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International Network for a Digital Cultural Heritage e-Infrastructure

Cases from Italy: Novel approach to 3D archeology, 3D semantics, open sources and open standards, experiences of geoparsing CulturaItalia

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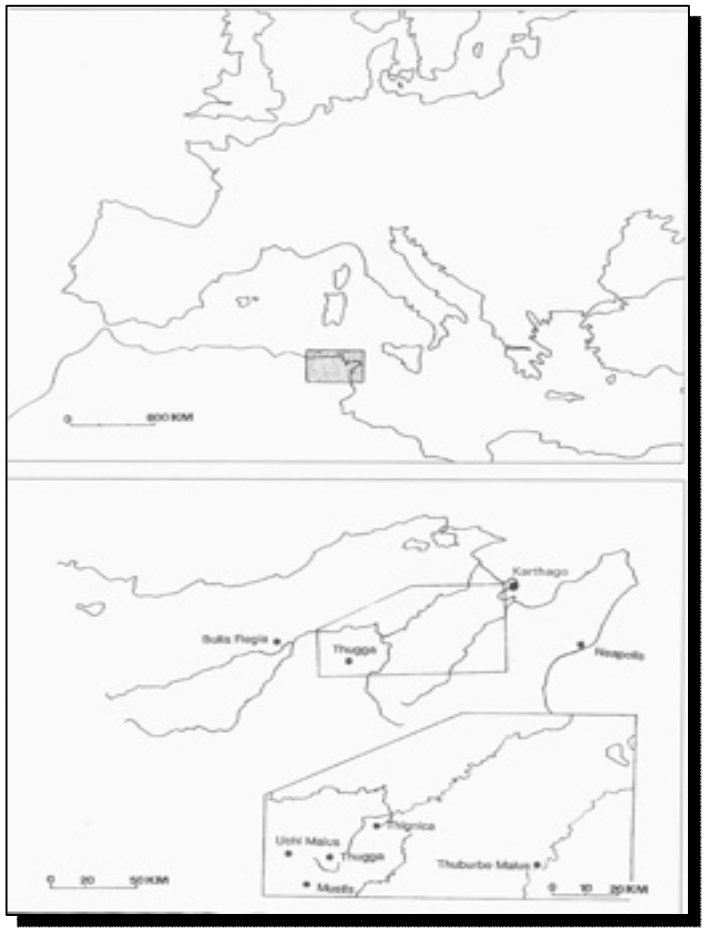
Goals of presentation

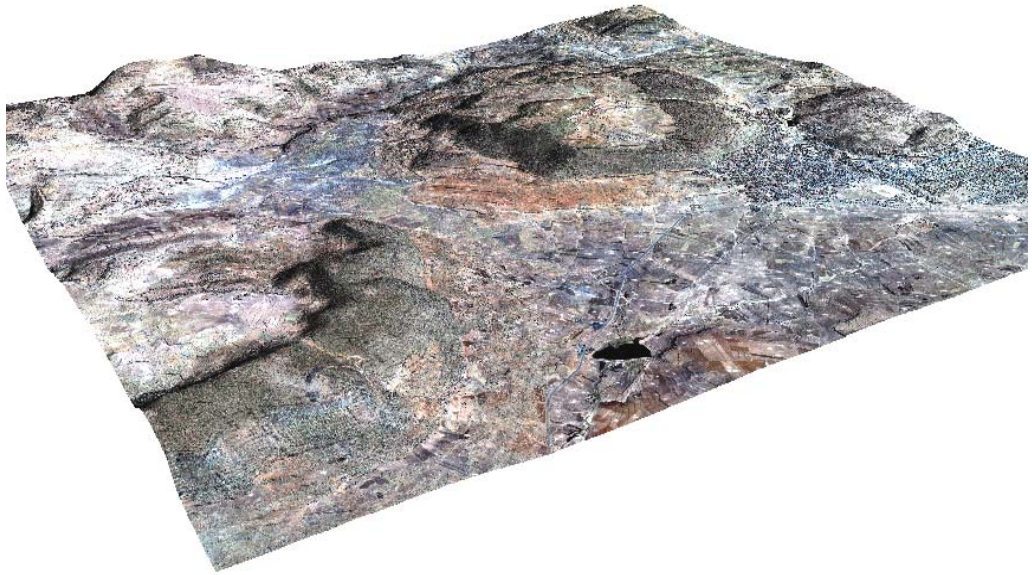
- Uchi Maius: best practices for 3D GIS archeological Solution

- CulturaItalia project: use case for managing georeferenced digital resources

Geographical background of site

Uchi Maius is located about 100 Km south of Tunis in a hilly region; the site is in the lowland of Mejerda in the area called Hencir ed Douamis on the left bank of the Oued Arkou river.

