

SYNTHESIS: A system for managing, documenting and promoting cultural assets

SYNTHESIS is an information system for the scientific and administrative documentation of monuments and museum objects, which also supports the dissemination of scientific knowledge. It supports a generic and flexible documentation model and provides a web user interface environment specifically adapted for the description of knowledge related to cultural assets, e.g. museum objects and collections, monuments, archaeological sites, works of art etc. It also allows different kinds of access to the system e.g. for administrators, scientists etc. It is multilingual and supports data exchange in the form of XML files with other systems that handle digitization and presentations over the Internet. The use of XML for data exchange ensures the validity and long viability of the data.

SYNTHESIS can be used for documenting cultural assets in the form of:

- A single user system for those people wishing to document one or more sets of cultural objects which may or may not belong to a collection.
- An individual system for an organization (museum, cultural institution or group etc.) wishing to document one or more sets of cultural objects that may or may not belong to a collection. The documentation may be carried out by one or more of the organization's members.
- A "federated" system, in the sense that many organizations can work in collaboration under one supervisor that acts as the system administrator and can create new organizations and administrators. Organizations can document sets of cultural objects and collections in their own data bases. Each organization has its own administrator and users. The administrator manages the organization's user and its XML documents.

The context of the scientific and administrative documentation

The scientific documentation includes cultural data about the objects, such as who, where and when it was made, which is the stylistic period it belongs to, how it was used, where and when it was found, how is it related to certain people, who are these people etc. For these kinds of scientific information SYNTHESIS complies with the CIDOC CRM ISO21127 standard.

The administrative documentation includes cultural data pertinent to the administrative procedures that take place in museums, such as exhibitions, loans in and out, the propriety status of the objects etc. For those procedures SYNTHESIS follows the SPECTRUM: The UK Museum Documentation Standard.

General system characteristics

The system utilizes XML technologies, multilayered architecture, open source software, and national and international standards in order to provide significant capabilities in relation to:

Documentation workflow model

SYNTHESIS supports a workflow for the process of documentation that allows authorized by the organization / federation of organizations, users of the system having specific roles to create, edit, publish and recall object XML documents. In particular, users – administrators (administrators), having the role of the administrator of an organization, can create XML documents for cultural objects of the organization which can then be assigned to editorial teams or individual user- editors(editors). The editors can collect manage and store information about the specific objects. When information processing is complete, the members of the editorial team (editors) can "flag" the XML document in order to be published (the XML document is flagged as "request for publication" and is no longer available for editing). The administrator will then publish the XML document. If for some reason the XML

document is not published, it is sent back to the editors for further reviewing and revision (at this point it is flagged as “not published” and it can be accompanied by a brief note that explains the reason for the rejection). The editors can further edit it and then place a new request for publication. If, for some reason, an already published XML document needs to be modified, the editor can ask the administrator to recall it. The XML document is then returned to the editors who can further revise it and then put a new request for publication.

Each user can view and work on the object XML documents for which he/she has editing rights. They can also view (but not edit) XML documents that belong to other users of the same organization. Published XML documents can be viewed by all users of the organization / federation but nobody can edit them.

The information entered in the XML documents is conceptually structured and allows editors to choose the sections they wish to document.

Data organization

Information about the objects is organized in structured XML files (documents) which:

- ✓ provide flexibility in relation to their structure
- ✓ allow the conceptual structuring of the information
- ✓ provide the capability to differentiate the various data structures according to the kind of the cultural assets
- ✓ allow multiple translations of the existing documents in many languages
- ✓ allow the dynamic dissemination of the information in web sites

The system provides structured XML documents for the administrative and scientific documentation of the objects and for the exploitation and promotion of the scientific knowledge.

Administrative and scientific xml documents

The current SYNTHESIS 3.0 version supports the following types of xml documents for the administrative and scientific documentation:

- | | |
|---|----------------|
| ✓ museum object | ✓ evidence |
| ✓ monument | ✓ person |
| ✓ digital and non digital file (photos, drawings, studies etc.) | ✓ organization |
| ✓ reference (publications) | ✓ location |
| ✓ collection | ✓ material |
| ✓ exhibition | ✓ event |

The conceptual structure of the museum object xml document distinguishes five functional units, each functional unit consists of major information units (information units) and each information unit consists of a set of fields (simple or complex). The functional units and the information units of an xml document for museum object are presented in the following table.

