

# **DIGITAL CULTURAL CONTENT: GUIDELINES FOR GEOGRAPHIC INFORMATION**



**DIGITAL CULTURAL CONTENT:  
GUIDELINES FOR  
GEOGRAPHIC INFORMATION**

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ATHENA WP7  
Working Group  
“Development of plug-ins  
to be integrated within the  
European Digital Library”

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The text of this booklet  
is included in deliverables 7.2  
“Guidelines for Geographic  
Location Description” and  
“Adds: Possible GIS Models”  
of the ATHENA project:  
<http://www.athenaeurope.org/getFile.php?id=666>  
and <http://www.athenaeurope.org/getFile.php?id=669>

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# Foreword

It is the aim of the ATHENA project to support especially museums in providing object data for publication in Europeana.

Following the publication of “Digitisation: standards landscape for European museums, archives, libraries” which was received very well, we decided to produce another set of guidelines relating to “Geographic information (GIS)” and hope that these are also helpful for the cultural heritage community.

When seeing a museum object, a question of high interest is: where to find it? For that the knowledge of its geographic location is essential.

These guidelines aim at providing basic information for the description of geographic locations. It needs to be implemented in such a way that the geographic location information is machine-readable and thus can be used also in Europeana and other relevant portals to identify the place of objects.



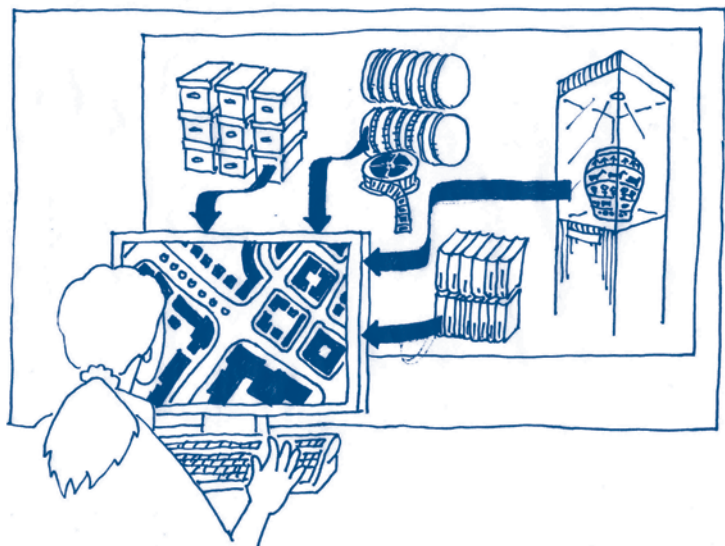
We hope that these guidelines are helpful for museums, other cultural institutions, content holders, curators and information engineers who wish to allow easy access to their heritage.

**Monika Hagedorn-Saupe**

WP2 - Awareness and dissemination:  
Enlarging the network and promoting  
the service



# 1. Introduction<sup>1</sup>



<sup>1</sup> Sources and literature are provided in a Literature chapter

It will be just a matter of time before we will realise that only browsing by a “keyword” or searching for a combination of words in a record will not be an efficient method of object discovery in increasingly larger pool of objects in the Europeana portal. At the time of writing Europeana is measured in the tens of millions of objects but soon it is expected there will be several hundreds of millions. As a result an efficient search engine cannot be imagined without the consideration of the spatial and time dimension of objects, together with their historical and cultural context.



We consider **geographic location** as one of the most important aspects of information which pertains to every cultural heritage item. Examples include provenience, current institution, and location of event. Therefore a formalized location attribute (e.g. geocode or geographical coordinates) will significantly enhance the power of searching and the visualization of the content in Europeana and other cultural portals as well.

The **added value** of the inclusion of geographic location in Europeana is in the:

- browsing of Europeana efficiently through space and time
- searching for content in a more user friendly way, without need to type geographical names
- making it possible to discover overlapping cultural content at the same location but originating from different sources and at different times
- mapping and visualization of the content
- performing of GIS calculations and simulations.

**The aim of these “Guidelines for geographic information”** is to provide basic information about geographic location description of digital cultural content for museums, other cultural institutions, content holders, curators, and information engineers.

They will enable them to:

- meet cultural documentation standards and the requirements of geographic information standards (e.g. ISO and OpenGIS)
- create an appropriate structure of geographic model for cultural content



- automatically encode geographic data for cultural content
- exploit geographic information when using digital cultural content
- take advantage of the infrastructure for spatial information established by INSPIRE EU Directive.

The **discovery of the power and value of geographic information** for digital cultural content has already been shown by several EU projects such as Digmap,<sup>2</sup> Minerva EC,<sup>3</sup> The Alexandria Digital Library,<sup>4</sup> DBpedia<sup>5</sup>, and other projects as well.

<sup>2</sup> <http://portal.digmap.eu>

<sup>3</sup> <http://www.minervaeurope.org/>

<sup>4</sup> <http://www.alexandria.ucsb.edu/>

<sup>5</sup> Becker, C., Bizer, C. (2009). *Exploring the Geospatial Semantic Web with DBpedia Mobile*. In: Web Semantics: Science, Services and Agents on the World Wide Web, Volume 7, Issue 4, December 2009, Pages 278-286

<sup>6</sup> <http://www.europeanconnect.eu/>

The current Europeana portal only has a classical search, browsing facets and an object data without map view. The next significant step is planned for the end of 2011. EuropeanaConnect,<sup>6</sup> a EC funded project, aims at the extension of the access modes for Europeana content by developing a spatial and temporal interface.

This will enable the establishment of a chronological and geographical context for interaction with Europeana database. It will combine spatial and temporal metadata for visualization and thus enrich the user experience.

The result will be an interactive and generic map of geo-related tagged events, places and characters in Europe combined with a timeline. When these plans are realised they will mean a significant improvement of Europeana services.



Mobile devices will be able to display information about cultural heritage objects in their geographical context.

Information could be integrated in mapping applications within other public and private services. The result would be to facilitate access to and the awareness of cultural heritage.

However these new access modes may not produce the expected impact if they do not become familiar to users and data providers as classical text searching is. This booklet aims to contribute to this familiarity.

### **What are the aims of these Guidelines?**

They aim to:

- raise awareness of the potential of GIS technologies in the cultural sector
- explain basic GIS terms and concepts
- demonstrate the benefits of including geographic information in the process of creating digital cultural content
- offer basic recommendations and tools to tackle possible bottlenecks in introducing GIS
- make strong suggestions to all European content providers on how to enrich their current content with appropriate geographic information.

### **These Guidelines are not:**

- research into the development of new GIS methods
- scientific, in-depth, theory or discussion of new methods in great detail



- how to develop to GIS software or adds-in like APIs
- technical specifications for GIS portals and databases
- requirements for a thesaurus or SKOS
- or a detailed plan for GIS implementation in cultural institutions.

The **primary audience** of these Guidelines are the content providers of Europeana Group projects. They are also useful to curators, librarians and archivists who are considering the application of GIS in their institutions and to their content. Also the Guidelines target Europeana itself and other portals who are in the process of preparing strategies for wider GIS implementation.







## 2. Basic terms

This chapter briefly describes basic terms of geographical information. Definitions aim to facilitate their understanding by those in the digital cultural content field.

### **aerial photo**

Aerial photo (also aerial photograph) is a photos of the ground taken from an elevated position (e.g. in an aircraft). Unlike an orthophoto the photo is not geometrically corrected.

### **digital topographic map**

Digital topographic map is a topographic map in digital form. It can be viewed on Internet using various web map services e.g. Google Maps.

### **gazetteer**

Gazetteer is a geographical dictionary or index which contains information on places and place names and is meant to be used in conjunction with a map or atlas. It can be simple alphabetical listing of geographical names or it can include further information on latitude/longitude, geographical profiles of continents, countries or regions, social statistics, and physical feature.

Examples are GeoNames<sup>7</sup> and The Getty Thesaurus of Geographic Names (TGN).<sup>8</sup>

<sup>7</sup> <http://www.geonames.org/>

<sup>8</sup> See <http://www.getty.edu/research/tools/vocabularies/tgn/index.html>



## geo portal

Geo portal (also GIS portal) is a web portal which enables users to discover, visualize, share and retrieve geographic data. The typical functionalities are interactive maps, exporting maps and data. They are usually integrated data from distributed geographical resources and in some cases allow for the editing of data.

Subset of geo portals are interactive maps on the web which feature display and interaction with maps and various layers, and searching, browsing and displaying data, and measuring distances. Examples are INSPIRE Geoportal<sup>9</sup> and GoogleEarth.<sup>10</sup>

<sup>9</sup> <http://www.inspire-geoportal.eu/>

<sup>10</sup> <http://earth.google.com/>

## geocoding

Geocoding is the process of assigning geographic coordinates to the location of real world entities such as houses, streets, parcels. The geocoded location can then be used in GIS.

