Ερευνητικό Κέντρο Αθηνά
Athena Research Center

Ερευνητικό Κέντρο Καινοτομίας στις Τεχνολογίες της Πληροφορίας, των Επικοινωνιών, της Γνώσης

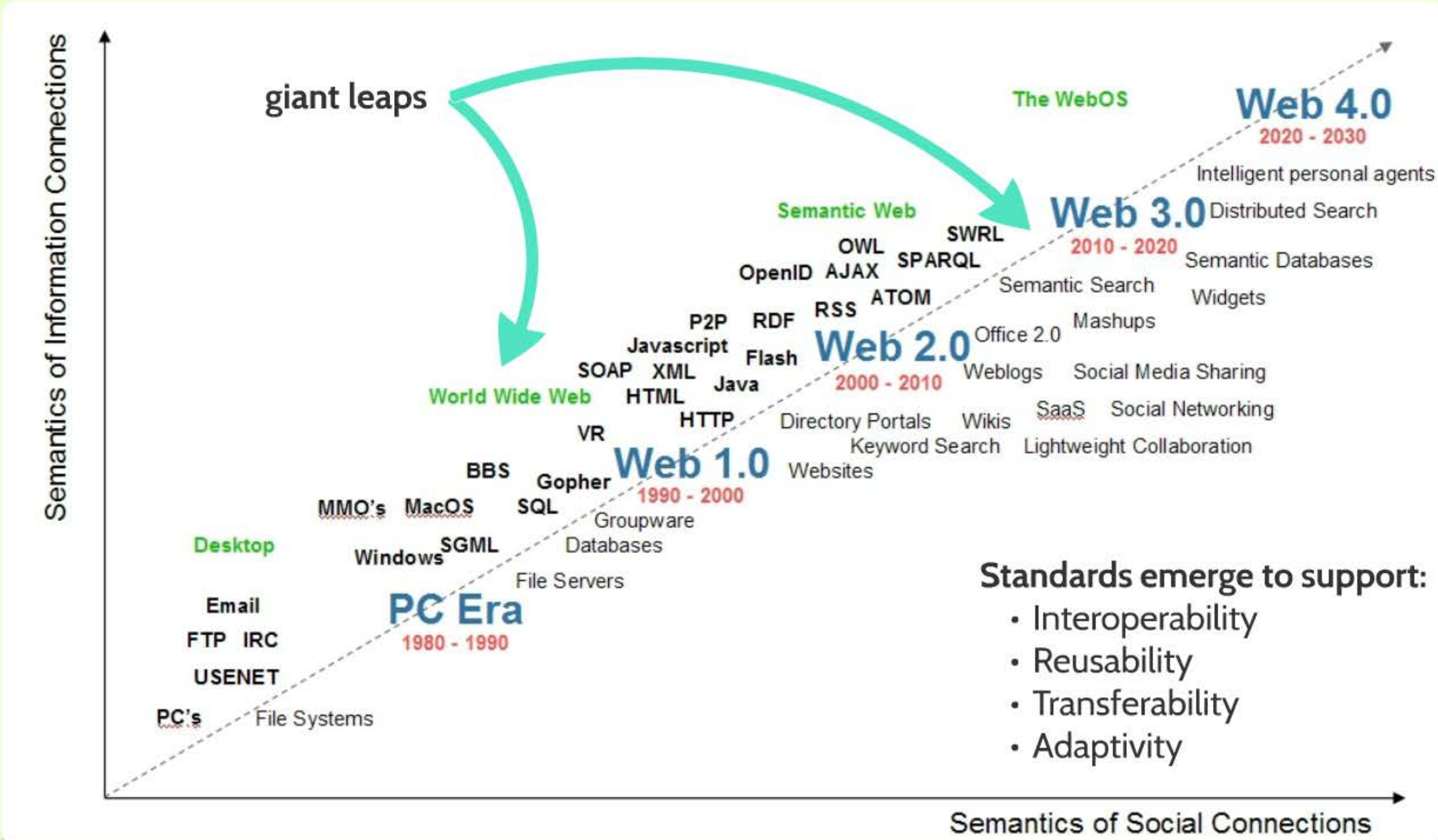
Research and Innovation Center in Information, Communication and Knowledge Technologies

# CULTURAL REPOSITORIES, DESCRIPTION OF CULTURAL HERITAGE, INTERNATIONAL STANDARDS

- Introduction to cultural databases, metadata schemas and international standards
- Europeana and the European cultural content

George Pavlidis
Dr. Electrical Engineer
Research Director

# SOME HISTORY...



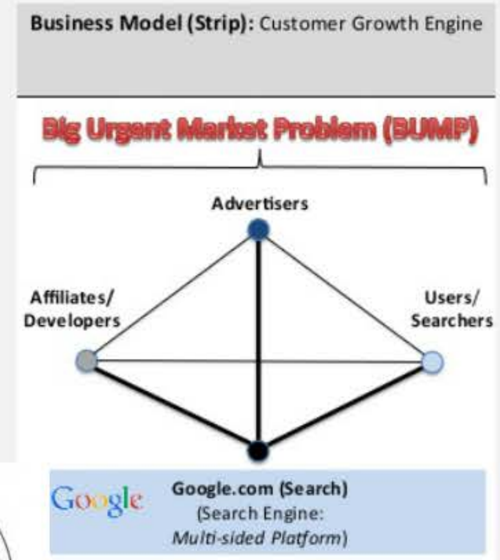


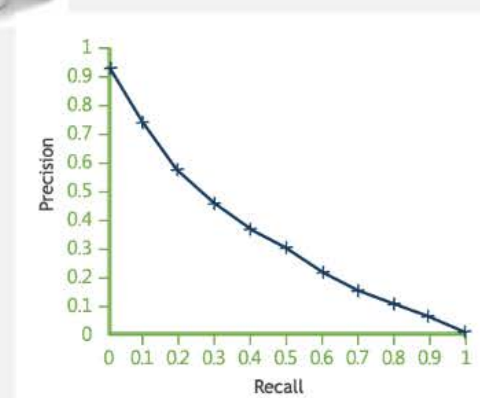

Source: Radar Networks & Nova Spivack, 2007 – www.radarnetworks.com

# ...SO...WHAT'S THE PROBLEM?

Let's see the Web as an Information System
(that we need to search and retrieve information)

- Search systems are motivated by business models, not user needs
- Index coverage is unpredictable and limited
- Too much recall, too little precision
- Index spam abounds
- Resources (and their names) are volatile
- Archiving is presently unsolved
- Authority and quality of service are spotty
- Managing intellectual property rights is hard




# METADATA CAN BE PART OF A SOLUTION

## Structured data about data

- Organization and management of content
- Support discovery
- Direct content in channels
- Enable automated discovery/manipulation

## Interoperabilityrequires conventions about

- Semantics
  - The meaning of the elements
- Structure
  - human-readable
  - machine-parseable
- Syntax
  - grammars to convey semantics and structure

# METADATA

Metadata are data about the data and can be

- structural (such as connections between data)
- descriptive (such as descriptions about the data)

Chronologically, the first metadata were devised in the libraries in the form catalogs and cards accompanying each book

In the digital era, everything becomes digital and so do metadata, along with their utility

- to become machine readable

# BASIC CATEGORIZATION

- **Descriptive metadata**
  - description of the data that supports identification and retrieval
- **Management metadata**
  - description of the history of the data and responsible for digital curation
- **Structural metadata**
  - description of relations between the data
- **User-defined metadata**
  - Any user-defined metadata

# A METADATA SCHEMA

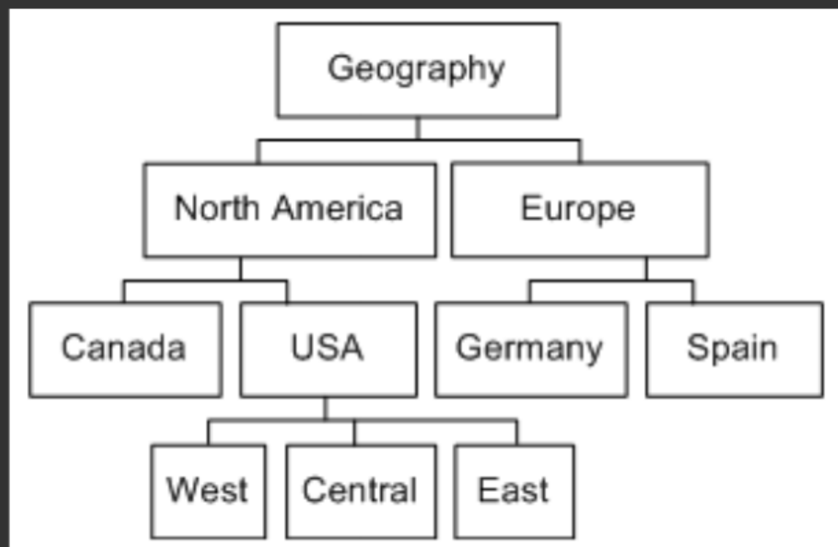
is a set of data fields and relations among them

A schema can be represented by various computer languages

- The Dublic Core schema can be represented as free text using either the XML or the RDF language

A schema can be

- **Hierarchical**
  - elements are nested so that parent-child relationships exist between the elements
- **Linear**
  - each element is completely discrete and classified according to one dimension
- **Planar**
  - two dimensional; each element is completely discrete but classified according to two orthogonal dimensions



Geography
North America
Europe
Canada
USA
Germany
Spain
West
Central
East

# A METADATA SCHEMA

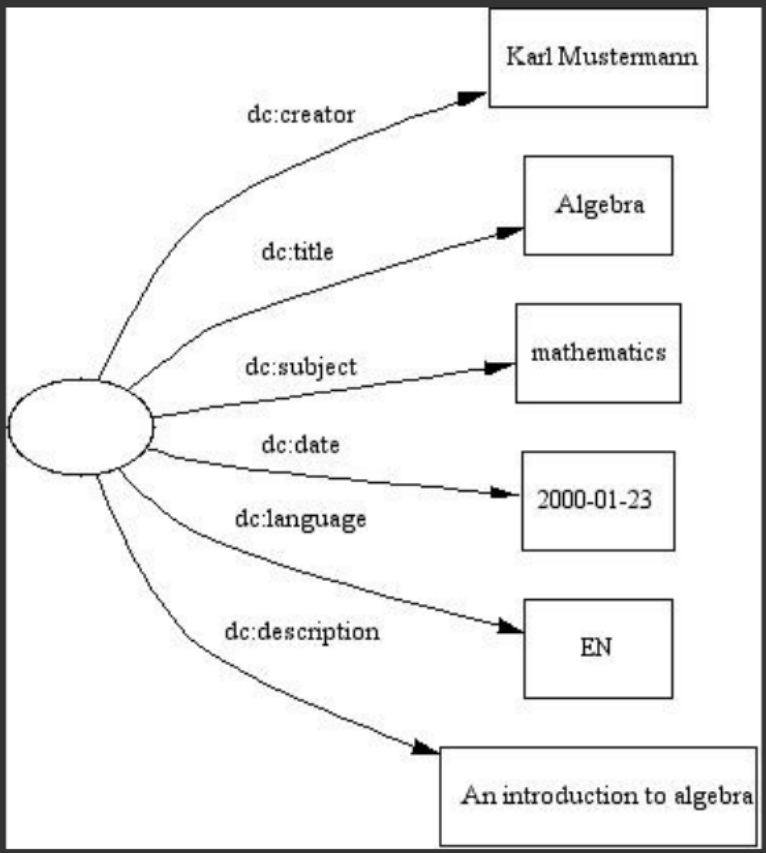
is a set of data fields and relations among them

A schema can be represented by various computer languages

- The Dublic Core schema can be represented as free text using either the XML or the RDF language

A schema can be

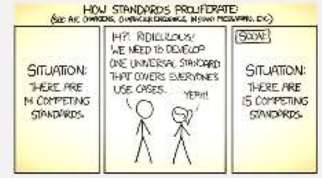
- **Hierarchical**
  - elements are nested so that parent-child relationships exist between the elements
- **Linear**
  - each element is completely discrete and classified according to one dimension
- **Planar**
  - two dimensional; each element is completely discrete but classified according to two orthogonal dimensions

