Paving the Way for the Next Generation of Cultural Digital Library Services: The Case Study of 'Fortuna visiva of Pompeii' within the BRICKS Project

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Abstract

The BRICKS EU Project (http://www.brickscommunity.org) is constructing a distributed, scalable, and safe infrastructure that will provide open-source technology for the European Digital Memory. This infrastructure, known as the "Foundation", has been implemented through the integration of independent software units called "Bricks", which are developed on the architecture nodes. A Brick is an independent building block whose functionality is made available through a formally defined interface. Bricks can be put together to provide richer functionality, and may encapsulate Content. In order to test and validate the Foundation infrastructure and demonstrate how to build value-added services overlapping such infrastructure, some significant added-value "Pillar" applications have been developed and made available, addressing the "Greek temple metaphor". The intention is to use such applications for validating the Foundation services and, at the same time, those applications will constitute the basis of the future advancement of the BRICKS sustainability concept and be an attractive feature for the creation of a future Cultural Heritage Community. The "Fortuna Visiva of Pompeii" Pillar application has been developed as a case study within the "Archaeological site" Pillar. By using most of the Bricks created within the overall framework, demonstrates how the final users will be provided with services designed to enable them to use Pompeii's Archaeological Digital Library and Geographic Information System for learning, research and cultural tourism. Final users have been largely involved from the very beginning in the design phase of the case study applications, ensuring that such application matched the initial requirements ("vertical integration"), thus contributing to bridge the gap between users' community and advanced ICTs in the Cultural Heritage domain.

Keywords: EU project; GIS; open source; peer-to-peer; web services

1 Introduction

The BRICKS European Project [1] is going to provide the organisational and technological building blocks to develop a Digital Library of the European Digital Memory as a networked system of services regarding globally available collections of multimedia digital content and providing a variety of knowledge levels for different users and access modalities.

The BRICKS' vision is that of an integrated system, offering functionality for a new generation of Digital Libraries, a comprehensive term covering "Digital Museums", "Digital Archives" and other kinds of digital memory systems. The results of the project will constitute the main assets of a newly funded BRICKS Factory, which will be the fundamental issue for guaranteeing future sustainability.

BRICKS' work-frame is based on the Greek Temple Metaphor, in which the Infrastructure Area is represented by the "Foundations" of the temple, the Application Services Area is connected to the "Pillars", and the Exploitation and Sustainability Area is the "Roof". The reference to this metaphor can help to explain how the "Bricks" will be used to build a "Temple " for the European Digital Memory. The metaphor also explains how, in the BRICKS Consortium, the Service-Oriented Area is represented by the Pillars for the future sustainability of the "BRICKS Factory", as they will constitute the real added value for final users.

2 The BRICKS Concept

BRICKS is developing the existing state-of-the-art concepts in the Open Digital Library Systems, based on the sharing and re-use of contents and services, and therefore enabling expansion with additional services of any kind, in a cost-effective manner. The key factor of this advancement is that the Digital Library depends on an open infrastructure. The recent idea of an open, service-based Digital Library infrastructure has been pursued in different application domains by a number of recently-launched projects: Scholnet, Greenstone, Digital Library in a Box [2]. BRICKS infrastructure offers more than these for several reasons:

- provides better scalability, self-reliability and sustainability, thanks to the decentralised architecture;
- offers a secure and trustworthy environment;
- provides a high degree of flexibility in the usage and composition of content and services;
- is equipped with advanced basic services, such as multi-dimensional and multi-lingual searches;
- rigorously meets international standards.

Most existing Digital Library systems still reflect organisational patterns that we are accustomed to from conventional libraries and archives: a central server or repository is the core of the system, where all content is maintained. This is convenient for those who maintain the library, because services can be kept on the desired level of quality in a reliable and well-established way. A centralized architecture, however, is no longer demanded by contemporary technology. Networking technology provides unprecedented opportunities to create decentralized architectures, allowing many partners to participate in the creation of virtual digital libraries, which offer access to the various resources provided by the individual partners. While this results in a new dimension of accessibility enjoyed by users, it also causes new problems, such as: new ways to manage decentralized, potentially non-homogeneous contents and metadata resources are needed in order to establish necessary library standards; access and modification rights need to be managed for various types of property right-holders; search and browse techniques need to be adapted.

The very diverse content of digital libraries makes new and challenging demands on the underlying storage and management systems and architectures. A multitude of different kinds of data (including images, video, audio, tables, arrays, graphics, algorithms and procedures, documents) and related formats, have to be addressed. Moreover, there is a need to expedite the access and use of cultural data and to consider emerging requirements such as distributed access, collaborative aspects, multimedia compositions, automatic extraction, sophisticated queries and browse functionalities, personalized access, etc. The main scientific and technological goal of BRICKS is to design and develop an open distributed service-oriented infrastructure for integrated access to distributed digital libraries. This means the following main scientific innovations in Digital Libraries' State of the Art Systems:

- to develop a Decentralised Service Infrastructure in order to increase flexibility and reliability of the systems and to improve the current web service architecture with a decentralised discovery service;
- to implement a Decentralised Metadata Storage for XML documents, which is used to store globally available information (e.g. service descriptions, ontologies) in a central repository. Such central repositories are not normally available in decentralized architectures, as in BRICKS architecture. To achieve the availability and reliability of the stored data, data placement, replication and update mechanisms have to be developed in order to support decentralized environments;
- to consider digital content collections as mechanisms for self-organising the information space that a digital library manages. In order to support the dynamic growth of the content space, the addition of new services and the variability of the digital library user's needs, the Collection Management Brick will not gather and store the documents of a collection in an internal repository, but will maintain them "virtually";
- to treat semantic agreement as a dynamic process and derive global semantics (agreements) from local interactions to handle heterogeneous metadata and ontologies. This means that explicit local mappings are used to derive an implicit global agreement/understanding. In this way, knowledge will be distributed among participants of the system. Furthermore, decentralised approaches like emergent semantics will be evaluated to handle the evolving set of descriptions when new services are added;
- to develop a Decentralised Data Rights Management architecture, increasing the overall system scalability and inter-operability. The standard Trust and Confidence approach uses trusted third parties (TTP) that introduce centralisation, dependency on outside authority in the system, and adds a substantial cost in the maintenance and usage of the system. BRICKS pursues an alternative, fundamentally different approach to manage online trusts that can work without enforcement by third parties. It will consider reporting, sharing and using reputation information in a society as part of a

mechanism that makes co-operation the dominant strategy in interactions. This approach aims at re-establishing a social framework that supports trusted interactions.

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As a main consequence, significant opportunities will become affordable to even small institutions to participate in the BRICKS network with reduced costs (no prerequisites of increased computing power) and increased security (shared data does not reside in one particular location, it is accessible from each node, without points of failures).

3 BRICKS' Technical Skills

3.1 Open Source Approach

The basic philosophy behind BRICKS technology Foundation approach is that of open source: applications based on open source technologies save money, support easy re-engineering and are tightly connected to offering added-value services:

- the basic open source software does not have a sizeable impact on the total cost of the application solutions;
- when buying proprietary software, it is necessary to buy a usage license, which is an investment cost, and a maintenance and support license, which is an operational cost. The maintenance and support license can only be acquired from the provider of the software solution from whom the usage license is bought;
- due to the fact that the software is open source, the source code is available, and at the same time, maintenance and support are suitable from a wider market;
- free software is considered a good investment for buyers, because they perceive its value in terms of technology innovation;
- free software availability is tightly related to the need for professional services, which are perceived as high quality services, thanks to the open source approach.

3.2 BRICKS' Architecture

BRICKS' architecture consists of a number of independent software units (the "Bricks"), derived from BRICKS Foundation developments, which can be integrated together, to provide rich functionality.

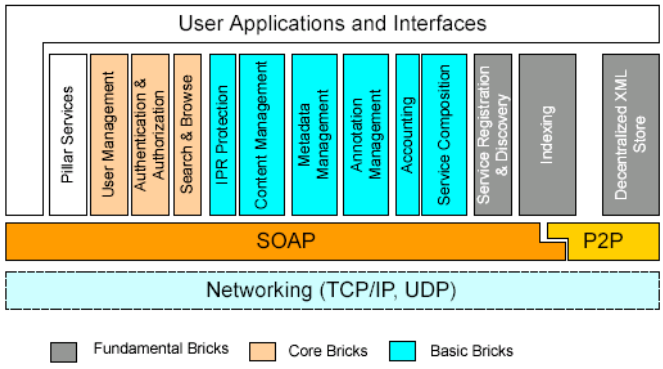

Figure 1: A view of the BRICKS Foundation Services

Within the BRICKS Project, a "BRICKS Node" or "BNode" refers to a software installation on a server in a trusted institution that is a member of a BRICKS cultural heritage network. The BNode is the bridge between the organisation's internal infrastructure and the BRICKS system. Within each BNode, Bricks services are employed and specific applications may also be included. BRICKS technology Foundation is built on a decentralised architecture, based on a peer-to-peer (P2P) paradigm, which means that no central server is employed. The absence of central administration structures, although posing various implementation challenges, is a major incentive for organisations to join the network. There will in fact be no administration costs other than those reserved for the setting up and maintenance of their own BNode. Every BNode represents a member institution, where the software for accessing BRICKS is installed. BNodes communicate with each other and use available resources for content and metadata management. Each BNode directly knows only one subset from the

other BNodes in the system. However, if a BNode needs to contact another member that is directly unknown to it, it will forward a request to some of its known neighbouring BNodes, which will deliver the request to the final destination or forward it again.

The network topographic distribution adopts a hybrid peer-to-peer approach, by which not all machines on the network have the same role. Some machines (BNodes) are peers in the network, connected so that they can find and recognize each other without any central "controller" and taking on equal roles, as resource providers and resource consumers. Other machines (Clients) are user machines that connect to a BNode, in order to use the Library.

