

Towards the creation of an Archaeological Urban Information System: Data Modeling of the Historical Heritage of Verona

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Abstract

In the last few years there has been a great interest in building open geographical datasets describing the historical heritage in the whole European Union, also with the aim to fulfil the INSPIRE Directive that includes in Annex 1 the Data Specification regarding the Protected Sites. In Italy, many important Archaeological Agencies, like the one in Rome, have started several projects in order to model, integrate and store, on the one side, and to publish, give access and query ability, on the other side, to the huge amount of archaeological data available in all Italian towns. In this paper we briefly describe the experience in Verona. In particular, some details about the activities currently running are presented: (i) the conceptual data modelling performed by applying the GeoUML methodology; (ii) the integration of attribute domains (vocabulary) and (iii) the modelling of time in archaeological data.

Keywords: Archaeological data modelling, conceptual design, GeoUML methodology, time in archaeology.

1 Introduction

Between 2012 and 2013, a project for developing the archaeological information system of Verona (called SITAVR), aimed to organize and archive the archaeological data of the town, was started by the University of Verona in a close collaboration with the Archaeological Agency of Veneto Region and with the financial support of the Regional Agency and the bank institute “Banca Popolare di Verona”.

The first step was determined by a cooperation agreement with the Archaeological Special Agency of Rome, which since 2007 was developing an Information System for the Italian capital [3]. Thanks to the support from the colleagues and the conventions between the public administrations involved, it was possible to start the project using the data model and databases created for Rome as a basis.

The second step was to study and adapt these artefacts to a smaller town like Verona, taking in consideration the different cataloguing necessities. During this phase, a new methodology, based on GeoUML model, and its tools were used in order to analyze the database of Rome and to create the conceptual schema as a reverse engineering process. The usage of the GeoUML tools [3] allows us to obtain automatically the physical schema and the documentation for the new database of Verona. Some data regarding a small pilot area have also been collected, as shown in Fig. 1.

Collected data and project documentation will be available to the general public, both for a better comprehension of the Information System content and eventually for reuse in other similar projects.

During conceptual data modelling activity we face some specific issues which, on the one side, are usually related to the archaeological data representation problem, and, on the other side, typically exist in the conceptual design of databases. In particular:

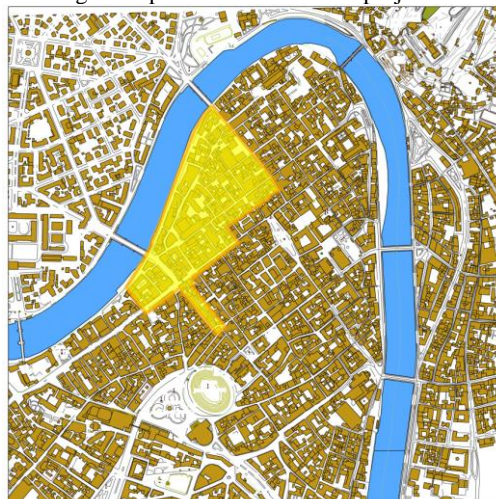
- the definition of specific elements in the schema for

representing temporal intervals with different accuracy levels;

- the specialization of attribute domains with a hierarchical approach, in order to preserve interoperability on the higher classification levels, while including the peculiarity of Verona heritage and local cataloguing methods in the lower levels.
- the refinement of some basic concepts introduced in the Rome database, in order to adapt them to Verona, without redesigning them from scratch thus preserving interoperability;

This paper is organized as follows. In section 2 we briefly describe the GeoUML methodology and how it helps in facing the above problems. Section 3 illustrates the current state of the conceptual schema and some of its elements. Finally in section 4 we draw conclusions and future work.

Figure 1: pilot area of SITAVR project.



2 GeoUML Methodology

The GeoUML Methodology [2] and the GeoUML Tools [3] have been developed in order to support the management of a geographical *conceptual schema* and to perform the automatic validation of the conformance of a *data product* to a given *conceptual schema*. The fundamental principles of this development have been:

- to adhere to the ISO 19100 standards whenever they apply;
- to be implementable on current technology;
- to be independent from any specific GIS product;
- to keep a clear separation between the conceptual and the implementation levels.

The development of this approach has been financed by CISIS, the coordinating authority of Italian Regions for spatial data, in order to guarantee that spatial databases created by different Regions satisfy common spatial properties. This is considered a fundamental requirement for the national SDI.