## geographic coordinate

Geographic coordinate (also coordinate) is presented as x, y and possibly z-values which define a position in a coordinate system. Examples of coordinated systems are system of latitude and longitude, used on the Earth's surface, and the Cartesian system.

## geographic coordinate system

Geographic coordinate system is a coordinate system that enables every location on the Earth to be specified by a set of numbers. The coordinates are often chosen in such way that one of the numbers represents vertical position, and two or three of the numbers represent horizontal position. A common choice of coordinates is latitude, longitude and elevation.<sup>11</sup>

<sup>11</sup> *A guide to coordinate systems in Great Britain.*  
See: [http://www.ordnancesurvey.co.uk/oswebsite/gps/docs/A\\_Guide\\_to\\_Coordinate\\_Systems\\_in\\_Great\\_Britain.pdf](http://www.ordnancesurvey.co.uk/oswebsite/gps/docs/A_Guide_to_Coordinate_Systems_in_Great_Britain.pdf)



### **geographic information (also spatial information, data on place)**

Geographic information is any data with direct or indirect reference to specific location or geographical area on the surface of the Earth and can be in the form of geographic coordinates and/or geographic names.

### **Geographic information system (GIS)**

Geographic information system (also geospatial information system) is an information system for the capture, editing, storage, analysis, management, integration, presentation, and visualization of geographical data (i.e. data linked to a location on the Earth's surface). GIS can be used in different areas such as archaeology, urban and landscape planning, navigation, and cultural tourism.

### **geographic metadata**

Geographic metadata (also spatial metadata) is a type of metadata used for the data describing geographical features. Geographic metadata include the geographic extent, content, quality, condition, and other characteristics of the geographic data. Example of geographic metadata standard is ISO 19115:2003.<sup>12</sup>

### **Geography markup language (GML)**

Geography Markup Language is “an XML grammar for expressing geographical features”.<sup>13</sup> It aims to further the interoperable exchange of geographic data. GML is used for two purposes: as a modeling language for geographic systems; and as an open interchange format for geographic transactions on the Internet. Its grammar has two parts:

<sup>12</sup> [http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=26020](http://www.iso.org/iso/catalogue_detail.htm?csnumber=26020)

<sup>13</sup> Geography Markup Language. Open Geospatial Consortium. See: <http://www.opengeospatial.org/standards/gml>



the schema that describes the document; and the instance document that contains the actual data. GML was developed by OpenGIS Consortium, it is also ISO standard 19136.

### geo-ontology

Geo-ontology (also geographical ontology) are concepts that correspond to things from the physical and social world having a location on the surface of the Earth. Geo-ontology also defines semantic and spatial relations between things (i.e. topology and mereology).<sup>14</sup>

### geoparsing

Geoparsing is the process of assigning geographic coordinates to textual words and phrases (e.g. “ten kilometers east of Rome”) or other media (e.g. audio recordings). Geoparsing is capable of handling ambiguous references in unstructured content. Geoparsed features can then be mapped and entered into a GIS. An example is Europeana Geoparsing Service (prototype version) and Europeana gazetteer service.<sup>15</sup>

### Global positioning system (GPS)

Global positioning system is a navigational system which uses radio signal from at least three satellites to determine its geographic position on Earth (latitude and longitude). With signal from a fourth satellite receiver it can also determine altitude.

### layer

Geographic features are organized in layers (also map layer, GIS layer). One layer consists of geographic data on some thematic topics, e.g. road network, cultural heritage or orthophoto. The layers are registered to a common coordinate system, which facilitate

<sup>14</sup> Riikka Henriksson, Tomi Kauppinen and Eero Hyvönen. *Core Geographical Concepts: Case Finnish Geo-Ontology*. See: <http://www.seco.tkk.fi/publications/2008/henriksson-kauppinen-hyvonen-suo-2008.pdf>

<sup>15</sup> See [http://digmap3.ist.utl.pt:8080/geoparser\\_econnect/](http://digmap3.ist.utl.pt:8080/geoparser_econnect/) <http://europeana-geo.isti.cnr.it/gazetteer>



analysis and integration across the various themes. A map is usually a composition of many layers.

### location

Location (also geographic location, spatial location) is a position or site occupied or available for occupancy or marked by some distinguishing feature or position defined by a set of coordinates within a spatial database, for example a street number.<sup>16</sup>

### orthophoto

Orthophoto is an aerial photo geometrically corrected (“orthorectified”) in such way that the scale is uniform and therefore presents accurate representation of the Earth’s surface.<sup>17</sup>

### raster data

Raster data is a type of geographic data in a GIS (see also vector data). Geographic space is presented as a matrix of cells. Cell data is arranged in a regular grid pattern. Attribute data is assigned to each unit or cell in the grid. Examples of raster data are digital orthophoto, imagery from satellites, digital elevation model, and digital scanned maps.

### topographic map

Topographic maps depict terrain relief by showing ground elevation either by the use of contour lines or spot elevations. They represent the horizontal and vertical positions of the features. As a graphic representation they delineate natural and man-made features of an area in a way that shows their relative positions and elevations.<sup>18</sup>

### vector data

Vector data is a type of geographic data in a GIS (see also raster data). A geographic feature

<sup>16</sup> Merriam-Webster Dictionary. See <http://www.merriam-webster.com/>

<sup>17</sup> <http://en.wikipedia.org>

<sup>18</sup> Stearns J. Wood and E. June Wood. *A practitioner's guide to GIS terminology*. Federal Way: Data West, 2000.



is described by a vector – as a list of ordered x, y (and z) coordinates and other attribute data. There are three main types of vector data: point (e.g. centroid of building), lines (e.g. road), and polygons (e.g. town area).

### **Web coverage service (WCS)**

Web coverage service interface standard defines a standard interface and operations that enables interoperable access to coverages<sup>19</sup> – digital geospatial information representing space/time-varying phenomena.<sup>20</sup> The specification was developed by the Open Geospatial Consortium.

### **Web feature service (WFS)**

Web feature service is a standard Internet protocol for retrieving and updating spatial features. The specification was developed by the Open Geospatial Consortium and adopted as ISO standard 19142.

### **Web map service (WMS)**

Web map service is a standard protocol for serving georeferenced map images over the Internet that are generated by a map server using data from a GIS database. The specification was developed by the Open Geospatial Consortium and adopted as ISO standard ISO 19128.

### **WGS 84**

WGS 84 (also World Geodetic System 1984) consists of a three-dimensional Cartesian coordinate system and an associated ellipsoid, which enables the description of positions as either XYZ Cartesian coordinates or latitude, longitude and ellipsoid height coordinates.<sup>21</sup> WGS 84 (dating from 1984 and last revised in 2004) is the reference coordinate system used by the Global positioning system.

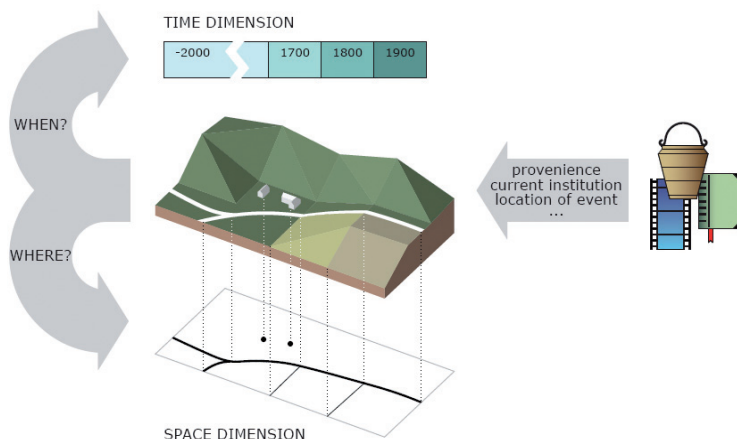
<sup>19</sup> Web Coverage Service. Open Geospatial Consortium. See: <http://www.opengeospatial.org/standards/wcs>

<sup>20</sup> OGC® WCS 2.0 Interface Standard – Core. See: [http://portal.opengeospatial.org/files/?artifact\\_id=41437](http://portal.opengeospatial.org/files/?artifact_id=41437)

<sup>21</sup> World Geodetic System 1984 (WGS84). See: <http://www.ordnancesurvey.co.uk/oswebsite/gps/information/coordinate/systemsinfo/guidecontents/guide4.html>



### 3. What is Geographic information system?



**GIS in digital cultural content** is a fairly new issue, especially when we are talking about movable cultural objects such as books, paintings, museum objects, intangible heritage and other objects collected in libraries, museums, archives, audiovisual and other cultural institutions.

