integrates the **principles and methods used in contemporary industry** - known as Enterprise 4.0 - in particular **Reverse-Engineering** = studying an object to determine its internal functioning or the manufacturing method
- Applied to heritage objects, it involves **modeling them in 3D** and **integrating historical, contextual, scientific and heritage knowledge**. Ultimately we want to be able to capture / conserve the **know-how** linked to these objects
- Establish a new **methodology, tools** and an **interoperable format** to build new ways to **capitalize, analyze** and **enhance** our heritage using digital tools
- **Connect communities** and their practices ... to create new **interdisciplinary skills**
- A project fueled by the case studies.

Usecase definition for www.ReSeed.fr

Scientific concepts



- Major scientific challenge is to allow the alliance of **semantic and physical digitization** of objects on the digital heritage cycle:

1. Digitalisation

Capturing traces of the object

2. Knowledge structuration

Digital modelisation of the object

3. Valuation - exploitation

Conservation

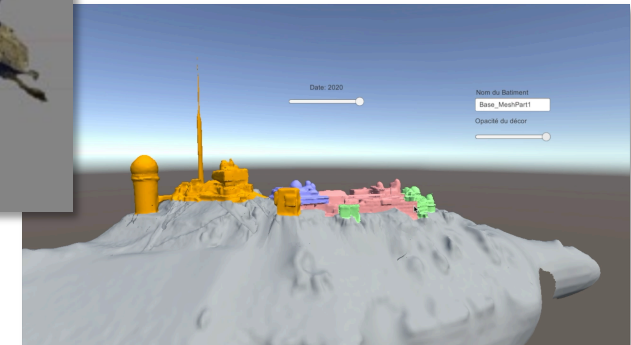
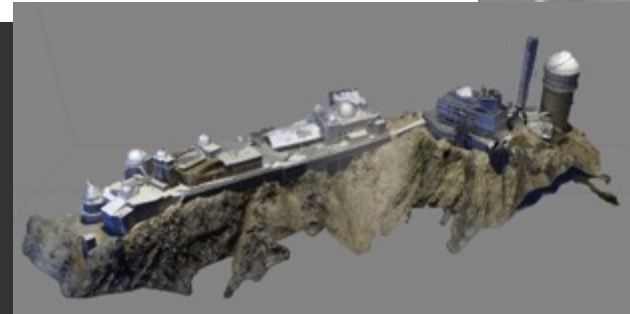
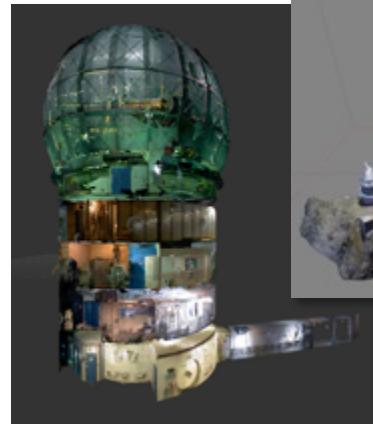
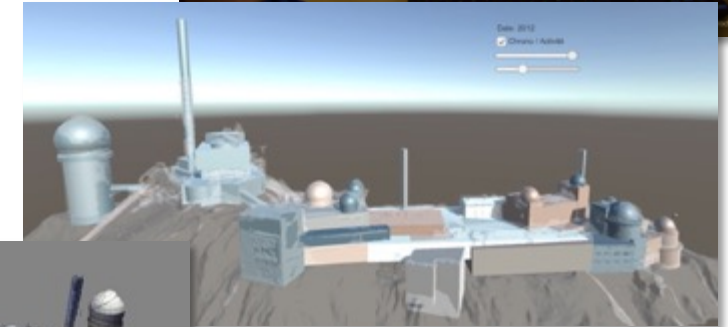
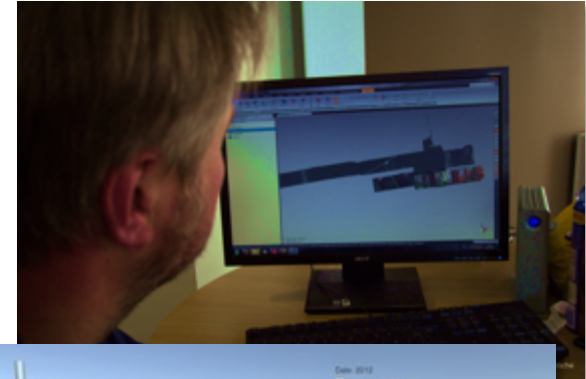
- Define **new methodological models, data models** and create **innovative computer file structures** in order to make all the results fully **interoperable** in the heritage environment.
- To be a tool to assist the **decision of experts** (ie for properties classified as UNESCO World Heritage), a collaboration platform that facilitates access and updating of data in a **multi-business view**