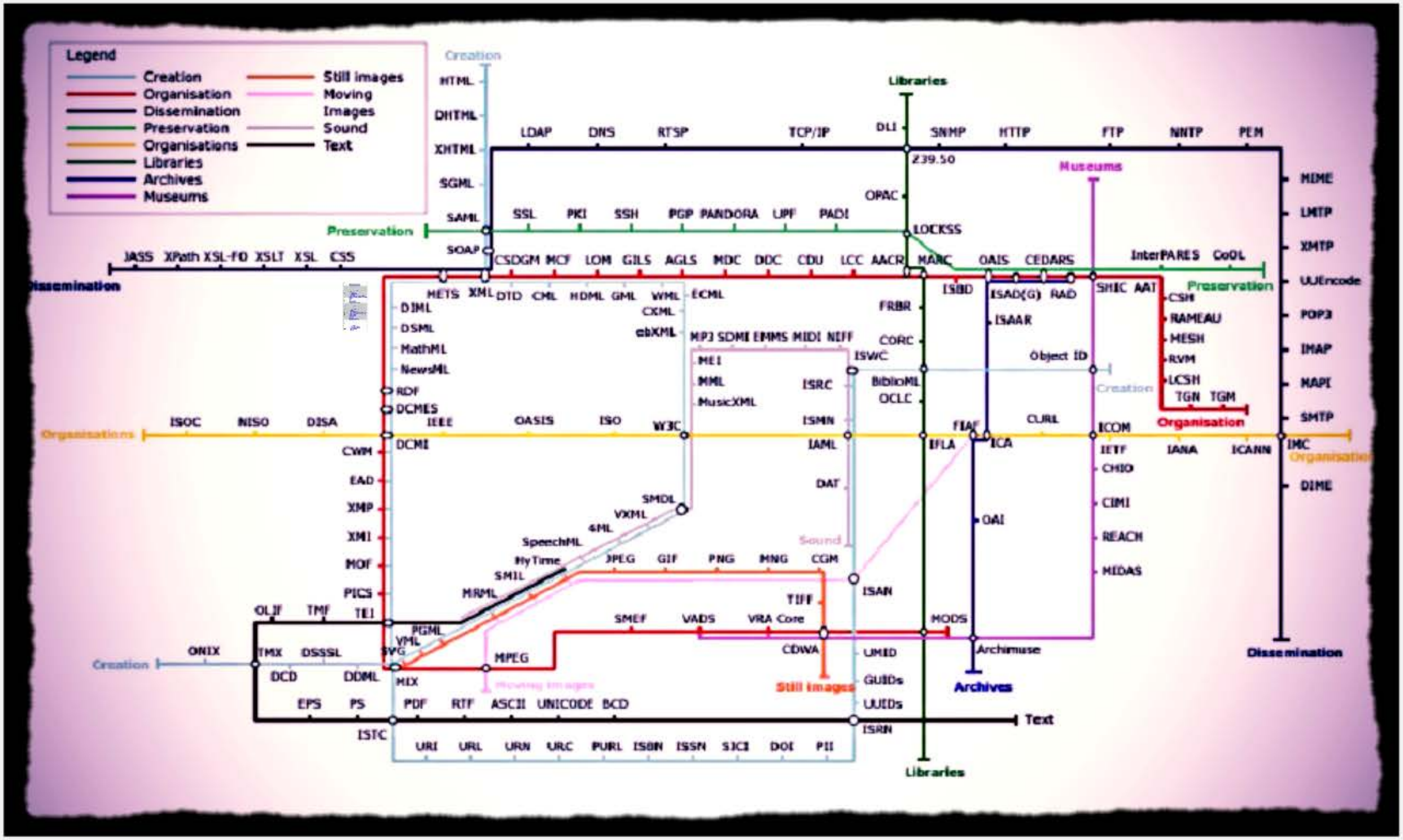

Karl Mustermann
dc:creator
Algebra
dc:title
dc:subject
mathematics
dc:date
2000-01-23
dc:language
EN
dc:description
An introduction to algebra

# METADATA DESCRIPTION LANGUAGES

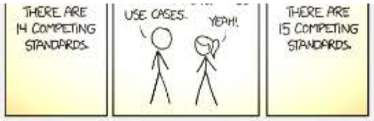
| Language | Web resource |
| --- | --- |
| Encoded Archival Description (EAD) | www.loc.gov/ead |
| Ecological Metadata Language (EML) | http://knb.ecoinformatics.org/software/eml |
| Geography Markup Language (GML) | www.opengeospatial.org/standards/gml |
| Contextual Query Language (CQL) | www.loc.gov/standards/sru/specs/cql.html |
| Keyhole Markup Language (KML) | http://code.google.com/apis/documentation |
| Open Digital Rights (ODRL) | http://www.w3.org/community/odrl/ |
| Resource Description Framework (RDF) | www.w3.org/TR/rdf-primer |
| Standard Generalized Markup Language (SGML) | www.iso.org/iso/catalogue_detail.html?csnumber=16387 |
| Synchronized Multimedia Integration Language (SMIL) | www.w3.org/TR/SMIL3 |
| Text Encoding Initiative (TEI) | www.tei-c.org |
| Extensible Markup Language (XML) | www.w3.org/XML |
| XPath | www.w3.org/TR/xpath |
| XQuery | www.w3.org/TR/xquery |

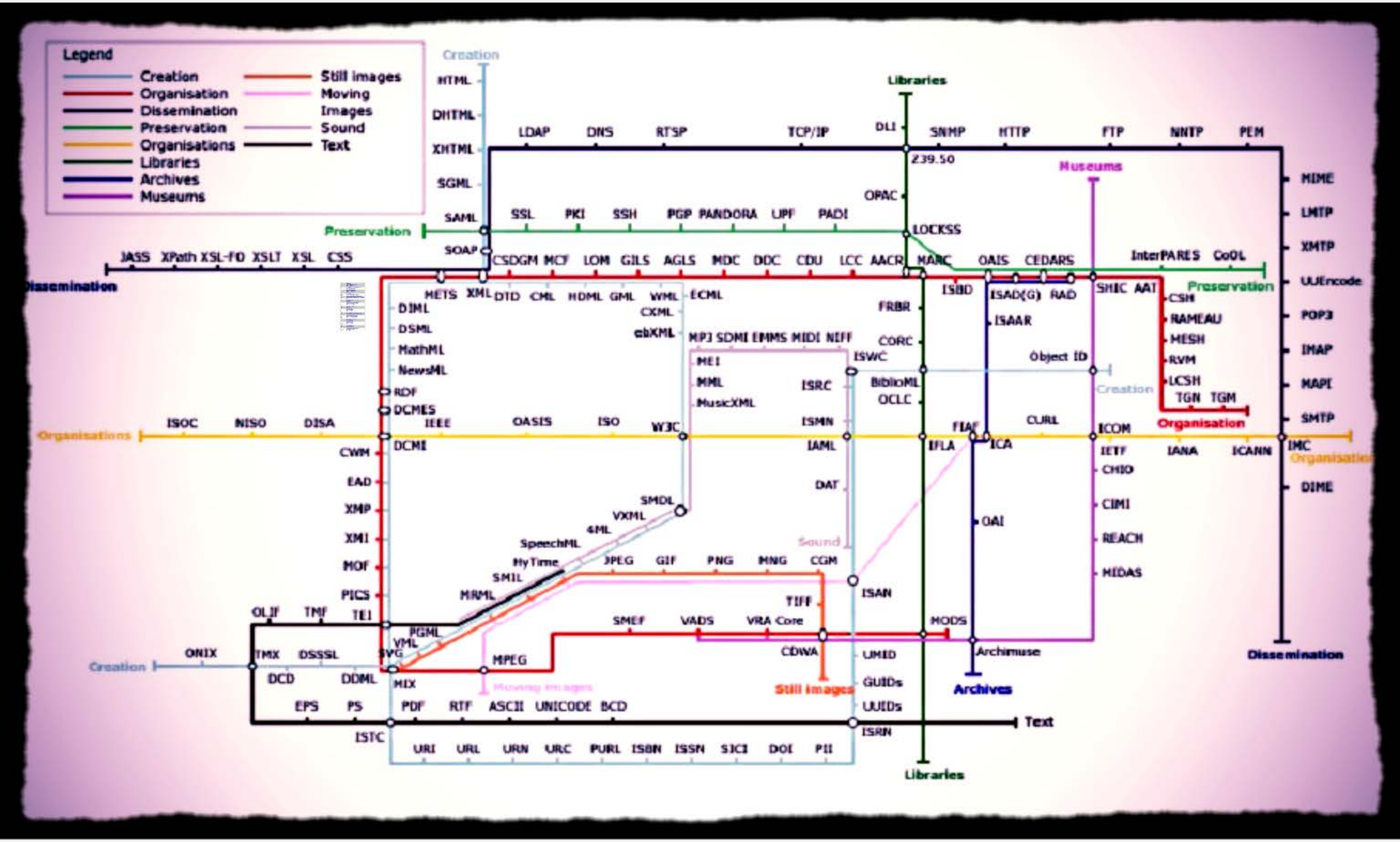
# STANDARDS

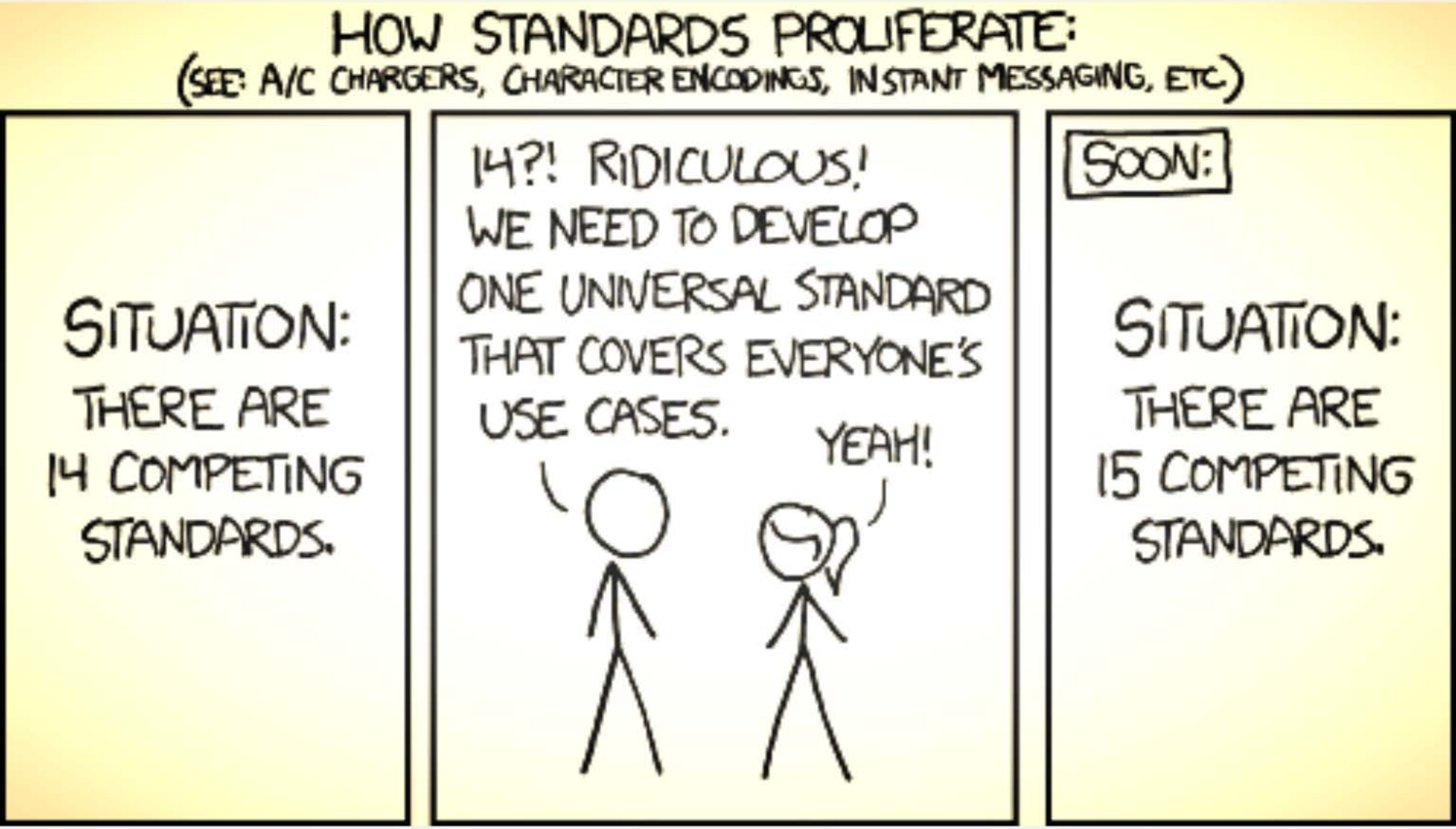

HOW STANDARDS PROLIFERATE:
SITUATION: THERE ARE 14 COMPETING STANDARDS.
14?! RIDICULOUS! WE NEED TO DEVELOP ONE UNIVERSAL STANDARD THAT COVERS EVERYONE'S USE CASES.
YEAH!
SOON:
SITUATION: THERE ARE 15 COMPETING STANDARDS.


Legend
Creation
Organisation
Dissemination
Preservation
Organisations
Libraries
Archives
Museums
Still images
Moving Images
Sound
Text
Creation
HTML
DHTML
XHTML
SGML
SAML
SOAP
Libraries
LDAP
DNS
RTSP
TCP/IP
DLI
SNMP
HTTP
FTP
NNTP
PEM
239.50
Museums
MIME
LMTP
XMTP
UUEncode
POP3
IMAP
MAPI
SMTP
DIME
OPAC
Preservation
SSL
PKI
SSH
PGP
PANDORA
UPF
PADI
LOCKSS
JASS
XPath
XSL-FO
XSLT
XSL
CSS
CSDGM
MCF
LOM
GILS
AGLS
MDC
DDC
CDU
LCC
AACR
MARC
OAIS
CEDARS
InterPARES
CoOL
Dissemination
METS
XML
DTD
CML
HDML
GML
WML
ECML
CXML
ebXML
ISBD
ISAD(G)
RAD
SHIC
AAT
CSH
RAMEAU
MESH
RVM
LCSH
TGN
TGM
Preservation
DIML
DSML
MathML
NewsML
RDF
DCMES
IEEE
OASIS
ISO
W3C
FRBR
ISAAR
CORC
ISWC
Object ID
BiblioML
OCLC
MP3
SDMI
EMMS
MIDI
NIFF
MEI
MML
MusicXML
ISRC
ISMN
IAML
DAT
Creation
Organisation
Organisations
ISOC
NISO
DISA
FIAF
ICA
CURL
ICOM
IFLA
IETF
IANA
ICANN
IMC
Organisations
CHIO
CIMI
REACH
MIDAS
OAI
DCMI
CWM
EAD
XMP
XMI
MOF
PICS
SMDL
VXML
4ML
SpeechML
HyTime
SMIL
MRML
JPEG
GIF
PNG
MNG
CGM
Sound
ISAN
TIFF
OLIF
TMF
TEI
PGML
VML
SVG
SMEF
VADS
VRA Core
MODS
ONIX
TMX
DSSSL
MPEG
CDWA
UMID
Archimuse
Dissemination
Creation
DCD
DDML
MIX
Moving images
GUIDs
Still images
Archives
EPS
PS
PDF
RTF
ASCII
UNICODE
BCD
UUIDs
Text
ISTC
ISRN
URI
URL
URN
URC
PURL
ISBN
ISSN
SICI
DOI
PII
Libraries

# STANDARDS


THERE ARE 14 COMPETING STANDARDS.
USE CASES.
YEAH!
THERE ARE 15 COMPETING STANDARDS.


