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Lido

Introduction

Lightweight Information Describing Objects (LIDO) was developed by CIDOC Working Group Harvesting and Integration with the purpose of contributing content to cultural heritage repositories. LIDO satisfies the need for a convenient common instrument for providing core data from different collections, data structures or software systems. The necessity for a common schema emerged as it was both time consuming and costly to integrate information from different resources in the same portal, considering that each resource has potentially a different metadata format. LIDO was developed to overcome this situation.

Outline

LIDO is an XML harvesting schema intended for delivering metadata, for use in a variety of online services, from an organization's on line collections database to portals of aggregated resources, as well as exposing, sharing and connecting data on the web [1]. It is capable of supporting the full range of descriptive information about museum objects. Particularly, it supports all kinds of objects, such as art, cultural, technology and natural science and can be used by multilingual portals. It is not intended to be used for proper cataloguing or to support loan and acquisition activities.

The architecture of LIDO is based on a nested set of "wrapper" and "set" elements which structure records in culturally significant ways. The development of its design was inspired by CIDOC CRM resulting into a consistent event-centric schema. Event-centric approaches consider that descriptions of objects should focus on describing the various events in which objects have participated. For instance, the creation, collection and use of an object are defined as events that are related to entities such as dates, places and actors.

The strength of LIDO lies not only on its ability to support extensive range of information, but also on its flexibility. LIDO defines seven groups of information of which only four are mandatory allowing for as large a variety of completeness of information as possible. This enables the organizations to choose which data they wish to provide to a portal and publish online. The mandatory fields are related to the definition of the type of the object described, its title and its record.

The structural elements of LIDO contain "data elements" which hold the information that is being harvested and is delivered to the user of the service environment. It allows an organization to support not only optimized searching and retrieval processes, but also the online presentation of the information and the demonstration of the sources of the data to the user of the portal. To succeed this, it allows the organization to provide indexing and display information and at the same time, supports the recording of information related to the sources of the data within a controlled terminology.

Construction Principles

The construction principles of LIDO [2] are the following:

- To provide a specification and related XML schema that describes cultural materials in a meaningful and comprehensive manner
- To allow the contribution of data and images related to described objects to union catalogues
- A record should provide all the necessary information for display and retrieval of a described object
- Individual data providers should be able to define the level of richness of the contributed metadata records
- Links from contributed metadata back to records in their "home" context should be provided
- It should supply optimized metadata for retrieval and display, with clear distinction between display and indexing elements

- To provide references to controlled environment

Conceptually the information in a LIDO record is organized in seven areas, of which four have descriptive and three administrative character. The descriptive metadata of an object record hold information about its type, identification, the events that has participated in and the relations to other resources. The administrative metadata hold information about the rights, the record and any digital resource being supplied to the service environment.

History of Lido

LIDO is result of collaborative work of the CDWA Lite, museumdat, SPECTRUM and CIDOC CRM communities. The schema is a combination of the CDWA Lite and museumdat schemas and has been aligned with the SPECTRUM collections management standard. It is CIDOC CRM compliant and can be used to submit information about all kinds of cultural heritage objects.

CDWA Lite is an XML schema provided for encoding core records for works of art and material culture based on the data elements and guidelines in Categories for the Description of Works of Art (CDWA) and following the data content standard Cataloguing Cultural Objects (CCO) provided by the J. Paul Getty Trust and ARTStor. More details about CDWA will follow in next chapters. museumdat is an XML schema, developed by the Documentation Committee of the German Museums Association, which builds on CDWA Lite but overcomes its focus on art by reconfiguring CDWA Lite elements that takes into account the event-oriented multi-disciplinary approach of the CIDOC Conceptual Reference Model.

CIDOC CRM suggests definitions and a formal structure for describing the implicit and explicit concepts and relationships used in cultural heritage documentation. More details about this schema will follow in next chapters. SPECTRUM is an XML schema based on the UK and international standard for collections management with the same name from the Collections Trust. It suggests a format for exchanging object records between different collection management systems.

LIDO was implemented by the collective efforts and support from: the CDWA Lite Advisory Committee, the Documentation Committee of the German Museums Association, the CDWA Lite – museumdat WorkingGroup, the CIDOC CRM Special Interest Group and the Athena Project.

MIDAS

MIDAS Heritage is a data standard for information about the historic environment. It states what information should be recorded to support effective sharing and long-term preservation of the knowledge of the historic environment. It was developed by English Heritage [3] in collaboration with the UK Forum for Information Standards in Heritage and a number of heritage organisations in the UK building on the CIDOC Archaeological Sites Core Data Index and the CIDOC CRM.

The first edition of MIDAS (1998) made 'recommendations' on the content of historic environment datasets. MIDAS Heritage introduces a more prescriptive approach, with specific standards to assess whether a dataset or information system is or is not compliant with the standard. The decision to do this has been taken in view of the improving technology for the sharing of data (e.g. the FISH Interoperability Toolkit), and also the professional requirement for more objective methods for assessing compliance. It must be stressed that the compliance approach adopted is adaptable. The Information Groups and compliance profile means that in effect MIDAS Heritage is a set of closely integrated data standards, rather than one single standard.

MIDAS Heritage Structure

The MIDAS Heritage data standard has a three-level structure. Working from the broadest to the most specific these are:

- Themes: the broadest level areas of interest to the historic environment community. These are set out below.
- Information Groups: these set the specific standard for what should be included in an entry covering a particular subject. They are thematic groupings of related Units of Information which together answer key questions about some aspect of the historic environment and its management
- Units of Information: the basic 'facts' or items that make up an entry.

Midas Heritage Themes

Themes can be used for convenient description of the principle focus of an information system or dataset. Most heritage sector information systems using the MIDAS Heritage standard will focus on one or more of the main themes of Heritage

Asset, Activity and Information Sources. Where the text, tables and definitions in MIDAS Heritage refer to a theme name, that reference should be taken to apply equally to all the Information Groups that make up that theme.

Main themes

The following are the principle themes of interest in heritage information recording as well ass the Information Groups that make up that theme.

- Heritage Asset: The Information Groups in this theme are the principal focus of study and investigation in the heritage sector. They are 'what we want to know about'. In the first edition of MIDAS (1998) the focus was on Monuments (buildings, archaeological remains, wreck sites, find-spots, etc.). MIDAS Heritage reflects changing approaches to the study of material remains of the past. 'Heritage Asset' has been adopted as an appropriately inclusive heading to embrace landscape-scale areas at one end of the scale, and individual artefacts and ecofacts at the other. The description and recording of the character of these closely related assets remains a core function of inventories using the MIDAS Heritage standard. However, each asset type requires slightly different treatment, reflecting the nature of the asset and professional practices employed in their understanding. Information Groups in this theme are:
    - Area
    - Monument
    - Artefact and Ecofact
- Activity: This theme covers things that have happened. However it can also include the recording of plans for future work. A structured record of events relating to a particular Heritage Asset can be used to give context and meaning to the records of heritage asset character. It provides information on 'how we know what we know' (Investigative Activity, Research and Analysis) or on how a particular Heritage Asset has been managed through time (Heritage Asset Management Activity, Casework and Consultation, Designation and Protection). Historical events, not related to the investigation or recording of an asset, are also covered by MIDAS Heritage, as these may be recorded to provide explanatory context, for example for educational or outreach uses. Most information systems will only cover a few of these different activities. They are separated into distinct Information Groups to allow discussion of key issues and relationships relevant to each Activity. Information Groups within this theme are:
    - Investigative Activity
    - Designation and Protection
    - Heritage Asset Management Activity
    - Casework and Consultation
    - Research and Analysis
    - Historical Event
- Information Sources: This theme covers traditional bibliographic references and references to primary archive materials, as well as online references. This is appropriate where the information is held outside an information system, for example in a publication, or on a web page. In this case the information system acts as a finding aid to point users to these further sources. Increasingly, however, additional information, for example text plus images, is being held within heritage information systems and may be deemed to be publications in their own right. This area is evolving as practice develops but two initial standards for this sort of content are included. Narrative and Synthesis covers education or instructional material integrated with the entries in an information system. Management Activity Documentation provides structured reports on aspects of the management of specific heritage assets. Information Groups included in this theme are:
    - Archive and Bibliography
    - Narrative and Synthesis
    - Management Activity Documentation

Supporting themes

The following themes provide supplementary information to the main themes.

- Spatial Information: Accurate knowledge of the position in space of Heritage Assets is central to their understanding and management. Similarly the location where events have occurred, or to which Information Sources are relevant, is essential. Information Groups in this theme are:
    - Location
    - Map Depiction
- Temporal Information: An understanding of the chronology of significant activities or events is common to all records of Heritage Assets. The standards presented here support recording of a wide variety of dates of different degrees of certainty, cultural periods and date ranges. These can either be derived from the physical aspects of the Heritage Asset itself (e.g. the style of a building) or from scientific investigation (e.g. radiocarbon dating) appropriate to recording the character of Heritage Assets. To avoid over-complication, where specific and undisputed 'point in time' dates are more appropriate, these are treated as separate units of information included in the appropriate Information Groups. The Information Group in this theme is:
    - Date and Period
- Actor Information: Heritage Assets were originally created by people, groups and cultures. The subsequent investigation, documentation, management and presentation of these assets are also the responsibility of organisations and individuals. The general term 'actors' is adopted by MIDAS Heritage, following usage in ISO 21127, for all the different organisations, groups, individuals documented in an information system. The information group in this theme is:
    - Actor and Role

DC(ESE)

Dublin Core [4] is a standard for cross-domain information resource description. Its name "Dublin" is due to its origin at a 1995 invitational workshop in Dublin, Ohio, while "core" because its elements are broad and generic, usable for describing a wide range of resources. It provides a simple and standardised set of conventions for describing things online in a machine understandable way making them easier to find. Dublin Core is a metadata standard used mainly to describe content of multimedia essence, such as video, sound, image, text and composite media. Early Dublin Core workshops popularized the idea of "core metadata" for simple and generic resource descriptions. Dublin Core achieved wide dissemination as part of the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) [5] and has been ratified as IETF RFC 5013 [6], ANSI/NISO Standard Z39.85-2007 [7], and ISO Standard 15836:2009 [8].

Starting in 2000, the Dublin Core community focused on "application profiles", the idea that metadata records would use Dublin Core together with other specialized vocabularies to meet particular implementation requirements. During that time, the World Wide Web Consortium's [9] work on a generic data model for metadata, the Resource Description Framework (RDF) [10], was maturing. As part of an extended set of DCMI Metadata Terms, Dublin Core became one of most popular vocabularies for use with RDF, more recently in the context of the Linked Data movement [11].

The consolidation of RDF motivated an effort to translate the mixed-vocabulary metadata style of the Dublin Core community into an RDF-compatible DCMI Abstract Model (2005). The DCMI Abstract Model was designed to bridge the modern paradigm of unbounded, linked data graphs with the more familiar paradigm of validatable metadata records like those used in OAI-PMH. A draft Description Set Profile specification defines a language for expressing constraints in a generic, application-independent way. The Singapore Framework for Dublin Core Application Profiles defines a set of descriptive components useful for documenting an application profile for maximum reusability.

The Dublin Core metadata standard includes two levels: Simple and Qualified. Simple Dublin Core, also known as Dublin Core Metadata Element set, is a vocabulary of fifteen properties for use in resource description. Qualified Dublin Core is an ongoing process to develop exemplary terms extending or refining the Dublin Core Metadata Element set. There exist two broad classes of qualifiers. These are Element Refinement and Encoding Scheme.

- Element Refinement: makes the meaning of an element narrower or more specific. A refined element shares the meaning of the unqualified element but with a more restricted scope. A client that does not understand a specific element refinement term should be able to ignore the qualifier and treat the metadata value as if it were an unqualified element.
- Encoding Scheme: identifies schemes that aid in the interpretation of an element value with the help of controlled vocabularies and formal notations or parsing rules. If an encoding scheme is not understood by a client or agent the value may still be useful to a human reader.

The Dublin Core metadata standard can be encoded in many syntax formats such as XML and RDF/XML. When considering an appropriate syntax, it is important to note that Dublin Core concepts and semantics are designed to be syntax independent and are equally applicable in a variety of contexts, as long as the metadata is in a form suitable for interpretation both by search engines and by human beings. In order to be able to proceed we present the following terminology concerning XML, RDF/XML and Dublin Core:

- Resource: anything that has identity. Familiar examples include an electronic document, an image, a service and a collection of other resources. Not all resources are network "retrievable"; e.g., human beings, corporations, and bound books in a library can also be considered resources.
- Property: a specific aspect, characteristic, attribute, or relation used to describe a resource.
- Record: some structured metadata about a resource, comprising one or more properties and their associated values.

Dublin Core in XML

One of the many syntax forms Dublin Core can be encoded in is XML. XML provides a very simple framework for the encoding of Dublin Core Elements. In the following we provide some simple rules regarding the XML syntax. These as well as recommendations, guidelines and examples for XML implementations can be found in [12].

A Dublin Core record is made up of one or more properties and their associated values. Each property is an attribute of the resource being described and can be either one of the simple elements or one of the qualified elements and may be repeated. Moreover each value is a literal string and may be associated to an encoding scheme, which always has a name. Finally each literal string value may have an associated language (e.g. en-GB).

Dublin Core in Ontology Definition Languages

Although XML provides a very simple framework for encoding Dublin Core elements its abstract syntax does not provide semantics to the content described. Taking into account that cultural heritage are mostly indexed on the basis of divergent metadata standards, that hampers the combination and opening up of the cultural content a more semantic language needs to be supported by Dublin Core. This is why Dublin Core can be encoded in Ontology Definition Languages [13]. RDF and OWL provide semantics making interoperability easier among knowledge bases. Moreover, through some tools provides reasoning such as checking the consistency and validity of metadata as well as extracting implicit from explicit knowledge.

Unlike the XML syntax, in the RDF/XML case there is a different syntax regarding unqualified and qualified elements. Representing unqualified Dublin Core elements requires a bit more extra information. Every assertion is made about a fixed resource. Each resource is identified between a pair of rdf:Description tags.

EDM

Introduction

The Europeana Data Model (EDM) is a new proposal, still under development, aimed at being an integration medium for collecting, connecting and enriching the descriptions provided by Europeana content provider [14]. The purpose of the open structure of EDM is to enable the linking of data, placing it in the vanguard of semantic web developments.

Outline of EDM

The initial development of Europeana was based on Europeana Semantic Elements (ESE) data model which is evolved into EDM. Particularly, ESE was developed in order to constitute the lowest common denominator of the different data standards used for each one of the heritage sectors. Whereas, EDM reverses this reductive approach and attempts to transcend the respective information perspectives of the sectors that are represented in Europeana.

In addition, EDM has upgraded ESE with respect to its content. In terms of a digitized book, the individual chapters, illustrations and index can be understood both individually and collectively. The same holds for an archival finding aid or fonds with respect to the constituent letters, deeds, manuscripts or other items. Finally, in contrary to ESE, EDM supports the preservation of original data while still allowing interoperability.

The strength of EDM lies on the fact that its development is not based on a specific standard but rather adopts an open, cross-domain Semantic Web based framework. It can accommodate several rich standards like LIDO for museums, EAD for archives or METS for digital libraries.

Apart from its ability to support standards of high richness, it also enables data enrichment from a range of third party sources. In this way, a particular digital object from a specific provider can be enriched by metadata from another

provider and at the same time by additional data held from a third party. EDM enables this interoperability while clearly providing the provenance of all the data linking to the digital object.

One of the crucial purposes of EDM is to answer the basic queries “Who?”, “What?”, “When?” and “Where?” for every digital object and to make connections between the networks that will animate Europeana’s content.