After 50 years of synthesis and development, there are still many **competing definitions of a geographic information system (GIS)**.<sup>22</sup>

The term describes any **information system** that integrates, stores, edits, analyzes, shares, and **displays geographic information**.

<sup>22</sup> Sources and literature are provided in a Literature chapter



In more generic sense, GIS applications are tools that allow users to create interactive queries (user created searches), analyze spatial information, edit data, maps, and present the results of all these operations.

GIS systems allow users to collate and analyze information far more readily than is possible with traditional research techniques.

It is an **integrating technology** because it draws upon and extends techniques that geographers have long used to analyze natural and social systems.

In GIS a database a **common spatial coordinate system** is used as the primary means of reference. It also requires: a means for data input, storage, retrieval, and query; data transformation, analysis, and modeling; and data reporting as maps, reports, and plans. The definition implies that a GIS is somehow different from other information systems, and that geographic data are different from non-geographic data.

Many have characterized **GIS as one of the most powerful of all information technologies** because it focuses on integrating knowledge from multiple sources and creates a crosscutting environment for collaboration. It combines a powerful visualization environment with a strong analytic and modeling framework. This combination has resulted in a technology that is science-based, trusted, and easily communicated across cultures, social classes, languages, and disciplines.

GIS is an astonishing technology that has become a complex system with a nearly **fifty year history**:



<b>late 1950s</b>	work on GIS began
<b>1960</b>	the world's first true operational GIS "Canada Geographic Information System" (CGIS) developed by Dr. Roger Tomlinson
<b>late 1970s</b>	first GIS software was developed from the laboratory of the ESRI
	<b>planar graphs:</b> graph theory is the foundation for understanding networks and topology used in geographic information systems
<b>1972</b>	Tobler, W. published book "Geocoding Theory": geocoding generally moves from place names to a more explicit geocoding of relationships
<b>1975</b>	specialized use in cartography and spatial simulations
<b>1985</b>	use in different fields
<b>1995</b>	formalization and standardization
<b>2000 onward</b>	wide use of GIS: electric/gas utilities, risk management, water/wastewater industry, environmental studies and management, forestry, geology and hydrology, business, land use planning and mapping, military, site planning and in transportation
<b>2000</b>	the Global Positioning System (GPS) enabled development of different navigation applications
<b>2005</b>	Google Earth: a widespread home application that enabled exploration of geographical content, cultural places, tourism and others
<b>2007</b>	The INSPIRE EU Directive: establishes an infrastructure for spatial information in Europe



23 Source: <http://www.codeproject.com>

To fulfill this vision, a GIS needs to support several views for working with geographic information.<sup>23</sup>

- **Database View:** GIS as a spatial database is a structured database that describes the world in geographic terms.
- **Map View:** GIS as a method for geovisualization. It is a set of intelligent maps and other views that show features and their relationships on the earth's surface in two-dimensional (2D) and three-dimensional (3D) map applications. These provide rich tools for working with geographic information.
- **Model View:** GIS as a tool for geoprocessing. It includes a set of information transformation tools that derive new geographic information datasets from existing datasets, apply analytic functions, and write results into new derived datasets.

### Questions a GIS can answer

- Location: What is at a given location?
- Condition: Where does something occur?
- Trends: What has changed since ...?
- Patterns: What spatial patterns exist?
- Modeling: What if ...?

**GIS as a tool** is an important technology to support databases, multimedia, Internet and other information technology in the **field of cultural heritage digitalization**.

Here are some examples of uses of GIS technology for protecting, management, education and marketing of cultural heritage:



1. Location data for cultural objects in museums, archives and libraries:
  - provenience
  - place of events
  - place of acquiring (context, layer)
  - place of present location of object
  - places connected with object, authors, organizations.
2. Location data for objects of cultural heritage:
  - macro location (scale 1: 50000 and more): overview level
  - mezzo location (scale 1:5000): identification in 'nature' level
  - micro location (scale 1:100 and less): detail level.
3. Tool for evidencing, registration, documenting cultural heritage, antiques, geological and biological samples, archaeological, ethnological objects and art.
4. Tool for analyzing, evaluating the architectural, social, economic, art meaning, vulnerability, sensitivity and risk estimation, strategic use planning, conservation, restoration, maintaining and monitoring state of art and use of immovable cultural heritage.
5. Legally valid GIS layer of protection areas is a basis for spatial planning procedures and building permissions issuing.
6. Tool for archeological research, excavations, analyses and documenting as topological, network, geostatistical analyses and expert systems.



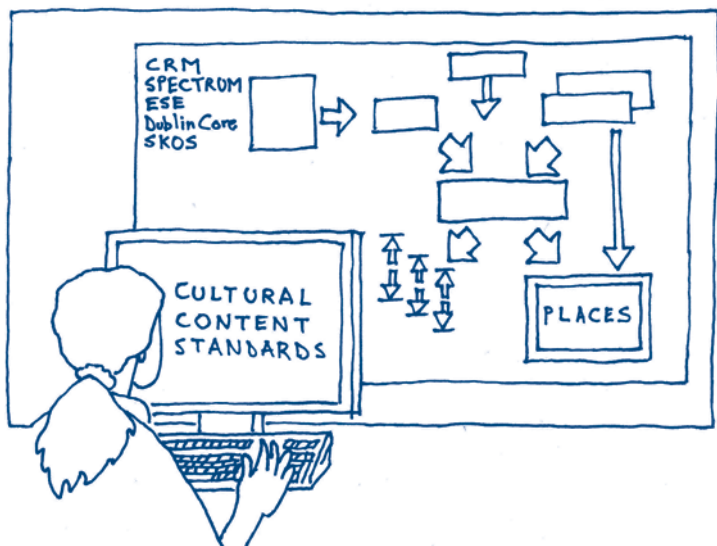
7. Two or three dimensional presentations of individual data and statistics of cultural heritage on static and historical maps (e.g. historical GIS).
8. Interactive web / local visualization, virtual reality, multimedia presentations in space and time, actors and events related to cultural heritage.
9. Measuring impacts on cultural heritage, searching optimal cultural routes, geocoding documents to follow in space and time, planning the development of cultural tourism, mapping accessibility of museums, and mapping routes exhibitions.



## 4. Standards

This chapter briefly describes the main standards which concern **digital cultural content**, with the emphasis on **geographical information**.

A short overview of the basic standards on geographic information systems is provided below. INSPIRE Directive is described at the end of the chapter where its core “implementing rules” are understood as “de facto” technical standards.





## 4.1. Cidoc Conceptual Reference Model

24 Crofts, Nick et al.  
*Definition of the  
CIDOC Conceptual  
Reference Model.*  
ICOM/CIDOC CRM  
Special Interest  
Group, 2010. See  
[http://www.  
cidoc-crm.org/  
docs/cidoc\\_crm\\_  
version\\_5.0.2.pdf](http://www.cidoc-crm.org/docs/cidoc_crm_version_5.0.2.pdf)

CIDOC Conceptual Reference Model<sup>24</sup> (CRM) is a **formal ontology** which enables exchange and integration between heterogeneous sources of cultural heritage information.

CRM defines and is restricted to the **underlying semantics** of database schemata and document structures used in cultural heritage and museum documentation in terms of a formal ontology.

It does not define any of the terminology as data in the respective data structures, but however it foresees the characteristic relationships for its use.

It does not define any of the terminology as data in the respective data structures, however it foresees the characteristic relationships for its use.

It does not aim to propose what cultural institutions should document, but explains the logic of what they actually currently document, and thereby enables **semantic interoperability**.

CRM is defined with the following content:

- principles of modeling
- definitions of entities classes
- definitions of attributes and connections with entities.



CRM is the result of the CIDOC Documentation Standards Working Group and CIDOC CRM SIG. It was accepted as standard ISO 21127:2006.

The last version is 5.0.2 from January 2010. CRM is a conceptual and classes framework, and when implementing it a geographical language or format as GML for example need to be used.

### *Geographical information*

Geographical information is included in CRM on **conceptual level as “Places”**. Structure of CRM establishes connection between classes “Temporal Entities”, “Physical Entities” and “Places”. “Temporal Entities” occurs at “Places” while “Physical Entities” are located at “Places”.

CRM defines following **classes which pertain to geographic information:**

- Class “Place” (E53) is defined as extents in space, in particular on the surface of the earth, in the pure sense of physics: independent from temporal phenomena and matter.
- Class “Place Appellation” (E44) is used for place identification and is defined as any sort of identifier characteristically used to refer to an E53 Place.
- Class “Spatial Coordinates” (E47) contains spatial coordinates (longitude, latitude and altitude) or any other regular system of reference.
- Class “Place Name” (E48) consists of geographical names typically taken from gazetteers.