Legend
Creation
Organisation
Dissemination
Preservation
Organisations
Libraries
Archives
Museums
Still images
Moving Images
Sound
Text
Creation
HTML
DHTML
XHTML
SGML
SAML
SOAP
Libraries
LDAP
DNS
RTSP
TCP/IP
DLI
SNMP
HTTP
FTP
NNTP
PEM
Z39.50
Museums
OPAC
LOCKSS
SSL
PKI
SSH
PGP
PANDORA
UPF
PADI
Preservation
JASS
XPath
XSL-FO
XSLT
XSL
CSS
Dissemination
CSDGM
MCF
LOM
GILS
AGLS
MDC
DDC
CDU
LCC
AACR
MARC
OAIS
CEDARS
InterPARES
CoOL
MIME
LMTP
XMTP
UUEncode
POP3
IMAP
MAPI
SMTP
DIME
METS
XML
DTD
CML
HDML
GML
WML
ECML
CXML
ebXML
DIML
DSML
MathML
NewsML
RDF
DCMES
ISBD
ISAD(G)
RAD
SHIC
AAT
Preservation
CSH
RAMEAU
MESH
RVM
LCSH
TGN
TGM
Organisation
ISAAR
FRBR
CORC
Object ID
MP3
SDMI
EMMS
MIDI
NIFF
MEI
MML
MusicXML
ISWC
ISRC
BiblioML
OCLC
Creation
ISMN
ISOC
NISO
DISA
IEEE
OASIS
ISO
W3C
FIAF
CURL
ICOM
Organisations
DCMI
IAML
IFLA
ICA
IETF
IANA
ICANN
IMC
Organisations
CWM
CHIO
EAD
DAT
CIMI
XMP
SMDL
VXML
OAI
XMI
4ML
REACH
SpeechML
Sound
MOF
MyTime
JPEG
GIF
PNG
MNG
CGM
MIDAS
SMIL
PICS
MRML
ISAN
TIFF
OLIF
TMF
TEI
PGML
SMEF
VADS
VRA Core
MODS
VML
CDWA
Archimuse
Dissemination
ONIX
TMX
DSSSL
SVG
UMID
Creation
MPEG
DCD
DDML
MIX
Moving images
Still images
GUIDs
Archives
EPS
PS
PDF
RTF
ASCII
UNICODE
BCD
UUIDs
Text
ISTC
ISRN
URI
URL
URN
URC
PURL
ISBN
ISSN
SICI
DOI
PII
Libraries


HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)
SITUATION: THERE ARE 14 COMPETING STANDARDS.
14?! RIDICULOUS! WE NEED TO DEVELOP ONE UNIVERSAL STANDARD THAT COVERS EVERYONE'S USE CASES.
YEAH!
SOON:
SITUATION: THERE ARE 15 COMPETING STANDARDS.

| Standard | Web resource |
|---|---|
| AACR2 | http://www.aacr2.org/ |
| AAT | http://www.getty.edu/research/tools/vocabularies/index.html |
| AES | http://www.aes.org/standards/meetings/project-status.cfm |
| AES Process History | http://www.aes.org/standards/meetings/project-status.cfm |
| Atom | http://tools.ietf.org/html/rfc4287 |
| BISAC | http://www.bisg.org/publications/product.php?p=14 |
| CCO | http://cco.vrafoundation.org/ |
| CDWA | http://www.getty.edu/research/publications/electronic_publications/index.html |
| CIDOC | http://www.cidoc-crm.org/ |
| CQL | http://www.loc.gov/standards/sru/specs/cql.html |
| DACS | http://www.archivists.org/governance/standards/dacs.asp |
| DC | http://www.dublincore.org/documents/dces/ |
| DCAM | http://dublincore.org/documents/abstract-model |
| DDC | http://www.oclc.org/dewey.en.html |
| DIF | http://gcmd.gsfc.nasa.gov/add/difguide/index.html |
| DIG35 | http://standards.ieee.org/develop/wg/CPIQ.html |
| DTD | http://xmlfiles.com/dtd/ |
| DwC | http://www.tdwg.org/activities/darwincore/ |
| EAC-CPF | http://eac.staatsbibliothek-berlin.de/ |
| EAD | http://www.loc.gov/ead/ |
| EML | http://knb.ecoinformatics.org/software/eml/ |
| FGDC/CSDGM | http://www.fgdc.gov/standards/projects/FGDC-standards-projects/ |
| FOAF | http://www.foaf-project.org/ |
| FRAD | http://www.ifla.org/publications/ifla-series-on-bibliographic-control-34 |
| FRBR | http://www.ifla.org/publications/functional-requirements-for-bibliographic-records |
| FRSAD | http://www.ifla.org/node/1297 |
| GEM | http://www.ifla.org/files/assets/classification-and-indexing/functional-requirements-for-subject-authority-data/frsad-final-report.pdf |
| GILS | http://www.gils.net/ |
| GML | http://www.opengeospatial.org/standards/gml |
| ID3 | http://id3.org/ |
| Indecs | http://www.doi.org/topics/indecs/indecs_framework_2000.pdf |
| ISAAR (CPF) | http://www.icacds.org.uk/eng/isaar2ndedn-e_3_1.pdf |
| IEEE LOM | http://ltsc.ieee.org/wg12/ |
| ISAD(G) | http://www.ica.org/en/node/30000 |
| ISBD | http://www.ifla.org/publications/international-standard-bibliographic-description |
| ISO 19115 | http://www.iso.org/iso/catalogue_detail.htm?csnumber=26020 |
| KML | https://developers.google.com/kml/documentation/?hl=el&csw=1 |
| LCC | http://www.loc.gov/catdir/cpso/lcc.html |
| LCSH | http://authorities.loc.gov/ |
| Linked Data | http://www.w3.org/DesignIssues/LinkedData.html |
| MADS | http://www.loc.gov/standards/mads/ |
| MARC | http://www.loc.gov/marc/ |
| MARC Relator Codes | http://www.loc.gov/marc/relators/relaterm.html |
| MARCXML | http://www.loc.gov/standards/marcxml/ |
| MathML | http://www.w3.org/Math/ |
| MEI | http://music-encoding.org/home |
| MESH | http://www.nlm.nih.gov/mesh/ |
| METS | http://www.loc.gov/standards/mets/ |
| METS Rights | http://www.loc.gov/standards/mets/news080503.html |
| MIX | http://www.loc.gov/standards/mix/ |
| MO | http://musicontology.com/ |
| MODS | http://www.loc.gov/standards/mods/ |
| MPEG-21 DIDL | http://mpeg.chiariglione.org/standards/mpeg-21 |
| MPEG-7 | http://mpeg.chiariglione.org/standards/mpeg-7 |
| MuseumDat / LIDO | http://network.icom.museum/cidoc/working-groups/data-harvesting-and-interchange/what-is-lido/ |
| MusicXML | http://www.musicxml.com/ |
| NewsML | http://www.iptc.org/cms/site/single.html?channel=CH0087&document=CMS1206527546450 |
| OAI-ORE | http://www.openarchives.org/ore/ |
| OAI-PMH | http://www.openarchives.org/pmh/ |
| OAIS | http://public.ccsds.org/publications/archive/650x0b1.pdf |
| ODRL | http://www.w3.org/community/odrl/ |
| OpenURL | http://www.oclc.org/research/activities/openurl.html?urlm=159705 |
| PB Core | http://www.pbcore.org/ |
| PREMIS | http://www.loc.gov/standards/premis/ |
| PRISM | http://prismstandard.org/ |
| QDC | http://www.dublincore.org/documents/dcmi-terms/ |
| RAD | http://www.cdncouncilarchives.ca/archdesrules.html |
| RDA | http://rdatoolkit.org/ |
| RDF | http://www.w3.org/TR/rdf-primer/ |
| Relax NG | http://www.relaxng.org/ |
| RSS | http://cyber.law.harvard.edu/rss/rss.html |
| SCORM | http://scorm.com/scorm-explained/ |
| SGML | http://www.iso.org/iso/catalogue_detail.htm?csnumber=16387 |
| SKOS | http://www.w3.org/2004/02/skos/ |
| SMIL | http://www.w3.org/TR/SMIL3/ |
| SPECTRUM | http://www.collectionstrust.org.uk/spectrum-heading-to-sweden/ |
| SRU | http://www.loc.gov/standards/sru/ |
| TEI | http://www.tei-c.org/index.xml |
| TextMD | http://www.loc.gov/standards/textMD/ |
| TGM I | http://www.loc.gov/rr/print/tgm1/ |
| TGM II | http://www.loc.gov/rr/print/tgm2/ |
| TGN | http://www.getty.edu/research/tools/vocabularies/index.html |
| Topic Maps | http://www.topicmaps.org/ |
| ULAN | http://www.getty.edu/research/tools/vocabularies/index.html |
| VRA Core | http://www.vraweb.org/projects/vracore4/ |
| VSO Data Model | http://docs.virtualsolar.org/wiki/DataModel18 |
| XML | http://www.w3.org/XML/ |
| XOBIS | http://xobis.stanford.edu/ |

# STANDARDIZATION ORGANIZATIONS

- Visual Resources Association foundation (VRA Foundation), http://vrafoundation.org/
  - mostly for educational purposes
- International Council on Archives (ICA), http://www.ica.org/
  - effective management of records and preservation, care and use of the world's archival heritage
- Society of American Archivists (SAA), http://www2.archivists.org/
  - enables archivists to achieve professional excellence and foster innovation to ensure the identification, preservation, and use of records of enduring value
- Collections Trust, http://www.collectionstrust.org.uk/
  - develop, promote, maintain and improve standards of collections and information management in museums, art galleries, heritage organisations and other collecting institutions
- Open Archives Initiative (OAI), http://www.openarchives.org/
  - develops and promotes interoperability standards that aim to facilitate the efficient dissemination of content
- American National Standards Institute (ANSI), http://www.ansi.org/
  - oversees the creation, promulgation and use of thousands of norms and guidelines that directly impact businesses in nearly every sector

# STANDARDIZATION ORGANIZATIONS

- Dublin Core Metadata Initiative (DCMI), http://dublincore.org/
  - supports shared innovation in metadata design and best practices across a broad range of purposes and business models
- Europeana, http://pro.europeana.eu/
  - promote digital cultural heritage, and to unlock it for future generations
- The International Council of Museums (ICOM), http://icom.museum/
  - defines professional standards of excellence for the global museum community
- Getty, http://www.getty.edu/
  - dedicated to critical thinking in the presentation, conservation, and interpretation of the world's artistic legacy
- Library Of Congress, http://www.loc.gov/index.html
  - largest library in the world with significant standardization activites
- Institute of Electrical and Electronics Engineers (IEEE), https://standards.ieee.org/
  - drives the functionality, capabilities and interoperability of a wide range of products and services
- International Organization for Standardization (ISO), http://www.iso.org/
  - independent, non-governmental membership organization and the world's largest developer of voluntary International Standards
- National Information Standards Organization (NISO), http://www.niso.org/
  - identifies, develops, maintains, and publishes technical standards to manage information, including retrieval, re-purposing, storage, metadata, and preservation

# SOME STANDARDS BY THEIR APPLICATION

| Application | Standard | Organization |
|---|---|---|
| Museums,<br>Libraries,<br>Archives | **VRA-Core** | Library Of Congress |
| | **MODS** | Library Of Congress |
| | **CIDOC-CRM** | The International Council of Museums |
| | **CCO** | Visual Resources Association foundation |
| Museums | **SPECTRUM** | Collections Trust |
| Libraries | **METS** | Library Of Congress |
| | **PREMIS** | Library Of Congress |
| Archaeology,<br>Cultural Heritage | **MIDAS Heritage** | Forum on Information Standards Heritage |
| Art,<br>Artifacts | **AAT** | Getty |
| | **ULAN** | Getty |
| | **TGN** | Getty |
| | **CONA** | Getty |
| Museum resources | **LIDO (f. MuseumDat)** | ICOM |
| | **OAI-PMH** | Open Archives Initiative |
| | **EAD** | Library Of Congress |
| Archives | **ISAD(G)** | International Council on Archives–Canadian Institute of Actuaries |
| | **DACS** | Society for All Artists |
| Resource description | **Dublin Core** | Dublin Core Metadata Initiative |
| | **FOAF** | FOAF project |
| | **EDM** | Europeana |

# ONTOLOGY

Ontology **is** the philosophical study of the nature of being, becoming, existence, or reality, as well as the basic categories of being and their relations

- **deals with** questions concerning what entities exist or may be said to exist, and how such entities may be grouped, related within a hierarchy, and subdivided according to similarities and differences

**In computer science**, an ontology is a formal naming and definition of the types, properties, and interrelationships of the entities that really or fundamentally exist for a particular domain of discourse

- It is a practical application of philosophical ontology, with a taxonomy

The word element ***onto-*** comes from the Greek ***ὤν, ὄντος*** (being, that which is), present participle of the verb ***εἰμί*** (be)

- core meaning within computer science is **a model for describing the world** that consists of a set of types, properties, and relationship types


- *Garshol, L. M. (2004). "Metadata? Thesauri? Taxonomies? Topic Maps! Making sense of it all".*
- *Gruber, Thomas R. (June 1993). "A translation approach to portable ontology specifications". Knowledge Acquisition 5 (2): 199–220. doi:10.1006/knac.1993.1008.*

# ONTOLOGY

Tom Gruber is credited with a deliberate definition of ontology as a technical term in computer science:

- *An ontology is **a description of the concepts and relationships** that can formally exist for an agent or a community of agents.*
- *Ontologies are often equated with taxonomic hierarchies of classes, class definitions, and the subsumption relation, but **ontologies need not be limited to these forms**.*
- *Ontologies are also **not limited to conservative definitions** – that is, definitions in the traditional logic sense that only introduce terminology and do not add any knowledge about the world.*
- *To specify a conceptualization, **one needs to state axioms** that do constrain the possible interpretations for the defined terms.*


- *Gruber, T. (1995). "Toward Principles for the Design of Ontologies Used for Knowledge Sharing". International Journal of Human-Computer Studies 43 (5-6): 907–928. doi:10.1006/ijhc.1995.1081.*
- *Gruber, T. (2001). "What is an Ontology?". Stanford University.*
- *Enderton, H. B. (1972-05-12). A Mathematical Introduction to Logic (1 ed.). San Diego, CA: Academic Press. p. 295. ISBN 978-0-12-238450-9.*
- *Gruber, Thomas R. (June 1993). "A translation approach to portable ontology specifications". Knowledge Acquisition 5 (2): 199–220. doi:10.1006/knac.1993.1008.*