Construction Principles

EDM complies with the modeling principles that underpin the approach of the Semantic Web. Therefore, there is no fixed schema that dictates a particular way to represent the data. Instead, the common model of EDM functions as an anchor to which various finer-grained models can be attached. In this way, they become partly interoperable at the semantic level, while the data retain their original expressivity and richness.

One of the main features of EDM is that via the digital representations submitted to Europeana it enables the representation and accessing of the provided objects. It is also able to ingest the descriptive metadata supplied by various providers and at the same time to represent new information added by Europeana. In addition to this, not only it accommodates various description paradigms of the ingested objects, but also enables further enrichment of the objects by connecting the to semantically enriched resources. At the same time, it still allows for different levels of granularity in the descriptions by taking advantage of special features of semantic mapping.

The requirements and principles that EDM follows according to Europeana [15] are:

- Distinct the provided object (book, painting, sculpture), which is the focus of the users’ interest, from its digital representations which are the elements manipulated by information systems like Europeana
- Distinct the provided object from the metadata record describing the object
- Allow for multiple records for the same object, even if they contain contradictory statements with each other
- Support objects that are composed of other objects
- Standard metadata format that can be specialized
- Standard vocabulary format that can be specialized
- Should be based on existing standards

Conceptually, four are the main concepts used in EDM and these are: ore:Aggregation, ore:Proxy, ore: EuropeanaAggregation and ens:WebResource. Following the Object Reuse and Exchange (ORE) model, EDM considers that the provided object, along with its digital representations contributed by any provider, form an aggregation that is represented as the ore: Aggregation class. Each instance of ore: Aggregation relates through the property ore:aggregates to one resource that represents the provided object and through the property ens:hasView to one or more resources (ens: WebResource) that are digital representations of the object. Each provider contributes a different set of digital representations and a new aggregation connected to the web resources.

Inspired again by ORE model, EDM leverages the proxy mechanism to enable the representation of different views on the same resource. Each provider contributes a separate metadata record using the ore: Proxy resource, in order to represent the description of the provided object as seen from the perspective of the specific provider. A proxy is related to the resource using the ore: proxyFor property and to the provider’s aggregation through the ore: proxyIn property.

Finally, Europeana creates it own aggregation, the ens: EuropeanaAggreagation, and proxy in order to be able to add new information to the original object description and representation while keeping a clear distinction from the contributed information.

CDWA

Introduction

Categories for the Description of Works of Art (CDWA) is a framework for describing and accessing information of cultural heritage resources. It provides access to art databases for describing and collecting information about works of art, architecture, other material culture, groups and collections of works, and related images.

This framework provides 532 categories in which to describe works of art. Some of these are bound to represent the minimum information necessary to ensure a sufficient description for work identification. These categories are considered to be the core. The CDWA includes discussions, basic guidelines for cataloging, and examples.

History

DWA was developed by the US-based Art Information Task Force (AITF),
with funding from the J. Paul Getty Trust, National Endowment for the Humanities (NEH), and the College Art Association (CAA). The purpose was to permit a dialog between cultural communities in order to develop guidelines for describing and presenting works of art, architecture, groups of objects, and visual and textual surrogates. The current version of CDWA (2.0) was published in 2000 and revised in 2006. CDWA is now maintained by the Getty Research Institute, who has developed CWDA Lite. CDWA Lite is an XML based schema that can be utilized in databases that using the Open Archives Initiative (OAI) harvesting protocol. It is intended to describe core records for works of art and material culture based on CDWA and CCO.

Outline of CDWA

The goal of CDWA is to provide guidelines in order to reach an agreement on the information that should accompany a surrogate work of art. CDWA contributes to data integrity and longevity while information systems evolve and data migrates to new systems. The common set of rules provided, form a common ground for curators, registrars, researchers, information managers, and systems vendors. These rules ensure compatible and accessible information. Existing information systems as well as new ones may both be developed upon CDWA framework. In addition, end- users are provided with system independent, reliable and consistent information.

CDWA aims to matching data deriving from different systems that conform to different standards. Therefore, it provides the necessary compatibility level for matching with other schemes such as MARC, Dublin Core, EAD, METS and DACS.

Construction Principles

CDWA recommends a relational data structure. Separate files or authorities are maintained for works and objects, related textual or visual materials, locations/place, persons/corporate bodies, generic concepts, and subjects.

Information on authority of persons, places, generic concepts, and subjects may be important for retrieval of the work, but it is recorded in separate authority files rather than in records about the work itself. These files are then linked to all relevant work files while they are recorded only once and easily updated. Authorities described in CDWA should be hierarchical; given that authority entities often require multiple broader contexts, a polyhierarchical structure is recommended.

Categories and subcategories of art information may differ depending on the end- user. Even the core categories which are meant to represent the minimum information necessary to describe and identify a work may be adapted to the needs of the information system to be served. As a result to this end- users are provided with helpful browsing options specified according to their needs. An example of the user friendly orientation is the classification category which provides broader and less detailed description of objects.

CDWA assumes information for display to be in a format and with syntax that is easily read and understood by users. Such free-texts or concatenated displays may contain all the nuances of language necessary to relay the uncertainty and ambiguity that are common in art information.

As far as retrieval is concerned, CDWA assumes that key elements should be formatted to allow for indexing. CDWA recommends that indexing should be performed by knowledgeable catalogers who reliably interpret the meanings of their indexing terms, in contrast to automated methods that perform parsing of a text.

In CDWA, display fields are often described as free-text fields (which may alternatively be concatenated from controlled fields, if necessary); indexing fields are intended to be controlled fields. CDWA advises the use of controlled vocabularies; CDWA describes when categories should be controlled by a simple controlled list (e.g., Classification), an authority (e.g., Creator), or by consistent formatting of certain information (e.g., Earliest and Latest Dates) to ensure efficient end-user retrieval.

CIDOC CRM

Introduction

The CIDOC Conceptual Reference Model (CRM) is a formal ontology that provides definitions and a structure for describing the implicit and explicit concepts and relationships used in cultural heritage documentation. The purpose of CIDOC CRM is to facilitate the integration, mediation and interchange of heterogeneous cultural heritage information. It contributes to the specification of a common ground for domain experts in conceptual modeling. Therefore, it promotes an extensible semantic framework where information deriving from sources such as libraries and archives, may be integrated.

History

The CRM was developed by different teams of experts such as archeologists, art historians, and computer scientists following the standards of International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM).

The first schema was analyzed in 1996 under the auspices of the ICOM-CIDOC Documentation Standards Working Group. Since 2000, development of the CRM has been officially delegated by ICOM-CIDOC to the CIDOC CRM Special Interest Group, which collaborates with the ISO working group ISO/TC46/SC4/WG9 to bring the CRM to the form and status of an International Standard.

The present model has been accepted as ISO 21127 since September 2006. It contains 80 classes and 132 properties, representing the semantics of various schemata.

Outline

The aim of CIDOC CRM was to gather scientific documentation of cultural heritage collections with a view to enabling wide area information exchange and integration of heterogeneous sources. This means that the information presented should be sufficiently descriptive and precise as it is intended not only for casual browsing but also for usage from the field experts, museums and professionals. The term cultural heritage collections includes all types of material displayed by museums, relevant collections, sites, monuments, that are related to natural history, archeology, ethnography, historic monuments as well as collections of fine and applied arts. The CIDOC CRM is intended to cover contextual information, the historical, geographical and theoretical background in which items are placed, which reveals much of their significance. Information exchange is achieved through a more abstract perspective, clear from any specific local context. Integration between different sources determines the level of detail in CIDOC CRM. It aims to leverage contemporary technology while it enables communication with other legacy systems.

The above description of CIDOC CRM reveals the intended scope that ontology aims to cover. The practical scope of CIDOM CRM may be defined as the current coverage of the ontology. It refers to documents and sources that have been used in its elaboration.

The initial practical scope of the CIDOC CRM was defined by the International Guidelines for Museum Object Information: The CIDOC Information Categories, published in June 1995 (the Guidelines). This document, edited by a joint team of the CIDOC Data and Terminology and the Data Model Working Groups, resulted from the consolidation of two parallel initiatives: the Information Categories for Art and Archaeology Collections, 1992 and the CIDOC Relational Data Model 1995, both of which had been in gestation since 1980. The Guidelines thus represent the fruit of many years of collective effort and reflection concerning museum information and constituted an obvious starting point for the development of the CIDOC CRM. The first published version of the CIDOC CRM, Melbourne 1998, covers all the Guidelines, with the exception of elements that fall outside the intended scope of the CIDOC CRM.

Construction Details

The basic principle underlying CRM is the explicit modeling of events. It allows for metadata representation such as creation, use, publication content summarization. Event oriented modeling permits the connection of facts into coherent representations of history. The language provided by CRM permits integration at the schema level. In fact, terminology is separated from schema. That is, classes of the ontology serve to define relationships, the ontology is then used as a schema and the classes that do not refer to range or domain restrictions for some relationship are treated as data. Furthermore, it important to note that any information

CRM conforms to some central ideas. Firstly, any ambiguity of the relationship between entities and their identifiers form a part of the historical reality to be described by the ontology and is not considered as a problem to be resolved. Entities representing the object itself are therefore, separated from those that serve for its identification.

Another idea, to which CRM conforms, is that documentation is considered as a part of the historical reality and may be described together with the documented content itself. Types and classification system form themselves part of the reality. In addition to this, the documented past can be formulated as series of events. Items, places and time form different entities are linked through events creating the impression of historical evolution. Classes that do not refer explicitly to time or space and have temporal boundaries are approximated by outer or inner bounds.

Finally, immaterial objects may be present in events through the respective physical information carriers. Although the carries may be destroyed, the immaterial objects cannot be lost.

The contents of CRM can be presented as distinct units that are linked to each other through relationships that form an IsA hierarchy. Functions supported by the relationships are identification of items by their names, classification of items, decomposition of physical and immaterial entities, temporal entities, place, times and people entities. In addition, functions refer to participation of persistent items in temporal entities, location of temporal entities in space and participation of time and physical things in space and reference of information object to real world items.

CIDOC CRM supports a wide range of classes and relationships that are considered as generic. Furthermore, the fact that terminology is separated from schema favours stability and therefore a considerable chance of agreement on common semantics for schema-level semantics rather than terminology.

4. The CARARE Schema

Introduction

One of CARARE's main objectives is to ensure interoperability between the native metadata held by heritage organisations and the metadata used by Europeana. The project is establishing a metadata schema which will be used to mediate between the original data and the standards and schemas defined by Europeana.

The proposed schema builds on existing standards and best practice from a number of different countries in Europe and the rest of the world including:

CIDOC Archaeological Sites Core Data Index

The Archaeological Sites Core Data Index was established by an international working group with the aim of facilitating communications between the national and international bodies responsible for the archaeological heritage, to assist the development of record systems and to facilitate research using archaeological site data.

Core Data Index to Historic Buildings and Monuments of the Architectural Heritage

Core Data Index as the "Recommendation on the co-ordination of documentation methods and systems related to historic buildings and monuments of the architectural heritage" was adopted by the Committee of Ministers of the Council of Europe on 11 January 1995. The basic aim of the Core Data Index is to make it possible to classify individual buildings and sites by name, location, functional type, date, architect or patron, building materials and techniques, physical condition, and protection status. It is not an end in itself, but a starting point to further information held in databases, documentation centres, and elsewhere that is necessary for the detailed understanding and care of individual monuments.

CIDOC CRM

The CIDOC Conceptual Reference Model (CIDOC CRM) is the result of over 10 years work by the CIDOC Documentation Standards Working Group and CIDOC CRM Special Interest Group, and is an ISO standard (ISO 21127 (2005)).

The CIDOC CRM is a formal standard that defines documentation concepts for the cultural heritage and the relationships between those concepts. It provides a flexible standard framework that cultural heritage data can be mapped to and provides a framework for semantic interoperability.

MIDAS Heritage

MIDAS Heritage is a data standard for information about the historic environment which was developed by English Heritage in collaboration with the UK Forum for Information Standards in Heritage and a number of heritage organisations in the UK building on the CIDOC Archaeological Sites Core Data Index and the CIDOC CRM. MIDAS Heritage covers the three main themes:

- **Heritage assets –** buildings, archaeological monuments, landscape areas, shipwreck sites, find-spots, artefacts and ecofacts.
- **Activities –** Field investigation, Research and Analysis, Management Activity, Casework and Consultation, Designation and Protection and also Historical events.
- **Information sources** – bibliographic sources, archive materials, management documentation, and narratives and syntheses (e.g. text plus images for educational purposes).

and the following supporting information:

- **Spatial information** – Location and map information
- **Temporal information** – Date and period
- **Actor information** – people, organisations and their roles

POLIS DTD

The POLIS DTD was produced as part of an EU funded Greek national research project to develop an interoperability framework for the cultural heritage. A series of DTDs were produced for different applications (including monument inventories, museums, archives, bibliographies etc) each derived from the CIDOC CRM. The Monument Inventory DTD was closely related to the core data index for archaeological sites.

LIDO

LIDO – Lightweight Information Describing Objects is a metadata harvesting schema developed by the ATHENA Project for harvesting museum data into the service environment of Europeana. LIDO is based on CDWA Lite, MuseumDat, the CIDOC CRM and SPECTRUM. LIDO is made up of a nested set of 'wrapper' and 'set' elements which structure records and contain 'data elements' which hold the information that is being harvested and delivered to the user of the service environment. There are 7 areas in a LIDO record for an object:

- Object identification
- Object classification
- Relations of the object
- Events – in which the object has taken part
- Rights work – information about the rights associated with the object, metadata and digital surrogate
- Record – basic information about the record
- Resource – information about the resource being supplied to the service environment (Europeana)

GIS (Geographic Information System) metadata

MIDAS Heritage complies with the UK GEMINI Discovery Metadata Standard, which specifies a set of metadata elements for describing geographic datasets (which is used by the UK's GIgateway™ metadata service run by the Association for Geographic Information). English Heritage has work underway to implement the INSPIRE directive for GIS metadata before the end of 2010.

ISO 8601

All dates in the CARARE schema conform with ISO 8601, i.e. they are specified largest temporal term first and according to the Gregorian calendar; e.g. 1981-04-05.

The CARARE schema builds on these standards and also the work of the members of the CARARE metadata working group, the DCU metadata team and the English Heritage Data Standards Unit including: Kate Fernie, Christian Ertmann-

Christiansen Christos Papatheodorou, Constantia Kakali, Giannis Tsakonas,
Dimitris Gavrilis, Stavros Angelis, Panos Constantopoulos, Costis Dallas, Maria Emilia Masci, Oliver Mamo, Börje Justrell, Sven Ole Clemens, Vassilis Tzouvaras, Sólborg Una Pálsdóttir, Effie Patsatzi, Lena Inger Larsen, Daniel Pletinckx, Nasos Drosopoulos, Vykintas Vaitkevičius, Rimvydas Laužikas, Phil Carlisle, Gillian Grayson and Stephen Stead.

Outline of the CARARE schema

It is important to note that this is a harvesting schema intended for delivering metadata to the CARARE service environment of an organisation's online collections, monument inventory database and digital objects. It does not support activities such as monument management and protection. The strength of the schema lies with its ability to support the full range of descriptive information about monuments, building, landscape areas and their representations.

The schema is an application profile based on MIDAS Heritage and the POLIS DTD for monument inventories. MIDAS Heritage is a detailed standard intended for the full documentation of all aspects of heritage management not all of which are relevant to the CARARE service environment. The CARARE schema's focus is on the detailed description of monuments, events in which the monument has been involved and resources which represent and provide sources of information about the monument following the structure of the core data index for archaeological sites and the POLIS DTD enhanced by the expressiveness of LIDO.