Use case 1: The Pic du Midi Observatory in the Pyrenees

- ✓ Complex scientific object which has evolved for over 135 years and which is still in activity
- ✓ A candidacy as a UNESCO world heritage is envisaged

Work done :

1. Indoor and outdoor 3D scanning
2. Significant documented database indexed and timed
3. A ReSeed prototype in Virtual Reality to demonstrate the evolution of the site

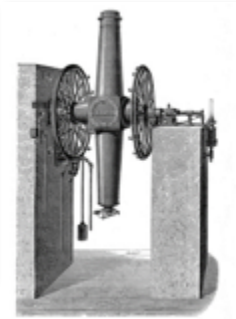


Use case 2: Observatory heritage: national series of lounges

- ✓ An exploded series of 13 unique instruments
- ✓ Objects with multiple statuses: functional, dismantled, visitable, not accessible...

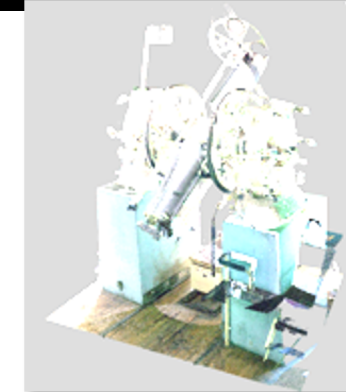
Work completed / in progress:

1. Mass digital scanning campaign for lounges
2. Automatic pattern recognition and semantic implementation to define the technical genetics of the object
3. Creation of a virtual document library
4. Creation of a virtual tool prototype to help space and time navigation