# ONTOLOGIES

- Are a formal way to **describe taxonomies and classification networks**, essentially **defining the structure of knowledge for various domains**
  - the *nouns* represent classes of objects and the *verbs* represent relations between the objects

- Are meant to represent information on the Internet
  - are expected to be evolving almost constantly
  - are coming from all sorts of heterogeneous data sources

*Knublauch, Holger; Oberle, Daniel; Tetlow, Phil; Wallace, Evan (2006). "A Semantic Web Primer for Object-Oriented Software Developers". W3C.*

# ONTOLOGY

## Components

Most ontologies describe individuals (instances), classes (concepts), attributes, and relations. Common components include:

- **Individuals**: instances or objects
- **Classes**: sets, collections, concepts, classes in programming, types of objects
- **Attributes**: aspects, properties, features, characteristics or parameters for objects and classes
- **Relations**: ways in which classes and individuals can be related to one another
- **Function terms**: complex structures formed from certain relations that can be used in place of an individual term in a statement
- **Restrictions**: formally stated descriptions of what must be true in order for some assertion to be accepted as input
- **Rules**: statements in the form of an if-then sentence that describe the logical inferences that can be drawn from an assertion in a particular form
- **Axioms**: assertions (including rules) in a logical form that together comprise the overall theory that the ontology describes in its domain of application; as used here, "axioms" also include the theory derived from axiomatic statements (not only a-priori knowledge as usually used)
- **Events**: the changing of attributes or relations

# ONTOLOGY

According to Michael Grobe (Univ. Kansas), here is a “big” formal definition:

An ontology **O** is a six-tuple **C, HC, HR, L, FC, FR,** where

- **C** is the set of concepts
- **HC** a taxonomy induced on the concepts
- **HR** the set of non-taxonomic relations
- **L** the set of terms (lexicals) which refer to concepts and relations
- **FC**, **FR** are relations that map the terms in L to the corresponding concepts and relations

$$O = f(C, HC, HR, L, FC, FR), \; HR, FR \text{ can be null}$$

If the ontology is **dynamic** all these structures are likely to change over time

# Simple Ontology Example

**Here is a set of concepts (C) represented as strings of English text:**
{ "Vehicle", "Car", "Truck", "2-wheel drive car", "4-wheel drive car", "front-wheel drive car", "rear-wheel drive car" }

**Here is a "taxonomy" (HC, called "is_a"?) "induced" on the set of concepts:**
{ ( "Car", "Vehicle" ), ( "Truck", "Vehicle" ),
( "2-wheel drive car", "Car" ), ( "4-wheel drive car", "Car" ),
( "front-wheel drive car", "2-wheel drive car" ), ( "rear-wheel drive car", "2-wheel drive car" ) }

**Here is a set of terms:**
L = ( 0, 1, 2, 3, 4, 5, 6 )

**Here is a relation (FC) mapping terms from the term set to concepts:**
{ ( 0, "Vehicle" ), ( 1, "Car" ), ( 2, "Truck" ), ( 3, "2-wheel drive car" ),
( 4, "4-wheel drive car" ), ( 5, "4-wheel drive car" ), ( 6, "4-wheel drive car" ) }

**Here is a representation of the taxonomy (HC) using terms:**
{ ( 1, 0 ), ( 2, 0 ), ( 3, 1 ), ( 4, 1 ), ( 5, 3 ), ( 6, 3 ) }

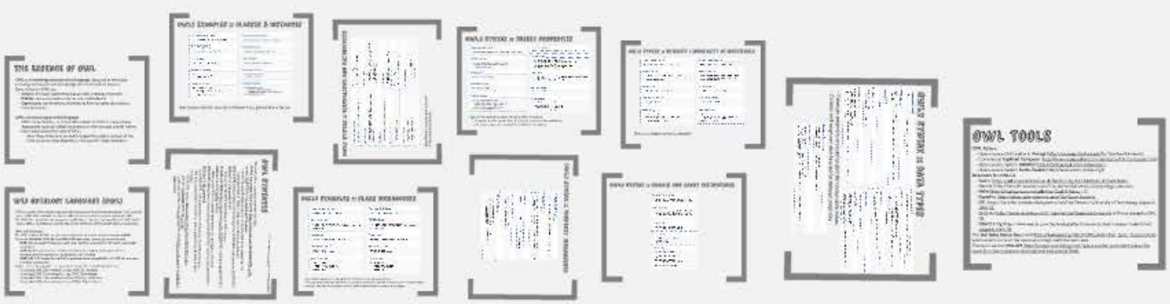
**Here is a relation ("is_transitively_a" or "is_a_descendent_of" or a "transitive closure") derived from the taxonomy assuming "transitivity" (items in red were added "by transitivity"):**
{ ( 1, 0 ),
( 2, 0 ),
( 3, 1 ), **( 3, 0 ),**
( 4, 1 ), **( 4, 0 ),**
( 5, 3 ), **( 5, 1 ), ( 5, 0 ),**
( 5, 3 ), **( 5, 1 ), ( 5, 0 )** }

*This seems to be one way of "sneaking" inference into the definition*

# ONTOLOGY LANGUAGE

Ontology languages are formal **languages used to construct ontologies**

- **Allow the encoding of knowledge** about specific domains and often include reasoning rules that support the processing of that knowledge
- The numerous ontology languages are **often classified by syntax or structure**
    - Syntax: **Traditional** (CycL, DOGMA, KIF, LOOM, OKBC) and **Markup** (OIL, OWL, RDF)
    - Structure: **Frame-based** (OKBC, KM), **Description logic-based** (KL-ONE, OWL) and **First-order logic-based** (CycK, KIF)



# WEB ONTOLOGY LANGUAGE (OWL)

OWL is a family of knowledge representation languages for authoring ontologies. They are built upon a W3C XML standard for objects called the Resource Description Framework (RDF).
The OWL family contains many species, serializations, syntaxes and specifications with similar names. **OWL** and **OWL2** are used to refer to the 2004 and 2009 specifications, respectively.

**OWL sub-languages**
The W3C-endorsed OWL specification includes the definition of **three variants of OWL**.
These are **OWL Lite**, **OWL DL** and **OWL Full** (ordered by increasing expressiveness).

- **OWL Lite:** to support those users primarily needing a classification hierarchy and simple constraints
- **OWL DL:** (Description Logic / Direct Semantics) to support max expressiveness, computational completeness, decidability and reasoning
- **OWL Full:** (RDF-based Semantics) to preserve some compatibility with RDF Schema and provides no reasoning

Each of these sublanguages is a syntactic extension of its simpler predecessor.

- Every legal OWL Lite ontology is a legal OWL DL ontology
- Every legal OWL DL ontology is a legal OWL Full ontology
- Every valid OWL Lite conclusion is a valid OWL DL conclusion
- Every valid OWL DL conclusion is a valid OWL Full conclusion

W3C http://www.w3.org/TR/2009/REC-owl2-primer-20091027/

# OWL SYNTAXES

There are various syntaxes available for OWL

- **OWL2 Functional-Style Syntax** (http://www.w3.org/TR/2009/REC-owl2-primer-20091027/#ref-owl-2-specification)
  - easier for specification purposes and to provide a foundation for the implementation of OWL 2 tools such as APIs and reasoners.
- **OWL2 XML Syntax** (http://www.w3.org/TR/2009/REC-owl2-primer-20091027/#ref-owl-2-xml-serialization)
  - XML syntax for OWL defined by an XML schema
- **Manchester Syntax** (http://www.w3.org/TR/2009/REC-owl2-primer-20091027/#ref-owl-2-manchester-syntax)
  - OWL syntax that is designed to be easier for non-logicians to read
- **RDF/XML syntax** (http://www.w3.org/TR/2009/REC-owl2-primer-20091027/#ref-owl-2-rdf-mapping)
  - just RDF/XML, with a particular translation for the OWL constructs
  - the only syntax that is mandatory to be supported by all OWL 2 tools
  - includes
    - RDF/XML syntax (http://www.w3.org/TR/2009/REC-owl2-primer-20091027/#ref-rdf-syntax)
    - Turtle syntax (http://www.w3.org/TR/2009/REC-owl2-primer-20091027/#ref-turtle)

# THE ESSENCE OF OWL

**OWL is a knowledge representation language**, designed to formulate, exchange and reason with knowledge about a domain of interest.
Basic notions in OWL are:

- **Axioms**: the basic statements that an OWL ontology expresses
- **Entities**: elements used to refer to real-world objects
- **Expressions**: combinations of entities to form complex descriptions from basic ones

**OWL 2 is not a programming language**

OWL 2 is declarative, i.e. it describes a state of affairs in a logical way

Appropriate tools (so-called reasoners) can then be used to infer further information about that state of affairs

How these inferences are realized algorithmically is not part of the OWL document but depends on the specific implementations

# OWL2 EXAMPLES :: CLASSES & INSTANCES

**Functional-Style Syntax**

```
ClassAssertion( :Woman :Mary )
```

**RDF/XML Syntax**

```
<Woman rdf:about="Mary"/>
```

**Turtle Syntax**

```
:Mary rdf:type :Woman .
```

**Manchester Syntax**

```
Individual: Mary
  Types: Woman
```

**OWL/XML Syntax**

```
<ClassAssertion>
   <Class IRI="Woman"/>
   <NamedIndividual IRI="Mary"/>
</ClassAssertion>
```

**Functional-Style Syntax**

```
ClassAssertion( :Person :Mary )
```

**RDF/XML Syntax**

```
<Person rdf:about="Mary"/>
```

**Turtle Syntax**

```
:Mary rdf:type :Person .
```

**Manchester Syntax**

```
Individual: Mary
  Types: Person
```

**OWL/XML Syntax**

```
<ClassAssertion>
   <Class IRI="Person"/>
   <NamedIndividual IRI="Mary"/>
</ClassAssertion>
```

** Note however that it is clear that a Woman is less general than a Person*

# OWL2 EXAMPLES :: CLASS HIERARCHIES

**Functional-Style Syntax**

```
SubClassOf( :Woman :Person )
```

**RDF/XML Syntax**

```
<owl:Class rdf:about="Woman">
  <rdfs:subClassOf rdf:resource="Person"/>
</owl:Class>
```

**Turtle Syntax**

```
:Woman rdfs:subClassOf :Person .
```

**Manchester Syntax**

```
Class: Woman
  SubClassOf: Person
```

**OWL/XML Syntax**

```
<SubClassOf>
  <Class IRI="Woman"/>
  <Class IRI="Person"/>
</SubClassOf>
```

**Functional-Style Syntax**

```
SubClassOf( :Mother :Woman )
```

**RDF/XML Syntax**

```
<owl:Class rdf:about="Mother">
  <rdfs:subClassOf rdf:resource="Woman"/>
</owl:Class>
```

**Turtle Syntax**

```
:Mother rdfs:subClassOf :Woman .
```

**Manchester Syntax**

```
Class: Mother
  SubClassOf: Woman
```

**OWL/XML Syntax**

```
<SubClassOf>
  <Class IRI="Mother"/>
  <Class IRI="Woman"/>
</SubClassOf>
```

- *The subclass axiom is used to define that a Woman is a subset of a Person*
- *This way every individual specified as an instance of the class Woman is an instance of the class Person*
- *Similarly, the subclass Monther is used to define that a Mother is a subset of a Woman*

# OWL2 SYNTAX :: EQUIVALENCE AND DISJOINTNESS

**Functional-Style Syntax**

```
EquivalentClasses( :Person :Human )
```

**RDF/XML Syntax**

```
<owl:Class rdf:about="Person">
  <owl:equivalentClass rdf:resource="Human"/>
</owl:Class>
```

**Turtle Syntax**

```
:Person owl:equivalentClass :Human .
```

**Manchester Syntax**

```
Class: Person
  EquivalentTo: Human
```

**OWL/XML Syntax**

```
<EquivalentClasses>
  <Class IRI="Person"/>
  <Class IRI="Human"/>
</EquivalentClasses>
```

**Functional-Style Syntax**

```
DisjointClasses( :Woman :Man )
```

**RDF/XML Syntax**

```
<owl:AllDisjointClasses>
  <owl:members rdf:parseType="Collection">
    <owl:Class rdf:about="Woman"/>
    <owl:Class rdf:about="Man"/>
  </owl:members>
</owl:AllDisjointClasses>
```

**Turtle Syntax**

```
[] rdf:type     owl:AllDisjointClasses ;
   owl:members  ( :Woman  :Man ) .
```

**Manchester Syntax**

```
DisjointClasses: Woman, Man
```

**OWL/XML Syntax**

```
<DisjointClasses>
    <Class IRI="Woman"/>
    <Class IRI="Man"/>
</DisjointClasses>
```

- *Every Person is expected to be a Human*
- *A Man cannot be a Woman*

# OWL2 SYNTAX :: OBJECT PROPERTIES

**Functional-Style Syntax**

```
ObjectPropertyAssertion( :hasWife :John :Mary )
```

**RDF/XML Syntax**

```
<rdf:Description rdf:about="John">
  <hasWife rdf:resource="Mary"/>
</rdf:Description>
```

**Turtle Syntax**

```
:John :hasWife :Mary .
```

**Manchester Syntax**

```
Individual: John
  Facts: hasWife Mary
```

**OWL/XML Syntax**

```
<ObjectPropertyAssertion>
  <ObjectProperty IRI="hasWife"/>
  <NamedIndividual IRI="John"/>
  <NamedIndividual IRI="Mary"/>
</ObjectPropertyAssertion>
```

**Functional-Style Syntax**

```
NegativeObjectPropertyAssertion( :hasWife :Bill :Mary )
```

**RDF/XML Syntax**

```
<owl:NegativePropertyAssertion>
  <owl:sourceIndividual rdf:resource="Bill"/>
  <owl:assertionProperty rdf:resource="hasWife"/>
  <owl:targetIndividual rdf:resource="Mary"/>
</owl:NegativePropertyAssertion>
```