The CARARE schema includes the LIDO Resource Set which covers the information needed for the digital resources being made accessible to the CARARE and Europeana service environment.

Conceptually the areas in a CARARE record for a monument are:

Heritage asset Identification – basic information about the monument, historic building, archaeological landscape area, shipwreck, artefact, ecofact etc.:

- Record information;
- Appellation (ID, name);
- Description
- Actors
- Designations
- Conditions
- Characters
    - Heritage asset type
    - Spatial (place, address, map coordinates)
    - Temporal (date, timespan, period)
    - Materials
    - Inscriptions
    - Dimensions
    - Craft
- Repository
- References

  - Record information - The ID, language, creation information
    and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8.
  - Appellation (ID, name: the title of the reference)
  - Actor (the actor participating in the reference, except for the publisher; e.g. creator, archive, inventory organization, repository, compiler, etc.)
  - Type (archive, file, record, book, chapter, article etc.)
  - Medium
  - Extent
  - Rights
  - Publication statement
  - Subject
  - Note
- Relations

Digital resource – these are digital resources (images, texts, videos, audio, 3D models) that provide sources of information about the monument being provided to the service environment (e.g. Europeana). They are often digital representations of monuments or of parts of monuments.

- Record information
- Appellation
- Actors
- Format
- Format Details
- Medium
- Extent
- Subject
- Spatial
- Temporal
- Publication statement
- Type
- Description
- Note
- Created
- Provenance
- Language
- Link
- IsShownAt
- Resource metadata location
- Relations
- Rights

Relations – relations of the monument, event or resource to other monuments, events, references or resources (see section 5):

- Type of relation
- Target of relation

Activity – events or activities that the monument has taken part in, such as: Creation, Field investigation; Research and analysis; Historical events, etc. For each event, information, if relevant, about:

- Record information;
- Appellation (ID, name);
- Description;
- Actors (persons and organisations);
- Event type;
- Temporal;
- Spatial;
- Assessments;
- Event method;
- Materials and techniques used;
- Relations

Record information – basic information about the record (see section 8):

- ID (the id in the provider's system) [mandatory];
- Type
- Source
- Creation – when created and who by;
  - Date
  - Actor
- Update – the date of the last update to the record and who by;
  - Date
  - Actor
- Language (of the metadata record)
- Rights
- Keywords

Rights – information about the rights associated with the object, metadata and the digital surrogate being harvested into the service environment (see section 9):

- Copyright
- Access rights
- Reproduction rights
- License

Global wrappers

The following elements define the top level elements of a CARARE:

CARARE – The CARARE schema start element. It wraps exactly one collection information wrapper and zero or more of each of the other global wrappers (Monument, Digital resource, Activity).

Collection information – holds the collection-level description.

Heritage asset – holds the metadata for a monument, including descriptive and administrative metadata.

Digital resource – holds the metadata about a digital resource.

Activity – holds the metadata about an event or activity.

Monuments, digital resources and activities are the "first-class" citizens of the CARARE schema. All other objects are hierarchically subsumed by them.

Heritage Asset Identification Set

The CARARE information set for heritage assets is based on the MIDAS Heritage standard, however the elements are compatible with the POLIS DTD and the CIDOC Core Data Index for Archaeological Sites.

The scope of this information set includes archaeological monuments, historic buildings, industrial monuments, archaeological landscape areas, shipwreck, artefacts and ecofacts. The ability to create relations between heritage asset records allows the relationships between individual monuments that form parts of a larger complex to be expressed, for example the Parthenon, Propylaea and the Erechtheum are part of the Acropolis of Athens.

Please note that global types are defined in section 11. The heritage asset information set includes:

Record information (source = MIDAS) (global) – The ID, language, creation information and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8.

Appellation (global) – This is information about the identifier (ID) and name of the monument (see section 11). The ID sub-element is the record ID in the CARARE repository and will be generated by CARARE on ingest. The name sub-element may be repeated if a monument is known by more than one name, using the XML:lang attribute if the names are in alternate languages. A preferred/alternate attribute may be used to indicate which name is preferred.

Description (source = MIDAS) (global) – of the features of the archaeological monuments, historic buildings, industrial monuments, archaeological landscape areas, shipwreck, artefact or ecofact.

Actors (source = MIDAS) (global) – the actors involved with this monument, may be repeated.

Designations (source = MIDAS);

This is information about any designations for a monument or building which provide it with protection in law. There may be more than one designation.

- Protection type – the type of designation or protection.
- Grade – the grade or level of protection.
- Date from – the date from which the protection came into force.
- Date to – the date until which the monument is protected

Conditions (source = MIDAS);

This is information about the condition of a monument or building. The element is repeatable.

- Condition – the observed condition (e.g. good, fair, bad, poor, part destroyed, under restoration.)

- Condition Assessment - A detailed assessment of the condition of a Heritage Asset and any treatment required and an estimation of the percentage of the monument affected.
- Condition Date – the date when the assessment of condition was made.
- Relations – to an associated event/activity

Characters (source = MIDAS);

This is a set of index information to describe the character of the monument

- **Heritage asset type** (source = MIDAS) – classification of the monument, building, landscape feature, artefact or ecofact primarily with respect to its function or use, e.g. house. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
  - Term
  - Namespace – this is the name/location of the controlled vocabulary from which the term is taken.
- **Temporal** (source = MIDAS) (Global) (see section 11)
- **Materials** (source = MIDAS) – the basic materials of which a monument is composed, e.g. brick, stone, tile. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
- **Inscriptions** (source = MIDAS) – text inscribed on a monument or building, if any. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred. The type of inscription may be indicated using an attribute. Use of a controlled vocabulary to indicate the type of inscription is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
- **Dimensions** (source = MIDAS, LIDO)
  - **Measurement type** – e.g. height, length, width, depth, shape (e.g. oval)
  - **Units** – e.g. metres, centimetres
  - **Scale**
  - **Value**
- **Craft** (source = MIDAS) – this is a set of information to describe shipwrecks if any
  - Placeofregistration – of the ship
  - Nationality – of the ship
  - Constructionmethod – of the ship
  - Propulsion – of the ship
  - Lastjourneydetails – of the ship
    - Departure – Port of departure
    - Destination – Port of destination
    - Cargo – of the ship
    - Mannerofloss – how the ship was lost
    - Dateofloss – when the ship was lost
  - Dimensions – of the ship
    - Measurement type
    - Units

- Scale
- Value

- **Repository location** (source = LIDO) – identification of the institution with custody of the artefact and possibly the current location.

Spatial (source = MIDAS) (Global) (see section 11)

This is information about the place at which the heritage asset is located, included named places, postal address, the map coordinates and geometry of the heritage asset.

References – these are sources of information about the heritage asset in publications and archival sources (for example, photographs, drawings, plans, bibliographic references etc.). Do not include the digital objects (image, text, video, audio, 3D model, etc.) which your organisation is making accessible to Europeana – these should be described as Digital Resources, not References. Source = MIDAS + DCMI Terms. The information includes:

- **Record information** (source = MIDAS) (Global)
- **Appellation** – the ID and name given to the information source.
- **Actors** (source = MIDAS) (Global) **–** (creator, author, contributor, editor, etc.)
- **Type** (archive, file, record, book, chapter, article etc.) Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
- **Medium** (source = DCMI Terms) – the medium or physical carrier of the resource.
- **Extent** (source = DCMI Terms) – the size or extent of the resource
- **Subject** (source = DCMI Terms) – the topic of the resource. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
- **Rights** (source = MIDAS)
- **Publication statement** (Global) (see section 11)
- **Note** (source = MIDAS) (Global)
- **Relations** – of the reference

Relations – of the heritage asset to other heritage assets, resources, events etc.

Relations

This is information about the relations between heritage assets, events or resources and other entities

- The type of relation, for example 'is successor of', 'is next in sequence', 'has part'.
- The target of the relation (the ID number of the related heritage asset, event or resource)

The relations which are included in the Europeana Data Model are as follows:

- Is Derivative Of – a version of another resource
- Is Next In Sequence – the ordered parts of a resource, e.g. the pages in a book or an ordered sequence of 3D models showing the change of a monument over time.
- Is Related To – a general relationship between objects

- Is Representation Of – associates an information resource to the object that it represents, e.g. a digital image is a representation of the monument which is the target of the relation. We use it in the CARARE schema to associate a heritage asset and a Digital Resource
- Is Successor Of – the relation between the continuation of a resource and that resource, e.g. a church is successor of an earlier church on the same site.
- Occurred At – associates an event to the smallest known time span that overlaps with the occurrence of that event.
- Happened At – relates a place to the events which happened at that place.
- Was Present At – this relation associates the people, things or information sources with the Event that they were present at.
- Has Part – used for objects that incorporate other objects, e.g. a monument made up of smaller monuments or a site with a number of monuments.

Additional CARARE properties:

- hasEvent – associates a heritage asset with an Activity.
- Is Replica of – used for heritage assets that replicate other heritage assets, including scale models.
- Is In Front Of – a spatial relationship signifying the relative position of one monument to another.
- Is Behind – a spatial relationship signifying the relative position of one monument to another.
- Is Above – a spatial relationship signifying the relative position of one monument to another.
- Is Below – a spatial relationship signifying the relative position of one monument to another.
- Is North Of – a spatial relationship signifying the relative position of one monument to another.
- Is South Of – a spatial relationship signifying the relative position of one monument to another.
- Is East Of – a spatial relationship signifying the relative position of one monument to another.
- Is West Of – a spatial relationship signifying the relative position of one monument to another.
- Same As (source = OWL) – indicates that the two participants in the relation actually refer to the same thing.

Digital Resource

These are digital resources (image, text, video, audio, 3D model) that are being made accessible to the service environment (e.g. CARARE, Europeana). Use this to describe those digital objects which your organisation is making accessible to Europeana to represent a heritage asset (use Reference under Heritage Asset to describe other sources of information about the asset, e.g. bibliographic references or analogue representations of the object). Source = LIDO + MIDAS + DCMI Terms + Europeana Data Model.

The information set includes:

Record information (source = MIDAS) (Global) - The ID, language, creation information and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8.

Appellation – the ID and the name given to the information source (see section 11).

Actors – The actors involved in the creation of a digital resource

Format (source = DCMI Terms) – the file format of the resource. Recommended best practice is to use a controlled vocabulary such as the list of Internet Media Types (MIME).

Format Details (source = DCMI Terms) – Additional information about the file or its production that could be of use in selecting an appropriate viewer for the resource, such as specific codecs used.

Medium (source = DCMI Terms) – the medium or physical carrier of the resource.

Extent (source = DCMI Terms) – the size or extent of the resource, including the unit of measurement.

Subject (source = DCMI Terms) – the topic of the resource. Use of a controlled vocabulary such as Getty Arts and Architecture thesaurus is recommended, and the vocabulary used may be indicated using an attribute.

Spatial (source = DCMI Terms) – the spatial characteristics of the digital resource (as opposed to the heritage asset it might represent).

Temporal (source = MIDAS) (Global) – use for dates associated with the topic of the resource, e.g. for digitised copies of historic photographs use for the date when the original photograph was taken (the date of the view of the monument) (see section 11).

Publication statement (see section 11)

Type (source = DCMI Terms) – The nature or genre of the resource. Use of the DCMI controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute.

Description (source = MIDAS) (Global) – The description of the resource, e.g. describe the view of the monument.

Note (source = MIDAS) (Global)

Created (source = DCMI Terms) – this is the date when the resource was created

Provenance (source = DCMI Terms) – A statement of any changes in ownership and custody of the resource since its creation that are significant for its authenticity, integrity, and interpretation.

Language (source = DC) – use for the language of the resource, e.g. the language sub-titles or a voice-over in a movie or a Virtual Reality model of a monument. Specified (like the xml:lang attribute) using ISO 639-1:2002, i.e. standard two letter language codes (en, fr, etc.).

Link (source = LIDO) – the URL of the resource. A reference to the digital object on the content provider's web site in the best available resolution/quality (i.e. a link to the resource as a text, image, sound, or video file, **not** to the webpage that contains it). The data given here will allow the automatic generation of a thumbnail by Europeana for its functionality.

IsShownAt (source = ESE v3.3) – A URL to the digital object on the content provider's website in its full information context (i.e. a link to the webpage that contains the digital object and contextual information).

Resource metadata location (source = LIDO) – pointer to other information about the resource making the resource available

Relations – to heritage assets, other resources or to references.

Rights (source = MIDAS)

Activity

This is information about the events or activities that the monument has taken part in, for example: Field investigation; Research and analysis; Creation; Change in use; Historical events, etc. Source = MIDAS + POLIS DTD.

The information includes:

Record information (source = MIDAS) – The ID, language, creation information and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8.

Appellation (source = MIDAS) (global) – This is the name of the event.

Description (source = MIDAS) (global) – of the event or activity which took place.

Actors (source = MIDAS) (global) – the people or organisations involved in this event, may be repeated.

Event type (source = MIDAS – classification of the type of event or activity which took place, e.g. survey, archaeological excavation, rebuilding. Use of a controlled vocabulary is recommended.

- Term
- Namespace – this is the name/location of the controlled vocabulary from which the term is taken.

Temporal (source = MIDAS) (Global) – the date or time span of the event.

Spatial (source = MIDAS) (Global) – the location or area covered by the event.

Assessments (source = MIDAS) – assessments made of the monument during the event, e.g. of the condition of the monument. Use of a controlled vocabulary is recommended.

- Term
- Namespace – this is the name/location of the controlled vocabulary from which the term is taken.

Event method (source = LIDO) – the method by which the event is carried out

Materials and techniques used (source = LIDO) – the materials and/or techniques used during the event. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.

Relations – of the event to other events, references, resources etc.

Record information

Basic administrative information about the record:

- ID – i.e. the local ID number in the content providers' information system; it is unique within the collection, but may follow any schema.
- Type – of the record. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
- Source – of the record (the name of the organisation that maintains the record)
- Country – in which the head office of the organisation which maintains the record is based.
- Creation – when created and who by;
    - Actor
    - Date
- Update – the date of the last update to the record and who by;
    - Actor
    - Date
- Language (of the metadata record). Specifies the default language of the record; deviations in particular elements are specified using the xml:lang attribute where allowed. Specified (like the xml:lang attribute) using ISO 639-1:2002, i.e. standard two letter language codes (en, fr, etc.).

- Rights – to the metadata
- Keywords – for the record. CARARE will add general subject keywords such as archaeology, architecture or archaeological sites to each record. The element will be repeated using the XML:lang attribute to indicate the languages in which the keyword is available.

Rights

Information about the rights associated with the object, metadata and the

digital surrogate being harvested into the service environment based on MIDAS Heritage. The information includes:

- Copyright
  - Rights holder;
  - Rights dates;
  - Credit line (statement)
- Access rights
  - Granted to
  - Conditions
  - Date from
  - Date to
  - Statement
- Reproduction rights
  - Statement
  - Contacts
  - Fees
- License – a URI indicating a license or conditions for the use of the object or data, e.g. a Creative Commons license[1] or the public domain mark[2]. Use as an alternative or supplement to the information above.

It is always recommended that the Copyright elements are given when known.

Collection information

The following elements provide a collection level description of the resources being harvested

- Title – the title of the collection. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.
- Keywords – for the collection. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. Use of a controlled vocabulary such as Getty Arts and Architecture Thesaurus is recommended, and the vocabulary used may be indicated using an attribute.
- Contacts – for the collection
- Rights – associated with the collection as a whole
- Source – organisation that is the source of the collection

[1] http://creativecommons.org/about/licenses/
[2] http://creativecommons.org/publicdomain/mark/1.0/

- Language – of the metadata. Specifies the default language of the records in the collection; deviations in particular records are specified in the record metadata, and deviations in particular elements are specified using the xml:lang attribute where allowed. Specified (like the xml:lang attribute) using ISO 639-1:2002, i.e. standard two letter language codes (en, fr, etc.).
- Statement – free text. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.
- Creation – information about how the resources being harvested were collected includes:
    - Createdon – when the collection was created
    - Query - The query used to extract the data.
- Coverage – of the collection
    - Temporal – general temporal coverage of the collection
    - Spatial – general spatial coverage of the collection, e.g. the country covered.
- Spatial reference system – Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. The OGC URN scheme for spatial reference systems is recommended for use.