40 years of Eichens-Gautier meridian circles

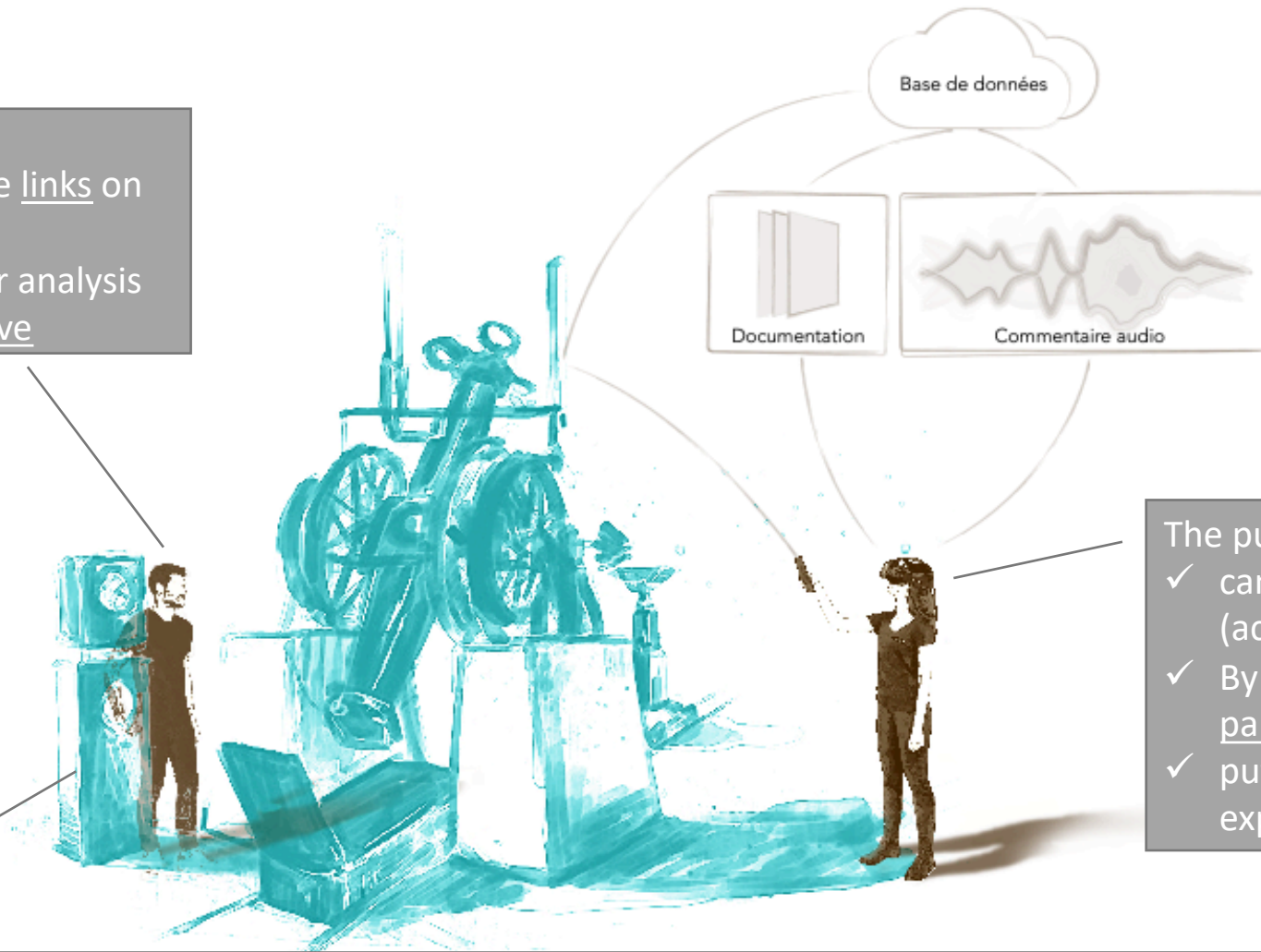
Observatory	Date	D circles	D opening	Focal length
Lima (Peru)	1868	1 m	19 cm	2.35 m
Paris	1877	1 m	19 cm	2.32 m
Marseille	1878	1 m	19 cm	2.30 m
Lyon	1879	80 cm	15 cm	2 m
Hendaye	1880	70 cm	15 cm	2 m
Bordeaux	1881	1 m	19 cm	2.32 m
Besançon	1885	1 m	19 cm	2.37 m
Alger	1888	1 m	19 cm	2.40 m
Toulouse	1890	1 m	19 cm	2.30 m
Rio de Janeiro (Brasil)	1890	1 m	19 cm	2.35 m
La Plata (Argentina)	1890	1 m	22 cm	2.80 m
Athènes (Grèce)	1899	1 m	16 cm	2.30 m
Tokyo (Japon)	1903	1 m	22 cm	3.10 m



Scientific results

The expert...

- ✓ can add informations, create links on the corpus (text and 3D)
- ✓ study and comment on their analysis to create a historical narrative



The public...