Functional units	Information units	Complex fields
Document identity	Document Identification, Version Identification	
Object identity		Object Identification number, Other Identification numbers, Originator of Reference, Collection, Management Category, Reference name, Principal Material, Description, Basic colour, Included In, Composition,

		Representative image, Current Condition, In house
Detailed documentation		
	Object description	Classification, inscriptions, markings, decorations, condition state, measurement
	Object history	production, uses, exhibitions, field collections, interventions, Ownership
	Object cross-references (with other objects and events)	
Management		
		loans, acquisition, location, movement, contracts, other acquisitions, packaging, object valuation, deaccession, loss, rights
References to		
	Bibliography, Digital and non digital archives related to photos, maps, drawings Other classification, Evidences	

For more information see [BEKIARI 2008].

Similarly, the conceptual structure of the monument xml document distinguishes five functional units. The functional units and the information units of an xml document for museum object is presented in the following table.

Functional units	Information units	Complex fields
Document identity	Document Identification, Version Identification	
Monument identity		Monument Identification number, Other Identification numbers, Originator of Reference, Institution, Management Category, Principal Current Denomination, Description, Included In, Monument Location, Condition, Representative image
Detailed documentation		
	Monument description	Monument Classification, Description, State of Preservation, Components, Surrounding Space, Inscriptions, Measurements
	Object history	Monument Names, Construction, Function/use, Intervention, Decoration, Protection, Ownership, Other Historical Events
	Object cross-references (with other objects and events)	
References to		
	Bibliographic reference, Archival reference, Other reference numbers, Evidences, Texts	

Types of Xml documents for the exploitation and promotion of scientific knowledge

- ✓ Digital archives
- ✓ Information texts

For more information see [BEKIARI 2014]

Documentation functions / user types

The current SYNTHESIS 3.0 version supports the following functions for processing xml documents.

Create new

This function creates a new XML document for an entity.

View

This function permits users to view the information contained in the XML document of an entity.

Edit

This function permits users to edit and modify the XML document of an entity. This is done with the help of the FeXML editor (see the “Data entry and editing” section)

Translate from

This function translates the XML document of an entity into another language.

Delete

This function permanently deletes a XML document from the system.

Request the publication of an “unpublished” monument or object XML document

With this function the editor can request the publication of an “unpublished” monument or object XML document which he/she edits.

Publication of an “unpublished” monument or object XML document

This function allows the system administrator to accept the request for the publication of a monument or object XML document that has been placed by an editor and then proceed to publish it.

Rejection of the request for the publication of an “unpublished” monument or object XML document

This function allows the system administrator to reject the request for the publication of an “unpublished” monument or object XML document that has been placed by an editor, and not publish it.

Recall of a published monument or object XML document

This function allows the system administrator to recall a published XML document. This changes the status of the XML document to “unpublished” and now the editor can further process it

Export XML documents in XML

This function exports locally, in the user’s computer, the contents of a XML document. The XML document is exported in XML.

Export XML documents in RDF

This function exports locally, in the user’s computer, the contents of a XML document. The XML document is exported in XML/RDF. SYNTHESIS exports the data in RDF according to the CIDOC CRM ontology. Data can also be

exported in RDF according to other ontologies (i.e. EDM), but for this, the schema of the XML document has first to be mapped to this other ontology. This can be done using the 3M mapping tool. [OLDMAN 2016].

This function exports locally, in the user's computer, a XML document's template. The template is exported in XML (an empty XML document is created).

Import XML document

This function allows a user to add new data, by importing one or more XML documents.

Copy XML document

This function allows the duplication of an XML document.

Search

This function allows an editor to search for XML documents of all type of entities supported by the system. By typing a word in the "search" field the system will display all the XML documents that contain this word. The editor can also group the results by performing a search based on the status of the XML documents (published, under publication etc).