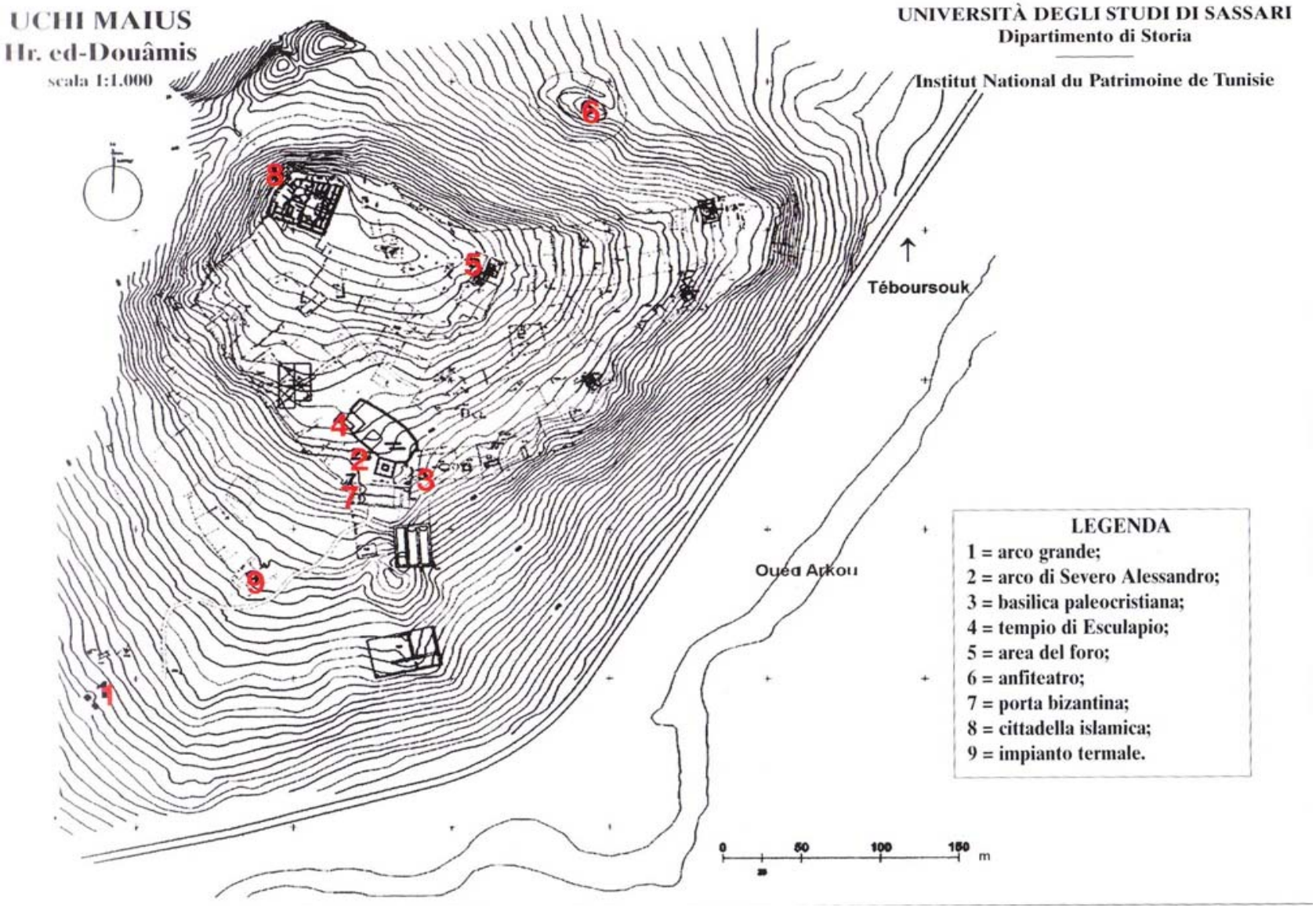




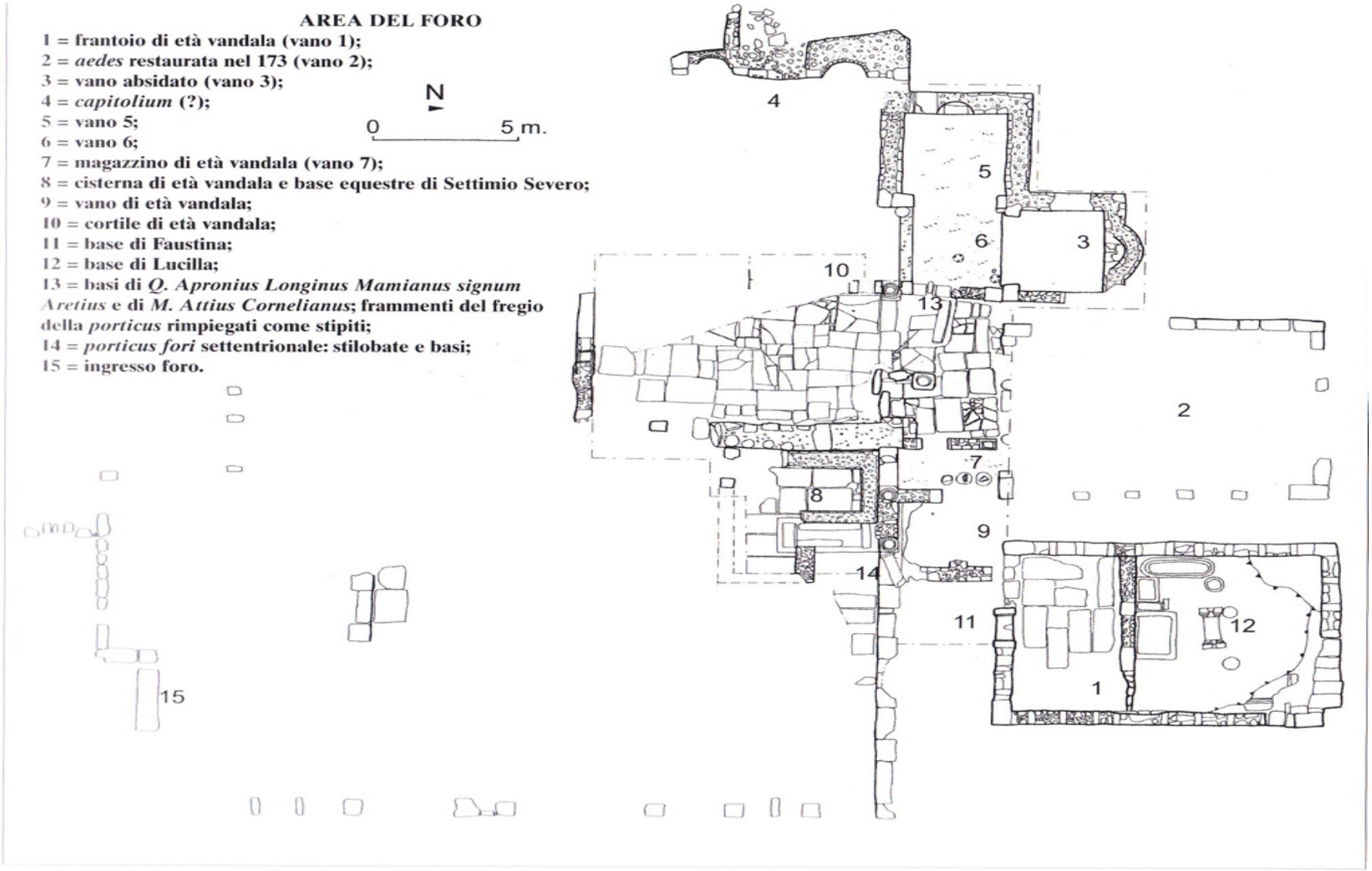
Historical background of site

The site was founded by numidian people in the V sec. b. C.
103 b.C after the Bellum Iugurtinum the veterans of Mario were installed in this aera
179 d.C Uchi Maius was named as “res publica Uchitanorum Maiorum”; in a ephigraph
197 d.C were maked a statue of Settimio Severo in phorum area.
207 d.C Settimio Severo founding the restored of the phorum.
230 a.C under the principate of Severo Alessandro, Uchi obtained the autonomy and the title of Roman Colony
411 d.C were cited in a ephiscopal conference the Vescovo of Uchi Maius Octavianus.
429 a.C vandal’s conquist of Africa
V sec a.C the city was still fluorishing. In this period there were many manufacture installations created by reuse of roman objects.
646 d.C were remember the Tripolius.
27 settembre 1882 the city was discovered by the French captain Valentin

Archeological investigation



Forum area



Disegno M. Biagini

The Archeological Process

The archaeological process is an unrepeatable operation documenting in an analytical way the excavation. For this reason we need:

SU (Stratigraphical Units Layers/Forms)
Photos
Maps, topographical plans, etc.
GIS platform

To share data in a scientific community, the solution adopted so far is represented by the development of standardized data-models.

But it is not enough !

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The best mode to share archaeological data is encoding them through a semantic approach.