3.3 Service Interfaces

Public interfaces are available in the form of web services, that allow platform and implementation independence, so that clients can be represented in any programming language, or as a Client Layer in Java, that operates locally and calls the web service completely transparently to the user. The Client Layer will be used only by Java clients (the language in which most of our client applications and Pillar services will be implemented), clients written in other languages must use the web service interface. The building of a Brick entails that the code is developed on an application server. It is also necessary that the metadata and service descriptions of the Brick are registered, making the Brick in question open to search and discovery services. Information about the new Brick is then spread to neighbouring BNodes, enhancing the efficiency of discovery.
Methodologies have been defined and tools have been implemented to create Bricks, starting from existing contents and services. Inter-operability has been addressed and existing international standards have been met including metadata formats and approaches. Interfaces for services are described using the WSDL general framework (Web Services Description Language), which associates a description including information about where a service is located, what operations are supported, and the format of the messages to be exchanged based on how the service is invoked.

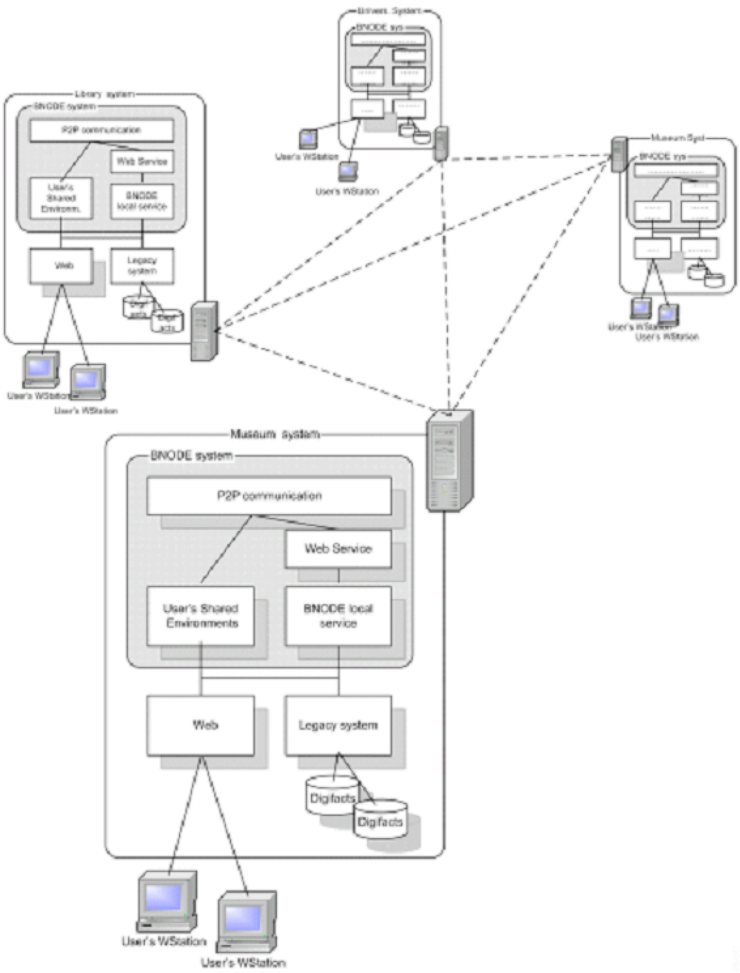

Figure 2: B-Node systems in a trusted network

The proliferation of services related to the Web Service vision requires the availability of public directories, used for the registration and looking up of services, that in the network are described as UDDI (Universal Description, Discovery and Integration) entries. These entries consist of white pages (e.g. address, contact information), yellow pages (e.g. industrial characterization based on standard ontologies), and green pages (e.g. references to specifications of services), and provide a mechanism for service providers to advertise their services in a standard form and for service consumers to make queries regarding services of interest, thereby paving the way for inter-operability between services.

Ontologies required for the description and discovery of Bricks on a semantic level will also be provided. They will allow the administrator to apply specific policies associated to the Bricks at the time of development, such as restriction of access to the Brick's functionality to specific users and groups. This makes users free from the need of having knowledge about the details of the implementation (object model, programming language, etc.).
Such a distributed architecture allows Digital Library Systems to act as BNodes in a trusted network, interrelated with other BNodes, each of which having its own specialisation. The following Fig. shows a sample, relating two Museum BNodes, a Library Bnode and a University BNode.

Access to the whole network and to virtually the entire Foundation's functionality is provided by a stand-alone Java application, forming a BRICKS Desktop which runs on the User's workstation: see Fig. 3.