Global types

The following types are used globally across the CARARE schema to define its elements.

Appellation (source = LIDO)

- ID – an identifier of an object. An attribute type should be accompany this sub-element denoting the type of the identifier (URI, ISBN, etc,) The element may be repeated.
- Name – this is the name of the entity. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.

Temporal (source = MIDAS).

Information about the date and/or period of an entity.

- Time span
    - start date – the earliest date in the range
    - end date – the latest date in the range
    - Dimension
        - measurement unit – e.g. ‘years’
        - value – e.g. ‘474’
        - type – e.g. ‘AD’, ‘BCE’, ‘BPE’. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
    - Date range qualifier – the nature of the time span given (e.g. throughout, at some time during, etc.) Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
- Period name – the name given to the period in history when something occurred. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.
- Display date – a free text field used to display the date or period for users (e.g. early 19th century, 1950s). The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.

- Scientific Date – date according to scientific dating methods, e.g. '1250 bp +/-30 PBN-1675', recorded precisely as received from the specialist.
- Scientific Date Method – e.g. 'radiocarbon dating'. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.

Spatial (source = MIDAS). Information about locations or positions in space.

- Location set
    - Named location – the name of a place or location which is relevant to the entity being described, for example 'Lake Windermere'. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred. Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.
    - Address – the postal address
    - Geopolitical area – the name of an administrative region which does not form part of the address, for example Scotland, England, Tuscany etc. May also be used for a historical geopolitical area, or an administrative unit (e.g. as defined in the INSPIRE directive).
    - Geopolitical area type. Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.
    - Cadastral reference
    - Historical name. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.
- Spatial reference system – Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. The OGC URN scheme for spatial reference systems is recommended for use.
- Cartographic reference
    - Spatial feature type (how a feature is depicted in a GIS, e.g. point, line, polygon, multi-point, multi-line, multi-polygon). Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.
    - Coordinates
        - X
        - Y
        - Z
- Geometry
    - Bounding box
        - Min X
        - Min Y
        - Max X
        - Max Y
    - Quickpoint
        - X
        - Y
    - Entity: GML, Well-known text (WKT).
    - Stored precision, delivery precision (the precision of a coordinate as stored in the system, and as delivered to users).

  - Height: datum, units
  - Area: units
- Representations – how a feature is represented on a map

Address (source= MIDAS).

This is the postal address for a building, contact, etc.

- Building name
- Number in road – the number in a road or street used to identify a property
- Road name
- Town or city
- Postcode or zipcode
- Locality – a named area within which a monument or building lies
- Admin area – the name by which an administrative area is known, e.g. Shropshire
- Country

Actors (source = MIDAS + elements from LIDO).

- ID
- Name (the name of the person or organisation)
- ActorType (source = LIDO – indicates whether the actor is an individual, a group of individuals or an organisation.
- Roles – the roles of the actor (creator, custody, repository, curator, architect, sculptor, photographer, compiler, etc.) Use of a controlled vocabulary such as Getty Arts and Architecture thesaurus is recommended, and the vocabulary used may be indicated using an attribute.
- Contacts – contact information if known
- Vital dates (source = LIDO) – date of birth, date of death if known.
- Place of birth – Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.
- Place of death – Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.
- Place of activity – Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.
- Biographical note – The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.

Contacts (source = MIDAS).

Information about how a person or organisation can be contacted

- Name – title, first name, last name, other name
- Role – the particular role played by the person or organisation
- Organisation
- Address – the postal address of the person or organisation
- Phone
- Fax

- Email

Description (source = MIDAS). The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.

- Full – a free text description of the entity
- Summary – a brief description of the entity

Publication statement

- Publisher
- Place – of publication
- Date – of publication

Elements Cardinality

The following table outlines the proposed schema and presents the cardinality of each element as well as defines if it is mandatory or not.

Element			**Attribute**	**Mandatory/Repeatable**
Carare				Y/N
Collection Information				Y/Y
	Title			Y/Y
			xml:lang	Y/N
			preferred	N/N
	Keywords			N/Y
			xml:lang	Y/N
	Contacts			Y/Y
	Rights			N/Y
	Source			Y/N
	Language			Y/Y Mandatory?
			xml:lang	Y/N
	Statement			N/Y
			xml:lang	Y/N
			preferred	N/N
	Creation			N/Y
		Createdon		N/Y
		Query		N/Y
	Coverage			N/Y
		Temporal		N/Y
		Spatial		N/Y

	Spatial reference system			Y/Y
			Preferred	N/N
Heritage asset Identification				Y/Y
	Record Information			Y/N
	Appellation			Y/Y
	Description			Y/N
	Actors			N/Y
	Designations			N/Y
		Protection type		Y/N
		Grade		N/N
		Date from		N/N
		Date to		N/N
	Conditions			N/Y
		Condition		N/N
		Condition Assessment		N/N
		Condition Date		N/N
		Relations		N/Y
	Characters			N/N
		Heritage asset type		Y/Y
			namespace	N/N
		Temporal		Y/Y to discuss ?
		Materials		N/Y
		Inscriptions		N/Y
			xml:lang	N/N
			type	N/N
			namespace	N/N
			preferred	N/N
		Dimensions		N/Y
		Craft		N/Y
	Repository location			N/Y
	Spatial			Y/Y to discuss ?
	References			N/Y
		Record information		Y/N
		Appellation		Y/Y
		Actors		Y/Y

		Type		Y/N
		Medium		N/N
		Extent		N/N
		Subject		N/Y
		Rights		N/Y
		Publication statement		Y/Y
		Note		N/N
		Relations		N/Y
	Relations			N/Y
Digital resource				N/Y
	Record information			Y/N
	Appellation			Y/Y
	Actors			N/Y
	Format			Y/Y
	Format Details			N/Y
	Medium			Y/Y
	Extent			Y/Y
	Spatial			N/Y
	Subject			N/Y
	Temporal			N/Y
	Publication statement			N/Y
	Type			Y/N
	Description			N/N
	Note			N/Y
	Created			N/N
	Provenance			N/N
	Language			N/Y
	Link			Y/N
	IsShownAt			N/N
	Resource metadata location			Y/N
	Relations			N/Y
	Rights			N/Y
			xml:lang	N/N
Relations				N/Y
	Appelation			Y/N
	Type of relation			Y/N
	Target of relation			Y/N

Activity				N/Y
	Record information			Y/N
	Appellation			Y/N
	Description			N/N
	Actors			N/Y
	Event type			Y/N
	Temporal			Y/Y
	Spatial			N/N
	Assessments			N/Y
			term	N/N
			namespace	N/N
	Event method			N/Y
	Materials and techniques			N/Y
	Relations			Y/Y
Record information				
	ID			Y/N
	Type			N/N
	Source			Y/N
	Country			Y/N
	Creation			
		Date		Y/N
		Actor		N/Y
	Update			
		Date		Y/N
		Actor		N/Y
	Language (of the metadata record)			Y/Y
			xml:lang	N/N
	Rights			N/Y
	Keywords			N/Y
			xml:lang	Y/N
Rights				N/Y
	Copyright			N/Y
		Rights holder		N/Y
		Rights dates		N/Y
		Credit line (statement)		N/Y
	Access rights			N/Y

		Granted to		N/Y
		Conditions		N/Y
		Date from		N/N
		Date to		N/N
		Statement		N/Y
	Reproduction rights			N/Y
		Statement		N/Y
		Contacts		N/Y
		Fees		N/Y
	License			N/Y
Appellation				
	Name			Y/Y
			xml:lang	Y/N
	ID			Y/N
Dimensions				N/Y
	Measurement type			Y/N
	Units			Y/Y
	Scale			Y/Y ?
	Value			Y/Y
Craft				N/Y
	Placeofregistration			N/Y
	Nationality			N/N
	Constructionmethod			N/Y
	Propulsion			N/N
	Lastjourneydetails			N/N
		Departure		N/N
		Destination		N/Y
		Cargo		N/Y
		Mannerofloss		N/N
		Dateofloss		N/N
Temporal				
	Time span			N/Y
		start date		N/Y
		end date		N/Y
		Dimension		N/Y
		Date range qualifier		N/Y
			namespace	N/N
	Period name			N/Y

			xml:lang	Y/N
			preferred	N/N
	Display date			N/Y
			xml:lang	Y/N
			preferred	N/N
	Scientific Date			N/Y
	Scientific Date Method			N/Y
Spatial				
	Location set			Y/N
		Named location		N/Y
			xml:lang	Y/N
			preferred	N/N
			namespace	N/N
		Address		N/N
		Geopolitical area		N/N
		Geopolitical area type		N/N
			namespace	N/N
		Cadastral reference		N/N
		Historical name		N/Y
			xml:lang	Y/N
			preferred	N/N
	Spatial reference system			Y/N
	Cartographic reference			N/N
		Spatial feature type		Y/N
		Coordinates		Y/N
	Geometry			N/N
		Bounding box		N/N
		Quickpoint		N/N
		Entity		N/N
		Stored precision		N/N
		Height		N/N
		Area		N/N
	Representations			N/N
Coordinates				
	X			Y/N

	Y			Y/N
	Z			Y/N
Bounding Box				
	maxX			Y/N
	maxY			Y/N
	minx			Y/N
	minY			Y/N
Quickpoint				
	X			Y/N
	Y			Y/N
Address				Y/Y
	Building name			N/N
	Number in road			N/N
	Road name			N/N
	Town or city			Y/N
	Postcode or zipcode			N/N
	Locality			N/N
	Admin area			N/N
	Country			Y/N
Actors				
	ID			Y/N
	Name			Y/Y
	ActorType			Y/Y
	Roles			N/Y
			namespace	N/N
	Contacts			N/Y
	Vital dates			N/Y
			type	N/N
	Place of birth			N/Y
			namespace	N/N
	Place of death			N/Y
			namespace	N/N
	Place of activity			N/Y
			namespace	N/N
	Biographical note			N/Y
			xml:lang	Y/N
			preferred	N/N
Contacts				N/Y
	Name			N/Y

	Role			N/Y
	Organisation			N/Y
	Address			N/Y
	Phone			N/Y
	Fax			N/Y
	Email			N/Y
Description				
			xml:lang	Y/N
			preferred	N/N
			type (full, summary)	N/N
Publication statement				
	Publisher			Y/Y
	Place – of publication			N/Y
	Date			N/Y

5. Metadata Mappings

The following table describes the mapping of the CARARE Schema elements to EDM 5.2. Since EDM is a conceptual model the CARARE Elements are mapped either directly to EDM Classes and ESE elements, or to particular EDM paths.

Comments are given where appropriate to highlight items of interest. These comments can also be a placeholder for further details about the implementation of the mapping.

The notation used is as follows:
- Mapping to EDM classes (and their subclasses) and elements: Class/subclass/Element
- Mapping to EDM paths: Sequences of (Class/subclass/Element -> EDM Property -> Class/subclass/Element)

Carare Elements	EDM Classes and Paths
Collection Information	ORE Aggregation -and- ORE Aggregation -> Provider -> Digital Curation Unit

Comment:
We need an ID for a collection and an ID for the proxy.

Collection Information/Title	ORE Aggregation/Europeana Aggregation/DC Title

Comment:

Collection Information/Title@xml:lang is mapped to *ORE Aggregation/Europeana Aggregation/Language.*

Collection Information/Keywords	ORE Aggregation /DC Subject
Collection Information/Contacts	ORE Aggregation -> Data Provider -> Agent -and- ORE Proxy -> Current Location -> Place
Collection Information/Rights	ORE Aggregation/DC Rights
Collection Information/Source	ORE Proxy -> ORE Proxy In -> ORE Aggregation -> Data Provider -> Agent/DC Title -and- ORE Aggregation -> Landing Page -> Web Resource

Comment:

According to EDM, we need an ID for each provider for the *ORE Proxy:= Agent* field.

Collection Information/Language	ORE Aggregation/Language
Collection Information/Statement	ORE Aggregation/DC Description

Collection Information/Creation	ORE Aggregation/ DCTERMS Provenance

Comment:

CARARE schema has not a clear statement for the custody of a collection. We could follow the practice suggested by the mapping.

Collection Information/Creation/Created on	ORE Aggregation/Time Span/DC Terms Created
Collection Information/Creation/Query	ORE Proxy
Collection Information/Coverage/Spatial	Place/ DCTERMS Spatial
Collection Information/Coverage/Temporal	Time Span/DC Coverage
Collection Information/Spatial Reference System	mapping not feasible
Heritage Asset Identification/Record Information /ID	RDFS:Resource/DC Identifier -> ORE Aggregates -> ORE Aggregation -> ORE Proxy In -> ORE Proxy -> ORE Proxy For -> Europeana Object/DC Identifier
Heritage Asset Identification/Appellation/Name	Europeana Object/DC Title
Heritage Asset Identification/Appellation/ID	Europeana Object/DC Identifier -and- Physical Thing /DC Identifier -> Realizes -> Europeana Object/DC Identifier
Heritage Asset Identification/Description	Physical Thing/DC Description
Heritage Asset Identification/Actors	Agent -> Was Present At -> Event -> Was Present At -> Physical Thing -and- Europeana Object/Provider:= Digital Curation Unit

Comment:

Repeatable path according to the role of the Actors.

Heritage Asset Identification/Actors/Name	Agent/DC Creator -or- Agent/DC Contributor -or- Agent/ DCTERMS Provenance

Comment:

If *Actor/Roles <> (creator and custodian)* then *Heritage asset Identification/Actors/Name* maps to *Physical Thing /Agent/DC Contributor.*

Heritage Asset Identification/Designations/Protection type	Physical Thing/DC Description -or- Physical Thing/DC Rights
Heritage Asset Identification/Designations/Grade	Physical Thing/DC Description
Heritage Asset Identification/Designations/Date from	mapping not feasible
Heritage Asset Identification/Designations/Date to	mapping not feasible
Heritage Asset Identification/Conditions/Condition	Physical Thing/DC Description
Heritage Asset Identification/Conditions/Condition Assessment	Physical Thing/DC Description
Heritage Asset Identification/Conditions/Condition Date	mapping not feasible
Heritage Asset Identification/Conditions/Relations	Physical Thing -> Has Met -> Event
Heritage Asset Identification/Characters/Heritage asset type	Physical Thing -> Has Type -> Type
Heritage Asset Identification/Characters/Temporal	Physical Thing -> Was Present At -> Event -> Occurred At -> Time Span
Heritage Asset Identification/Characters/Materials	Physical Thing/ DCTERMS Medium
Heritage Asset Identification/Characters/Dimensions	Physical Thing/ DCTERMS Extent
Heritage Asset Identification/Characters/Craft	Physical Thing -> Has Type ->Type
Heritage Asset Identification/Repository location	Ore Proxy -> ORE Proxy For -> Europeana Object -and- Ore:Proxy -> Current Location -> Place
Heritage Asset Identification/Spatial	Physical Thing -> Was Present At -> Event -> Happened At -> Place
Heritage Asset Identification/References	Physical Thing -> DCTERMS Is Referenced By -> Information Resource
Heritage Asset Identification/References/Record information/ID	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC Identifier
Heritage Asset Identification/References/Appellation	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DCTERMS References
Heritage asset Identification/References/Actors	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC creator

Comment:
If *Actors/roles <> creator* then mapped to *Information Resource/DC Contributor*

Heritage Asset Identification/References/Type	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC Type
Heritage Asset Identification/References/Medium	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/ DCTERMS Medium
Heritage Asset Identification/References/Extent	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/ DCTERMS Extent
Heritage Asset Identification/References/Subject	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC Subject
Heritage Asset Identification/References/Rights	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC Rights
Heritage Asset Identification/References/Publication statement	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC Publisher
Heritage Asset Identification/References/Note	Physical Thing -> DCTERMS Is Referenced By -> Information Resource/DC Description
Heritage Asset Identification/References/Relations	Physical Thing -> DCTERMS Is Referenced By -> Information Resource
Heritage Asset Identification/Relations	In general: Europeana Object/DC Relation -and- Physical Thing/DC Relation In detail: - We denote the fact that a Heritage Asset is part of a collection using the path: ORE Aggregation/Europeana Aggregation -> Aggregated CHO -> Europeana Object - We denote the relation of a Heritage Asset with an Event, using the path: Europeana Object -> Was Present At -> Event - We denote the relation of a Heritage Asset with a Digital Resource using the path: Europeana Object -> Is Representation Of -> Physical Thing We could also use the sub-properties of the DC Relation appeared in EDM.
Digital Resource	Web Resource/Europeana Object
Digital Resource/Record information/ID	ORE Proxy/DC Identifier -> ORE Proxy For -> Web Resource/Europeana Object/DC Identifier
Digital Resource/Appellation/Name	Web Resource/Europeana Object/DC Title
Digital Resource/Appellation/ID	Web Resource/Europeana Object/DC Identifier

Digital Resource/Actors	Agent -> Was Present At -> Event -> Was Present At -> WebResource/Europeana Object -and- Europeana Object/Provider:= Digital Curation Unit

Comment:

Repeatable path according to the role of the Actors.