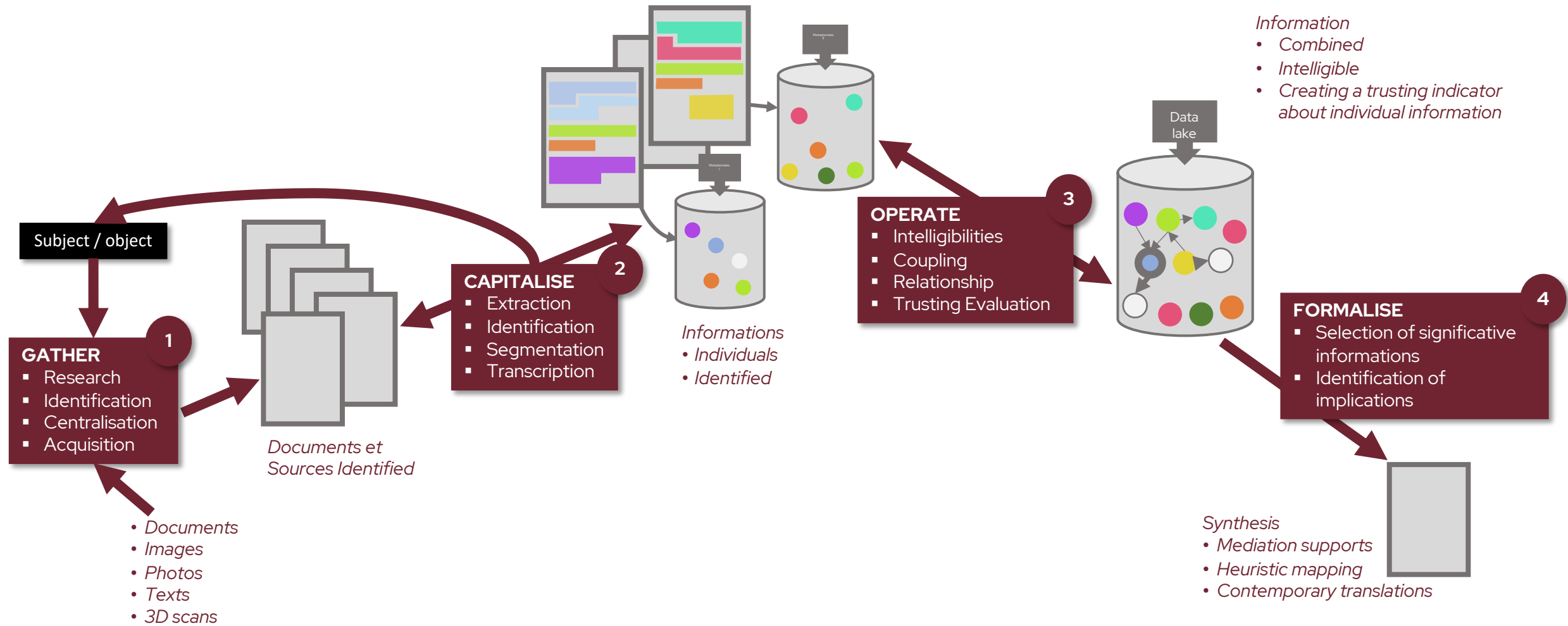
- ✓ can see / consult informations (access sources)
- ✓ By varying the time and space parameters
- ✓ put himself in the place of the expert to follow his story