The adoption of this approach in the SITAVR project has produced some additional benefits:

- It has helped the data designer to abstract from a specific GIS technology, and to describe the intrinsic properties of the archaeological information they are dealing with.
- It has helped to integrate attribute domains and to discover common design patterns for archaeological information.
- It has supported the coherence preservation between conceptual schema and its related documentation.
- It has supported the implementation of the physical structures of the database by producing automatically the SQL scripts for database schema creation.
- It can simplify the interoperability between the SITAVR database and other datasets whose schema is based on the ISO 19100 standards (like for instance the Italian National Core or the INSPIRE Data) since schema mapping is easier when data share a common model.

More details about the GeoUML tools can be found in <http://spatialdbgroup.polimi.it/en/>

3 SITAVR Conceptual Schema

In Fig. 2 the process of creation of the SITAVR conceptual schema is shown. Starting from the relational database of Rome a reverse engineering task was performed in order to obtain the corresponding conceptual schema in GeoUML. Subsequently we had refined it for the context of Verona.

Regarding the core of SITAVR conceptual schema, shown in Fig. 3, we highlight the following points:

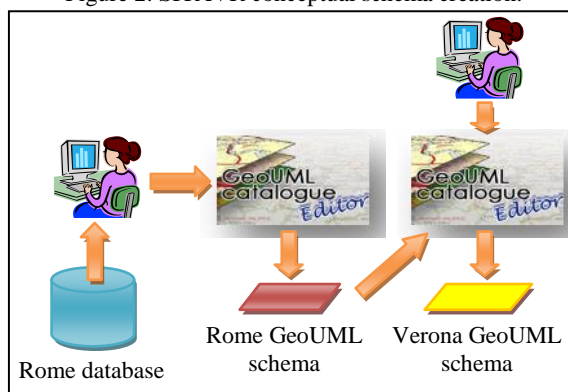
- Its core classes are: (i) *Information Source*, (ii) *Archaeological Partition* and (iii) *Archaeological Unit*, with the following semantics: (i) documents or actions through which a specific archaeological context is known (surveys, excavations, etc.); (ii) archaeological elements, classified in a specific context by function, chronology etc. (structures, architectural elements, etc.); (iii) logical union of the singular elements of the same or of different archaeological contexts, aimed to rebuild the ancient topography (temple, houses, etc).

- Any historical instant of time, i.e. an instant of time in the past, have to be represented by means of a common *Datatype* called *DT_HistoricalTemporalInstant* which has the following structure:
 - *TimeGranularity*: <enumeration> [*year, century*];
 - *TimeDirection*: <enumeration> [*BC, AD*];
 - *Year* [0,1]: integer
 - *Century* [0,1]: <enumeration> [*I, II, III, ...*];
 - *CenturyPeriod* [0,1]: <enumeration> [*firstHalf, secondHalf, firstQuarter, secondQuarter, thirdQuarter, fourthQuarter*];

This structure allows one to represent different temporal granules: from a single year, to a quarter/half of a century or a whole century.

- In definition of vocabularies the compatibility with the Rome schema has been obtained by exploiting the hierarchical domains of GeoUML. For example, in order to represent the accessibility type domain, in Rome they have identified only three possible values: *existing, notExisting, dispersed*, while in Verona they need to specialize the case *existing* in: *visitable, visible, not visible, partiallyRuined visitable, partiallyRuined visible and partiallyRuined not visible*.

Figure 2: SITAVR conceptual schema creation.



4 Conclusions and future work

The archaeological information system of Verona is still under construction and a great amount of work regarding mainly the survey and insertion of data has to be done. However, the idea of building a system that has to interoperate at regional, national and European level, based on the international standards and on the GeoUML methodology could be the key for allowing spreading of this experience to other Italian Archaeological Agencies or to other contexts.

Future work items could include: (i) the definition of the mapping from Verona GeoUML schema to INSPIRE Data Specification for Protected Sites; (ii) the building of a standard interface for providing open access to the collected data, (iii) the study of advanced feature for data querying (considering the temporal dimension); (iv) the study of new methods for integrating and analyzing archaeological data collected in different instances of the SITAVR system.

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Figure 3: Core conceptual schema of SITAVR project.