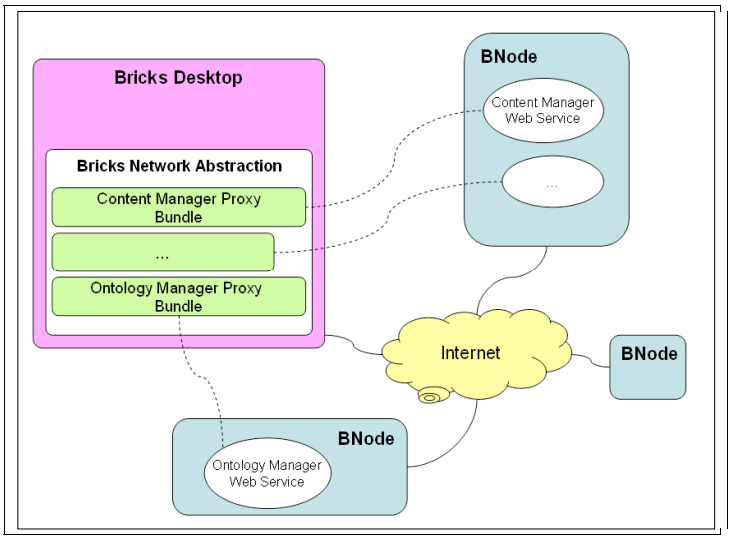

Figure 3: Example of a Brick Desktop interfacing B-Nodes

A Web Application, referred to as BRICKS Workspace, is hosted or served by the BNode. Both the Workspace and the Desktop allow users to access BRICKS content; Desktop has a more advanced interface (supporting, for instance, "drag and drop") and offers more advanced BRICKS features, as well.
Finally, a last layer is responsible for user-system interactions. Through this layer, information and services are presented to a user and he/she can perform defined actions. This layer accepts commands from users and transforms them into appropriate service invocations. The layer could be created as an application installed on the user side (thick client) or as a web application accessible though a browser (thin client), and should support a proper user scenario.

3.4 Classes of Bricks

The library of reusable components includes "Fundamental", "Core" and "Basic" Bricks, that configure the functionality level of the distributed architecture based on BNodes. The number of services offered by a BNode determines the level of participation that the node brings to the network and the hardware requirements of the server.

Fundamental Bricks	Bricks in this category provide the minimum requested functionality for using the BRICKS system, which is essential to support peer-to-peer network communication.	Decentralised XML Storage Service Registration and Discovery Index Manager

Core Bricks	Bricks in this category are essential for allowing the server to function and feature as a BNode.	User Management Authentication and Authorisation Search and Browse
Basic Bricks	Bricks in this category are additional service layers, which "can" be developed on a BNode. At least one instance of each Basic Brick must be available in a BRICKS network, but needs not to be available on every BNode. A failure on one of these services will not affect the whole system, but will reduce the functionality of some parts of BRICKS system.	Content Management IPR Management Metadata Manager Annotation Manager Service Composition

Table 1: Classes of BRICKS

"Fundamental Bricks" and "Core Bricks" together provide the server with the capability of:

- Executing the Bricks code (an application server);
- Interfacing Web Services;
- Supporting peer-to-peer communication between the BNodes.
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"Basic Bricks" added to "Fundamental Bricks" and "Core Bricks", provide building blocks for applications, such as specific application services (Pillars), which are typically composed of Foundation services extended with additional functionalities. These application services can be of a generic nature, therefore they can be used by more than one application.

4 BRICKS Working Methodology: The "User in the Loop"

The adopted working methodology is based on the need to ensure deep and continuous communication between cultural and technical partners, in order to develop effective user-oriented systems. The infrastructure is designed, developed, tested and validated according to the requirements given by the "cultural" partners (Pillars). Drawing from their specific experiences, the cultural partners produced user requirements, cases and scenarios. The documents are instruments of communication to be submitted to the technical partners, who are developing the system on the basis of practical samples and clear requirements, with continuous feedback from the cultural partners. Close cooperation has been established amongst the three areas of the project (Foundation, Pillars, Roof), and different strategies have been used for involving the final users in such a process:

- Pillar applications;
- Ad hoc demonstrators;
- BRICKS Community set up.

The process for building the Pillar applications is shown in Fig. 4: during the first year of BRICKS Project, end users and content providers defined some pilot scenarios. Then, supported by the Pillar application developers, they extracted needs and requirements from scenarios (branch-1), forwarded them to the Foundation (branch-2) and designed the Pillar applications (branch-3). The release of the first Foundation prototype (branch-4) initiated the development of the first integrated Pillars' applications. In this phase of the project, developers are giving two types of feedback which, in turn, initiate two refinement cycles:

- the Foundation BRICKS refinement (branch-5);
- pilot scenarios refinement and thereby a refinement of the Pillar application (branch-6).

During the next year, the released Pillar applications (branch-7) will be evaluated by end users, so proper questionnaires will be implemented to gather their comments and suggestions (branch-8). This will start the third refinement cycle. The last step (branch-9), consists in the validation of the final Pillar application: groups of end users will be requested to validate what BRICKS Project produced.