Digital Resource/Format	Web Resource/Europeana Object/DC Format
Digital Resource/Format Details	Web Resource/Europeana Object/DC Format
Digital Resource/Medium	Web Resource/Europeana Object/ DCTERMS Medium
Digital Resource/Extent	Web Resource/Europeana Object/ DCTERMS Extent
Digital Resource/Spatial	Web Resource/Europeana Object/DC TERMS Spatial
Digital Resource/Subject	Web Resource/Europeana Object/DC Subject
Digital Resource/Temporal	Web Resource/Europeana Object/DC TERMS Temporal
Digital Resource/Publication statement	Web Resource/Europeana Object/DC Publisher
Digital Resource/Type	Web Resource/Europeana Object/DC Type
Digital Resource/Description	Web Resource/Europeana Object/DC Description
Digital Resource/Note	Web Resource/Europeana Object/DC Description
Digital Resource/Created	Web Resource/Europeana Object/DC TERMS Created
Digital Resource/Provenance	Web Resource/Europeana Object/ DCTERMS Provenance
Digital Resource/Language	Web Resource/Europeana Object/DC Language
Digital Resource/Link	Web Resource/Europeana Object/Object
Digital Resource/Object	Web Resource/Object
Digital Resource/IsShownAt	Web Resource/Europeana Object -> Is Shown By -> Landing Page

Digital Resource/Resource metadata location	Web Resource/Europeana Object -> Is Shown At -> Landing Page
Digital Resource/Relations	In general: Europeana Object/DC Relation In detail: - We denote the fact that a Heritage Asset is part of a collection using the path: ORE Aggregation/Europeana Aggregation -> Aggregated CHO -> Europeana Object - We denote the relation of a Heritage Asset with an Event, using the path: Europeana Object -> Was Present At -> Event - We denote the relation of a Heritage asset with a Digital Resource using the path: Europeana Object -> Is Representation Of -> Physical Thing We could also use the sub-properties of the DC Relation appeared in EDM
Digital Resource/Rights	Web Resource/Europeana Object/DC Rights
Relations	DC Relation
Relations/Appellation	mapping not feasible
Relations/Type of Relation	According to the CARARE vocabulary, as well as the EDM and DCTERMS vocabularies
Relations/Target of Relation	The DC Identifier of the related object
Activity	Event
Activity/Record information	Event /DC Identifier
Activity/Appellation	Event/DC Title
Activity/Description	Event/DC Description
Activity/Actors	Agent -> Was Present At -> Event
Activity/Event type	Event -> Has Type -> skos: Concept
Activity/Temporal	Event -> Happened At -> Time Span
Activity/Spatial	Event -> Occurred At -> Place

Activity/Assessments	Event/DC Description
Activity/Event method	Event/DC Description
Activity/Materials and techniques	Event/DC Description
Activity/Relations	RDFS:Resource -> Has Met -> Event
Record Information/ID	Resource/DC Identifier
Record Information/Type	RDFS:Resource/ORE Proxy/DC Identifier -> Has Type ->Type
Record Information/Source	RDFS:Resource/ORE Proxy/DC Title
Record Information/Country	RDFS:Resource/ORE Proxy/Country
Record Information/Creation	mapping not feasible
Record Information/Creation/Date	RDFS:Resource/ORE Proxy/ DCTERMS Created
Record Information/Creation/Actor	RDFS:Resource/ORE Proxy/DC Creator
Record Information/Update	mapping not feasible
Record Information/Update/Date	Information Resource -> Was Present At -> Event -> Happened At -> Time Span
Record Information/Update/Actor	Information Resource -> Was Present At -> Event -> Was Present At -> Agent
Record Information/Language	Information Resource/DC Language
Record Information/Rights	Information Resource/DC Rights
Record Information/Keywords	Information Resource/DC Subject
Rights/Copyright	RDFS:Resource/Rights
Rights/Copyright/Rights holder	RDFS:Resource/Rights
Rights/Copyright/Rights dates	RDFS:Resource/Rights

Rights/Copyright/Credit line (statement)	RDFS:Resource/Rights
Rights/Access rights	RDFS:Resource/DC Rights
Rights/Access rights/Granted to	RDFS:Resource/DC Rights
Rights/Access rights/Conditions	RDFS:Resource/DC Rights
Rights/Access rights/Date from	RDFS:Resource/DC Rights
Rights/Access rights/Date to	RDFS:Resource/DC Rights
Rights/Access rights/Statement	RDFS:Resource/DC Rights
Rights/Reproduction rights	RDFS:Resource/DC Rights
Rights/Reproduction rights/Statement	RDFS:Resource/DC Rights
Rights/Reproduction rights/Contacts	RDFS:Resource/DC Rights
Rights/Reproduction rights/Fees	RDFS:Resource/DC Rights
Rights/License	RDFS:Resource/DC Rights
Appellation/Name	Agent/DC Creator Agent/DC Contributor Europeana Aggregation/DC Title Europeana Object/DC Title Event/DC Title Information Resource/DC Title Non-Information Resource/DC Title Physical Thing/DC Title Web Resource/DC Title

Comment:
It depends on the roles sub-element and also the element for which the Appellation element is sub-element.

Appellation/ID	Agent/DC Identifier Europeana Aggregation/DC Identifier Europeana Object/DC Identifier Event/DC Identifier Information Resource/DC Identifier Non-Information Resource/DC Identifier Physical Thing/DC Identifier Web Resource/DC Identifier

Dimensions	mapping not feasible
Dimensions/Measurement type	Physical Thing/DC Format -> Has Type -> Type
Dimensions/Units	Physical Thing/DC Format
Dimensions/Scale	mapping not feasible
Dimensions/Value	Physical Thing/DC Extent
Craft/Placeofregistration	Physical Thing/DC Place
Craft/Nationality	Physical Thing/Country
Craft/Constructionmethod	Physical Thing/DC Description
Craft/Propulsion	Physical Thing/DC Description
Craft/Lastjourneydetails	Physical Thing/DC Description
Craft/Lastjourneydetails/Departure	Physical Thing -> Was Present At -> Event -> Occurred At -> Place
Craft/Lastjourneydetails/Destination	Physical Thing/ DCTERMS Spatial
Craft/Lastjourneydetails/Cargo	Physical Thing/DC Description
Craft/Lastjourneydetails/Mannerofloss	Physical Thing -> Was Present At -> Event/DC Description
Craft/Lastjourneydetails/Dateofloss	Physical Thing -> Was Present At -> Event -> Happened At -> Time Span
Temporal/Time span	Time Span
Temporal/Time span/start date	Time Span/DC Date
Temporal/Time span/end date	Time Span/DC Date
Temporal/Time span/Dimension	Time Span/ DCTERMS Temporal
Temporal/Time span/Date range qualifier	Time Span/ DCTERMS Temporal
Temporal/Period name	Time Span/ DCTERMS Temporal

Temporal/Scientific Date	Time Span/DC Date
Temporal/Scientific Date Method	Time Span/ DCTERMS Temporal
Temporal/Display date	Time Span/DC Date
Spatial/Location set	Place
Spatial/Location set/Named location	Place/DC Title
Spatial/Location set/Address	Place/ DCTERMS Spatial
Spatial/Location set/Geopolitical area	Place/ DCTERMS Spatial
Spatial/Location set/Geopolitical area type	Place/ DCTERMS Spatial
Spatial/Location set/Cadastral reference	Place/ DCTERMS Spatial
Spatial/Location set/Historical name	Place/DC Title
Spatial/Spatial reference system	Place/ DCTERMS Spatial
Spatial/Cartographic reference/	Place/ DCTERMS Spatial
Spatial/Cartographic reference/Spatial feature type	Place/ DCTERMS Spatial
Spatial/Cartographic reference/Coordinates	Place/ DCTERMS Spatial
Spatial/Geometry	Place/ DCTERMS Spatial
Spatial/Geometry/Bounding box	Place/ DCTERMS Spatial
Spatial/Geometry/Quickpoint	Place/ DCTERMS Spatial
Spatial/Geometry/Entity	Place/ DCTERMS Spatial
Spatial/Geometry/Stored precision	Place/ DCTERMS Spatial
Spatial/Geometry/Height	Place/ DCTERMS Spatial
Spatial/Geometry/Area	Place/ DCTERMS Spatial

Spatial/Representations	Place/ DCTERMS Spatial
Coordinates	Place/ DCTERMS Spatial
Coordinates/X	Place/ DCTERMS Spatial
Coordinates/Y	Place/ DCTERMS Spatial
Coordinates/Z	Place/ DCTERMS Spatial
Bounding Box/	Place/ DCTERMS Spatial
Bounding Box/maxX	Place/ DCTERMS Spatial
Bounding Box/maxY	Place/ DCTERMS Spatial
Bounding Box/minx	Place/ DCTERMS Spatial
Bounding Box/minY	Place/ DCTERMS Spatial
Quickpoint	Place/ DCTERMS Spatial
Quickpoint/X	Place/ DCTERMS Spatial
Quickpoint/Y	Place/ DCTERMS Spatial
Address	Place
Address/Building name	Place/ DCTERMS Title
Address/Number in road	Place/ DCTERMS Spatial
Address/Road name	Place/ DCTERMS Spatial
Address/Town or city	Place/ DCTERMS Spatial
Address/Postcode or zipcode	Place/ DCTERMS Spatial
Address/Locality	Place/ DCTERMS Spatial
Address/Admin area	Place/ DCTERMS Spatial

Address/Country	Place/ DCTERMS Country
Actors/ID	Agent/DC Identifier
Actors/Name	Agent/DC Creator -or- Agent/DC contributor -or- Agent /DC Title
Actors/ActorType	Agent -> Has Type -> Type
Actors/Roles	skos:Concept
Actors/Contacts	ORE Proxy
Actors/Vital dates	Agent/DC Date
Actors/Place of birth	Agent/DC Place
Actors/Place of death	Agent/DC Place
Actors/Place of activity	Agent/DC Place
Actors/Biographical note	Agent/DC Description
Contacts	ORE Proxy
Contacts/Name	Agent/DC Contributor
Contacts/Role	skos:Concept
Contacts/Organisation	ORE Proxy
Contacts/Address	Place
Contacts/Phone	mapping not feasible
Contacts/Fax	mapping not feasible
Contacts/Email	mapping not feasible

Description	Agent/DC Description
Publication statement/Publisher	Information Resource/DC Publisher
Publication statement/Place of publication	Information Resource/DC Place
Publication statement/Date	Information Resource/DC Date

6. *Metadata Mapping Tool*

In the Cultural Content Metadata Space, the largest technological challenge is to ensure syntactic and semantic interoperability across the different types of metadata that exist in the Cultural Heritage sector. The technical standards enabling interoperability form an important dimension of this work. In order to achieve semantic interoperability we need a common automatic interpretation of the meaning of the exchanged information, i.e. the ability to automatically process the information in a machine-understandable manner. The first step of achieving a certain level of common understanding is a representation language that exchanges the formal semantics of the information. Then, systems that understand these semantics can process the information and provide web services like searching, retrieval etc.

The following figure illustrates the proposed worksflow for ingesting metadata in DC-DI.

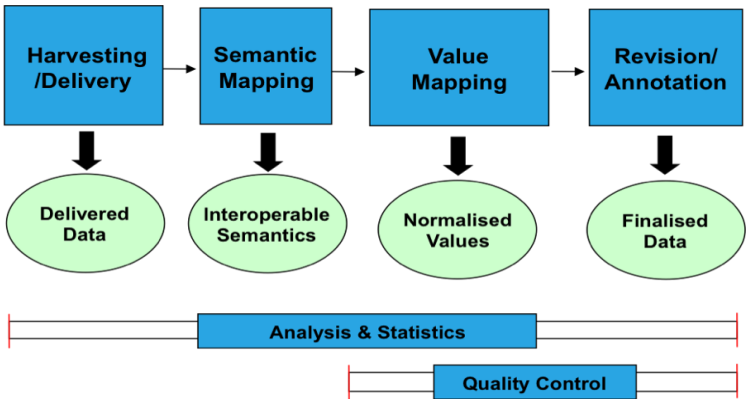

Figure: ingestion workflow

The workflow consist of four phases. Each phase is responsible for specific services all needed to ensure the quality of the ingestion process.

Harvesing/delivery is responsible for collecting the metadata It will be an interface for different methods of data delivery including, OAI-PMH, HTTP upload/download FTP upload/download

Semantic Mapping will provide the service for assigning semantics to the harvested metadata. It will assist to manually map Providers fields to a reference rich schema. Providers that have metadata in supported known formats might be able to omit this step (use stored transformations from selected schemas to the reference schema based on existing crosswalks).

Value Mapping will take existing attribute values and produce different/edited values. In particular:

- It will enable providers to resolve data issues, e.g. map own terminology list to selected terminology lists
- It will then automatically normalize data e.g. dates, geographical locations, nationality/language, name writing convention to selected vocabulary standards.

Revision/Annotation will enable the addition of data that is not in the original metadata (e.g empty fields, fields that take values from controlled vocabularies).

Analysis & Statistics service will provide detailed analysis and statistics of metadata contributed by a provider. (i.e. number of items imported, total values per field etc).

Quality Control will automatically check and report on Content Provider's data (i.e. missing values, malformed data). Error reports and warnings will be produced to facilitate editing the semantic mappings, value mappings and/or edit items until the Provider's data successfully passes the Quality control checks.

Mapping Procedure

For the needs of the CARARE service, an import is not required to include the schema used. This simplifies the actual work for the user and at the same time the set of schema components that have to be mapped is reduced to only those that are used, thus reducing redundancy. The Schema Generator module produces the required simplified version of the schema that corresponds to a specific import by the user. When a user triggers the invocation of the mapping tool for a specific import, this module is also invoked. The next step in the workflow is to parse the data for a specific import and generate a tree like structure using HTML elements that represents the schema used. This tree like structure is then transmitted to the mapping Interface in order to create an interactive tree that represents a snapshot of the XML schema that the user is going to use as input for the mapping process.