**Turtle Syntax**

```
[]  rdf:type               owl:NegativePropertyAssertion ;
    owl:sourceIndividual   :Bill ;
    owl:assertionProperty  :hasWife ;
    owl:targetIndividual   :Mary .
```

**Manchester Syntax**

```
Individual: Bill
  Facts: not hasWife Mary
```

**OWL/XML Syntax**

```
<NegativeObjectPropertyAssertion>
  <ObjectProperty IRI="hasWife"/>
  <NamedIndividual IRI="Bill"/>
  <NamedIndividual IRI="Mary"/>
</NegativeObjectPropertyAssertion>
```

- *Specify how individuals relate (or not) to other individuals*
  - *Properties are the entities that describe the relation of two individuals*
  - *attention to the order in which the individuals are written*

# OWL2 SYNTAX :: PROPERTY HIERARCHIES

**Functional-Style Syntax**

```
SubObjectPropertyOf( :hasWife :hasSpouse )
```

**RDF/XML Syntax**

```
<owl:ObjectProperty rdf:about="hasWife">
  <rdfs:subPropertyOf rdf:resource="hasSpouse"/>
</owl:ObjectProperty>
```

**Turtle Syntax**

```
:hasWife rdfs:subPropertyOf :hasSpouse .
```

**Manchester Syntax**

```
ObjectProperty: hasWife
  SubPropertyOf: hasSpouse
```

**OWL/XML Syntax**

```
<SubObjectPropertyOf>
  <ObjectProperty IRI="hasWife"/>
  <ObjectProperty IRI="hasSpouse"/>
</SubObjectPropertyOf>
```

# OWL2 SYNTAX :: DOMAIN AND RANGE RESTRICTIONS

**Functional-Style Syntax**

```
ObjectPropertyDomain( :hasWife :Man )
ObjectPropertyRange( :hasWife :Woman )
```

**RDF/XML Syntax**

```
<owl:ObjectProperty rdf:about="hasWife">
  <rdfs:domain rdf:resource="Man"/>
  <rdfs:range rdf:resource="Woman"/>
</owl:ObjectProperty>
```

**Turtle Syntax**

```
:hasWife rdfs:domain :Man ;
         rdfs:range  :Woman .
```

**Manchester Syntax**

```
ObjectProperty: hasWife
  Domain: Man
  Range: Woman
```

**OWL/XML Syntax**

```
<ObjectPropertyDomain>
  <ObjectProperty IRI="hasWife"/>
  <Class IRI="Man"/>
</ObjectPropertyDomain>
<ObjectPropertyRange>
  <ObjectProperty IRI="hasWife"/>
  <Class IRI="Woman"/>
</ObjectPropertyRange>
```

# OWL2 SYNTAX :: EQUALITY / INEQUALITY OF INDIVIDUALS

**Functional-Style Syntax**

```
DifferentIndividuals( :John :Bill )
```

**RDF/XML Syntax**

```
<rdf:Description rdf:about="John">
  <owl:differentFrom rdf:resource="Bill"/>
</rdf:Description>
```

**Turtle Syntax**

```
:John owl:differentFrom :Bill .
```

**Manchester Syntax**

```
Individual: John
  DifferentFrom: Bill
```

**OWL/XML Syntax**

```
<DifferentIndividuals>
  <NamedIndividual IRI="John"/>
  <NamedIndividual IRI="Bill"/>
</DifferentIndividuals>
```

**Functional-Style Syntax**

```
SameIndividual( :James :Jim )
```

**RDF/XML Syntax**

```
<rdf:Description rdf:about="James">
  <owl:sameAs rdf:resource="Jim"/>
</rdf:Description>
```

**Turtle Syntax**

```
:James owl:sameAs :Jim.
```

**Manchester Syntax**

```
Individual: James
  SameAs: Jim
```

**OWL/XML Syntax**

```
<SameIndividual>
  <NamedIndividual IRI="James"/>
  <NamedIndividual IRI="Jim"/>
</SameIndividual>
```

**There is no unique names assumption*

# OWL2 SYNTAX :: DATA TYPES

**Functional-Style Syntax**

```
DataPropertyAssertion( :hasAge :John "51"^^xsd:integer )
```

**RDF/XML Syntax**

```
<Person rdf:about="John">
  <hasAge rdf:datatype="http://www.w3.org/2001/XMLSchema#integer">51</hasAge>
</Person>
```

**Turtle Syntax**

```
:John  :hasAge  51 .
```

**Manchester Syntax**

```
Individual: John
  Facts: hasAge "51"^^xsd:integer
```

**OWL/XML Syntax**

```
<DataPropertyAssertion>
  <DataProperty IRI="hasAge"/>
  <NamedIndividual IRI="John"/>
  <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#integer">51</Literal>
</DataPropertyAssertion>
```

**Functional-Style Syntax**

```
NegativeDataPropertyAssertion( :hasAge :Jack "53"^^xsd:integer )
```

**RDF/XML Syntax**

```
<owl:NegativePropertyAssertion>
  <owl:sourceIndividual rdf:resource="Jack"/>
  <owl:assertionProperty rdf:resource="hasAge"/>
  <owl:targetValue rdf:datatype="http://www.w3.org/2001/XMLSchema#integer">
    53
  </owl:targetValue>
</owl:NegativePropertyAssertion>
```

**Turtle Syntax**

```
[]  rdf:type              owl:NegativePropertyAssertion ;
    owl:sourceIndividual   :Jack ;
    owl:assertionProperty  :hasAge ;
    owl:targetValue        53 .
```

**Manchester Syntax**

```
Individual: Jack
  Facts: not hasAge "53"^^xsd:integer
```

**OWL/XML Syntax**

```
<NegativeDataPropertyAssertion>
  <DataProperty IRI="hasAge"/>
  <NamedIndividual IRI="Jack"/>
  <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#integer">53</Literal>
</NegativeDataPropertyAssertion>
```

- *Datatype properties are used to describe various data values*
- *Domain and range can also be used for dataype properties*

**Functional-Style Syntax**

```
DataPropertyDomain( :hasAge :Person )
DataPropertyRange( :hasAge xsd:nonNegativeInteger )
```

**RDF/XML Syntax**

```
<owl:DatatypeProperty rdf:about="hasAge">
  <rdfs:domain rdf:resource="Person"/>
  <rdfs:range rdfs:Datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger"/>
</owl:DatatypeProperty>
```

# OWL TOOLS

**OWL Editors**

- Open-source OWL editor is **Protégé** (http://protege.stanford.edu) by Stanford University
- Commercial **TopBraid Composer** (http://www.topquadrant.com/products/TB_Composer.html)
- Open-source system **SWOOP** (http://code.google.com/p/swoop/)
- Open-source system **NeOn-Toolkit** (http://www.neon-toolkit.org/)

**Reasoners for OWL DL**

- **Fact++** (http://owl.cs.manchester.ac.uk/fact++/) by the University of Manchester
- **Hermit** (http://hermit-reasoner.com/) by Oxford University Computing Laboratory
- **Pellet** (http://clarkparsia.com/pellet) by Clark & Parsia, LLC
- **RacerPro** (http://www.racer-systems.com/) by Racer Systems
- **CEL** (http://lat.inf.tu-dresden.de/systems/cel/) by Dresden University of Technology supports OWL EL
- **QuOnto** (http://www.dis.uniroma1.it/~quonto/) by Sapienza Università di Roma supports OWL QL
- **ORACLE 11g** (http://www.oracle.com/technology/tech/semantic_technologies/index.html) supports OWL RL

The **Test Suite Status document** (http://www.w3.org/2007/OWL/wiki/Test_Suite_Status) lists to which extent some of the reasoners comply with the test cases

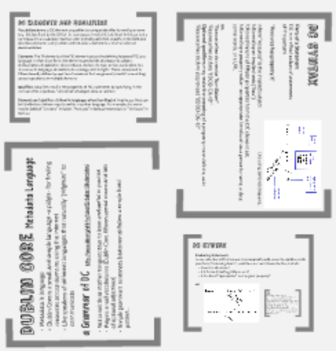
The open-source **OWL API** (http://owlapi.sourceforge.net/) plays a rather prominent role as the currently most important development tool around OWL.

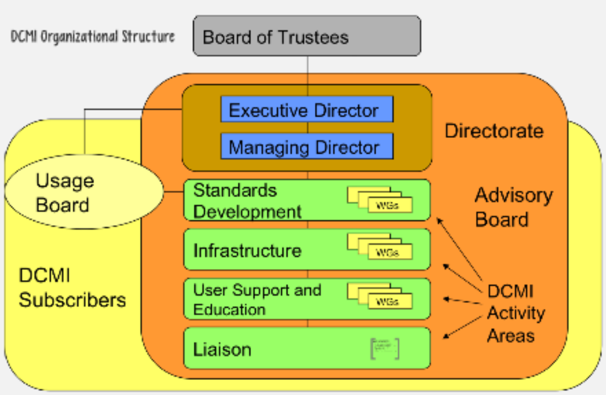
# DUBLIN CORE

## Metadata Initiative

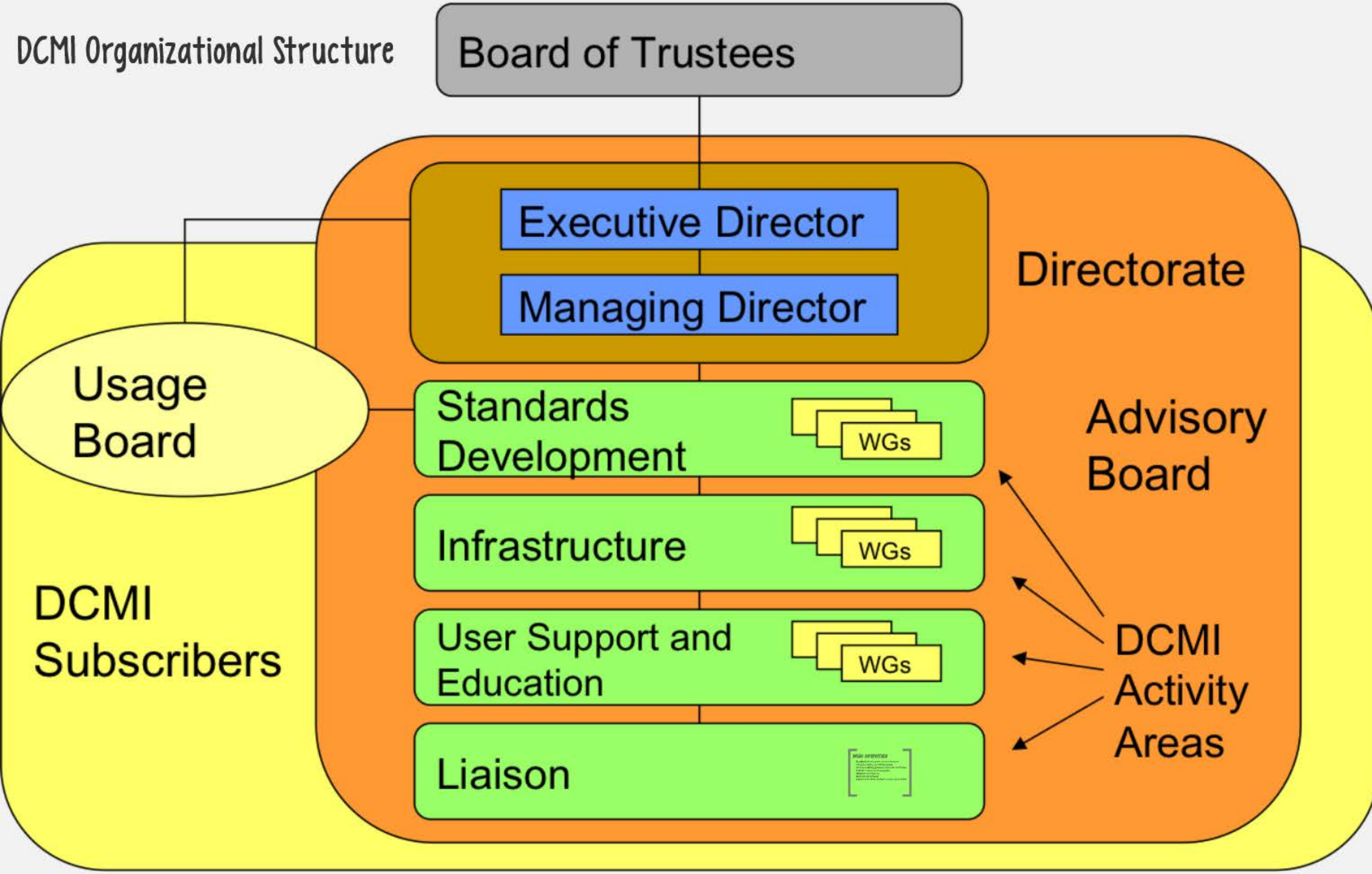
The mission of DCMI is to make it easier to search on the Web through the following resources activities:

- Develope metadata standards for discovery across domains (example: the Dublin Core)
- Define frameworks for the interoperation of metadata sets
- Facilitate the development of community or disciplinary specific metadata sets





# DCMI Organizational Structure



# DCMI ACTIVITIES

- **Standards** development and maintenance
- Metadata registry and **infrastructure**
- Technical **working groups** and periodic workshops
- **Tutorial** materials and user guides
- **Education** and training
- **Open source software**
- **Liaisons** with other standards or user communities

# DUBLIN CORE Metadata Language

- Metadata is language
- Dublin Core is a small and simple language -*a pidgin*- for finding resources across domains using the internet
- Like speakers of different languages that naturally *"pidginize"* to communicate

## a Grammar of DC http://www.dlib.org/dlib/october00/baker/10baker.html

- Not as subtle as mother tongues; easy to learn and useful in practice
- Pidgins: small vocabularies (Dublin Core: fifteen special nouns and lots of optional adjectives)
- Simple grammars: sentences (statements) follow a simple fixed pattern...