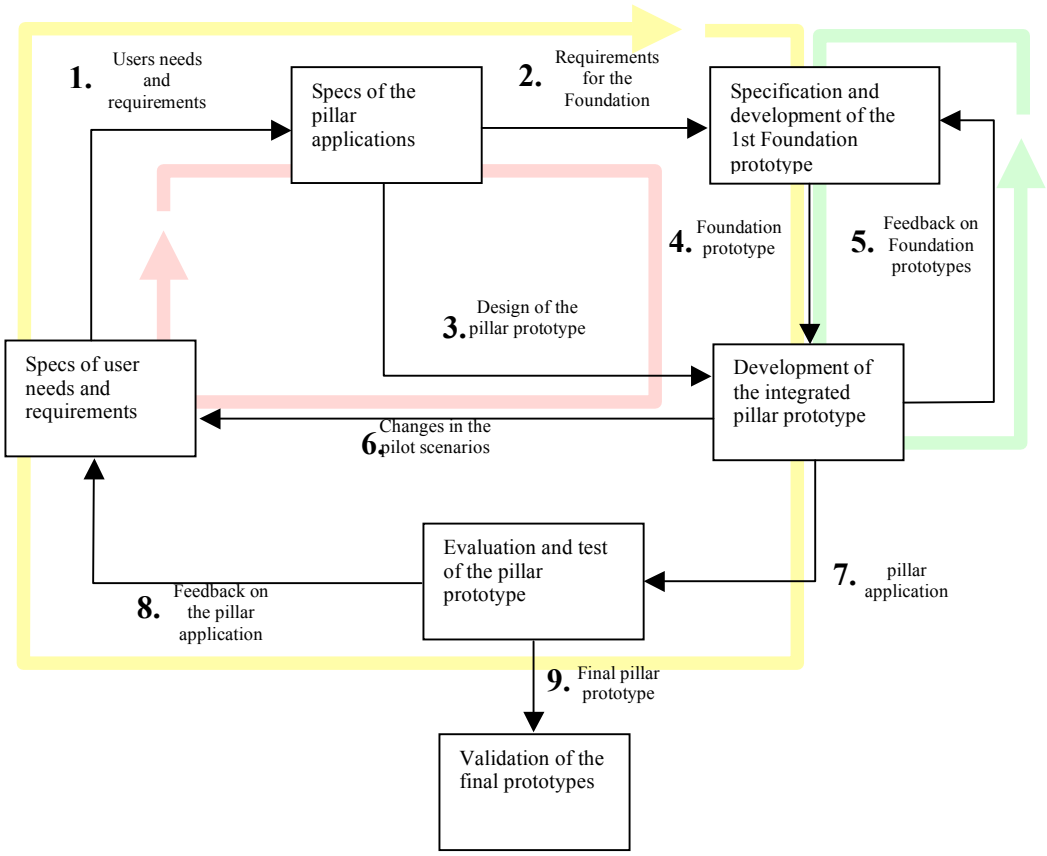

Figure 4: User requirements elicitation and prototypes refinement

5 The "Fortuna Visiva of Pompeii": A Specific Case Study for Complex Cultural Content Integrated in BRICKS

The case study of the "Fortuna Visiva of Pompeii" Project represents a pilot case that is quoted here as a sample of successful usage of the Foundation services for implementing a significant application within the archaeological domain. Since its birth in 2002, the "Fortuna Visiva of Pompeii" project has been promoted and carried out by Consorzio FORMA and Scuola Normale Superiore of Pisa (SNS), together with the Archaeological Superintendence of Pompeii (SAP) and the technical staff from Sistemi Informativi Srl Liberologico [3].

The Project analyses the perception of the monumental and archaeological ensemble and the landscape of Pompeii, through the graphic sources and texts produced starting from the years immediately following its discovery, in 1748, until the end of the XIX century. It harbours an organisational system, based on data that inter-relates images, texts and geographic information, collecting in an on-line Archive visual and written documents from the XVIII and XIX centuries, ordered in an inter-related database and in a digital library and connected to a Geographic Information System (GIS).

The contents of the "Fortuna Visiva of Pompeii" was made available to BRICKS in the "Archaeological Site" work-package. For the demonstrator shown in the occasion of the first review of the project (March 2005), the metadata related to the contents of the "Fortuna visiva of Pompeii" has been transposed in XML, mapped in Dublin Core standard and harvested through OAI-PMH into BRICKS system, in order to allow inter-operability with other contents provided by other organisations to the BRICKS Community [4]. For the second review in March 2006, the functionalities of BRICKS system will be demonstrated through the installation of a BNode in real time, showing Pompeii's contents and other resources directly drawn from their own OAI Servers.

During the second year of the project, an XML schema of the "Fortuna Visiva of Pompeii" metadata schema has been provided for BRICKS. On the base of this schema, it will be possible to make available on BRICKS platform Pompeii's contents in its own schema and to also support schemas other than Simple Dublin Core Element Set. From this perspective, Pompeii's schema has been mapped into different metadata standard schemas and into the CIDOC Conceptual Reference Model. Moreover, work carried out provided Pompeii's

GIS, which is linked to the "Fortuna visiva" database, through a Map Server based on Web Services in order to integrate it with the other components of BRICKS technical platform.

5.1 The "Fortuna Visiva of Pompeii" Contents

The name that was chosen for the project clearly reveals its predominant purpose, which is to analyse the impression that Pompeii, in its numerous forms and variations in time and space, has made. The main objects of research are therefore the figurative representations in themselves (engravings, pictures, watercolours, etc.) and the 'fortuna' of the subjects that are reproduced in these, related to the archaeological site and its monuments. In fact we are able to reconstruct, through those kinds of documents, the different perceptions of Pompeii and its monuments, to better understand the stratification of meanings that, joined all together, constitute the cultural identity of Pompeii, as we perceive it today. The "Fortuna visiva of Pompeii" Archive is conceived as a system joining an inter-related database, a digital library and a GIS. The database connects three kinds of sources:

- Iconographic sources: all sort of images (drawings, watercolours, engravings, etc.;
- Bibliographic sources: edited books containing Iconographic sources;
- Unedited sources: manuscripts and unedited documents containing Iconographic sources.