The Mapping Interface is responsible for creating and presenting an intuitive and visual appealing environment for the user to define mappings, without sacrificing any of the functionality needed to properly achieve the task of schema mapping.

In order to offer a more user friendly environment to perform the task of schema mapping, the tool can be configured to provide to the user groups of high level elements that constitute separate semantic entities. These top level sets of elements are presented on the right side of the mapping Interface as can be seen in Figure XX. On the left side of the mapping tool User Interface a tree structure is always present that represents the schema produced by the Schema Generation module for a specific import. The user is able to interact with this tree, expand or collapse the elements of the tree and retrieve brief statistics for each element and its values. An example of the info provided for each element can be found in Figure XXX.

Figure XX Screenshot of the mapping tool.

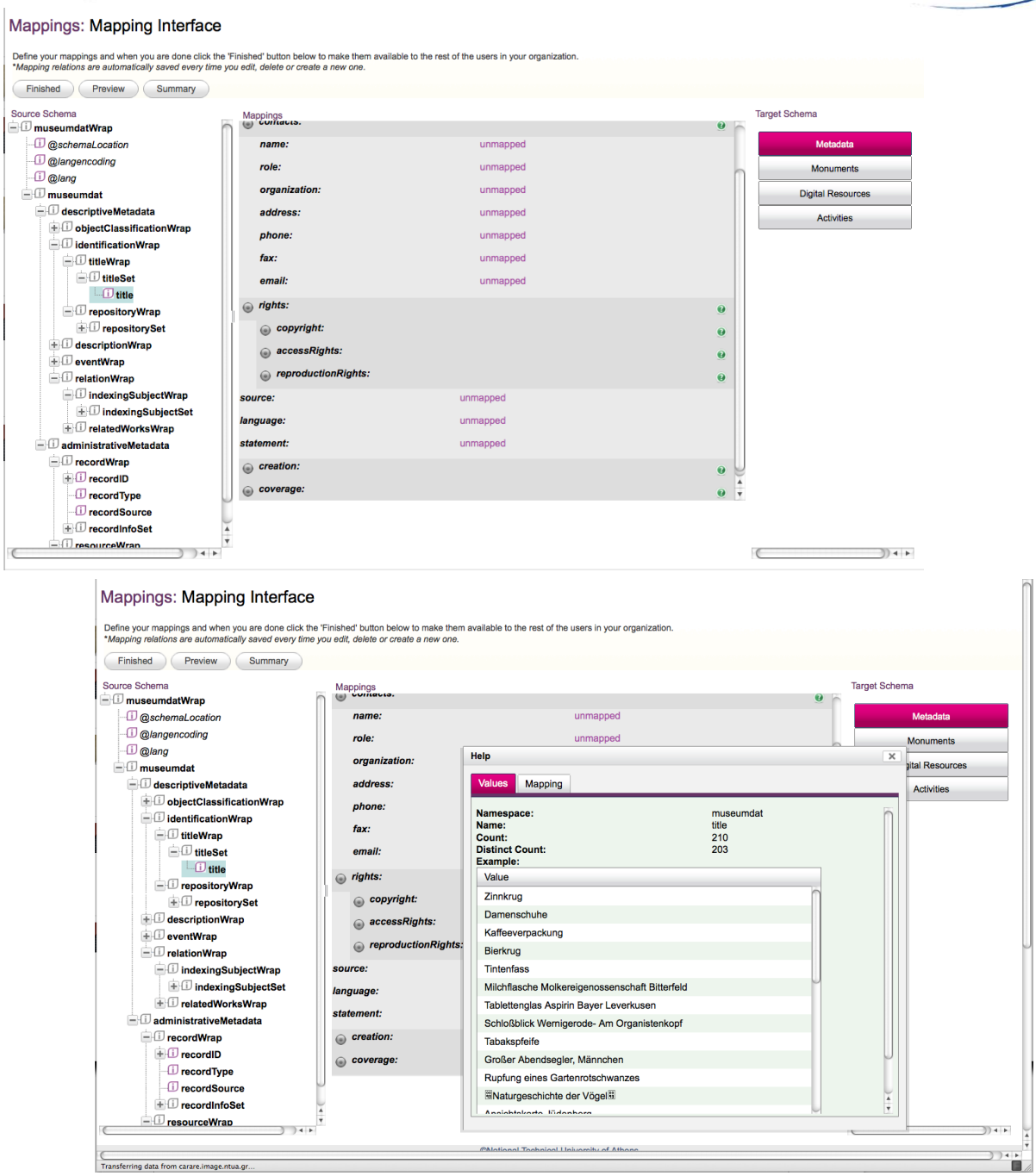

Figure XXX Statistics for an input element

When a user wants to create or edit a mapping, he initially has to select one of the top level element groups that are presented on the right side of the mapping interface. Clicking the corresponding button, the set of the sub-elements that are part of that group are presented to him in the middle part of the screen. This part of the user interface has a tree structure of embedded boxes that represents the internal structure of the complex element. The user is able to interact with this structure by clicking to collapse and expand it, similar to what he is able to do the with the tree representation of the input schema. Every embedded box represents an element and the user is able to request and view any information about it that is part of the XML schema.

When a user wants to perform an actual mapping between the input and the target schema, he has to drag and drop any element he wishes from the tree structure on the left part of the user interface to one of the boxes in the middle. When a

successful mapping occurs, the user gets notified for the event and he is able to view the mappings in the middle part of the screen. Using the delete button the user is able to delete and correct any mappings he has made so far and repeat the procedure.

The user interface of the mapping tool is completely schema aware regarding the target schema. That means that many operations might be restricted based on constraints that appear in the target XML schema. For example, if an element can be repeated the user is able by using a button that appears on the visual representation of that element to add another one and make a new mapping.

7. Conclusions

8. References

[1] LIDO v0.9 Specification Document: http://www.lido-schema.org/schema/v0.9/lido-v0.9-specification.pdf

[2] Introduction to Lido (Regina Stein): http://www.athenaeurope.org/getFile.php?id=559

[3] http://www.english-heritage.org.uk/

[4] http://dublincore.org/

[5] OAI-PMH, http://www.openarchives.org/pmh/

[6] http://www.ietf.org/rfc/rfc5013.txt

[7] http://www.niso.org/kst/reports/standards?step=2&gid=&project_key=9b7bffcd2daeca6198b4ee5a848f9beec2f600e5

[8] http://www.iso.org/iso/search.htm?qt=15836&searchSubmit=Search&sort=rel&type=simple&published=on

[9] http://www.w3.org/

[10] Resource Description Framework, http://www.w3.org/TR/rdf-primer/

[11] Linked Data Movement, http://linkeddata.org/

[12] Guidelines for implementing Dublin Core in XML, http://dublincore.org/documents/dc-xml-guidelines/index.shtml

[13] Expressing Qualified Dublin Core in RDF / XML, http://dublincore.org/documents/2002/05/ 15/dcq-rdf-xml/

[14] EDM Data Model Primer (http://version1.europeana.eu/c/document_library/get_file?uuid=718a3828-6468-4e94-a9e7-7945c55eec65&groupId=10605)

[15] Europeana Data Model presentation (for v5.2) (http://version1.europeana.eu/c/document_library/get_file?uuid=76eff9ae-5a70-409c-87b0-baf46ede7bd9&groupId=10602)