The system also provides an advanced search. Here the editor can define the criteria of the search. These criteria correspond to the fields the editor fills during data entry in the system. The system displays all the XML documents that meet the search criteria.

Create versions

This function allows the editor to create a new version of an XML document.

View versions

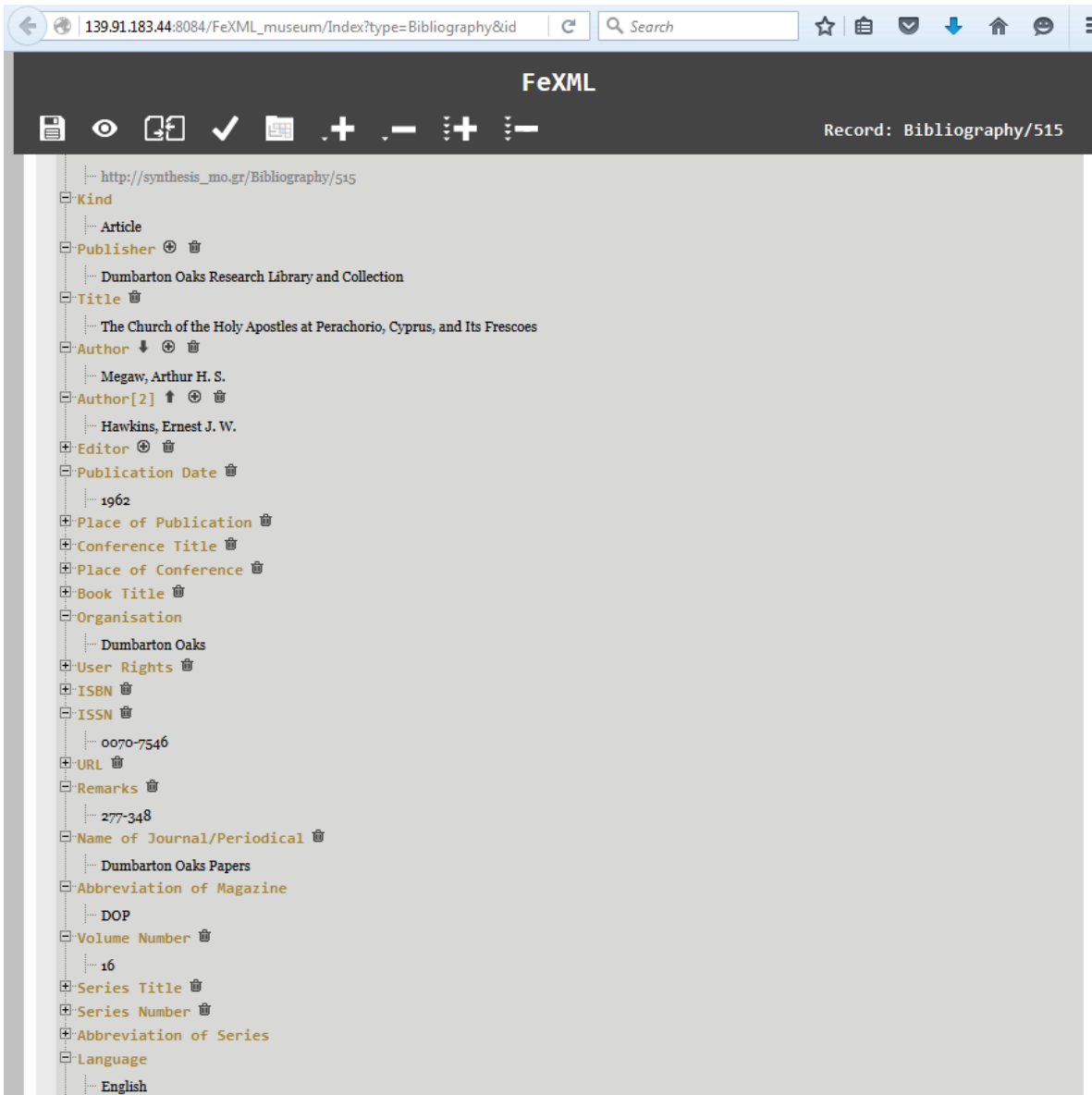
This function allows the editor to view all the versions that have been created for a certain XML document.