All the sources are linkable to the 'Catalogue of the People' and to the 'List of the Places', both conceived in form of authority files. People and places stored in these authority files are linkable to the records of the Iconographic, Bibliographic and Unedited Sources, through the entering of some pre-defined 'roles', that can be selected from some expandable dictionaries. All three catalogued sources can finally be interrelated by means of pre-established roles. As the principal aim of the project consists in the reconstruction of the different perceptions of Pompeii and its monuments, the specific cut chosen for the research determined a strong need to create a subject-oriented database of the Iconographic Sources. Thus, the structure of the Iconographic Sources has been enriched with a tree-like Subject Ontology, which permits the cataloguing of the graphic documentation on the basis of its type, and of the represented subjects. The unity of ancient books and manuscripts described in the database is preserved through a digital library, in which each of these documents is entirely reproduced.

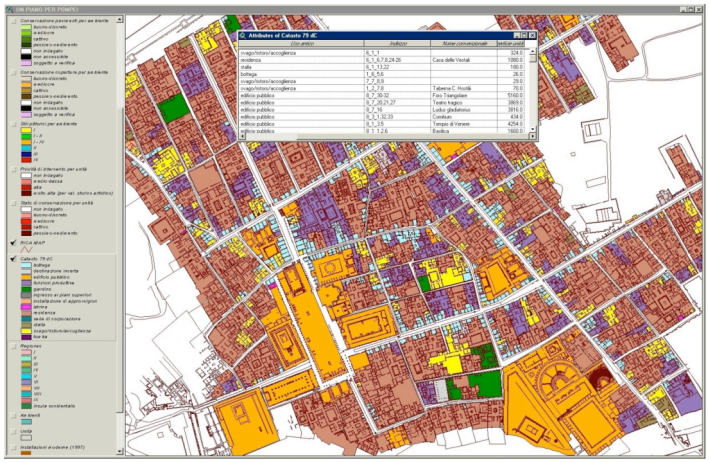

Figure 5: A screenshot of Pompeii's GIS

Finally, the system also comprises the GIS "Un piano per Pompei" [5], which covers about 100 hectares (approximately 1/2 sq. mile), corresponding to the extension of Pompeii's excavations. The GIS contains 3.000 polygons, describing the buildings and monuments of Pompeii, which are linked to the Iconographic sources of the database through Pompeii's address book. This address book is a controlled vocabulary list which identifies each polygon with its Regio, Insula and Civic number as well as with the name of the building.

6 Making Available the "Fortuna Visiva" Contents into BRICKS

The first requisite for obtaining real integration of different kinds of digital resources, is establishing a common metadata schema, which guarantees efficient retrieval and inter-operability of the contents. Thus, after an accurate analysis based on user requirements, cases and case studies, the Dublin Core Element Set has been chosen as the minimum requisite for integrating resources in BRICKS. Furthermore, as BRICKS system is also

able to support other metadata schemas and ontologies, some of the partners involved are conducting an experimentation consisting in mapping and displaying the same contents encoded in different schemas, in order to understand which of them are more useful. In this way, a mapping of Pompeii's metadata schema into the principal metadata standards has been provided during the first year. In particular, the following standards have been considered: Categories for the Description of Works of Art (CDWA); VRA Core Categories; DC Element Set [6]. The crosswalk with DC has been used for the porting of the 'Fortuna visiva' contents into BRICKS for the demonstrator shown during the first review of the project, in March 2005, using the codification in XML of documents and the metadata porting with OAI/PMH. During the second year an XML schema of Pompeii's "Fortuna visiva" metadata schema and its ontology have been provided for BRICKS. On the basis of this schema it will be possible to make available on the BRICKS platform Pompeii's contents in its own schema and to support schemas other than Simple DC.

POMPEII'S FORTUNA VISIVA FIELDS	CDWA CATEGORIES	VRA CORE CATEGORIES	DC ELEMENTS
OBJECT AREA			
Identity	Current location – Repository number	ID number – Current repository	Resource identifier
Alternative Identity	Current location – Repository number	ID number – Current repository	Resource identifier
Type	Object/work - Type	Type	Type
Subject	Titles or names - Text	Title	Title
Subject within the source	Titles or names - Text	Title variant	Title
Technical information	Materials and techniques - Description	Technique Material. Medium Material. Support	Format. Medium
Caption transcription	Inscriptions / Marks – Transcription or description		Description
Dimensions	Measurements - Dimensions	Measurements Dimensions	Format . extent
Notes	Object/Work - Citations	Description	Description
RELATION AREA			
Related people **Role**	Creation – Creator role Creation – Creator name	Creator. Personal name Creator. Role	Creator Contributor
Related places **Role**	Creation – Place / Original location Creation – Dates Current location – Repository name Current location – Repository number	Subject Location. Current repository	Coverage. Spatial
Related sources **Role**	Related works – Identification Related works – Relationship type	Relation	Relation
Related subjects	Subject matter – description / indexing terms	Subject	Subject
Related images	Related visual documentation	Relation	Relation
ADMINISTRATIVE AREA			
Owner	Copyright / Restrictions – Holder name	Rights	Rights
Copyright	Copyright / restrictions	Rights	Rights
Filed by	Creation – Creator name	Creator. Personal name	Creator
Revised by	Creation – Creator name	Creator. Personal name	Creator