The ReSeed tool = the « Swiss army knife » of heritage

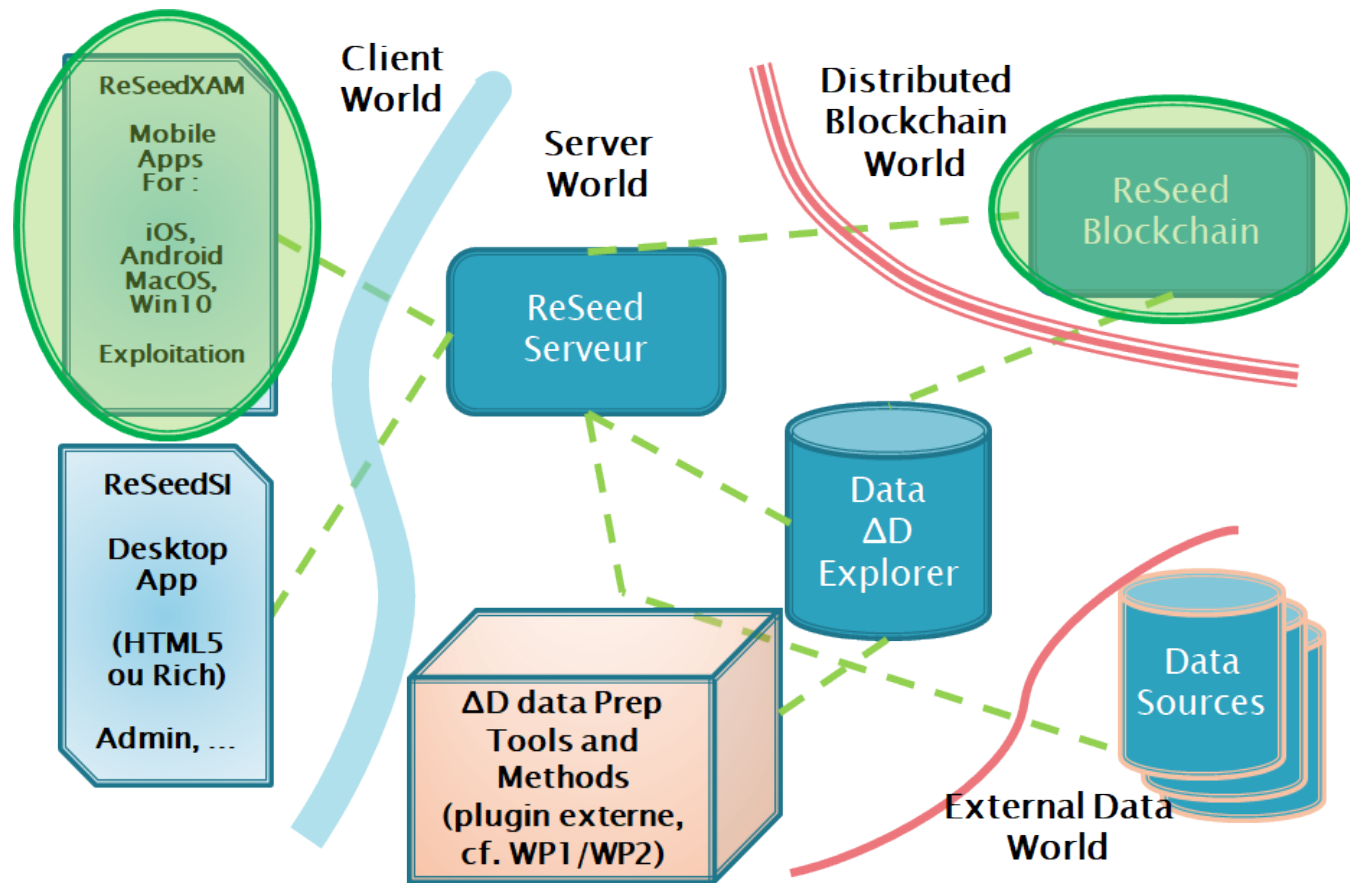
- Integrate multi-dimensions: spatial, temporal, granularity, semantics ...
- captures and structures heterogeneous data for both the expert and the public → guarantees integrity
- Integrates a system of certification and traceability of heterogeneous digital data and of the narrative (linking data) → guarantees authenticity
- Adapts to all types of Human-Machine Interfaces = touch screen, AR tablet, VR headset, standalone computer...



Conceptual framework of ReSeed



Technical results



Informatic infrastructure of ReSeed

The “Swiss Knife” Heritage

A multi-scale tool suitable for both small objects and complete heritage sites.

Multiple ReSeed plugins independent and adaptable to each situation:

- "ReSeedXAM ΔD Explorer" → spatial, temporal and semantic exploration of heterogeneous data
- “ReSeed App” with public version, pro version and several tools: “ReSeed Eye”, “ReSeed Snap”...
- "ReSeed Blockchain" supports traceability links as certification of the digital object
-

Interest of the approach:

- Ontological freedom / complexity
- Collaboration
- Decentralized storage
- Redundancy
- Version management



Prototype demonstration

Open your camera on your smartphone:

- 1. flash the QR code*
- 2. use the marker on the right to see in Augmented Reality*



ReSeed
prototype

DATA ACCESS USE



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www.reseed.fr