And for 3D data?

✓ Normally, 3D models are encoded using proprietary format like dwg, 3d shape or 3ds, etc.

✓ Models developed by means of proprietary format aren't interoperable.

✓Although they are standard de facto it is impossible in general to use them to share the data

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Possible solution to the problem is the using of format XML oriented, but it is useful to make a distintion to different XML

	X3D	U3D	KML	COLLADA	IFC	CityGML
geometry	+	+	0	+	++	+
georeferencing	+		+		(IFG) +	++
appearance	+	+	0	++	0	+
topology	0	0		0	+	+
semantics	0			0/+	++	++
linking / embedding	+		++	++		++

Legend: 0 = basic, + = sophisticated, ++ = comprehensive; empty = not supported

CityGML feature

- Suitable for spatial data infrastructure
- Mappable on appropriate exchange format GML3
- Linkable to any CityGML feature more specialized, functional models or external data sources

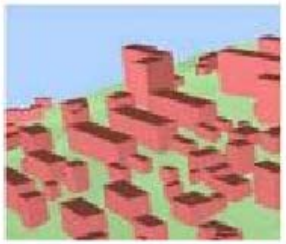
It can express four levels to encode the details (LOD)

- It is a subset of GML3 geometries:
  - Boundaries representation in absolute coordinates
  - It is directly manageable within 3DGIS / Geo DB

Unfortunately is developed for defining just modern feature

Different LOD of details

- LOD 0 – Regional model



- LOD 1 – City model

- LOD 2 – City model with explicit roof structure

- LOD 3 – Detailed architectural model

- LOD 4 – Interior Model

...our solution...

Our proposal consist of using of an integrated system composed by:

Blender software to develop the 3D model from the raw data of the total station

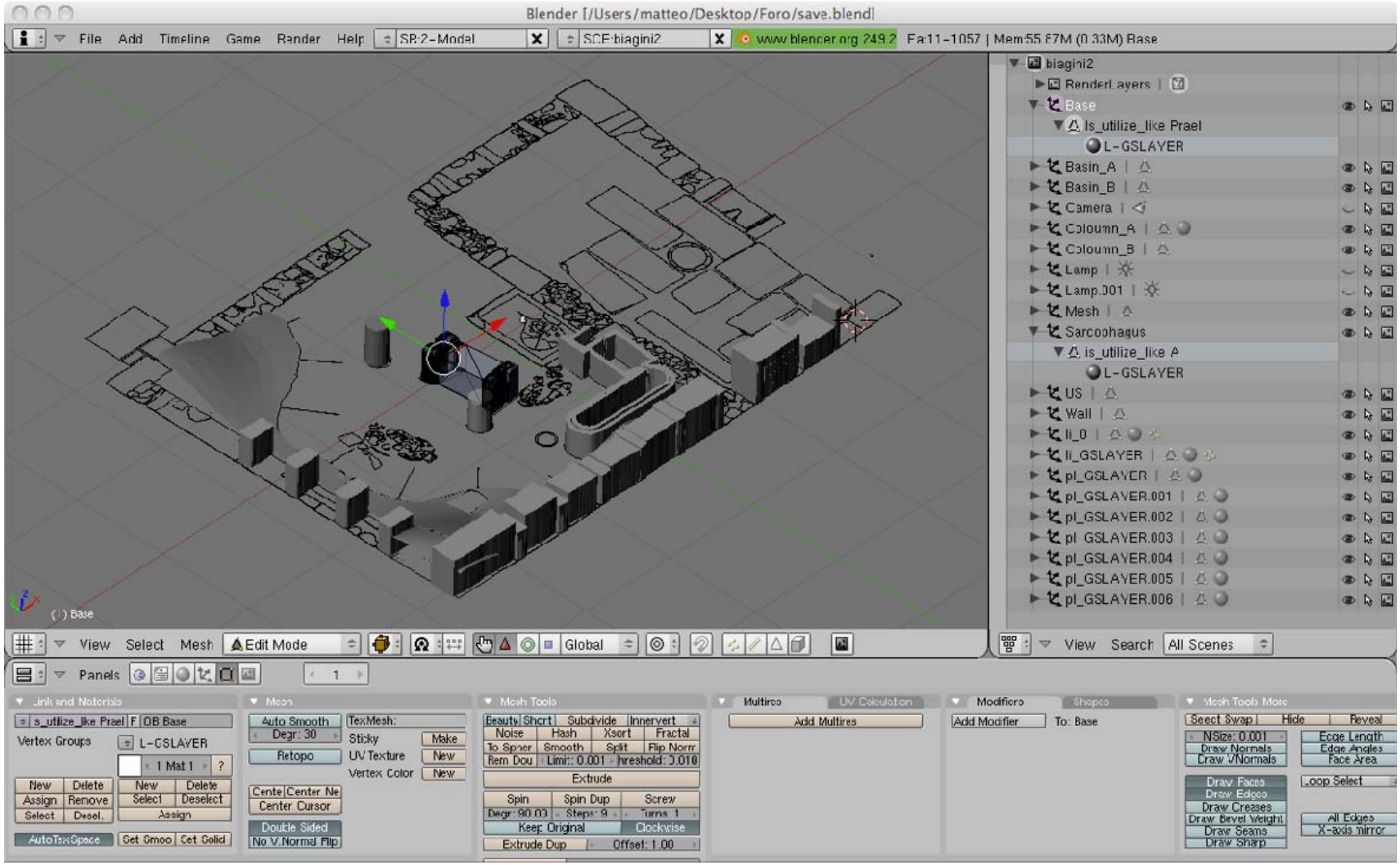
Protegè software for the development of the archaeological ontology based on CityGML schema