## 4.2. Spectrum Standard for Collections Information Management

- 25 Gordon McKenna and Efthymia Patsatzi. *SPECTRUM: The UK Museum Documentation Standard*. Cambridge: Collections Trust, 2009. See: <http://www.collectionstrust.org.uk>

**SPECTRUM Standard** for Collections Information Management<sup>25</sup> (SPECTRUM standard) is an open standard for management of information in museums. The standard contains descriptions of procedures for documenting objects and also processes the objects are subject to. It also aids in the identification and description of information that needs to be recorded in order to support the procedures. Each unit of information required throughout the procedures is described with a definition and how to record it. Examples of the information which might be recorded are given and the relationship between this unit and other units of information are explained. Every unit of information appears in the information group.

It was first published in 1994 by Collections Trust in United Kingdom, the current version is 3.2 from year 2009.

### *Geographic information*

SPECTRUM standard uses geographic information to describe different key aspects of object information and management which have spatial relevance. Standard lists these units of information mainly under “**place information group**”.

Standard defines several **information groups** that are sets of related units of information to record a particular aspect of an object, procedure, process or other ‘entity’.



Groups with their descriptions having information units **referencing geographical locations** are:

- Object collection information records information about the field collection of objects, e.g. during an archaeological excavation.  
Information unit: field collection place.
- Object description information records the categories of the description of an object.  
Information unit: content – place.
- Object history and association information records the historic use and associations of an object. Information units: associated event place, associated place.
- Object production information records the aspects of the creation of an object.  
Information unit: object production place
- Address information is information group normally used for current information which is used and updated. For historical information the Place information group is used. Its information unit's reference place, postcode etc.
- Place information is the information group used for historical or static location information. Within this group information unit "Place coordinates" describes precise location with coordinates of chosen system. The system is then specified in unit "Place coordinates type". Information unit "Place name" contains normally known name of a place.

**LIDO metadata standard** (Light Information for Describing Objects), based partly on SPECTRUM is however less complex.<sup>26</sup> Version 1.0 was released at CIDOC annual meeting in November 2010. The LIDO metadata has been developed within the ATHENA project.

<sup>26</sup> <http://www.lido-schema.org/documents/LIDO-Handout.pdf>



### 4.3. Europeana Semantic Elements Specifications

27 Europeana Semantic Elements specifications: Version 3.3.1. See: [http://version1.europeana.eu/c/document\\_library/get\\_file?uuid=a830cb84-9e71-41d6-9ca3-cc36415d16f8&groupId=10602](http://version1.europeana.eu/c/document_library/get_file?uuid=a830cb84-9e71-41d6-9ca3-cc36415d16f8&groupId=10602)

Europeana Semantic Elements specifications<sup>27</sup> (ESE) is specification of metadata elements for digital objects which will be used for **Europeana portal** operations especially for harvesting and searching. It is required that providers' metadata should map to ESE requirements. The specifications are published as a result of Europeana project. Version 3.3.1 was issued on 24 January 2011.

#### *Geographic information*

ESE uses geographic information to further specify subject description of digital object. **Coverage metadata element** is used for spatial or temporal subject description of the resource and spatial applicability or jurisdiction.

It is used for a named place, a location, a spatial coordinate, a period, date, date range or a named administrative entity. Element does not differentiate between temporal and spatial descriptions. However distinction between temporal and spatial aspects of object is crucial to geocoding.

Coverage element can be refined using the element "spatial" which is intended to provide information of spatial characteristics of digital object as for example named place, a location, a spatial coordinate (latitude/longitude), or named administrative entity.



## 4.4. Dublin Core Metadata Element Set

28 Dublin Core  
Metadata Element  
Set, Version 1.1.  
See: [http://  
dublincore.org/  
documents/dces/](http://dublincore.org/documents/dces/)

The **Dublin Core** metadata element set<sup>28</sup> (DCMES) is a vocabulary of fifteen properties for use in resource description. Descriptive metadata is used for discovery and interpretation of digital objects. DCMES is a simple descriptive metadata schema suitable for different domains. It contains a vocabulary of fifteen properties for use in resource description: contributor, coverage, creator, date, description, format, identifier, language, publisher, relation, rights, source, subject, title and type. DCMES can be used as “simple” or “qualified” Dublin Core. Simple version uses only main fifteen elements as simple attribute-value pairs. “Qualified” version makes use of three additional elements: audience, provenance and rights holder and also a group of element refinements (qualifiers). They provide more detailed information about resource and thus enhances resource discovery.

The **semantics of DCMES** have been established by cooperation of libraries, museums, computer scientists and others. The current version 1.1 is accepted as ISO standard 15836:2006.

### *Geographic information*

In similar way to ESE, DCMES uses geographic information to specify subject description of digital object. It lacks the formalization of geographic information. Metadata element “coverage” is defined as “the spatial or temporal topic of the



resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant”.

**Coverage** can refer to a named place or a location specified by its geographic coordinates, named administrative entity or a geographic place.

Use of a controlled vocabulary is recommended.

Metadata element “coverage” as declared in DCMES can contain both temporal and spatial object descriptions and does not differentiate between them.

However distinction between **temporal and spatial aspects of object** is crucial to geocoding.

The refinement metadata element “spatial” can contain spatial characteristics such as geographic names, latitude/longitude, or other established georeferenced values.



## 4.5. Simple Knowledge Organization System

Simple Knowledge Organization System (SKOS) provides “a model for expressing the basic structure and content of concept schemes such as thesauri, classification schemes, subject heading lists, taxonomies, folksonomies, and other similar types of controlled vocabulary”.<sup>29</sup>

<sup>29</sup> SKOS Simple Knowledge Organization System Primer. W3C. See: <http://www.w3.org/TR/skos-primer/>

It is an **application of the Resource Description Framework (RDF)**.

SKOS supports the composition of concepts and publishing on the World Wide Web, linking with data on the Web and integration into other concept schemes.

In basic SKOS, **conceptual resources** (concepts) are identified with URIs, labeled with strings in one or more natural languages, documented with various types of notes, semantically related to each other in informal hierarchies and association networks, and aggregated into concept schemes.

In advanced SKOS, conceptual resources can be mapped across concept schemes and grouped into labeled or ordered collections. Relationships can be specified between concept labels. Finally, the SKOS vocabulary itself can be extended to suit the needs of particular communities of practice or combined with other modeling vocabularies.<sup>30</sup>

<sup>30</sup> SKOS Simple Knowledge Organization System Reference. W3C. See: <http://www.w3.org/TR/skos-reference/>

SKOS has a status of **W3C Recommendation** from 18 August 2009.

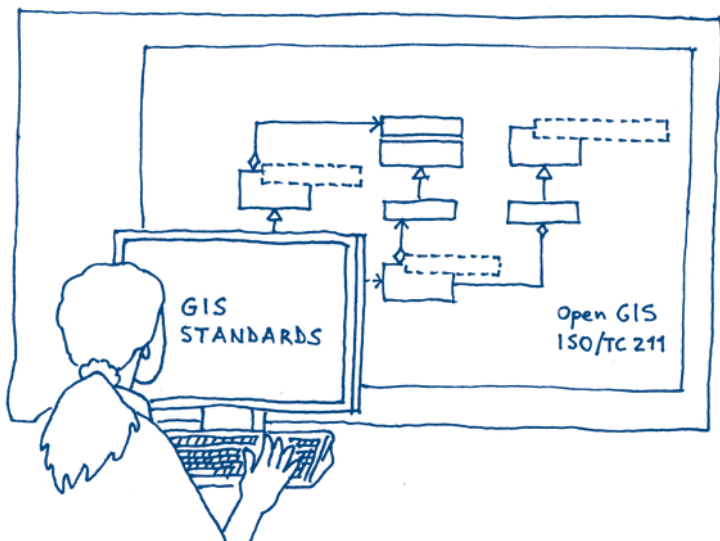


### *Geographic information*

SKOS has potential to aid user access to digital resources **via place name**.

SKOS could provide standard way of representing geographical thesauruses and other controlled vocabularies using Resource Description Framework (RDF).

Information can then be exchanged between computer applications in interoperable way for use in Semantic Web, enabling machines to understand the meaning of information on the Web.





## 4.6. ISO/TC 211 Geographic Information/Geomatics

Standardization in the field of digital geographic information is in the domain of Technical Committee 211 of International Organization for Standardization (ISO/TC 211 Geographic information/Geomatics).

**Technical Committee 211** is working towards establishing “a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth”.<sup>31</sup>

Standards address the infrastructure for geospatial standardization, data models for geographic information, geographic information management, geographic information services, encoding of geographic information and specific thematic areas. More specifically they include methods, tools and services for data management and also its definition and description.

They concern acquiring, processing, analyzing, accessing, presenting and transferring geographical data in digital form between different users, systems and locations.