Managing the rights of the users to edit XML documents

This function allows the administrator to link editor/s with a certain XML document/s that belongs to the organization.




Data entry and editing







For entering and editing data in the fields of an unpublished monument or object XML document or an entity, SYNTHESIS uses the **FeXML** editor. The **FeXML editor** is an open source application developed within the current project, and supports the creation and editing of XML XML documents. The **FeXML editor** is activated during editing or viewing a XML document. The following figure presents the window of the **FeXML editor**.



An example of editing an XML document with the FeXML editor

The toolbar at the top of the above picture show the icons that correspond to the functions explained in the table below.

Icon	Action	Description
	Save	Save current document
	View	View current document in read-only mode
	References	Display references from/to current document to other documents

	Validate XML	Validate XML document (i.e. check that it is “well-formed” and also conforms to the rules of an XML schema)
	XML Map	Display XML document map
	Expand	Expand XML document one level
	Collapse	Collapse XML document one level
	Expand All	Expand all levels of XML document (full extend)
	Collapse All	Collapse all levels for XML document

Field types and special expressions

The field types supported by the FeXML editor are:

1. Text Fields
2. Controlled vocabulary fields
3. Fields that allow date and time expressions
4. Fields that link to other files

User types

SYNTHESIS supports the following user types:

System Administrator

The system administrator creates new Organizations and Organization Administrators. Each Organization can have only one organization administrator.

Organization Administrator

The Organization administrator creates new users, new documents for objects and monuments and assigns rights to editors (grants an editor the right to edit a particular document). The organization administrator also accepts or rejects publications and recalls published documents.

Editors

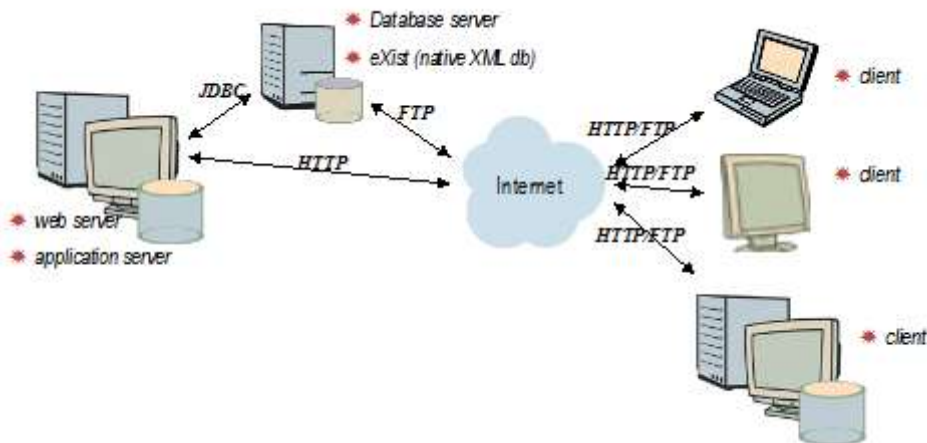
Editors process and translate the documents that are assigned to them by the organization administrator and can request their publication.

Guest Users

They can only view some documents.

System architecture

SYNTHESIS is a web application which uses the 3-tier architecture model. This allows for the separation of the application logic, the data, and the user interface, ensures open architecture, expandability, adaptability and flexibility. The three major independent modules are the data base, the functional components and the user interface and are presented in the following diagram:



The general idea is that data are stored in a central database and users (curators, administrators) can access them through the internet, using the system's functional components according to the type of access rights they are given.