Grass GIS in order to

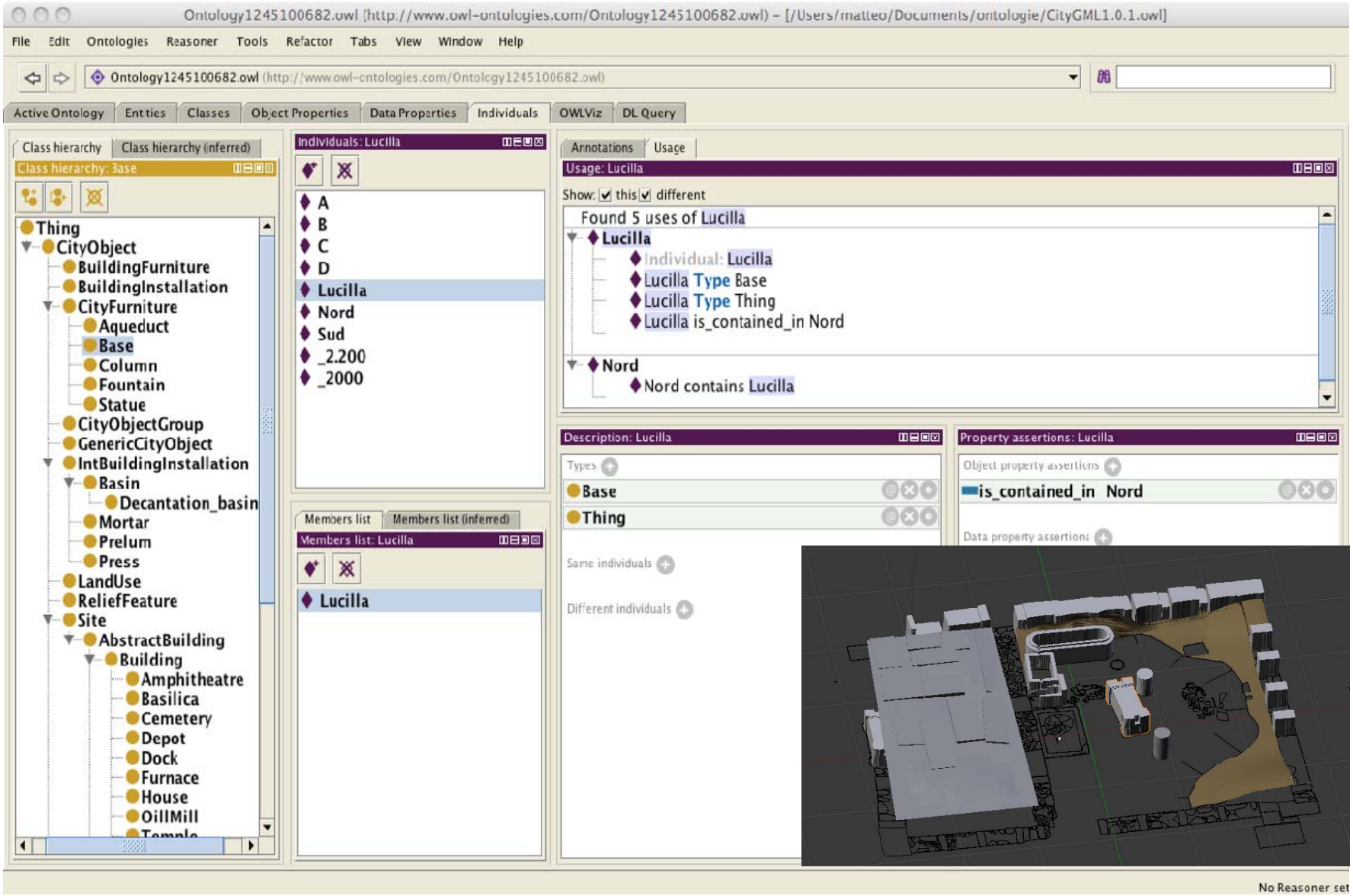
➔ Geo referenced the model in DTM scene

➔Convert the dataset in GML format

3D model


Blender [/Users/matteo/Desktop/Foro/save.blend]
File Add Timeline Game Render Help
biagini2
RenderLayers
Base
Basin_A
Basin_B
Camera
Column_A
Column_B
Lamp
Lamp.001
Mesh
Sarcophagus
US
Wall
pl_GSLAYER
pl_GSLAYER.001
pl_GSLAYER.002
pl_GSLAYER.003
pl_GSLAYER.004
pl_GSLAYER.005
pl_GSLAYER.006
View Select Mesh Edit Mode Global
View Search All Scenes
Panels
Extrude
Add Multires
Add Modifier