ISO has published fiftytwo standards under the direct responsibility of Technical Committee 211 by February 2011.<sup>32</sup>

### *Relevance to cultural heritage field*

The ISO/TC 211 group of standards provides for a **fundamental structure of geographic information** thus enabling its computational processing. They lay the foundation on which other developments are possible, like INSPIRE Directive.

The table below briefly lists ISO/TC 211 group of standards with title, short description and reference number.<sup>33</sup>

31 ISO/TC 211  
Geographic  
information/  
Geomatics.  
See: [http://www.iso/](http://www.iso/iso/tc211.org)  
[tc211.org](http://www.iso/tc211.org)

32 See: [http://www.iso.org/iso/iso\\_technical\\_committee.html?commid=54904](http://www.iso.org/iso/iso_technical_committee.html?commid=54904)

33 Source: [http://www.iso.org/iso/catalogue/catalogue\\_tc/catalogue\\_tc\\_browse.htm?commid=54904](http://www.iso.org/iso/catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=54904)



## Overview of ISO/TC 211 standards

### infrastructure for geospatial standardization

- Reference model, the overall requirements for standardization and the fundamental principles, ISO/TS 19101.
- Conceptual schema language, Unified Modelling Language (UML) static structure diagram with its associated Object Constraint Language (OCL), ISO/TS 19103
- Terminology, the structure of the terminological record, and the principles for definition writing, ISO/TS 19104.
- Conformance and testing, the framework, concepts and methodology for testing and criteria to be achieved to claim conformance to the family of ISO geographic information standards, ISO 19105.
- Profiles, identification and documentation of specific subsets of the ISO geographic information standards in a prescribed manner in conformance with these standards, ISO 19106.

### data models for geographic information

- Rules for application schema, formal description of the data structure and content required by one or more applications, ISO 19109.
- Spatial schema, conceptual schemas for describing and manipulating the spatial characteristics of geographic features, ISO 19107.
- Core profile of the spatial schema, core profile as specified in ISO 19107, and ISO 19137.
- Schema for coverage geometry and functions, conceptual schema for the spatial characteristics of coverage, ISO 19123.
- Temporal schema, standard concepts needed to describe the temporal characteristics of geographic information, ISO 19108.



## Overview of ISO/TC 211 standards

### **data models for geographic information**

- Schema for moving features, conceptual schema that addresses moving features, ISO 19141.
- Spatial referencing by coordinates, schema for describing the coordinate reference systems used to relate the position of geometric primitives to the earth or another object, ISO 19111.
- Spatial referencing by geographic identifiers, general model for spatial referencing using geographic identifiers and the essential components of a gazetteer, ISO 19112.

### **geographic information management**

- Methodology for feature cataloguing, methodology for developing catalogues containing definitions of feature types and their property types, ISO 19110.
- Metadata, structure for describing digital geographic data, ISO 19115.
- Quality principles, principles for describing the quality for geographic data and concepts for handling quality information for geographic data, ISO 19113.
- Quality evaluation procedures, framework of procedures for determining and evaluating quality that is applicable to digital geographic datasets, ISO 19114.
- Data product specifications, content and structure of a data product specification, ISO 19131.
- Procedures for item registration, elements of information that are necessary to provide identification and meaning to the registered items, ISO 19135.



## Overview of ISO/TC 211 standards

### geographic information management

- Geodetic codes and parameters, rules for the population and maintenance of registers of geodetic codes and parameters and identifies the data elements in compliance with ISO 19111 and ISO 19135, ISO/TS 19127.
- Data quality measures, set of data quality measures, ISO/TS 19138.

### geographic information services

- Services, defining services according to approach used in the ISO 19100 series of standards, ISO 19119.
- Positioning services, data structure and content of an interface that permits communication between position-providing device(s) and position-using device(s), ISO 19116.
- Portrayal, defines a schema for describing the portrayal of geographic information in a form understandable by humans, ISO 19117.
- Simple feature access — Part 1: Common architecture, common architecture for simple feature geometry, ISO 19125-1.
- Simple feature access — Part 2: SQL option, defines a standard Structured Query Language (SQL) schema that supports storage, retrieval, query and update of feature collections via the SQL Call-Level Interface (SQL/CLI) (ISO/IEC 9075-3:2003), ISO 19125-2.
- Web map server interface, specifies the behaviour of a Web Map Service (WMS) that produces spatially referenced maps dynamically from geographic information, ISO 19128.



## Overview of ISO/TC 211 standards

### **geographic information services**

- Location based services — Reference model, defines a reference model and a conceptual framework for location-based services (LBS), and describes the basic principles by which LBS applications may interoperate, ISO 19132.
- Location based services — Tracking and navigation, description of the data and services needed to support tracking and navigation applications for mobile clients, ISO 19133.
- Location base services — Multimodal routing and navigation, a conceptual schema for describing the data and services needed to support routing and navigation application for mobile clients who intend to reach a target position using two or more modes of transportation, ISO 19134.

### **encoding of geographic information**

- Encoding, ISO 19118.
- Standard representation of geographic point location by coordinates, ISO 6709.
- Geography Markup Language (GML), ISO 19136 - Metadata — XML schema implementation, Geographic MetaData XML (gmd) encoding, an XML schema implementation derived from ISO 19115, ISO/TS 19139.

### **standards for specific thematic areas**

- Reference model — Part 2: Imagery, reference model for standardization in the field of geographic imagery processing, ISO/TS 19101-2.
- Metadata — Part 2: Extensions for imagery and gridded data, ISO 19115-2.



## 4.7. Open Geospatial Consortium Standards

34 Source:  
<http://www.opengeospatial.org>

The Open Geospatial Consortium<sup>34</sup> (OGC) is a voluntary consensus organization that is leading the development of **standards for geospatial content and location based services and also for GIS data processing and sharing**. They are encouraging the development and implementation of open standards, free and openly available to the market.

Organisation has close connections with **other international standards bodies**, especially ISO/TC 211 (Geographic Information/ Geomatics). The ISO 19100 series under development by Technical Committee 211 will progressively replace the OGC abstract specification. The OGC standards Web Map Service, Geography Markup Language (GML), and Simple feature access have become ISO standards.

### *Relevance to cultural heritage field*

The main concern of OGC is development of standards and specifications which would establish **interoperability in the processing of geographical information**. Interoperability is considered as one of the key aspects in designing information systems in cultural heritage field.

35 <http://openlayers.org/>

36 <http://geoserver.org/display/GEOS/Welcome>

37 Source:  
<http://www.opengeospatial.org/standards>

The OpenGIS standards have formed the basis for the development of **open source software** which is frequently used in the cultural heritage field, for example OpenLayers<sup>35</sup> and Geoserver.<sup>36</sup>

The overview of the **OpenGIS® standards** is presented in the table below.<sup>37</sup>



## Overview of OpenGIS® standards

<b>Catalogue Service Interface Standard (CAT)</b>	Supports the ability to publish and search collections of descriptive information (metadata) about geospatial data, services and related resources.
<b>City Geography Markup Language Encoding Standard (CityGML)</b>	This standard is for the representation, storage and exchange of virtual 3D city and landscape models.
<b>Coordinate Transformation Service (CT)</b>	Provides a standard way for software to specify and access coordinate transformation services for use on specified spatial data.
<b>The Filter Encoding Standard (FES)</b>	Defines an XML encoding for filter expressions.
<b>Geographic Objects Interface Standard (GOS)</b>	Provides an open set of common, lightweight, language-independent abstractions for describing, managing, rendering, and manipulating geometric and geographic objects within an application programming environment.
<b>Geography Markup Language Encoding Standard (GML)</b>	The Geography Markup Language (GML) is an XML grammar for expressing geographical features.
<b>Geospatial eXtensible Access Control Markup Language Encoding Standard (GeoXACML)</b>	Defines a geospatial extension to the OASIS (Organization for the Advancement of Structured Information Standards) standard.
<b>GML in JPEG 2000 for Geographic Imagery Encoding</b>	JPEG 2000 is a wavelet-based image compression standard that provides the ability to include XML data for description of the image within the JPEG 2000 data file.



## Overview of OpenGIS® standards

<b>Grid Coverage Service</b>	The specification allows interoperability by providing grid (raster) analysis and processing capabilities.
<b>KML</b>	KML (submitted by Google) version 2.2 has been adopted as an OGC implementation standard.
<b>Location Service (OpenLS)</b>	Open Location Services specifies interfaces that enable companies in the Location Based Services (LBS).
<b>Observations and Measurements</b>	Defines an abstract model and an XML schema encoding for observations and provides support for common sampling strategies.
<b>Sensor Model Language (SensorML)</b>	Specifies models and XML encoding that provide a framework within which the geometric, dynamic, and observational characteristics of sensors and sensor systems can be defined.
<b>Simple Feature Access - Part 1: Common Architecture</b>	Supplies the common feature model for use by applications that will use the Simple Features data stores and access interfaces.
<b>Simple feature access - Part 2: SQL option</b>	Provides a standard SQL implementation of the abstract model in Part 1.
<b>Styled Layer Descriptor</b>	Defines an encoding that extends the WMS standard to allow user-defined symbolization and coloring of geographic feature.