# DC ELEMENTS AND QUALIFIERS

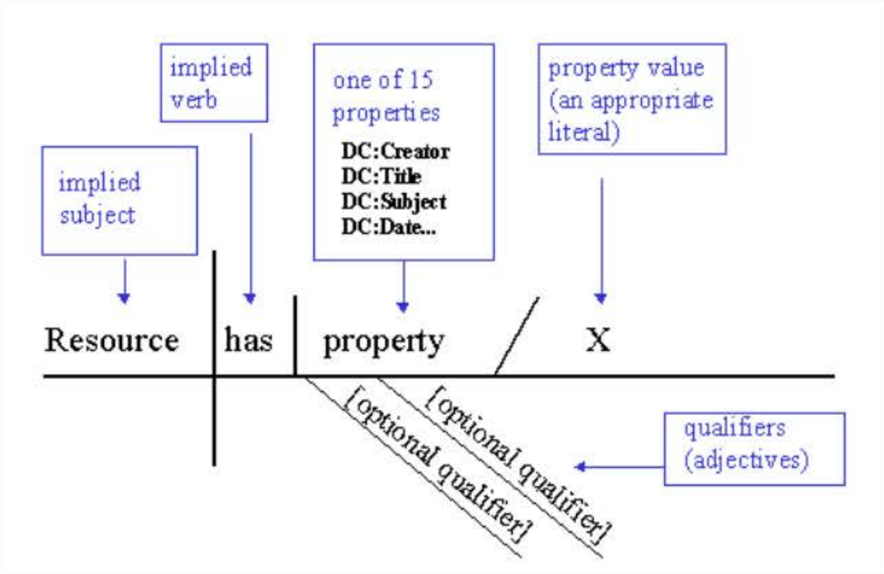
**Vocabulary terms:** a DC element or qualifier is a unique identifier formed by a name (e.g., title) prefixed by the URI of the namespace in which it is defined. In this context a namespace is a vocabulary that has been formally published, usually on the Web and describes elements and qualifiers with NL labels, definitions and other relevant documentation

**Elements:** The 15 elements of the DC element set are the defining feature of DC as a language. In their short form, the elements are dc:title, dc:creator, dc:subject, dc:description, dc:publisher, dc:contributor, dc:date, dc:type, dc:format, dc:identifier, dc:source, dc:language, dc:relation, dc:coverage, and dc:rights. These correspond to fifteen broadly defined properties of resources that are generally useful for searching across repositories in multiple domains

**Qualifiers:** Qualifiers modify the properties of DC statements by specifying, in the manner of NL adjectives, "what kind" of subject, date, or relation

**Elements and qualifiers defined in languages other than English**. In principle they can be labelled and defined equally well in any other language. For example, dc:creator may be labeled "Creatore" in Italian, "Pencipta" in Bahasa Indonesian, or "Verfasser" in German

# DC SYNTAX




Like using sentence diagrams...

**Parts of a Statement**
DC is in effect a class of statements of the pattern

**"Resource has property X"**

where "resource" is the implied subject;
followed by an implied verb ("has");
followed by one of fifteen properties from the DC element set;
followed by a property value - an appropriate literal such as a person's name, a date, some words, or a URL

**ex.**
"Resource has dc:creator 'Tom Baker'"
"Resource has dc:date '2000-06-13'"
**Optional qualifiers** may make the meaning of a property more definite, as in
"Resource has dc:date dcq:revised '2000-06-13'"

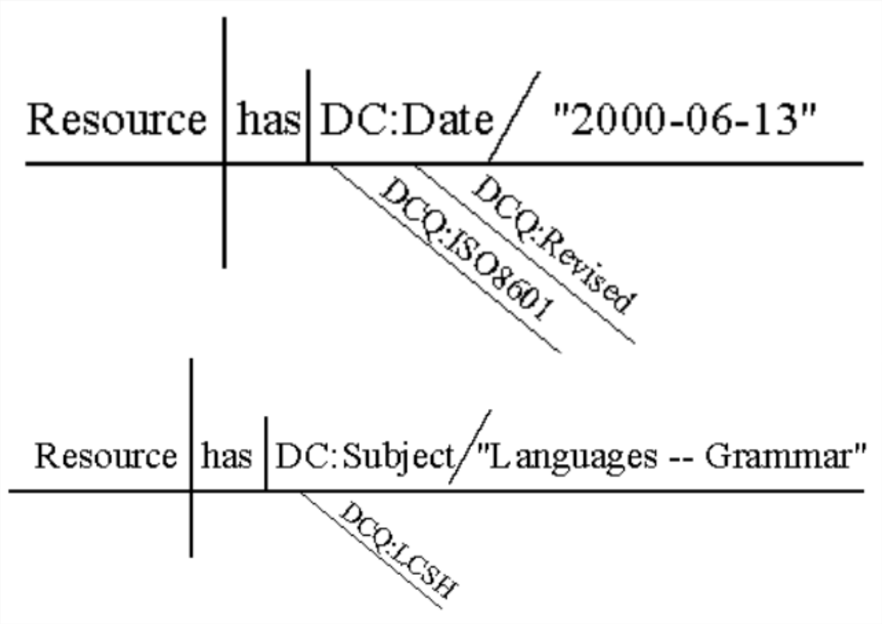
# DC SYNTAX

**Evaluating Statements**

To test whether a DC statement is conceptually solid, cover the qualifiers with your hand ("dumbing down"), read the statement above the line, and ask:

- Does it make sense?
- Is it factually and logically correct?
- Is the literal "appropriate" for the given property?

**ex.**




## EX.

**Resource has dc:title 'A Grammar of Dublin Core'**
Does it make sense? Yes. Is it correct? Yes. Is the literal "appropriate"? Yes, a sequence of words is normal and expected for the property dc:title.

**Resource has dcq:iso8601 dcq:revised dc:date '2000-06-13'**
This means that a resource was revised on 6 June 2000. The statement dumbs down to "Resource has dc:date '2000-06-13'," which means that the date 6 June 2000 has something to do with the life-cycle of the resource. This is less specific than the qualified statement, but still correct.

**Resource has dcq:lcsh dc:subject 'Languages -- Grammar'**
This says that the resource is about the subject "grammar of languages," and that these words are a controlled term from the Library of Congress Subject Headings. The statement dumbs down to "Resource has dc:subject 'Languages -- Grammar'," which makes sense even if we do not know that the term comes from the Library of Congress.

EX.

**Resource has dc:title 'A Grammar of Dublin Core'**
Does it make sense? Yes. Is it correct? Yes. Is the literal "appropriate"? Yes, a sequence of words is normal and expected for the property dc:title.

**Resource has dcq:iso8601 dcq:revised dc:date '2000-06-13'**
This means that a resource was revised on 6 June 2000. The statement dumbs down to "Resource has dc:date '2000-06-13'," which means that the date 6 June 2000 has something to do with the life-cycle of the resource. This is less specific than the qualified statement, but still correct.

**Resource has dcq:lcsh dc:subject 'Languages -- Grammar'**
This says that the resource is about the subject "grammar of languages," and that these words are a controlled term from the Library of Congress Subject Headings. The statement dumbs down to "Resource has dc:subject 'Languages -- Grammar'," which makes sense even if we do not know that the term comes from the Library of Congress.

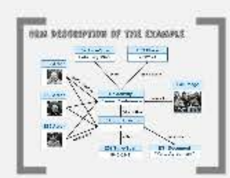
# CIDOC-CRM

Committee on Documentation of the International Council – Conceptual Reference Model
(Comite International pour la DOCumentation)

"The primary role of the CRM is to serve as a basis for mediation of cultural heritage information and thereby provide the semantic 'glue' needed to transform today's disparate, localised information sources into a coherent and valuable global resource."

Martin Doerr & Nick Crofts http://cidoc.ics.forth.gr/

- CIDOC formed in 1950 as one of the ICOM's 31 Inl. Committees
- 550 members from 70 countries
- Publishes recommendations, standards, guidelines



# ICOM

The International Council of Museums http://icom.museum/

By the way...here is ICOM's definition of a museum

"A museum is a non profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment"

*ICOM Statutes, Vienna, Austria, 2007*

# THE NEED FOR THE CRM

## The Yalta Conference – a demonstration case

Let us regard a realistic demonstration case about **information objects related to the Yalta Conference February 1945**, the event designating somehow officially the end of WWII. Probably the best documented event in history.

**1 - photograph (DC record) - The Bettmann Archive in New York**

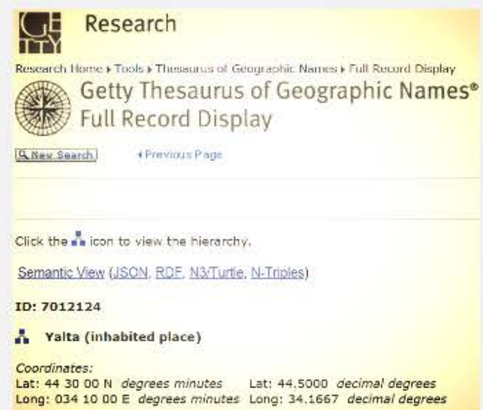

**Type:** Image
**Title:** Allied Leaders at Yalta
**Date:** 1945
**Publisher:** United Press International (UPI)
**Source:** The Bettmann Archive
**Copyright:** Corbis
**Keywords:** Churchill, Roosevelt, Stalin

**2 - document (DC record) -- The State Department of the United States**

> *"The following declaration has been approved:*
> The Premier of the Union of Soviet Socialist Republics, the Prime Minister of the United Kingdom and the President of the United States of America have consulted with each other in the common interests of the people of their countries and those of liberated Europe. They jointly declare their mutual agreement to concert… and to ensure that Germany will never again be able to disturb the peace of the world…"

**Type:** Text
**Title:** Protocol of Proceedings of Crimea Conference
**Title.Subtitle:** II. Declaration of Liberated Europe
**Date:** February 11, 1945.
**Creator:** Premier of the Union of Soviet Socialist Republics Prime Minister of the United Kingdom President of the United States of America
**Publisher:** State Department

**3 - Getty TGN record**




**TGN ID:** 7012124
**Names:** Yalta (C,V), Jalta (C,V)
**Types:** inhabited place(C), city (C)
**Position:** Lat: 44 30 N, Long: 034 10 E
**Hierarchy:** Europe (continent) <- Ukrayina (nation) <- Krym (autonomous republic)
**Note:** ...Site of conference between Allied powers in WWII in 1945...
**Source:** TGN, Thesaurus of Geographic Names

*see also here [http://www.cidoc-crm.org/crm_core/core_examples/yalta.htm](http://www.cidoc-crm.org/crm_core/core_examples/yalta.htm)*

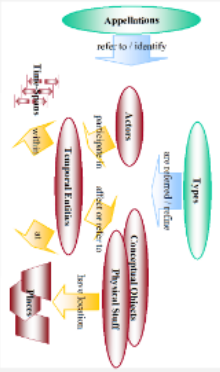
# The example demonstrates a fundamental problem

In order to retrieve information related to one specific subject, **information from multiple sources must be integrated**. Vocabulary and data structure unification only does not solve the problem.

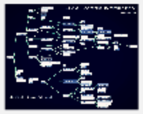
One problem of this example is to be able to relate Crimea to Krym and to Yalta, the Premier of the Union of Soviet Socialist Republics to Joseph Stalin and to the Allied Leaders etc...

A **deeper problem** is the fact that the artifacts do not fit our question: **People document persistent items** like images, texts, places, but **our question was about an event**, something that is only indirectly preserved in those items.

# CIDOC-CRM OVERVIEW



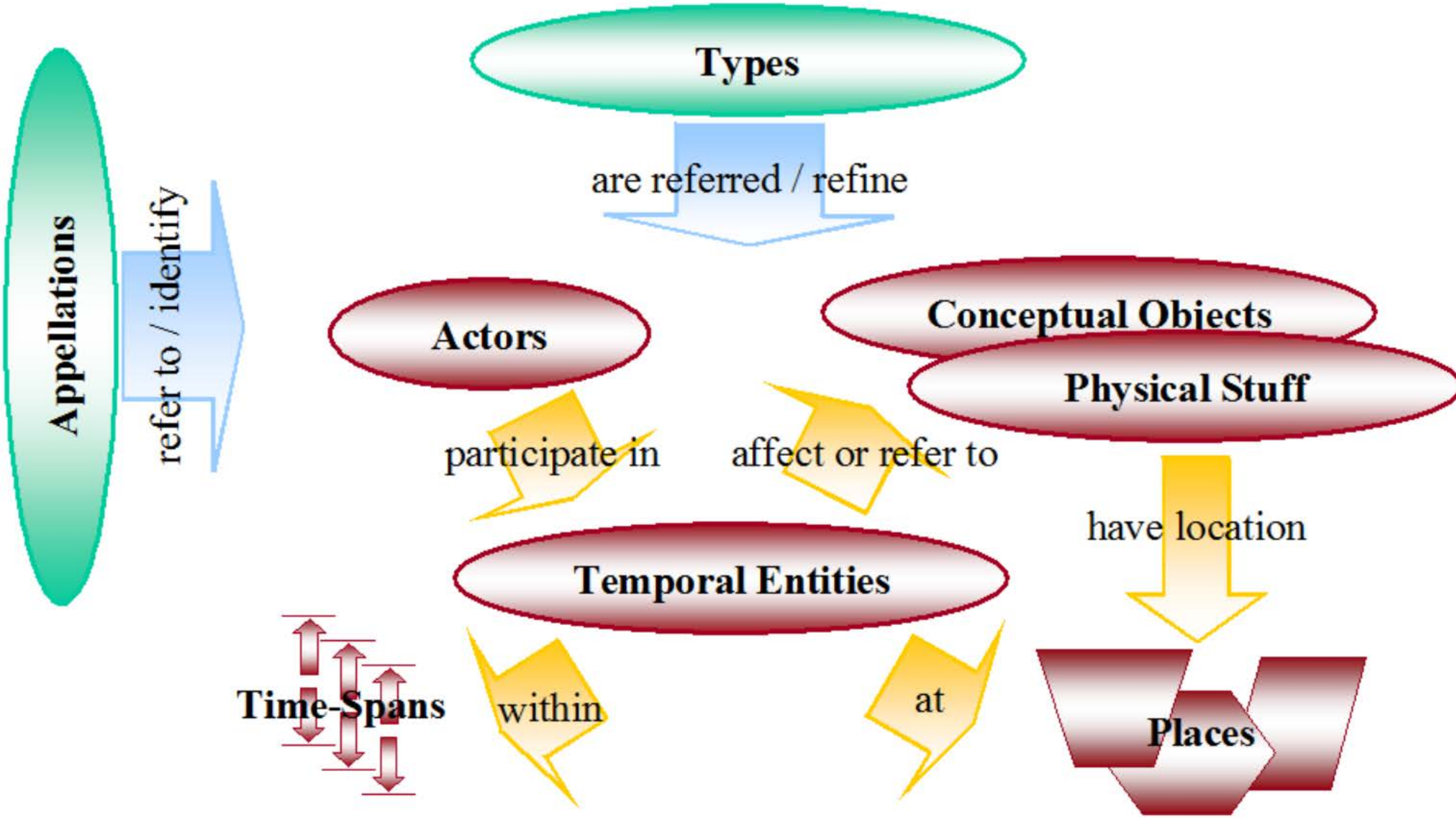

- CRM v3.4 comprises 84 Classes interlinked by 139 Properties
- Classes inherit properties from their parents, or Superclasses
- Event-centric and empirical; observations about the world
- Short-cuts, for typically incomplete knowledge
- Highly extensible through Sub-typing of classes and properties
- Ideally suited to RDF implementation