Table 2: Mapping of the "Fortuna Visiva of Pompeii" metadata schema into CDWA, VRA, DC categories [sample for Iconographic Sources]

As archaeological, artistic and historical information often have complex articulation, their mapping into DC significantly simplifies the conceptual architecture of that information, which is good for inter-operability with other resources but less useful for an efficient retrieval. This consideration brought the partners involved in BRICKS' 'Archaeological site' wp to start an experimentation with the mapping of their resources into CIDOC Conceptual Reference Model [7]. Thus, a first mapping of Pompeii's schema into CIDOC-CRM was provided at the beginning of the third year, and a further refinement of this mapping is planned for the next activities.
Another field of activity was the interest in the GIS: firstly, the contents of the GIS has been connected to the Iconographic sources through Pompeii's address book, each instance of which recalls a key linked to each polygon represented in the map. Then, the GIS original application, which is based on a proprietary system, has been made available through a new on-line application using web services.

7 The "Fortuna Visiva of Pompeii" Application

The whole system for the "Fortuna visiva of Pompeii" application is presently being carried out and installed on the BNode offered by the CNR of Pisa, Italy, which is a BRICKS partner. Future activity will consider the development of the interface.

7.1 Work Carried out: Overall Architecture of the System

The "Fortuna Visiva of Pompeii" application uses the following Foundation Services from the technological platform of BRICKS:

- content manager
- IPR manager
- collection manager
- metadata manager
- query mediator
- thesaurus manager (under evaluation)
- security manager
- annotation manager

Textual metadata are managed through the Metadata Manager. At the moment, the contents is provided in both Dublin Core format and the 'Pompeii' proprietary schema; the latter may be mapped to the CIDOC-CRM and/or into other ontologies.

All images and textual data linked to records in Pompeii's database, are managed through the Content Manager and through the DRM. Security policy will be applied to images in order to allow authenticated users to see the images in a large format (1000x1000 pixels), while Watermarking will permit the management of their usage.
The collection manager is used to organise and manage the different kinds of sources (Iconographic, Bibliographic, Unedited) and to allow authenticated users to create logical collections of items selected from the various sources in Pompeii's digital library. The query mediator is used for specific research masks available for the three kinds of sources in Pompeii's database. Security Manager is used for user authentication and the related actions.

The Annotation Manager will be used to permit annotations and enrichment of the existing resources. The use of the Thesaurus Manager in exploiting the hierarchical Thesaurus of Subjects will be evaluated. The Subject Thesaurus works with the Pompeii Iconographic Sources to support research by subject. At present, subject is presented only through the DC metadata element <dc:subject> without any hierarchy, which restricts flexibility in searching the Iconographic Sources. Thus, the technical platform and the services offered by BRICKS covered the management of all the contents pertaining to Pompeii's database.

The archaeological domain and the specific case study of Pompeii, brought the necessity to also manage geographical data into the BRICKS Community. Therefore, the "Fortuna visiva" application is being used as a grounds for experimentation, in order to find the way to integrate a GIS into BRICKS.

Pompeii's GIS has been transposed into web services and connected with the contents pertaining to the database using BRICKS services at the level of the interface: the architecture described below has been integrated joining a Map Server, which is compatible with OGC (Open Geospatial Consortium) standard. The integration of contents from BNode and Map Server, will be implemented at the Application level.

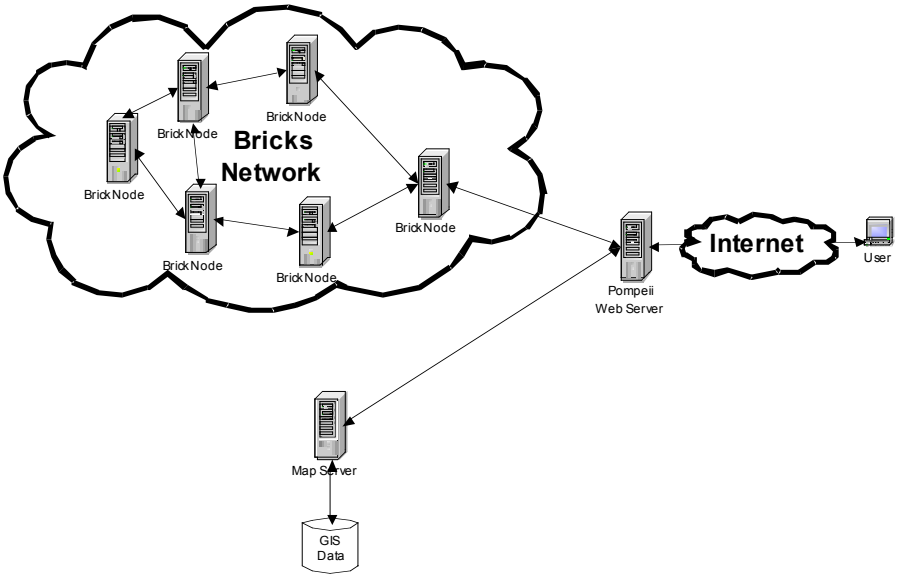

Figure 6: The "Fortuna visiva of Pompeii" BRICKS' application [architecture]