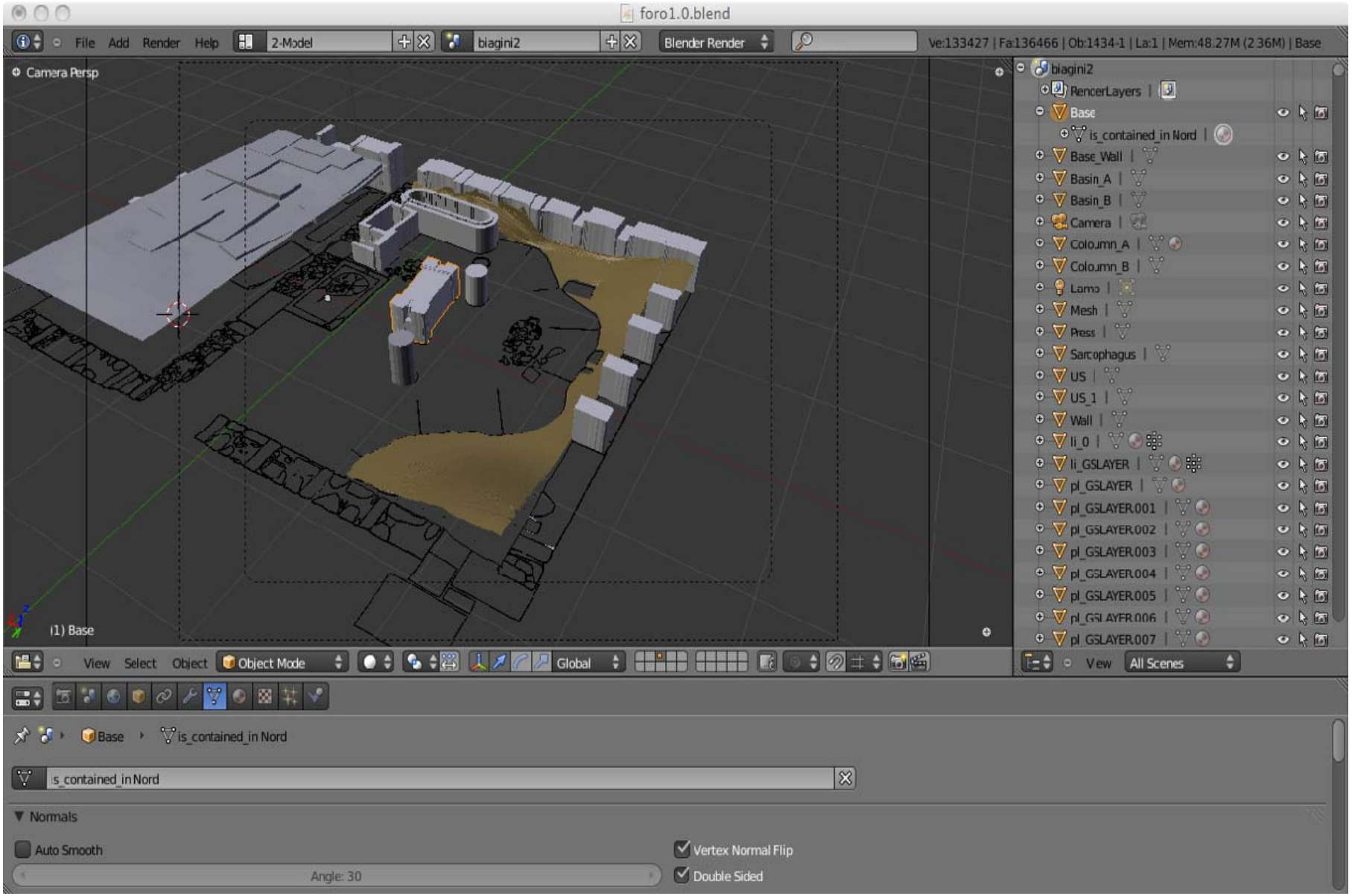
ontology


Ontology1245100682.owl (http://www.owl-ontologies.com/Ontology1245100682.owl) - [/Users/matteo/Documents/ontologie/CityGML1.0.1.owl]
File Edit Ontologies Reasoner Tools Refactor Tabs View Window Help
Active Ontology Entities Classes Object Properties Data Properties Individuals OWLViz DL Query
Class hierarchy Class hierarchy (inferred)
Class hierarchy: Base
Thing
CityObject
BuildingFurniture
BuildingInstallation
CityFurniture
Aqueduct
Base
Column
Fountain
Statue
CityObjectGroup
GenericCityObject
IntBuildingInstallation
Basin
Decantation_basin
Mortar
Prelum
Press
LandUse
ReliefFeature
Site
AbstractBuilding
Building
Amphitheatre
Basilica
Cemetery
Depot
Dock
Furnace
House
OilMill
Individuals: Lucilla
A
B
C
D
Lucilla
Nord
Sud
_2.200
_2000
Members list Members list (inferred)
Members list: Lucilla
Lucilla
Annotations Usage
Usage: Lucilla
Show: this different
Found 5 uses of Lucilla
Lucilla
Individual: Lucilla
Lucilla Type Base
Lucilla Type Thing
Lucilla is_contained_in Nord
Nord
Nord contains Lucilla
Description: Lucilla
Types
Base
Thing
Same individuals
Different individuals
Property assertions: Lucilla
Object property assertions
is_contained_in Nord
Data property assertions
No Reasoner set

3D object and DTM integration

<owl:Thing rdf:about="">
<rdf:type rdf:resource="http://www.owl-ontologies.com/Ontology1245100682.owl#Base"/> <rdf:type rdf:resource="&owl;NamedIndividual"/>
<is_contained_in rdf:resource="http://www.owl-ontologies.com/Ontology1245100682.owl#Nord"/> </owl:Thing>

3d view and hypergraph navigation



Conclusion of case nr 1

- The use of Open Format is a good solution for data sharing
- CityGML and OWL represent a good integration for the management of 3D data
- This is a good standardization according to standard ISO
- The implemented ontology allows the reuse of data
- Open Source solution

Disadvantages

- The visualization of semantical relations is able to just by Blender with hypergraph

Next steps

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- Integrating CityGML.owl with SKOS thesauri (ex. Ghetty thesaurus)
- Developing a GUI for WEB GIS in order to view the semantical model in DTM as web application

CulturaItalia project

CulturaItalia promotes an integrated access to the italian cultural resources.

Contents

Metadata Index
More than 2 million of records from the providers data sources (except bibliographic records)

Editorial articles
News and articles from the editorial staff

Web sites selection
More than 5.000 web sites selected

Multimedia
More than 100 Videos

Culturaltalia data management

More different from Uchi Maius:

- ✓ Concerning just 2D data
- ✓ Interaction between application profile (PICO) and OAI-PMH repository
- ✓ Social platform (actually in definition)

Pico Thesaurus

The PICO Thesaurus is a hierarchical controlled list of terms for the classification of the resources in the Italian Culture Portal.

Its purposes:

- Describing topics of resources – both from external data sources and from editorial board
- Classifying resources, codified with the PICO AP, within the Index of metadata.

Pico thesaurus

The PICO Thesaurus is a controlled list of hierarchical terms, aimed to describe the topic of the resource and to classifiy the metadata whithin the Index.

It has been designed to manage an aggregation of resources from cross domain providers.

It is an encoding scheme of PICO AP to refine the simple element dc:subject:

<dc:subject xml:lang="en" xsi:type="pico:Thesaurus">
http://culturaitalia.it/pico/thesaurus/4.0#photographs</
dc:subject>

It is published on a persistent URL:
http://purl.org/pico/thesaurus_4.1.0.skos.xml

PICO Thesaurus
(available in Italian and English)

Who – The cultural life protagonists:

- Persons
- Families
- Public and private bodies

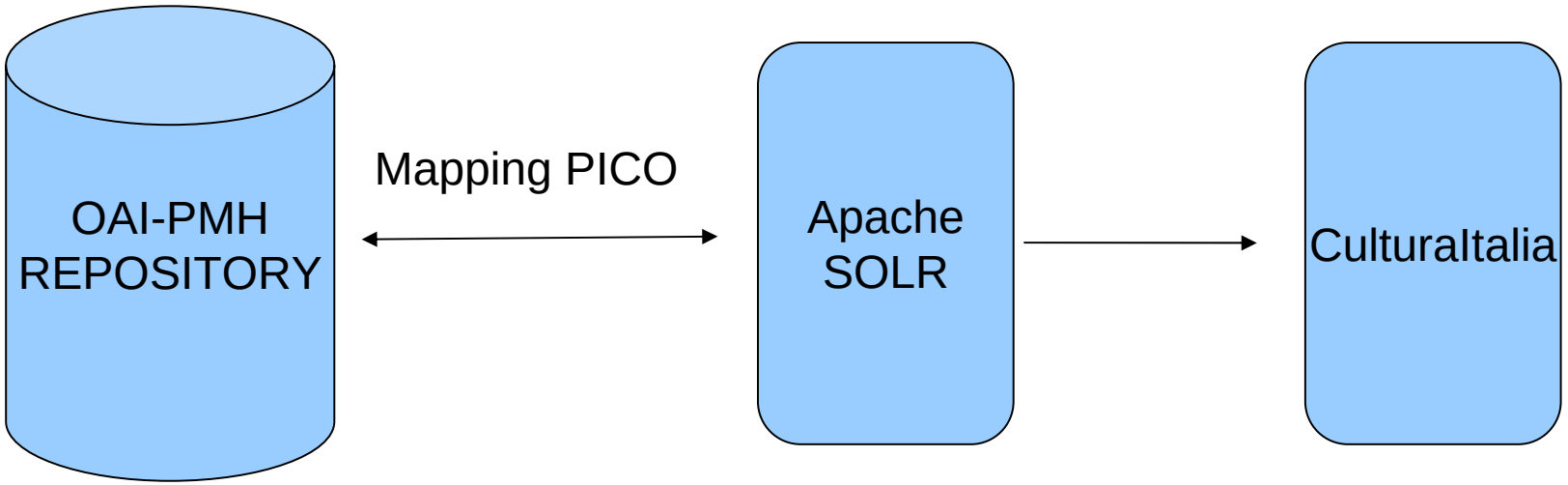
What – Cultural heritage, documentary resources, services, domain areas, activities for the development and the preservation of cultural heritage:

- Cultural repositories
- Cross domain artworks
- Applied art
- Scientific research and education
- Events, services, law

Where – Locations

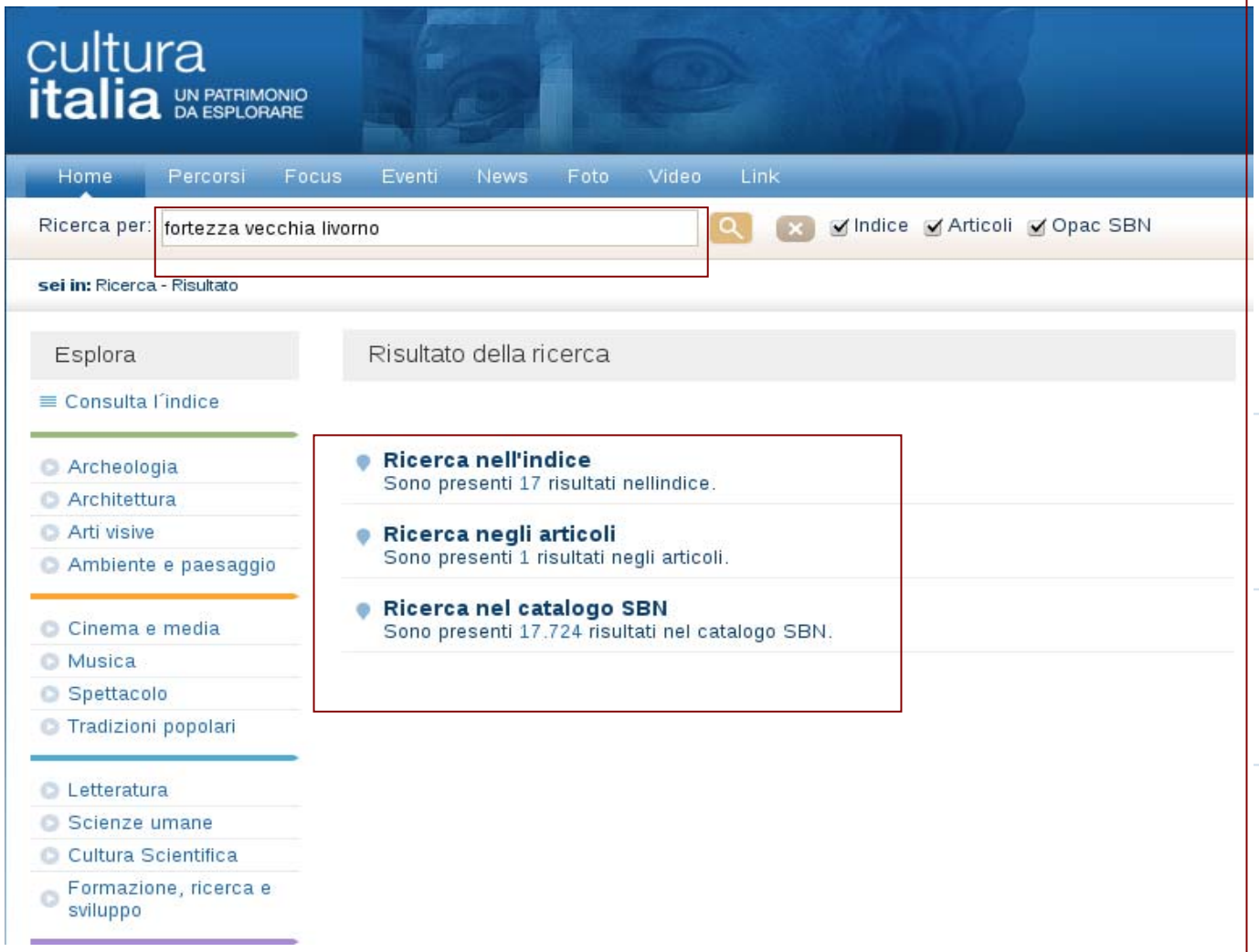
When – Cronology

Data processing



<dcterms:spatial xsi:type="pico:PostalAddress">
PlaceName=zona Venezia Nuova ; city=Livorno ; province=LI
</dcterms:spatial>