The three major system components are:

- (1) **The Database Server Tier:** It is the most important tier of the system. It provides all the necessary functionality for storing, retrieving, updating and maintaining the data, as well as the mechanisms to ensure data integrity. The Database Server Tier is implemented in "eXist" (<http://exist.sourceforge.net/>) - a native xml database which allows insertions, deletions and searching of the XML documents. eXist is an open source software.
- (2) **The Web Services:** it is the main component of the software, where all but the processes that are related to the configuration of the user interface are executed. The functional components use the technology of Web services. The web services architecture facilitates the following:
 - a. **Interoperability:** a web service provides independence both from the operating system and the hardware. Any program consistent with this technology can easily access such a service.
 - b. **Integration:** in any existing web application the creation of a new web service does not require changes in the system mechanism.
 - c. **Availability and publication:** data about web services are published when they can be located and used fast.
 - d. **Expansion:** an already existing web service can be easily updated, thus providing more services to its users.
 - e. **Cost effective creation and use:** the cost of integrating a web service into a web site or application is very low.
 - f. **Use of software:** the same HTTP protocol used by browsers for browsing in the web is also used here.
- (3) **The Client Tier:** This is the level where end users interact with the system. On this level the management of user screens and data formatting take place. The client software is a web application accessible from all

browsers (Chrome, Mozilla, Internet Explorer etc.), using technologies like jQuery, JavaScript, ajax, bootstrap, etc. The XML document editing system, FeXML editor, is an open source application developed by the Center of Cultural Informatics.

Summarizing, the system architecture features are:

- ✓ 3-tier architecture
- ✓ low cost addition, removal and updating of functions
- ✓ additional categories of cultural documents can be documented at low cost
- ✓ remote access
- ✓ updating the platform is cost free
- ✓ can interface with other museum networks and cultural organizations
- ✓ open source software

Other systems based on SYNTHESIS

1. The “Anna Komnene” information system which is used to manage, document and promote byzantine monuments by the European Centre for Byzantine and Post-Byzantine Monuments (EKBMM) in Thessaloniki. “SYNTHESIS” was used in the form of a federated system with 8 organizations supervised by (EKBMM).
<http://www.ekbmmdb.gr/annakom/>, <http://www.exploringbyzantium.gr/>
<http://www.exploringbyzantium.gr/EKBMM/Page?lang=en&template=infokiosk>
2. The information system used to manage the museum objects of the Monastery of Mount Sina by the Mount Sina Foundation in Athens. SYNTHESIS was used as an individual system for one organization.
3. The information system used by the 13th Ephorate of Byzantine Antiquities in Heraklion for the scientific documentation of the wall paintings of the Cretan byzantine churches. SYNTHESIS was used as an individual system for one organization.
<http://139.91.183.44:8084/agia/Page?name=index&lang=gr#>
4. The information system used for documenting and promoting the Venetian monuments and their accompanying multimedia promotional material by the municipality of Lefki which is located in Ziros, in the county of Sitia. SYNTHESIS was used as an individual system for one organization.
<http://www.medieval-etia-pafos.gr/etiaSite/Page?page=Index>

Extensions of SYNTHESIS

In relation to the entities

SYNTHESIS can be easily expanded and specialized for other types of cultural assets, such as archives, books, works of art etc. This entails the creation of new schemata for the description of these new documentation entities.

In relation to the entities

The system can also be easily expanded with respect to the presentation of the scientific knowledge. For more information see [BEKIARI 2014].

In relation to the languages used

SYNTHESIS can support a large number of languages. So far it supports Greek, Arabic, English, Italian, French, Dutch and Swedish. Adding a new language in SYNTHESIS entails the translation of the UI, the entities' name and their functional / information units, fields and some built in controlled vocabulary in this language.

References

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[BEKIARI 2014], BEKIARI, C. , DOERR, M., AGELAKIS, D. KARAGIANI, F. (2014) Building comprehensive management systems for cultural – historical information, Proceedings of the 42nd Annual Conference on Computer Applications and Quantitative Methods in Archaeology, CAA 2014, Paris, 2014 F. Giligny (ed.)

CIDOC CRM (2011), *Current Official Version of the CIDOC CRM. Definition of the CIDOC Conceptual Reference Model. The version 5.0.4 of the reference document.* [online]. Available from: http://www.cidoc-crm.org/docs/cidoc_crm_version_5.0.4.pdf [Accessed, 30th July 2014]

[OLDMAN 2016], Dominic Oldman, Maria Theodoridou, Giorgos Samaritakis, Using Mapping Memory Manager (3M) with CIDOC CRM, draft version 4g. Available from: <http://139.91.183.3/3M/> [last accessed: 9th February 2016]

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