7.2 Work in Progress: The Interface

During the next months of activity the interface of the BRICKS' "Fortuna visiva of Pompeii" application will be created on the basis of the following specifications. The "Fortuna Visiva of Pompeii" interface will integrate Pompeii's Digital Library with ArchaeoTour.

1- POMPEII'S DL
Three advanced search masks will be available for the three kinds of Sources as part of the application interface. A research tool using the hierarchical Subjects Thesaurus will be evaluated. The interface will give authorised users access to the following areas, allowing for the creation of specific types of collections and annotations where appropriate:

- EXPERTS' DISCUSSION AREA: this will be a 'forum' for researchers, scholars and other experts to share access to collections and annotations. Users will be able to create thematic collections and draw on annotations to enrich the contents. They could see the annotations written by others and reply by adding comments etc.;
- PROJECT: this will allow users to create a personal collection, to start a project (research project, article, teaching material, etc.) and connect single records to contents inserted through the annotation tool (e.g. add text or an image and link it to a resource in Pompeii's digital library);
- ALBUM: in the album area users will retrieve images (photos, drawings, etc.) and create a slide-show, in the form of a collection of images with annotations.

2- POMPEII'S ARCHAEOTOUR
Users of Pompeii's ArchaeoTour will be able to access the resources of Pompeii's Digital Library through GIS. Both simple and authorised users will access Pompeii's map through ArchaeoTour. The user will could carry out:

- Geographic searches by clicking on a polygon. The system will display a list of results (the abstracts of resources) linked to the selected polygon;
- Searches for buildings registered in the GIS by using the Pompeii address book.

Authorised users will then be able to create collections of items and annotate them, they also could see the annotations and link them to the map. All users will have access to the new enriched contents.
Pompeii's ArchaeoTour will enable authorised users to create targeted kinds of collections:

- TOURIST GUIDE / TRAVEL DIARY: for general tourists, tour operators, teachers, students and general users. Authorised users will retrieve resources through the GIS and will use the annotation tool to create a guide for tourists of places within the site of Pompeii. This could be an important tool for building a base before or after the visit to the archaeological site.

- GIS ENRICHER: this will be targeted to more specialised users such as archaeologists or art historians. Authorised users could link items (texts or images) to the map which are not contained in Pompeii's digital library, thus enriching the contents linked with Pompeii's GIS.

8 Conclusions

The main innovations that the BRICKS project is putting forth, and the significant advantages that they will provide for Cultural Heritage institutions have been outlined here. The "vertical integration" process strengthening the link between the final user of BRICKS applications and the technology providers has been presented.

The "Fortuna Visiva of Pompeii" application has been described as a significant and successful sample of added–value application in the context of the "Archaeological site" Pillar of the BRICKS European project. The results already reached within this case study are offering tangible material to the BRICKS' technical staff for the refinement and the final delivery of the Foundation technology framework, and for designing services that will be specifically tailored to the real users' needs and requirements.

References

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[3] The "Fortuna Visiva of Pompeii. An Archive of visual and written documents from the XVIII and XIX centuries" – website of the project: http://pompei.sns.it/. Consorzio FORMA: http://forma.sns.it; Scuola Normale Superiore di Pisa: http://www.sns.it/; Soprintendenza Archeologica di Pompei: http://www.pompeiisites.org/; Sistemi Informativi Srl Liberologico: http://www.liberologico.com/.

[4] Extensible Markup Language (XML): http://www.w3.org/XML/ - http://www.xml.com/; Open Archive Initiative – Protocol for Metadata Harvesting (OAI – PMH): http://www.openarchives.org/OAI/openarchivesprotocol.html; Dublin Core Metadata Initiative (DCMI): http://dublincore.org/.

[5] The GIS "Un piano per Pompeii" has been designed and implemented by the architects Giovanni Longobardi and Andrea Mandara (Studio di architettura – Rome: http://www.studiar.it/) for the Soprintendenza Archeologica of Pompeii.

[6] Categories for the Description of Works of Art (CDWA): http://www.getty.edu/research/conducting_research/standards/cdwa/; Visual Resources Association Core Categories (VRA): http://www.vraweb.org/vracore3.htm; Dublin Core Metadata Element Set (DCES): http://dublincore.org/documents/dces/.

[7] CIDOC Conceptual Reference Model (CRM): http://cidoc.ics.forth.gr/.