Appendix A The Carare xsd

```
<?xml version="1.0" encoding="utf-8" ?>

<xs:schema xmlns="http://www.dcu.gr/carareSchema" elementFormDefault="qualified" targetNamespace="http://www.dcu.gr/carareSchema"
xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="carare">

    <xs:annotation>

      <xs:documentation xml:lang="en">The CARARE schema start element. It wraps exactly one collection information wrapper and zero or more of
each of the other global wrappers (Monument, Digital resource, Activity).</xs:documentation>

    </xs:annotation>

    <xs:complexType>
```

```
    <xs:sequence>
      <xs:group minOccurs="0" maxOccurs="unbounded" ref="collectionInformation" />
      <xs:group minOccurs="0" maxOccurs="unbounded" ref="heritageAsset" />
      <xs:group minOccurs="0" maxOccurs="unbounded" ref="digitalResource" />
      <xs:group minOccurs="0" maxOccurs="unbounded" ref="activity" />
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:group name="collectionInformation">
  <xs:annotation>
    <xs:documentation xml:lang="en">holds the collection-level description.</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="collectionInformation">
      <xs:annotation>
        <xs:documentation>The following elements provide a collection level description of the resources being harvested</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:all>
          <xs:element minOccurs="1" name="title">
            <xs:annotation>
              <xs:documentation>the title of the collection. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>
            </xs:annotation>
            <xs:complexType>
              <xs:attribute name="lang" use="required" />
              <xs:attribute name="preferred" type="xs:boolean" />
            </xs:complexType>
          </xs:element>
          <xs:element name="keywords">
            <xs:annotation>
              <xs:documentation>for the collection. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. Use of a controlled vocabulary such as Getty Arts and Architecture Thesaurus is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
            </xs:annotation>
            <xs:complexType>
```

```
    <xs:attribute name="lang" use="required" />
  </xs:complexType>
</xs:element>
<xs:element minOccurs="1" name="contacts" type="contacts">
  <xs:annotation>
    <xs:documentation>for the collection</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="rights" type="rights">
  <xs:annotation>
    <xs:documentation>associated with the collection as a whole</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element minOccurs="1" name="source">
  <xs:annotation>
    <xs:documentation>organisation that is the source of the collection</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="language">
  <xs:annotation>
    <xs:documentation>of the metadata. Specifies the default language of the records in the collection; deviations in particular records are specified in the record metadata, and deviations in particular elements are specified using the xml:lang attribute where allowed. Specified (like the xml:lang attribute) using ISO 639-1:2002, i.e. standard two letter language codes (en, fr, etc.).</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:attribute name="lang" use="required" />
  </xs:complexType>
</xs:element>
<xs:element name="statement">
  <xs:annotation>
    <xs:documentation>free text. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:attribute name="lang" use="required" />
    <xs:attribute name="preferred" type="xs:boolean" />
```

```
  </xs:complexType>
</xs:element>
<xs:element name="creation">
  <xs:annotation>
    <xs:documentation>information about how the resources being harvested were collected includes:</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element name="createdOn">
        <xs:annotation>
          <xs:documentation>when the collection was created</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="query">
        <xs:annotation>
          <xs:documentation>The query used to extract the data.</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element name="coverage">
  <xs:annotation>
    <xs:documentation>of the collection</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element name="temporal" type="temporal">
        <xs:annotation>
          <xs:documentation>general temporal coverage of the collection</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="spatial" type="spatial">
        <xs:annotation>
```

```
                <xs:documentation>general spatial coverage of the collection, e.g. the country
covered.</xs:documentation>

              </xs:annotation>

            </xs:element>

          </xs:all>

        </xs:complexType>

      </xs:element>

      <xs:element name="spatialReferenceSystem">

        <xs:annotation>

          <xs:documentation>Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. The OGC
URN scheme for spatial reference systems is recommended for use.</xs:documentation>

        </xs:annotation>

      </xs:element>

    </xs:all>

  </xs:complexType>

 </xs:element>

</xs:sequence>

</xs:group>

<xs:group name="heritageAsset">

 <xs:annotation>

  <xs:documentation xml:lang="en">holds the metadata for a monument, including descriptive and administrative metadata.</xs:documentation>

 </xs:annotation>

 <xs:sequence>

  <xs:element minOccurs="1" maxOccurs="1" name="heritageAsset">

   <xs:complexType>

    <xs:all>

     <xs:element minOccurs="1" maxOccurs="1" name="recordInformation">

      <xs:annotation>

        <xs:documentation>The ID, language, creation information and other metadata describing the record. The ID element of this information
block holds the ID assigned by the content provider, cf. section 8. </xs:documentation>

      </xs:annotation>

      <xs:complexType>

        <xs:complexContent mixed="false">

          <xs:extension base="recordInformation" />

        </xs:complexContent>

      </xs:complexType>
```

```
</xs:element>

<xs:element name="appellation" type="appellation">

  <xs:annotation>

    <xs:documentation>This is information about the identifier (ID) and name of the monument (see section 11). The ID sub-element is the record ID in the CARARE repository and will be generated by CARARE on ingest. The name sub-element may be repeated if a monument is known by more than one name, using the XML:lang attribute if the names are in alternate languages. A preferred/alternate attribute may be used to indicate which name is preferred. </xs:documentation>

  </xs:annotation>

</xs:element>

<xs:element maxOccurs="1" name="description" type="description">

  <xs:annotation>

    <xs:documentation>of the features of the archaeological monuments, historic buildings, industrial monuments, archaeological landscape areas, shipwreck, artefact or ecofact.</xs:documentation>

  </xs:annotation>

</xs:element>

<xs:element name="actors" type="actors">

  <xs:annotation>

    <xs:documentation>the actors involved with this monument, may be repeated.</xs:documentation>

  </xs:annotation>

</xs:element>

<xs:element name="designations">

  <xs:annotation>

    <xs:documentation xml:lang="en">This is information about any designations for a monument or building which provide it with protection in law.  There may be more than one designation. </xs:documentation>

  </xs:annotation>

  <xs:complexType>

    <xs:all>

      <xs:element name="protectionType">

        <xs:annotation>

          <xs:documentation xml:lang="en">the type of designation or protection.</xs:documentation>

        </xs:annotation>

        <xs:complexType>

          <xs:attribute name="lang" use="required" />

        </xs:complexType>

      </xs:element>

      <xs:element name="grade">

        <xs:annotation>
```

```
            <xs:documentation>the grade or level of protection.</xs:documentation>
          </xs:annotation>
          <xs:complexType>
            <xs:attribute name="lang" />
          </xs:complexType>
        </xs:element>
        <xs:element minOccurs="1" maxOccurs="1" name="dateFrom" type="xs:date">
          <xs:annotation>
            <xs:documentation>the date from which the protection came into force.</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="dateTo" type="xs:date">
          <xs:annotation>
            <xs:documentation>the date until which the monument is protected.</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:all>
    </xs:complexType>
  </xs:element>
  <xs:element name="conditions">
    <xs:annotation>
      <xs:documentation>This is information about the condition of a monument or building. The element is repeatable.</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:all>
        <xs:element maxOccurs="1" name="condition">
          <xs:annotation>
            <xs:documentation>the observed condition (e.g. good, fair, bad, poor, part destroyed, under restoration.)</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element maxOccurs="1" name="conditionAssessment">
          <xs:annotation>
            <xs:documentation>A detailed assessment of the condition of a Heritage Asset and any treatment required and an estimation of the
percentage of the monument affected. </xs:documentation>
          </xs:annotation>
```

```
      </xs:element>
      <xs:element maxOccurs="1" name="conditionDate">
        <xs:annotation>
          <xs:documentation>the date when the assessment of condition was made.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="relations">
        <xs:annotation>
          <xs:documentation>to an associated event/activity.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:attribute name="id" />
          <xs:attribute name="url" />
        </xs:complexType>
      </xs:element>
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="characters">
  <xs:annotation>
    <xs:documentation>This is a set of index information to describe the character of the monument</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element maxOccurs="1" name="heritageAssetType">
        <xs:annotation>
          <xs:documentation>classification of the monument, building, landscape feature, artefact or ecofact primarily with respect to its function or use, e.g. house. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:attribute name="term" />
          <xs:attribute name="namespace">
            <xs:annotation>
              <xs:documentation>this is the name/location of the controlled vocabulary from which the term is taken.</xs:documentation>
            </xs:annotation>
```

```
      </xs:attribute>
    </xs:complexType>
  </xs:element>
  <xs:element minOccurs="1" maxOccurs="1" name="temporal" type="temporal">
    <xs:annotation>
      <xs:documentation>(see section 11)</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="materials">
    <xs:annotation>
      <xs:documentation>the basic materials of which a monument is composed, e.g. brick, stone, tile. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="inscriptions">
    <xs:annotation>
      <xs:documentation>text inscribed on a monument or building, if any. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred. The type of inscription may be indicated using an attribute. Use of a controlled vocabulary to indicate the type of inscription is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:attribute name="lang" />
    </xs:complexType>
  </xs:element>
  <xs:element minOccurs="1" name="dimensions">
    <xs:complexType>
      <xs:all>
        <xs:element minOccurs="1" maxOccurs="1" name="measurementType">
          <xs:annotation>
            <xs:documentation>e.g. height, length, width, depth, shape (e.g. oval)</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element minOccurs="1" name="units">
          <xs:annotation>
            <xs:documentation>e.g. metres, centimetres</xs:documentation>
```

```
        </xs:annotation>
      </xs:element>
      <xs:element minOccurs="1" name="scale" />
      <xs:element minOccurs="1" name="value" />
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element name="craft">
  <xs:annotation>
    <xs:documentation>– this is a set of information to describe shipwrecks if any</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element name="placeOfRegistration">
        <xs:annotation>
          <xs:documentation>of the ship</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element maxOccurs="1" name="nationality">
        <xs:annotation>
          <xs:documentation>of the ship</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="constructionMethod">
        <xs:annotation>
          <xs:documentation>of the ship</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element maxOccurs="1" name="propulsion">
        <xs:annotation>
          <xs:documentation>of the ship</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element maxOccurs="1" name="lastJourneyDetails">
```

```
<xs:annotation>
  <xs:documentation>of the ship</xs:documentation>
</xs:annotation>
<xs:complexType>
  <xs:all>
    <xs:element maxOccurs="1" name="departure">
      <xs:annotation>
        <xs:documentation>Port of departure</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="destination">
      <xs:annotation>
        <xs:documentation>Port of destination</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="cargo">
      <xs:annotation>
        <xs:documentation>of the ship</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="mannerOfLoss">
      <xs:annotation>
        <xs:documentation>how the ship was lost </xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="dateOfLoss">
      <xs:annotation>
        <xs:documentation>when the ship was lost </xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:all>
</xs:complexType>
</xs:element>
<xs:element name="dimensions">
  <xs:annotation>
```

```
<xs:documentation>of the ship</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:all>
<xs:element minOccurs="1" maxOccurs="1" name="measurementType" />
<xs:element minOccurs="1" name="units" />
<xs:element minOccurs="1" name="scale" />
<xs:element minOccurs="1" name="value" />
</xs:all>
</xs:complexType>
</xs:element>
</xs:all>
</xs:complexType>
</xs:element>
<xs:element minOccurs="1" maxOccurs="1" name="repositoryLocation">
<xs:annotation>
<xs:documentation>identification of the institution with custody of the artefact and possibly the current location.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:all>
</xs:complexType>
</xs:element>
<xs:element name="references">
<xs:annotation>
<xs:documentation>these are sources of information about the heritage asset in publications and archival sources (for example, photographs, drawings, plans, bibliographic references etc.). Digital objects (image, text, video, audio, 3D model, etc.) which are accessible online and will represent the asset in Europeana should be describe as Digital Resources, not References. </xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:all>
<xs:element minOccurs="1" maxOccurs="1" name="recordInformation" type="recordInformation" />
<xs:element minOccurs="1" name="appellation" type="appellation">
<xs:annotation>
<xs:documentation>the ID and name given to the information source. </xs:documentation>
</xs:annotation>
```

```
</xs:element>
<xs:element minOccurs="1" name="actor" type="actors">
  <xs:annotation>
    <xs:documentation>(creator, author, contributor, editor, etc.)</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element minOccurs="1" maxOccurs="1" name="type">
  <xs:annotation>
    <xs:documentation>(archive, file, record, book, chapter, article etc.) Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="medium">
  <xs:annotation>
    <xs:documentation>the medium or physical carrier of the resource.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="extent">
  <xs:annotation>
    <xs:documentation>the size or extent of the resource</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="rights" />
<xs:element minOccurs="1" name="publicationStatement" type="publicationStatement" />
<xs:element name="subject">
  <xs:annotation>
    <xs:documentation>the topic of the resource. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="note" />
</xs:all>
</xs:complexType>
</xs:element>
<xs:element name="relations" type="relations">
  <xs:annotation>
```

```
            <xs:documentation>of the heritage asset to other heritage assets, resources, events etc.</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:all>
    </xs:complexType>
  </xs:element>
 </xs:sequence>
</xs:group>
<xs:group name="digitalResource">
 <xs:annotation>
  <xs:documentation xml:lang="en">holds the metadata about a digital resource.</xs:documentation>
 </xs:annotation>
 <xs:sequence>
  <xs:element name="digitalResource">
   <xs:annotation>
    <xs:documentation>These are digital resources (image, text, video, audio, 3D model) that are being made accessible to the service environment (e.g. CARARE, Europeana).  Use this to describe those digital objects which will represent a heritage asset in Europeana. (And use Reference under Heritage Asset to describe other sources of information about the asset, e.g. bibliographic references or analogue representations of the object.)</xs:documentation>
   </xs:annotation>
   <xs:complexType>
    <xs:all>
     <xs:element minOccurs="1" maxOccurs="1" name="recordInformation" type="recordInformation">
      <xs:annotation>
       <xs:documentation>The ID, language, creation information and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8.</xs:documentation>
      </xs:annotation>
     </xs:element>
     <xs:element minOccurs="1" name="appellation" type="appellation">
      <xs:annotation>
       <xs:documentation>the ID and the name given to the information source (see section 11).</xs:documentation>
      </xs:annotation>
     </xs:element>
     <xs:element name="actor" type="actors">
      <xs:annotation>
       <xs:documentation>The actors involved in the creation of a digital resource</xs:documentation>
```

```
    </xs:annotation>
  </xs:element>
  <xs:element minOccurs="1" name="format">
    <xs:annotation>
      <xs:documentation>the file format of the resource. Recommended best practice is to use a controlled vocabulary such as the list of Internet Media Types (MIME).</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="formatDetails">
    <xs:annotation>
      <xs:documentation>Additional information about the file or its production that could be of use in selecting an appropriate viewer for the resource, such as specific codecs used.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element minOccurs="1" name="medium">
    <xs:annotation>
      <xs:documentation>the medium or physical carrier of the resource.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element minOccurs="1" name="extent">
    <xs:annotation>
      <xs:documentation>the size or extent of the resource, including the unit of measurement.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="subject">
    <xs:annotation>
      <xs:documentation>the topic of the resource. Use of a controlled vocabulary such as Getty Arts and Architecture thesaurus is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="spatial" type="spatial">
    <xs:annotation>
      <xs:documentation>the spatial characteristics of the digital resource (as opposed to the heritage asset it might represent).</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="temporal" type="temporal">
```

```
<xs:annotation>
<xs:documentation>use for dates associated with the topic of the resource, e.g. for digitised copies of historic photographs use for the date when the original photograph was taken (the date of the view of the monument) (see section 11).</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="publicationStatement" type="publicationStatement">
<xs:annotation>
<xs:documentation>(see section 11)</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element minOccurs="1" maxOccurs="1" name="type">
<xs:annotation>
<xs:documentation>The nature or genre of the resource. Use of the DCMI controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="description" type="description">
<xs:annotation>
<xs:documentation>The description of the resource, e.g. describe the view of the monument.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="note" />
<xs:element maxOccurs="1" name="created">
<xs:annotation>
<xs:documentation>this is the date when the resource was created</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="provenance">
<xs:annotation>
<xs:documentation>A statement of any changes in ownership and custody of the resource since its creation that are significant for its authenticity, integrity, and interpretation.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="language">
<xs:annotation>
<xs:documentation>use for the language of the resource, e.g. the language sub-titles or a voice-over in a movie or a Virtual Reality model of a monument. Specified (like the xml:lang attribute) using ISO 639-1:2002, i.e. standard two letter language codes (en, fr, etc.).</xs:documentation>
```

```
          </xs:annotation>
          <xs:complexType>
            <xs:attribute name="lang" />
          </xs:complexType>
        </xs:element>
        <xs:element minOccurs="1" name="link">
          <xs:annotation>
            <xs:documentation>the URL of the resource. A reference to the digital object on the content provider's web site in the best available resolution/quality. (i.e. a link to the resource as a text, image, sound, or video file, not to the webpage that contains it.) Data here will allow the full functionality of Europeana and the automatic generation of a thumbnail by them.

Object (source = ESE v3.3) – a URL containing a thumbnail or other reduced-quality version of the resource.

IsShownAt (source = ESE v3.3) – A URL to the digital object on the content provider's website in its full information context.


</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element maxOccurs="1" name="object" />
        <xs:element maxOccurs="1" name="isShownAt" />
        <xs:element minOccurs="1" name="resourceMetadataLocation">
          <xs:annotation>
            <xs:documentation>pointer to other information about the resource making the resource available</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="relations" type="relations">
          <xs:annotation>
            <xs:documentation>to heritage assets, other resources or to references.</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="rights" type="rights" />
      </xs:all>
    </xs:complexType>
  </xs:element>
 </xs:sequence>
</xs:group>
<xs:group name="activity">
```

```
  <xs:annotation>

    <xs:documentation xml:lang="en">This is information about the events or activities that the monument has taken part in, for example: Field investigation; Research and analysis; Creation; Change in use; Historical events, etc. Source = MIDAS + POLIS DTD.</xs:documentation>

  </xs:annotation>

  <xs:sequence>

    <xs:element name="activity">

      <xs:complexType>

        <xs:all>

          <xs:element minOccurs="1" maxOccurs="1" name="recordInformation" type="recordInformation">

            <xs:annotation>

              <xs:documentation>The ID, language, creation information and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8.</xs:documentation>

            </xs:annotation>

          </xs:element>

          <xs:element minOccurs="1" maxOccurs="1" name="appellation" type="appellation">

            <xs:annotation>

              <xs:documentation>This is the name of the event.</xs:documentation>

            </xs:annotation>

          </xs:element>

          <xs:element maxOccurs="1" name="description" type="description">

            <xs:annotation>

              <xs:documentation>of the event or activity which took place.</xs:documentation>

            </xs:annotation>

          </xs:element>

          <xs:element name="actors" type="actors">

            <xs:annotation>

              <xs:documentation>the people or organisations involved in this event, may be repeated.</xs:documentation>

            </xs:annotation>

          </xs:element>

          <xs:element minOccurs="1" maxOccurs="1" name="eventType">

            <xs:annotation>

              <xs:documentation>classification of the type of event or activity which took place, e.g. survey, archaeological excavation, rebuilding. Use of a controlled vocabulary is recommended.</xs:documentation>

            </xs:annotation>

            <xs:complexType>

              <xs:attribute name="term" />
```

```
      <xs:attribute name="namespace">
        <xs:annotation>
          <xs:documentation>this is the name/location of the controlled vocabulary from which the term is taken.</xs:documentation>
        </xs:annotation>
      </xs:attribute>
    </xs:complexType>
  </xs:element>
  <xs:element minOccurs="1" name="temporal" type="temporal">
    <xs:annotation>
      <xs:documentation>the date or time span of the event.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element maxOccurs="1" name="spatial" type="spatial">
    <xs:annotation>
      <xs:documentation>the location or area covered by the event.</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="assessments">
    <xs:annotation>
      <xs:documentation>assessments made of the monument during the event, e.g. of the condition of the monument.  Use of a controlled vocabulary is recommended.</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:attribute name="term" />
      <xs:attribute name="namespace">
        <xs:annotation>
          <xs:documentation>this is the name/location of the controlled vocabulary from which the term is taken.</xs:documentation>
        </xs:annotation>
      </xs:attribute>
    </xs:complexType>
  </xs:element>
  <xs:element name="eventMethod">
    <xs:annotation>
      <xs:documentation>the method by which the event is carried out</xs:documentation>
    </xs:annotation>
```

```
        </xs:element>
        <xs:element name="materialsAndTechniques">
          <xs:annotation>
            <xs:documentation>the materials and/or techniques used during the event. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="relations" type="relations">
          <xs:annotation>
            <xs:documentation>of the event to other events, references, resources etc.</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:all>
    </xs:complexType>
  </xs:element>
 </xs:sequence>
</xs:group>
<xs:complexType name="recordInformation">
 <xs:annotation>
  <xs:documentation xml:lang="en">The ID, language, creation information and other metadata describing the record. The ID element of this information block holds the ID assigned by the content provider, cf. section 8. </xs:documentation>
 </xs:annotation>
 <xs:all>
  <xs:element minOccurs="1" maxOccurs="1" name="id">
   <xs:annotation>
    <xs:documentation>i.e. the local ID number in the content providers' information system; it is unique within the collection, but may follow any schema.</xs:documentation>
   </xs:annotation>
  </xs:element>
  <xs:element maxOccurs="1" name="type">
   <xs:annotation>
    <xs:documentation>of the record. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
   </xs:annotation>
  </xs:element>
  <xs:element minOccurs="1" maxOccurs="1" name="source">
   <xs:annotation>
```

```
      <xs:documentation>of the record (the name of the organisation that maintains the record)</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element name="creation">
    <xs:annotation>
      <xs:documentation>when created and who by;</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:all>
        <xs:element minOccurs="1" maxOccurs="1" name="actor" type="actors" />
        <xs:element name="date" />
      </xs:all>
    </xs:complexType>
  </xs:element>
  <xs:element name="update">
    <xs:annotation>
      <xs:documentation>the date of the last update to the record and who by</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:all>
        <xs:element minOccurs="1" maxOccurs="1" name="actor" type="actors" />
        <xs:element name="date" />
      </xs:all>
    </xs:complexType>
  </xs:element>
  <xs:element minOccurs="1" name="language">
    <xs:annotation>
      <xs:documentation>(of the metadata record). Specifies the default language of the record; deviations in particular elements are specified using the xml:lang attribute where allowed. Specified (like the xml:lang attribute) using ISO 639-1:2002, i.e. standard two letter language codes (en, fr, etc.).</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:attribute name="lang" />
    </xs:complexType>
  </xs:element>
```

```
    <xs:element name="rights" type="rights">
      <xs:annotation>
        <xs:documentation>to the metadata</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="keywords">
      <xs:annotation>
        <xs:documentation>for the record. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. Use of a controlled vocabulary such as Getty Arts and Architecture Thesaurus is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:attribute name="lang" use="required" />
      </xs:complexType>
    </xs:element>
  </xs:all>
</xs:complexType>
<xs:complexType name="rights">
  <xs:annotation>
    <xs:documentation xml:lang="en">Information about the rights associated with the object, metadata and the
digital surrogate being harvested into the service environment based on MIDAS Heritage.  </xs:documentation>
  </xs:annotation>
  <xs:all>
    <xs:element name="copyright">
      <xs:complexType>
        <xs:all>
          <xs:element name="rightsHolder" />
          <xs:element name="rightsDates" />
          <xs:element name="creditLine">
            <xs:annotation>
              <xs:documentation>(statement)</xs:documentation>
            </xs:annotation>
          </xs:element>
        </xs:all>
      </xs:complexType>
    </xs:element>
```

```
    <xs:element name="accessRights">
      <xs:complexType>
        <xs:all>
          <xs:element name="grantedTo" />
          <xs:element name="conditions" />
          <xs:element maxOccurs="1" name="dateFrom" type="xs:date" />
          <xs:element maxOccurs="1" name="dateTo" type="xs:date" />
          <xs:element name="statement" />
        </xs:all>
      </xs:complexType>
    </xs:element>
    <xs:element name="reproductionRights">
      <xs:complexType>
        <xs:all>
          <xs:element name="statement" />
          <xs:element name="contacts" />
          <xs:element name="fees" />
        </xs:all>
      </xs:complexType>
    </xs:element>
    <xs:element name="licence">
      <xs:annotation>
        <xs:documentation>a URI indicating a license or conditions for the use of the object or data, e.g. a Creative Commons license  or the public domain mark . Use as an alternative or supplement to the information above.</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:all>
</xs:complexType>
<xs:complexType name="appellation">
  <xs:annotation>
    <xs:documentation xml:lang="en">This is information about the identifier (ID) and name of the monument (see section 11). The ID sub-element is the record ID in the CARARE repository and will be generated by CARARE on ingest. The name sub-element may be repeated if a monument is known by more than one name, using the XML:lang attribute if the names are in alternate languages. A preferred/alternate attribute may be used to indicate which name is preferred. </xs:documentation>
  </xs:annotation>
  <xs:all>
```

```
    <xs:element minOccurs="1" maxOccurs="1" name="id">
      <xs:annotation>
        <xs:documentation>an identifier of an object. An attribute type should be accompany this sub-element denoting the type of the identifier (URI, ISBN, etc,) The element may be repeated.</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element minOccurs="1" name="name">
      <xs:annotation>
        <xs:documentation>this is the name of the entity. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:attribute name="lang" use="required" />
      </xs:complexType>
    </xs:element>
  </xs:all>
</xs:complexType>
<xs:complexType name="temporal">
  <xs:annotation>
    <xs:documentation xml:lang="en">Information about the date and/or period of an entity.</xs:documentation>
  </xs:annotation>
  <xs:all>
    <xs:element name="timeSpan">
      <xs:complexType>
        <xs:all>
          <xs:element name="startDate">
            <xs:annotation>
              <xs:documentation>the earliest date in the range</xs:documentation>
            </xs:annotation>
            <xs:complexType>
              <xs:attribute name="startDate" type="xs:date" />
            </xs:complexType>
          </xs:element>
          <xs:element name="endDate">
            <xs:annotation>
              <xs:documentation>the latest date in the range</xs:documentation>
```

```
          </xs:annotation>
          <xs:complexType>
            <xs:attribute name="endDate" type="xs:date" />
          </xs:complexType>
        </xs:element>
        <xs:element name="dimension" />
        <xs:element name="dateRangeQualifier">
          <xs:annotation>
            <xs:documentation>the nature of the time span given (e.g. throughout, at some time during, etc.) Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
          </xs:annotation>
          <xs:complexType>
            <xs:attribute name="namespace" />
          </xs:complexType>
        </xs:element>
        <xs:element name="language">
          <xs:complexType>
            <xs:attribute name="lang" />
          </xs:complexType>
        </xs:element>
      </xs:all>
    </xs:complexType>
  </xs:element>
  <xs:element name="periodName">
    <xs:annotation>
      <xs:documentation>the name given to the period in history when something occurred. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred. </xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:attribute name="lang" use="required" />
      <xs:attribute name="preferred" type="xs:boolean" />
    </xs:complexType>
  </xs:element>
  <xs:element name="displayDate">
```

```
      <xs:annotation>

        <xs:documentation>a free text field used to display the date or period for users (e.g. early 19th century, 1950s). The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>

      </xs:annotation>

      <xs:complexType>

        <xs:attribute name="lang" use="required" />

        <xs:attribute name="preferred" type="xs:boolean" />

      </xs:complexType>

    </xs:element>

    <xs:element name="scientificDate">

      <xs:annotation>

        <xs:documentation>date according to scientific dating methods, e.g. ‘1250 bp +/-30 PBN-1675’, recorded precisely as received from the specialist.</xs:documentation>

      </xs:annotation>

    </xs:element>

    <xs:element name="scientificDateMethod">

      <xs:annotation>

        <xs:documentation>e.g. ‘radiocarbon dating’. Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>

      </xs:annotation>

    </xs:element>

  </xs:all>

</xs:complexType>

<xs:complexType name="spatial">

  <xs:annotation>

    <xs:documentation xml:lang="en">Information about locations or positions in space.</xs:documentation>

  </xs:annotation>

  <xs:all>

    <xs:element minOccurs="1" maxOccurs="1" name="locationSet">

      <xs:complexType>

        <xs:all>

          <xs:element name="namedLocation">

            <xs:annotation>

              <xs:documentation>the name of a place or location which is relevant to the entity being described, for example ‘Lake Windermere’. The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred. Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
```

```
    </xs:annotation>
    <xs:complexType>
      <xs:attribute name="lang" use="required" />
      <xs:attribute name="preferred" type="xs:boolean" />
      <xs:attribute name="namespace" />
    </xs:complexType>
  </xs:element>
  <xs:element maxOccurs="1" name="address" type="address">
    <xs:annotation>
      <xs:documentation>the postal address</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element minOccurs="1" maxOccurs="1" name="geopoliticalArea">
    <xs:annotation>
      <xs:documentation>the name of an administrative region which does not form part of the address, for example Scotland, England, Tuscany etc. May also be used for a historical geopolitical area, or an administrative unit (e.g. as defined in the INSPIRE directive).</xs:documentation>
    </xs:annotation>
  </xs:element>
  <xs:element minOccurs="1" maxOccurs="1" name="geopoliticalAreaType">
    <xs:annotation>
      <xs:documentation>Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:attribute name="namespace" />
    </xs:complexType>
  </xs:element>
  <xs:element maxOccurs="1" name="cadastralReference">
    <xs:complexType>
      <xs:attribute name="ref" />
    </xs:complexType>
  </xs:element>
  <xs:element minOccurs="1" name="historicalName">
    <xs:annotation>
      <xs:documentation>The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>
```

```
        </xs:annotation>
        <xs:complexType>
          <xs:attribute name="lang" use="required" />
          <xs:attribute name="period" />
        </xs:complexType>
      </xs:element>
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="cartographicReference">
  <xs:complexType>
    <xs:all>
      <xs:element minOccurs="1" maxOccurs="1" name="spatialFeatureType">
        <xs:annotation>
          <xs:documentation>(how a feature is depicted in a GIS, e.g. point, line, polygon, multi-point, multi-line, multi-polygon). Use of a controlled vocabulary is recommended, and the vocabulary used may be indicated using an attribute. No particular common vocabulary is recommended for use.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element minOccurs="1" maxOccurs="1" name="coordinates">
        <xs:complexType>
          <xs:all>
            <xs:element minOccurs="1" maxOccurs="1" name="x" type="xs:decimal" />
            <xs:element minOccurs="1" maxOccurs="1" name="y" type="xs:decimal" />
            <xs:element minOccurs="1" maxOccurs="1" name="z" type="xs:decimal" />
          </xs:all>
        </xs:complexType>
      </xs:element>
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element name="geometry">
  <xs:complexType>
    <xs:all>
      <xs:element maxOccurs="1" name="boundingBox">
        <xs:complexType>
```

```
    <xs:all>
      <xs:element minOccurs="1" maxOccurs="1" name="minX" />
      <xs:element minOccurs="1" maxOccurs="1" name="maxX" />
      <xs:element minOccurs="1" maxOccurs="1" name="minY" />
      <xs:element minOccurs="1" maxOccurs="1" name="maxY" />
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="quickpoint">
  <xs:complexType>
    <xs:all>
      <xs:element minOccurs="1" maxOccurs="1" name="x" type="xs:decimal" />
      <xs:element minOccurs="1" maxOccurs="1" name="y" type="xs:decimal" />
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="entity">
  <xs:annotation>
    <xs:documentation>GML, Well-known text (WKT).</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="storedPrecision">
  <xs:annotation>
    <xs:documentation>delivery precision (the precision of a coordinate as stored in the system, and as delivered to users).</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="height" type="xs:decimal">
  <xs:annotation>
    <xs:documentation>datum, units</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element maxOccurs="1" name="area">
  <xs:annotation>
    <xs:documentation>units</xs:documentation>
```

```
        </xs:annotation>
      </xs:element>
    </xs:all>
  </xs:complexType>
 </xs:element>
 <xs:element maxOccurs="1" name="representations">
  <xs:annotation>
    <xs:documentation>how a feature is represented on a map</xs:documentation>
  </xs:annotation>
 </xs:element>
</xs:all>
</xs:complexType>
<xs:complexType name="address">
 <xs:annotation>
  <xs:documentation xml:lang="en">This is the postal address for a building, contact, etc.</xs:documentation>
 </xs:annotation>
 <xs:all>
  <xs:element maxOccurs="1" name="buildingName">
   <xs:complexType>
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
   </xs:complexType>
  </xs:element>
  <xs:element maxOccurs="1" name="roadNumber">
   <xs:annotation>
    <xs:documentation>the number in a road or street used to identify a property</xs:documentation>
   </xs:annotation>
   <xs:complexType>
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
   </xs:complexType>
  </xs:element>
  <xs:element maxOccurs="1" name="roadName" />
  <xs:element minOccurs="1" maxOccurs="1" name="city">
   <xs:complexType>
```

```
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="postcode">
  <xs:complexType>
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="locality">
  <xs:annotation>
    <xs:documentation>a named area within which a monument or building lies</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
  </xs:complexType>
</xs:element>
<xs:element maxOccurs="1" name="adminArea">
  <xs:annotation>
    <xs:documentation>the name by which an administrative area is known, e.g. Shropshire</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
  </xs:complexType>
</xs:element>
<xs:element minOccurs="1" maxOccurs="1" name="country">
  <xs:complexType>
    <xs:attribute name="lang" />
    <xs:attribute name="authority" />
  </xs:complexType>
</xs:element>
```

```
  </xs:all>
</xs:complexType>
<xs:complexType name="actors">
  <xs:annotation>
    <xs:documentation xml:lang="en">the actors involved with this monument, may be repeated.</xs:documentation>
  </xs:annotation>
  <xs:all>
    <xs:element minOccurs="1" maxOccurs="1" name="id" />
    <xs:element minOccurs="1" name="name">
      <xs:annotation>
        <xs:documentation>the name of the person or organisation)</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element minOccurs="1" name="actorType">
      <xs:annotation>
        <xs:documentation>indicates whether the actor is an individual, a group of individuals or an organisation.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:attribute name="lang" />
      </xs:complexType>
    </xs:element>
    <xs:element minOccurs="1" name="roles">
      <xs:annotation>
        <xs:documentation>the roles of the actor (creator, custody, repository, curator, architect, sculptor, photographer, compiler, etc.) Use of a
controlled vocabulary such as Getty Arts and Architecture thesaurus is recommended, and the vocabulary used may be indicated using an
attribute.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:attribute name="lang" />
        <xs:attribute name="namespace" />
      </xs:complexType>
    </xs:element>
    <xs:element name="contact">
      <xs:annotation>
        <xs:documentation>contact information if known</xs:documentation>
      </xs:annotation>
```

```
</xs:element>
<xs:element name="vitalDates">
  <xs:annotation>
    <xs:documentation>date of birth, date of death if known.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element name="birthDate" />
      <xs:element name="deathDate" />
      <xs:element name="type" />
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element name="placeOfBirth">
  <xs:annotation>
    <xs:documentation>Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element name="namespace" />
    </xs:all>
  </xs:complexType>
</xs:element>
<xs:element name="placeOfDeath">
  <xs:annotation>
    <xs:documentation>Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:all>
      <xs:element name="namespace" />
    </xs:all>
  </xs:complexType>
</xs:element>
```

```
    <xs:element name="placeOfActivity">
      <xs:annotation>
        <xs:documentation>Use of a controlled vocabulary such as http://www.geonames.org/ is recommended, and the vocabulary used may be indicated using an attribute.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:all>
          <xs:element name="namespace" />
        </xs:all>
      </xs:complexType>
    </xs:element>
    <xs:element minOccurs="1" maxOccurs="1" name="bibliographicalNote">
      <xs:annotation>
        <xs:documentation>The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
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        <xs:attribute name="preferred" type="xs:boolean" />
      </xs:complexType>
    </xs:element>
  </xs:all>
</xs:complexType>
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  <xs:annotation>
    <xs:documentation xml:lang="en">Information about how a person or organisation can be contacted</xs:documentation>
  </xs:annotation>
  <xs:all>
    <xs:element name="name">
      <xs:annotation>
        <xs:documentation>title, first name, last name, other name</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="role">
      <xs:annotation>
        <xs:documentation>the particular role played by the person or organisation</xs:documentation>
```

```
      </xs:annotation>
    </xs:element>
    <xs:element name="organization" />
    <xs:element name="address">
      <xs:annotation>
        <xs:documentation>the postal address of the person or organisation</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="phone" />
    <xs:element name="fax" />
    <xs:element name="email" />
  </xs:all>
</xs:complexType>
<xs:complexType name="description">
  <xs:annotation>
    <xs:documentation xml:lang="en">The element may be repeated using the XML:lang attribute if the element value is available in alternate languages. A preferred/alternate attribute may be used to indicate which value is preferred.</xs:documentation>
  </xs:annotation>
  <xs:attribute name="lang" use="required" />
  <xs:attribute name="preferred" type="xs:boolean" />
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  </xs:annotation>
  <xs:all>
    <xs:element minOccurs="1" name="publisher" />
    <xs:element name="place">
      <xs:annotation>
        <xs:documentation>of publication</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="date">
      <xs:annotation>
```

```
      <xs:documentation>of publication</xs:documentation>
     </xs:annotation>
    </xs:element>
   </xs:all>
  </xs:complexType>
  <xs:complexType name="relations">
   <xs:annotation>
    <xs:documentation xml:lang="en">This is information about the relations between heritage assets, events or resources and other entities
```