## Overview of OpenGIS® standards

### Transducer Markup Language (TML)

An application and presentation layer communication protocol for exchanging live streaming or archived data to (i.e. control data) and/or sensor data from any sensor system.

### Web Coverage Service (WCS)

Defines a standard interface and operations that enables interoperable access to geospatial “coverages”.

### Web Feature Service (WFS)

OpenGIS Specification that supports INSERT, UPDATE, DELETE, QUERY and DISCOVERY of geographic features. WFS delivers GML representations of simple geospatial features in response to queries from HTTP clients. Clients access geographic feature data through WFS by submitting a request for just those features that are needed for an application.

### Web Map Context

Specifies how individual map servers describe and provide their map content. The present Context specification states how a specific grouping of one or more maps from one or more map servers can be described in a portable, platform-independent format for storage in a repository or for transmission between clients. This description is known as a “Web Map Context Document” or simply a “Context”.



## Overview of OpenGIS® standards

### **Web Map Service (WMS)**

The OpenGIS® Web Map Service Interface Standard (WMS) provides a simple HTTP interface for requesting georegistered map images from one or more distributed geospatial databases. A WMS request defines the geographic layer(s) and area of interest to be processed. The response to the request is one or more georegistered map images (returned as JPEG, PNG, etc.) that can be displayed in a browser application. The interface also supports the ability to specify whether the returned images should be transparent so that layers from multiple servers can be combined or not.

### **Web Processing Service**

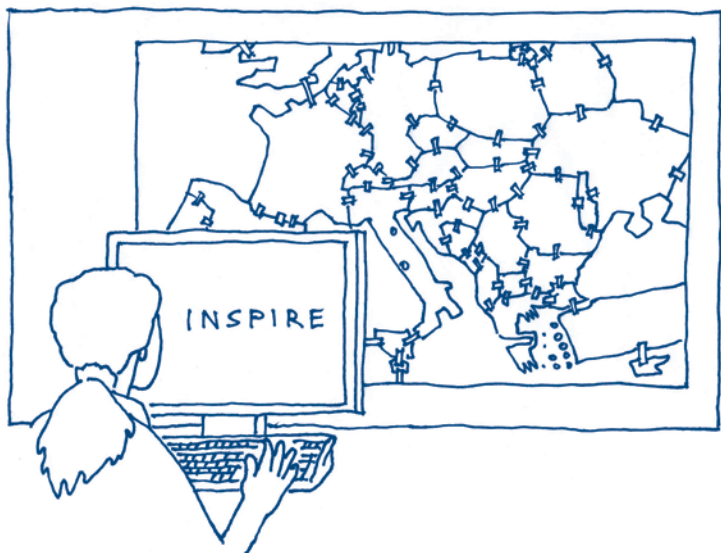
Provides rules for standardizing how inputs and outputs (requests and responses) for geospatial processing services, such as polygon overlay.

### **Web Service Common**

Specifies parameters and data structures that are common to all OGC Web Service (OWS) Standards.



## 4.8. INSPIRE EU Directive



<sup>38</sup> Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). See: <http://inspire.jrc.ec.europa.eu>

The INSPIRE Directive aims to establish **spatial information infrastructure in Europe** in order “to support Community environmental policies, and policies or activities which may have an impact on the environment”.<sup>38</sup>

It came into force on 15 May 2007 and its implementation will follow various stages until full implementation in 2019.

The INSPIRE Directive **ensures compatibility and usability of the spatial data infrastructures of the Member States in European Union.**



To achieve that the Directive requires that common Implementing Rules are adopted in a number of specific areas: metadata, data specifications, network services, data and service sharing and monitoring and reporting.

These Implementing Rules are adopted as Commission Decisions or Regulations, and are binding in their entirety.

The Directive is addressing 34 spatial data themes organized in three annexes.

### *Relevance to cultural heritage field*

INSPIRE spatial infrastructure provides great **opportunity** to be used also in the **digital cultural heritage field**.

Firstly the implementation rules as they are set for coordinate reference systems, geographical names and administrative units can be used as a methodological background and as technical standards.

On the other side the INSPIRE spatial data as orthoimagery and geographical names could be directly used when representing digital cultural content on web maps.

Table below provides the overview of first priority themes most relevant for digital cultural content.



## Most relevant INSPIRE themes for digital cultural content

<b>Coordinate reference systems</b>	Systems for uniquely referencing spatial information in space as a set of coordinates (x,y,z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.
<b>Geographical grid systems</b>	Harmonized multi-resolution grid with a common point of origin and standardized location and size of grid cells.
<b>Geographical names</b>	Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest.
<b>Administrative and statistical units</b>	Territorial units of administration for local, regional and national governance, separated by administrative boundaries. It also consists of the statistical units for dissemination or use of statistical information.
<b>Addresses and buildings</b>	Locations based on address identifiers, usually by road name, house number, postal code. It also consists of the geographical location of buildings.
<b>Protected sites</b>	Formally by law protected areas such as archaeological sites and architectural buildings.
<b>Orthoimagery</b>	Georeferenced image data of the Earth's surface, from either satellite or airborne sensors.



## Most relevant INSPIRE themes for digital cultural content

### Metadata

Metadata description consisting of: identification, classification of spatial data and services, keywords, geographic location, temporal reference, quality and validity, conformity, constraints related to access and use, organizations responsible for the establishment, management, maintenance and distribution of spatial data sets and services, metadata on metadata.



## 5. Possible cases of use

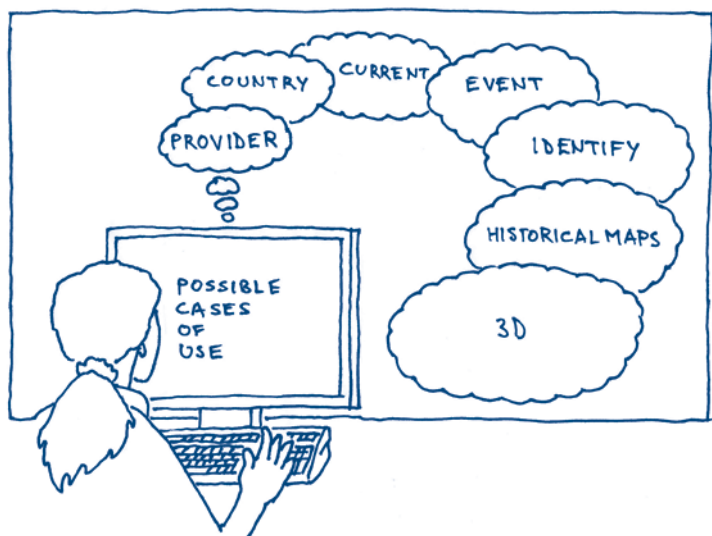
It is commonly said that up to **80% of all digital data** generated today includes geospatial references. Some of these digital data, like digital maps and other cartographic products, are directly georeferenced with geographic coordinates. However a large volume of the available data does not use coordinates but is indirectly georeferenced with geographic names and other text descriptors of geographic objects and features.

**Geographic information systems** technology is a tremendous tool when **identifying and searching digital cultural objects** in global world: using geolocation services for cultural tourism; discovering the cultural content in the education and lifelong learning processes; and in adding value using cultural content in creative industry.

The aim of this chapter is to convince the museums, libraries, archives, audio visual institutions and other cultural institutions of the usefulness of GIS technology by presenting seven use cases.



With prototyping these cultural institutions can clearly “**see what they get**” when they implement a particular case.



In **ATHENA project** the authors have elaborated concepts of these possible GIS use cases and prepared a small sample database for each case.

**Prototype Internet applications** have been developed and accompanied with simulation and discussion of issues pertaining to each case.

<sup>39</sup> <http://www.athenaeurope.org/getFile.php?id=669>

Videos demonstrating features of each case are published at ATHENA website.<sup>39</sup>



**The seven possible types of use cases of GIS** are presented from the simplest to the most complex:

- “Provider”, only the geographic locations of content providers
- “Country”, a graphical representation of country of content providers
- “Current”, the current geographic location of the physical objects
- “Event”, the geographic locations of events associated with physical objects
- “Identify”, makes use of geotopological relations among several GIS entities
- “Historical maps”, geocoded historical maps
- “3D”, three dimensional representations of movable or immovable cultural objects.

These basic use cases can be implemented singly or in combinations.



## 5.1. GIS case: Provider

### *Concept*

This is the simplest approach for presenting the geographic location of digital cultural content.

The geographic coordinates of a content provider's location (point) on the earth's surface are used.