Use case I


cultura italia
UN PATRIMONIO DA ESPLORARE
Home
Percorsi
Focus
Eventi
News
Foto
Video
Link
Ricerca per:
fortezza vecchia livorno
Indice
Articoli
Opac SBN
sei in: Ricerca - Risultato
Esplora
Consulta l´indice
Archeologia
Architettura
Arti visive
Ambiente e paesaggio
Cinema e media
Musica
Spettacolo
Tradizioni popolari
Letteratura
Scienze umane
Cultura Scientifica
Formazione, ricerca e sviluppo
Risultato della ricerca
Ricerca nell'indice
Sono presenti 17 risultati nellindice.
Ricerca negli articoli
Sono presenti 1 risultati negli articoli.
Ricerca nel catalogo SBN
Sono presenti 17.724 risultati nel catalogo SBN.

Filtri applicati:
[x] Ambito geografico = Italia
[x] - Toscana
[x] - - Livorno
Fonte dati
ArtPast - catalogo opere d'arte (700)
Touring Club Italiano (70)
ICCU Anagrafe delle biblioteche italiane (48)
Categoria
Beni culturali (700)
Enti (48)
Tipo
Oggetto fisico (700)
Oggetto fisico (70)
Ambito geografico
Livorno (556)
Portoferraio (209)
Piombino (11)
Campiglia Marittima (7)
» Altri 14 elementi

Use case II

Veduta della vecchia darsena e della fortezza vecchia

Tipo: Immagine fissa
Categoria: Beni architettonici
Copertura: Non applicabile
Ambito geografico: *********, Livorno, Italia

Immagini di anteprima

Veduta della vecchia darsena e della fortezza vecchia

Fonte dati

Archivio Scala Group / Nome del set di immagini rese disponibili su CI
Identificatore: 0075355

xml consulta la scheda esterna

PICO XML resources

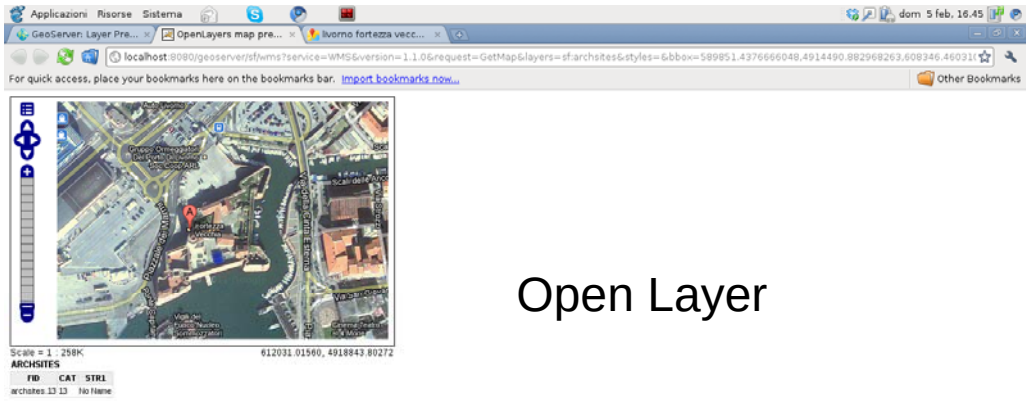
```
▼<pico:record xmlns:pico="http://purl.org/pico/1.0/" xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:dcterms="http://purl.org/dc/terms/"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://purl.org/pico/1.0/ http://purl.org/pico/1.0/pico.xsd">
  ▼<dc:description xml:lang="it">
     Realizzata nel 1590-94 sui marazzi del porto pisano, voluta da Ferdinando I e disegnata da Bernardo Buontalenti, era originariamente unita alla Fortezza Vecchia;
     danneggiata nella seconda guerra mondiale, è oggi adibita a parco pubblico; alcuni locali sono stati trasformati in sale per conferenze e mostre.
   </dc:description>
   <dc:identifier>56263</dc:identifier>
  ▼<dc:subject xsi:type="pico:Thesaurus">
     http://culturaitalia.it/pico/thesaurus/4.0#mura_fortificazioni
   </dc:subject>
   <dc:title xml:lang="it">Fortezza Nuova, Livorno</dc:title>
   <dc:type xsi:type="dcterms:DCMIType">PhysicalObject</dc:type>
  ▼<dcterms:isReferencedBy xsi:type="dcterms:URI">
     http://www.touringclub.com/monumento/toscana/livorno/fortezza-nuova.aspx
   </dcterms:isReferencedBy>
  ▼<dcterms:spatial xsi:type="pico:PostalAddress">
     PlaceName=zona Venezia Nuova ; city=Livorno ; province=LI
   </dcterms:spatial>
</pico:record>
```

Culturaltalia GIS architecture

Apache SOLR

OAI-PMH REPOSITORY

Geoserver



Open Layer

Geoserve & OpenLayer: Why?

- Open Source sulution
- Guarantee the managin of format suggested by INSPIRE directive
- Integration with WMS/WFS/OAI-PMH
- Very good tyling system

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Next step

- Developing a social GIS platform
- Integration between PICO thesaurus and geographical ontology
- Development of GIS mobile app for CulturaItalia project

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Thanks for the attention!

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