- The type of relation, for example ‘is successor of’, ‘is next in sequence’, ‘has part’.
- The target of the relation (the ID number of the related heritage asset, event or resource)

The relations which are included in the Europeana Data Model are as follows:

- Is Derivative Of – a version of another resource
- Is Next In Sequence – the ordered parts of a resource, e.g. the pages in a book or an ordered sequence of 3D models showing the change of a monument over time.
- Is Related To – a general relationship between objects
- Is Representation Of – associates an information resource to the object that it represents, e.g. a digital image is a representation of the monument which is the target of the relation. We use it in the CARARE schema to associate a heritage asset and a Digital Resource
- Is Successor Of – the relation between the continuation of a resource and that resource, e.g. a church is successor of an earlier church on the same site.
- Occurred At – associates an event to the smallest known time span that overlaps with the occurrence of that event.
- Happened At – relates a place to the events which happened at that place.
- Was Present At – this relation associates the people, things or information sources with the Event that they were present at.
- Has Part – used for objects that incorporate other objects, e.g. a monument made up of smaller monuments or a site with a number of monuments.

Additional CARARE properties:

- hasEvent – associates a heritage asset with an Activity.
- Is Replica of – used for heritage assets that replicate other heritage assets, including scale models.
- Is In Front Of – a spatial relationship signifying the relative position of one monument to another.
- Is Behind – a spatial relationship signifying the relative position of one monument to another.
- Is Above – a spatial relationship signifying the relative position of one monument to another.
- Is Below – a spatial relationship signifying the relative position of one monument to another.

- Is North Of – a spatial relationship signifying the relative position of one monument to another.
- Is South Of – a spatial relationship signifying the relative position of one monument to another.
- Is East Of – a spatial relationship signifying the relative position of one monument to another.
- Is West Of – a spatial relationship signifying the relative position of one monument to another.
- Same As (source = OWL) – indicates that the two participants in the relation actually refer to the same thing.

```
</xs:documentation>
    </xs:annotation>
    <xs:all>
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      <xs:element minOccurs="1" maxOccurs="1" name="target" />
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