When a user clicks on the map at this location all the collections of the content provider are shown. Alternatively when a user selects the collection the location of the content provider can be zoomed to on the map.

### *Prototyping*

As a prototype the database of ATHENA project collections were used with the location of their content providers.

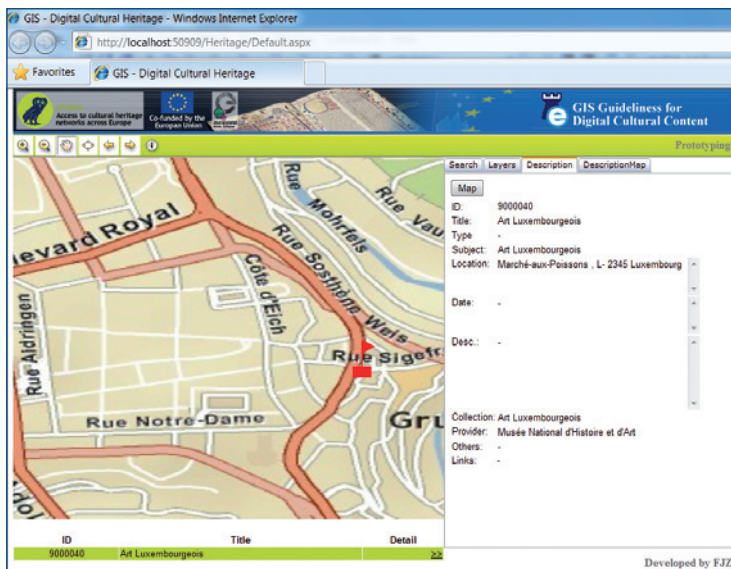
All ATHENA content providers were geocoded using simple GoogleEarth free Internet tool.<sup>40</sup>

40Downloadable  
from: [http://  
www.google.com/  
earth/index.html](http://www.google.com/earth/index.html)

### *Discussion*

This case is very simple but very effective. The geographic coordinates of a content provider usually are already known, but if they are not they can easily be identified.





The map view of the content provider gives a geographic context for a collection, and also the site for cultural tourism, if the location of the content provider is also the location of physical cultural objects.

It is suggested that each content provider within Europeana projects gives its coordinates with the description of its collection.



## 5.2. GIS case: Country

### *Concept*

This is the generalization of the GIS case “Provider” where the provider of digital cultural content is identified by the country of the provider (European or other).

The concept of this use case is that a user simply “clicks on the map” in order to select the country of the collection instead of being forced to use long pull down menu of the country names.

The concept can be used in similar way when somebody searches for certain object or subject, for example “situla”, all countries which possess the item, or are the original source of the item, or where this item has been found are indicated by discreet colouring on the map.

### *Prototyping*

As a prototype, the database of ATHENA project collections and the country of their content providers was used.

### *Discussion*

This case is not a real GIS layer but more of a graphic scheme.



GIS - Digital Cultural Heritage - Windows Internet Explorer

http://localhost:50909/Heritage/Default.aspx

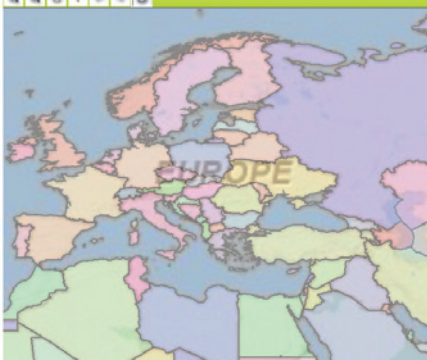
GIS - Digital Cultural Heritage

Access to cultural heritage networks across Europe  
Co-funded by the European Union

GIS Guideliness for Digital Cultural Content

Prototype

Search | Layers | Description | DescriptionMap



ID: 8799  
Title: Ljubljana - Gosposvetska cesta  
Type: naselbinska dediščina  
Subject: ulica  
Location: LJUBLJANA, Gosposvetska cesta med Slovensko in Tirolsko cesto.  
Date: rimska doba, 19. stol., rimska doba  
Desc.: Ena najstarejših vpadnic v mesto, izvirajoča še iz rimske dobe, se je ohranila skoraj v nespremenjeni trasi do danes. Današnja obzidna izkira v glavnem iz 19. stol. in predstavlja značilen vhod v mesto.  
Collection: NKD  
Others: urbanistična zgodovina, umetnostna zgodovina, s  
Provider: Ministrstvo za kulturo Republike Slovenije  
Links:

ID	Title	Detail
8799	Ljubljana - Gosposvetska cesta	22
8819	Ljubljana - Hiša Gosposvetska 10	22

Developed by FJZ

It can be used in digital cultural portals as an overview map and, in minor degree, as large map.



### 5.3. GIS case: Current

#### *Concept*

This use case describes the current geographic location of the physical object. In contrast to “Provider”, where the location is defined on collection or provider level, here location is defined at the object level. The same concept can be used for immovable cultural objects such as architectural buildings, monuments or archaeological sites. It is possible that a movable cultural object is indirectly geocoded to an immovable object. This can happen when a movable object is displayed in an immovable object or in some other way connected with it. Usually georeferences are points but could also be polygons or lines.

#### *Prototyping*

As a prototype a sample of objects from the ATHENA project were used. If they did not have coordinates they were determined by the use of an Internet geocoding tool such as Digimap.<sup>41</sup>

<sup>41</sup> <http://portal.digimap.eu/>

#### *Discussion*

This use case is very scalable and could be used for all objects in Europeana in the near future.

The benefits of this use case are not only as functions that answer questions like: “where is?” and “what is here?”, but also as the background for a more complex spatial and temporal search.



GIS - Digital Cultural Heritage - Windows Internet Explorer

http://localhost:50909/Heritage/Default.aspx

GIS - Digital Cultural Heritage

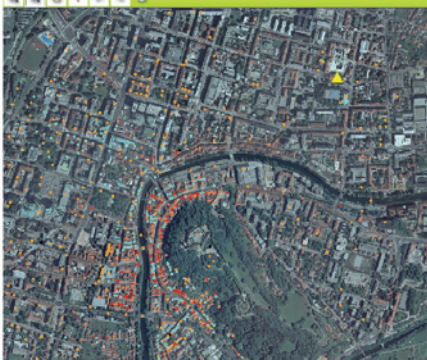
Access to cultural heritage networks across Europe

Co-funded by the European Union

GIS Guidelines for Digital Cultural Content

Search Layers Description DescriptionMap

Map



ID: 9000099

Title: Violinske akordne citre

Type: ljudska glasbila

Subject: ljudska glasbila, citre

Location: Vihpolje pri Moravčah, Gorenjska

Date: neznano

Desc.: Violinske citre z akordi so sestavljene iz melodjskih in spremjevalnih strun. Na melodjske strune se igra z lokom (desna roka) in s papirno predlogo napisanih pesmi pod strunami. Z levo roko pa se ubirajo akordi.

Collection: ljudska glasba

Provider: Slovenski etnografski muzej, Metelkova 2, 1000 L

Others: etnologija

Links: -

ID	Title	Detail
9000099	Violinske akordne citre	22

Developed by FJZ

In this use case map coloring and symbolization could be used when presenting some attribute of the object (e.g. date of creation information).

The bottleneck in implementation is the shortage of coordinates for objects. Data mining or an artificial expert system could be provided for semi-automatic geocoding.



## 5.4. GIS case: Event

### Concept

This is an extension of “Current”.

Events, that are in some way related to the object, are geocoded.

Examples include birth place of creator or author, place of production, place of use, and current institution.

The screenshot shows a web browser window titled "GIS - Digital Cultural Heritage - Windows Internet Explorer". The address bar shows "http://localhost:50909/Heritage/Default.aspx". The page features a header with logos for Europa, the European Union, and the project title "GIS Guidelines for Digital Cultural Content". Below the header is a map of Europe with various cities labeled, including London, Amsterdam, Berlin, Warsaw, Saint Petersburg, Paris, Poland, Vienna, Kiev, France, Rome, Istanbul, Spain, Madrid, Algiers, Athens, Turkey, Casablanca, Tripoli, and Cairo. A search interface on the right allows users to search by title and location, with a search button. Below the map, a table lists events with columns for ID, Title, and Detail.

ID	Title	Detail
9000066	L'arrivée des Beatles, ça c'est du sport !	22
9000063	Les Beatles au Palais d'Hiver...	22
9000079	The Beatles before their show in Edinburgh	22
9000062	The Beatles	22

Developed by FJZ



Usually there is more than one event connected to one object and therefore more than one coordinate per object. The LIDO standard can be used to implement this.

### *Prototyping*

The prototype used data in Europeana about the “Beatles” which described their tour in Europe. The relevant places were geocoded using the description element and the geoparser Digma<sup>42</sup> tool.

<sup>42</sup> <http://portal.digmap.eu/>

When a user browses the map and clicks on it he or she can see the description and a video of the arrival of the group.

### *Discussion*

This case is simple enough, however it possesses a great potential that could be implemented in future as a GIS framework in Europeana and other cultural portals.

The question still remains of how to combine geoparsing and geoontology when using online or off line services.



## 5.5. GIS case: Identify

### Concept

This case is an example of the power of geotopological relations among several GIS entities.

GIS - Digital Cultural Heritage - Windows Internet Explorer  
http://localhost:50909/Heritage/Default.aspx

GIS - Digital Cultural Heritage

GIS Guideline for Digital Cultural Content

Search Layers Description DescriptionMap

Map

ID: 100  
Title: Ljubljana - Ambient kozolcev v Dobrunjah  
Type: profana stavbna dediščina  
Subject: ambient, kozolec  
Location: LJUBLJANA, Ambient s kozolci stoji na vzhodnem obrobju Ljubljane, v Dobrunjah, S od naselja.  
Date: zadnja četrtina 19. stol., prva polovica 20. stol., 19. stoletje  
Desc.: Ambient sestavlja večja skupina enojnih stegnenih kozolcev, razporejenih na trakastih parcelah.  
Collection: NKD  
Provider: Ministrstvo za kulturo Republike Slovenije  
Others: etnologija, dediščina, skupina objektov  
Links:

ID	Title	Detail
100	Ljubljana - Ambient kozolcev v Dobrunjah	22
392	Ljubljana - Spomenik Primožu Trubarju	22
332	Ljubljana - Cerkev sv. Jakoba	22
333	Ljubljana - Cerkev sv. Nikolaja	22

Developed by FJZ

When a user selects a specific location on the map (e.g. point, rectangle, polygon) all GIS entities which are geotopologically related to this location are identified. Examples of geotopological relations includes: point in polygon, intersection of polygons and spatial buffer of segment.



### *Prototyping*

The prototype used data samples from Register of cultural heritage of Slovenia. When user clicks on the map the related polygons are identified and displayed in an “onion” structure.

### *Discussion*

This use case is usually used in combination with other cases.

In order to achieve a usable result it is very important that individual GIS layers are geocoded with an appropriate accuracy.



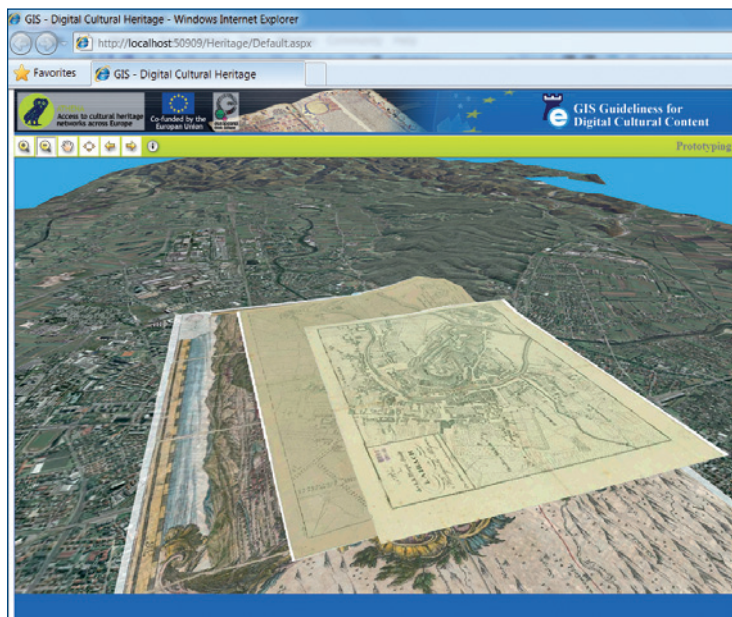
## 5.6. GIS case: Historical maps

### Concept

Historical maps offer spatial and temporal information with associated cultural information or attributes.

They usually include at least one dynamic map with multiple layers, or multiple maps.

They have a specific focus, theme, and/or intended audience. This can be large or small scale in time and space.





Information included can be generalized or complex and detailed.

Historical maps include all the features of the print version but pose new questions about the best ways to represent the information on the Internet.

Geocoded historical maps can include new functionality enabled by the use of electronic media including:

- interactive viewing and dynamic presentation of the material
- content searches
- map annotations
- content filtering
- spatial and statistical analysis
- incorporation of larger volumes and more complex data
- flexibility in integrating content for specific authors goals and intended audiences
- possibility of online community input of information and feedback.

### *Prototyping*

The presentation of cadastral and city maps of the City of Ljubljana dating from several different periods were used.

### *Discussion*

This is a very appropriate approach for the cases when the cultural content is historical maps.

The basic georeferencing of historical maps is cost effective.

There are several projects currently running in this area, and we note that there is a need for some practical standardization on this topic.



## 5.7. GIS case: 3d

### *Concept*

There are a lot of efforts in the standardization, preparation and presentation of three dimensional models of movable (e.g. museum objects) and immovable (e. g. architectural buildings) cultural objects.

In the context of GIS 3D modeling is more applicable to immovable cultural objects. So called 3D GIS includes x, y and z coordinates.

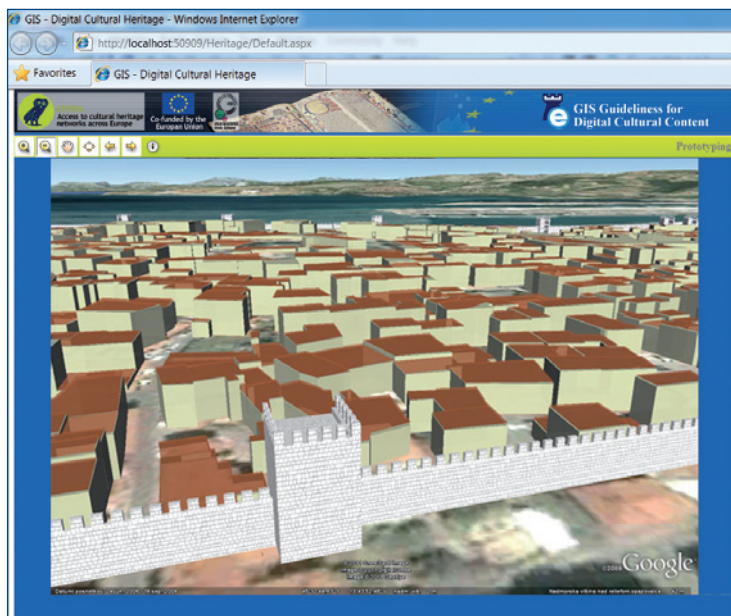
GIS cases could:

- be simple when geoshapes are only extruded to its proper height
- have real 3D shapes
- have detailed textures (e.g. facades).

### *Prototyping*

The presentation of the 3D reconstruction of the city walls of Koper, that are no longer visible in the townscape, were used to demonstrate this case.





### *Discussion*

This digital representation of cultural heritage is especially effective when the heritage itself has already been totally or partially dismantled.







## 6. Conclusions

Let us conclude with some “quick thoughts” for cultural institutions which would like to begin enriching their digital cultural content with appropriate, formalized and structured geographical information or enhance already existing data:

1. Act immediately. Begin thinking of an appropriate geographical reference for your digital cultural content otherwise it will be lost in the global information space.
2. When inventorying or documenting newly acquired cultural objects include geocoding and/or geographical ontology in data capture.
3. Download free GIS software. Do this to demonstrate the usefulness of GIS to your colleagues.
4. Whenever taking photograph of cultural objects in the field (e.g. natural science specimens) use GPS with appropriate coordinate system and accuracy.



5. Consider encoding your geographical names thesaurus using the SKOS standard (a “SKOSified” thesaurus) or use automatic geocoding.
6. If historical maps represent your valuable cultural assets then consider geocoding them as the first step to your digital georeferencing future.
7. Consider linking your cultural objects to already geocoded immovable cultural heritage.
8. When you are about to enrich your metadata either manually or automatically do everything possible to achieve as complete and as precise a description of geographical data as possible. Pay particular attention when you contribute your metadata to portals such as Europeana.
9. When selecting new or upgrading existing collections management software check what geographic information system functionalities it is capable of.
10. Monitor what is going on about INSPIRE project in your country. Pay attention especially to the developments regarding territorial unit’s layer.
11. Invest time in training on the concepts and uses of GIS in order to gain a basic and practical understanding of GIS concepts, analyses, techniques and real world applications. With this knowledge you can efficiently plan the introduction of GIS technology in your collections.



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Printed in the month  
of April 2011  
by Repro Stampa Ind. Grafica,  
Villa Adriana - Tivoli (Roma)