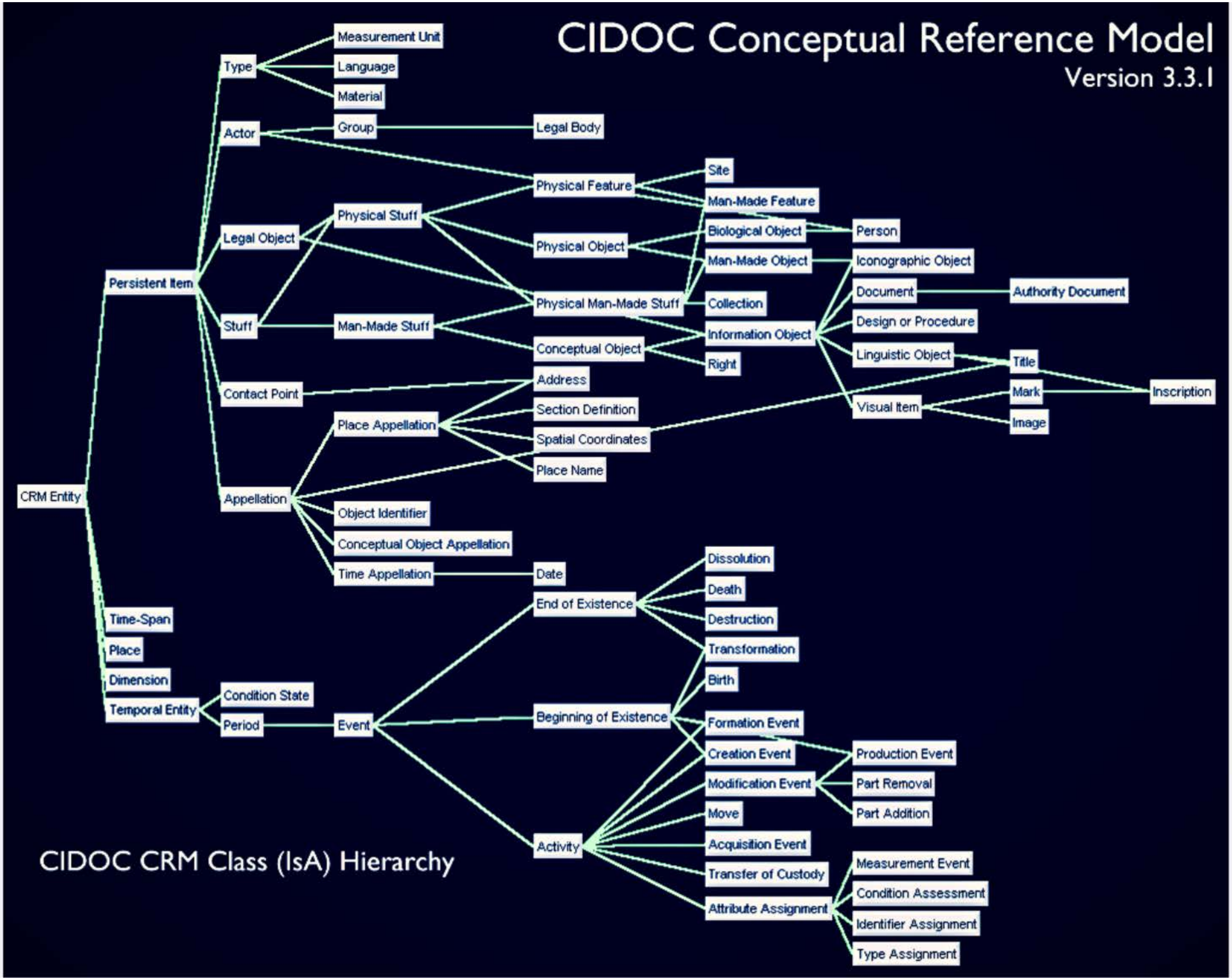


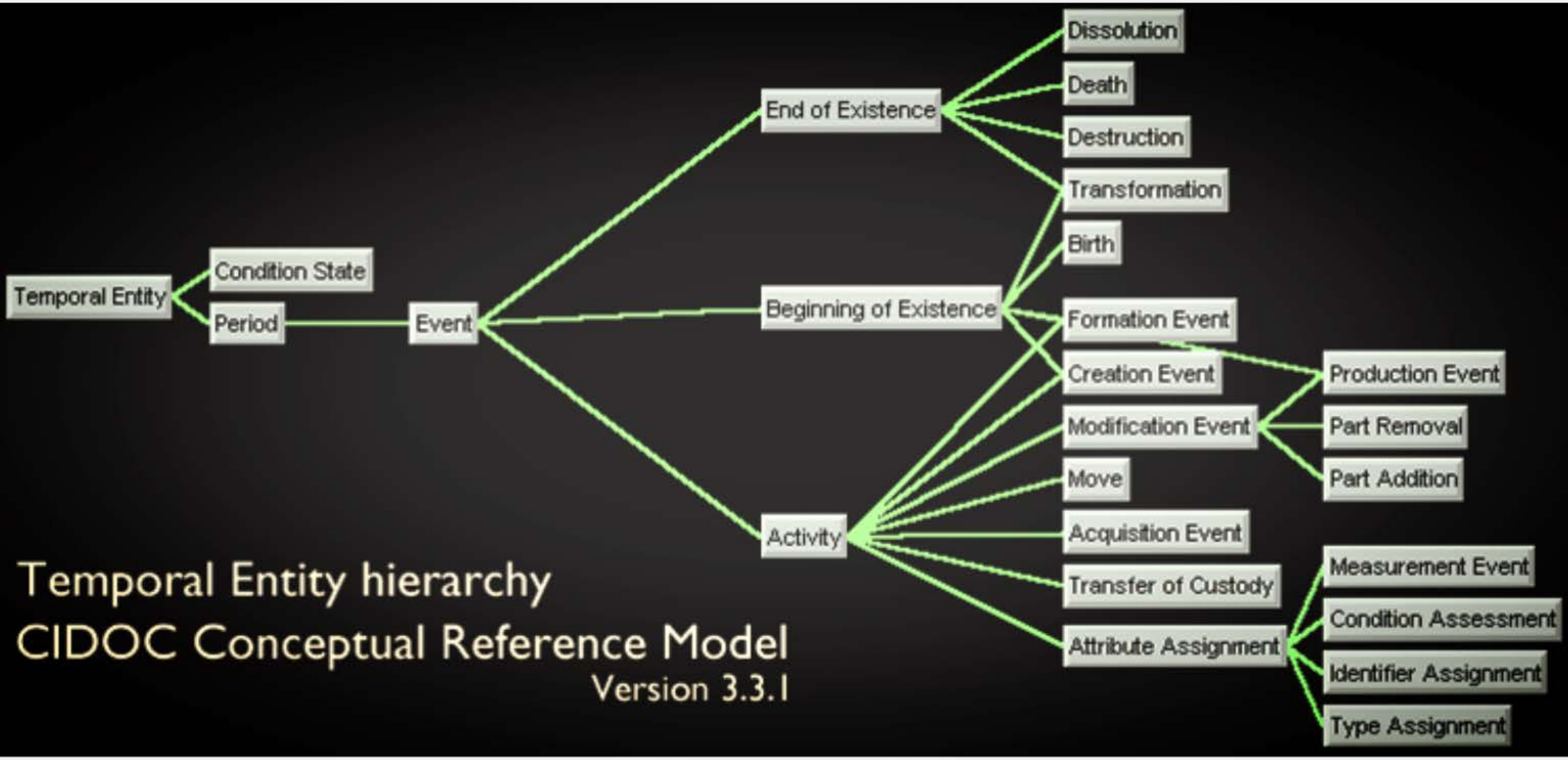
**Intended scope:** Exchange and integration of scientific documentation about museum collections

- "Scientific" means sufficient depth & precision for research
- "Museum" defined by ICOM
- Includes contextual information
- Includes exchange between museums, libraries & archives
- Excludes administrative information, e.g. visitor statistics

**Practical scope:** The set of extant data sets and structures used in museum documentation


Types
are referred / refine
Appellations
refer to / identify
Actors
Conceptual Objects
Physical Stuff
participate in
affect or refer to
have location
Temporal Entities
Time-Spans
within
at
Places


CIDOC Conceptual Reference Model
Version 3.3.1
CRM Entity
Persistent Item
Type
Measurement Unit
Language
Material
Actor
Group
Legal Body
Legal Object
Physical Stuff
Physical Feature
Site
Man-Made Feature
Physical Object
Biological Object
Person
Man-Made Object
Iconographic Object
Physical Man-Made Stuff
Collection
Document
Authority Document
Stuff
Man-Made Stuff
Information Object
Design or Procedure
Conceptual Object
Linguistic Object
Title
Right
Contact Point
Address
Mark
Inscription
Visual Item
Image
Place Appellation
Section Definition
Spatial Coordinates
Place Name
Appellation
Object Identifier
Conceptual Object Appellation
Time Appellation
Date
Dissolution
Death
End of Existence
Destruction
Transformation
Time-Span
Place
Birth
Dimension
Temporal Entity
Condition State
Period
Event
Beginning of Existence
Formation Event
Creation Event
Production Event
Modification Event
Part Removal
Move
Part Addition
Acquisition Event
Activity
Transfer of Custody
Measurement Event
Attribute Assignment
Condition Assessment
Identifier Assignment
Type Assignment
CIDOC CRM Class (IsA) Hierarchy


Temporal Entity
Condition State
Period
Event
End of Existence
Beginning of Existence
Activity
Dissolution
Death
Destruction
Transformation
Birth
Formation Event
Creation Event
Modification Event
Move
Acquisition Event
Transfer of Custody
Attribute Assignment
Production Event
Part Removal
Part Addition
Measurement Event
Condition Assessment
Identifier Assignment
Type Assignment
Temporal Entity hierarchy
CIDOC Conceptual Reference Model
Version 3.3.1

# MAKING IMPLICIT CONCEPTS EXPLICIT

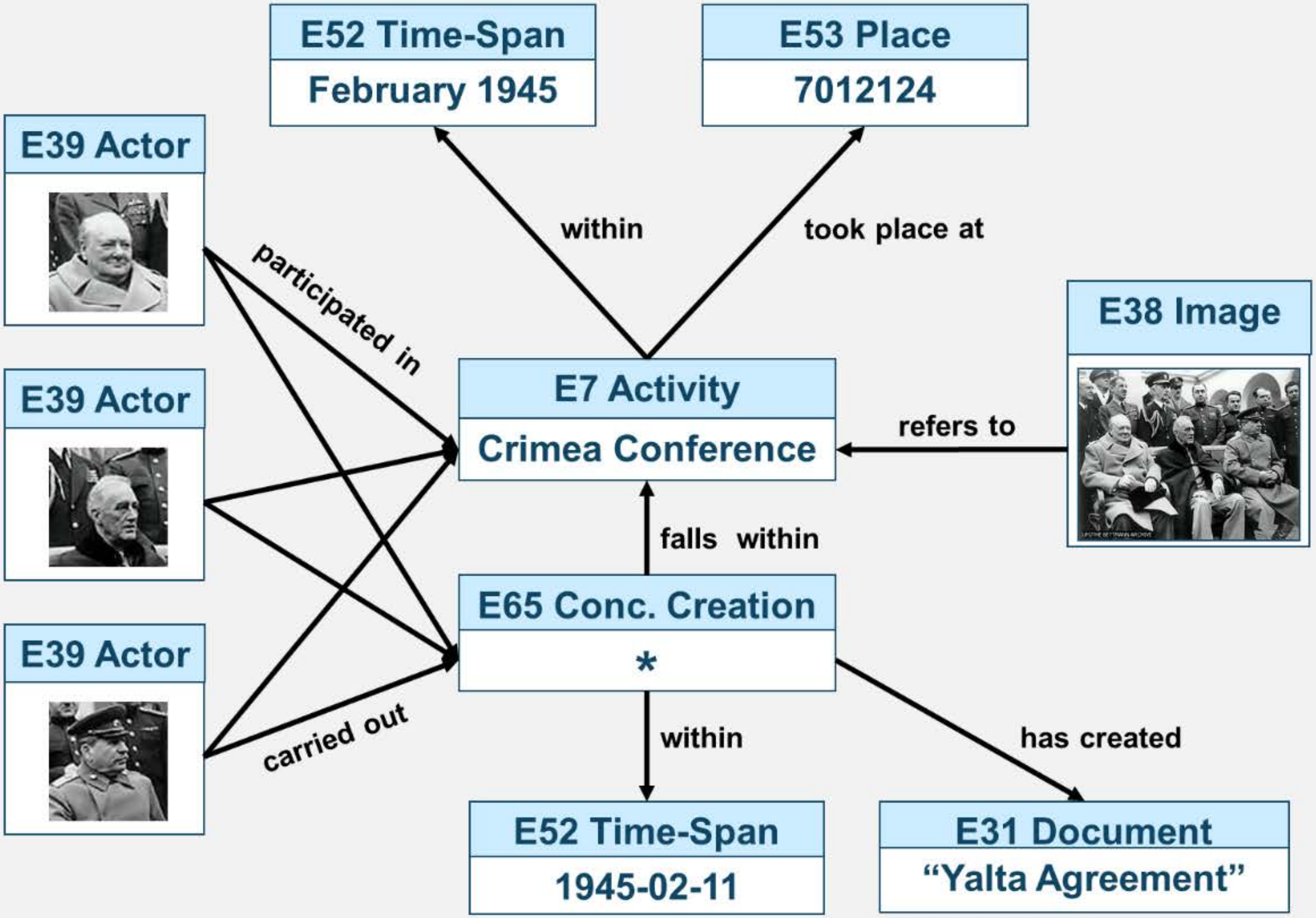
The element **DC.Creator** implies:

- An **Actor**, who created something
- An **Actor Appellation** by which to identify the creator
- An **Event**, the act of creation
- Some **Man-Made Stuff**, the physical or conceptual thing that was created and is being described by the DC record

**E24 Physical Man-Made Stuff** *p108 was produced by* **E12 Production Event** *p14 carried out by* **E39 Actor** *p131 is identified by* **E82 Actor Appellation**

**E28 Conceptual Object** *p94 was created by* **E65 Creation Event** *p14 carried out by* **E39 Actor** *p131 is identified by* **E82 Actor Appellation**

# CRM DESCRIPTION OF THE EXAMPLE



# Benefits of the CRM

- **Elegant and simple** compared to comparable Entity-Relation model
- Coherently **integrates information** at varying degrees of detail
- **Readily extensible** through object-oriented class ‘typing’ and ‘specializations’
- **Richer semantic content**; allows (some) inferences to be made from **‘fuzzy’ data**
- Designed for **semantically lossless mediation** of heterogeneous cultural heritage information

# EUROEPANA

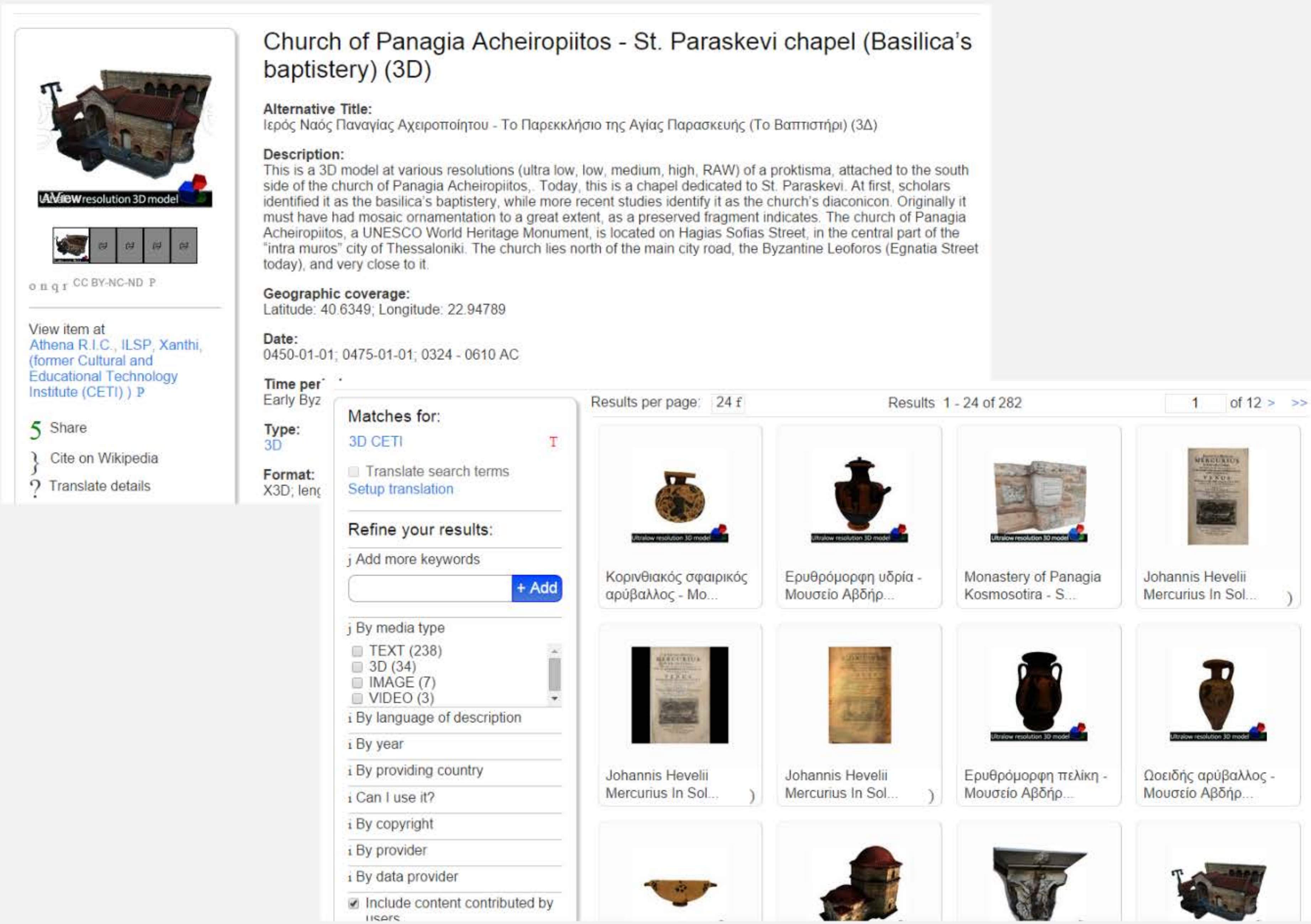
**Europeana is a cultural heritage organisation** whose goal is

- to provide access to Europe's entire heritage
- to bring cultures together
- to offer different approaches and point of views of any individual event
- to enchase the European identity
- to create new ways for people to engage with their cultural history through one single access point, the Europeana portal.

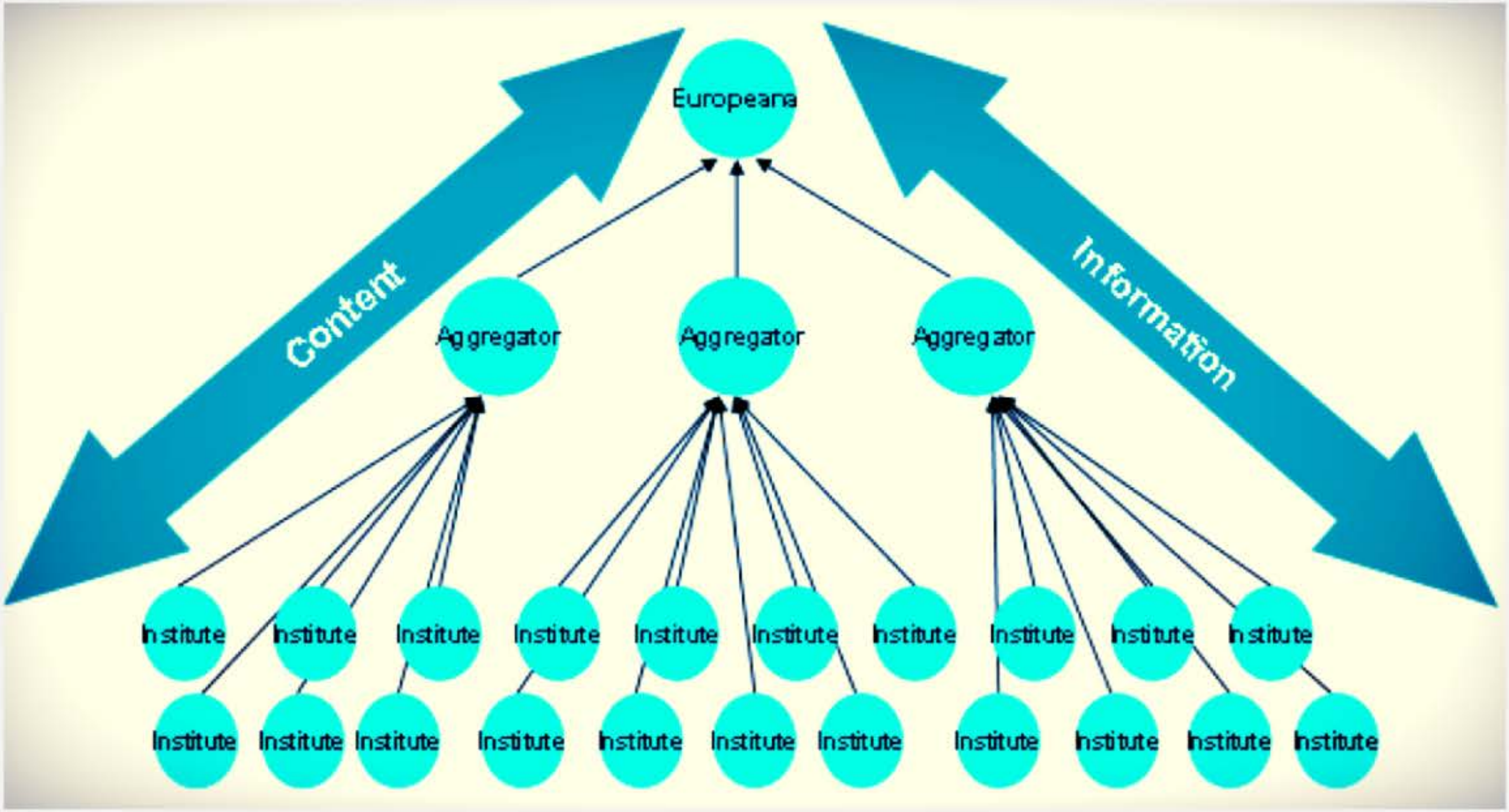
Europeana aims to develop a **European Digital Library** containing digitised material about the European scientific and cultural heritage.

The metadata description schema, known as EDM (Europeana Data Model), has **adopted CIDOC-CRM core**.

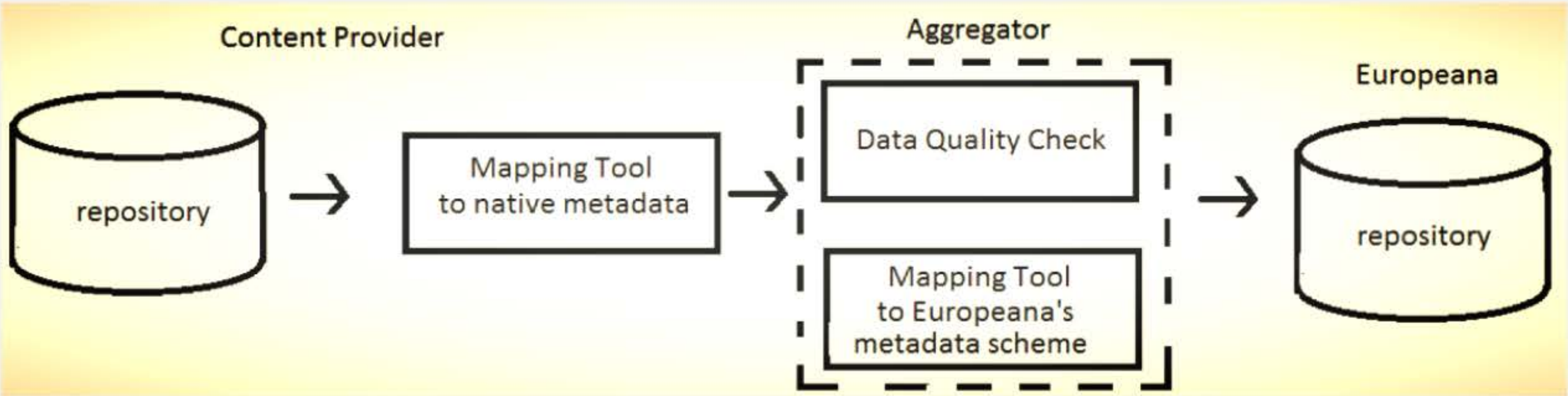
The consortium emphasises the need for linking existed descriptions of the digitised material in EDM descriptions, according to the **Linked Data approach**.


Church of Panagia Acheiropiitos - St. Paraskevi chapel (Basilica's baptistery) (3D)
Alternative Title:
Ιερός Ναός Παναγίας Αχειροποίητου - Το Παρεκκλήσιο της Αγίας Παρασκευής (Το Βαπτιστήρι) (3Δ)
Description:
This is a 3D model at various resolutions (ultra low, low, medium, high, RAW) of a proktisma, attached to the south side of the church of Panagia Acheiropiitos,. Today, this is a chapel dedicated to St. Paraskevi. At first, scholars identified it as the basilica's baptistery, while more recent studies identify it as the church's diaconicon. Originally it must have had mosaic ornamentation to a great extent, as a preserved fragment indicates. The church of Panagia Acheiropiitos, a UNESCO World Heritage Monument, is located on Hagias Sofias Street, in the central part of the "intra muros" city of Thessaloniki. The church lies north of the main city road, the Byzantine Leoforos (Egnatia Street today), and very close to it.
Geographic coverage:
Latitude: 40.6349; Longitude: 22.94789
Date:
0450-01-01; 0475-01-01; 0324 - 0610 AC
Time per
Early Byz
Type:
3D
Format:
X3D; leng
CC BY-NC-ND
View item at
Athena R.I.C., ILSP, Xanthi, (former Cultural and Educational Technology Institute (CETI) )
Share
Cite on Wikipedia
Translate details
Results per page: 24
Results 1 - 24 of 282
1 of 12 > >>
Matches for:
3D CETI
Translate search terms
Setup translation
Refine your results:
Add more keywords
+ Add
By media type
TEXT (238)
3D (34)
IMAGE (7)
VIDEO (3)
By language of description
By year
By providing country
Can I use it?
By copyright
By provider
By data provider
Include content contributed by users
Κορινθιακός σφαιρικός αρύβαλλος - Μο...
Ερυθρόμορφη υδρία - Μουσείο Αβδήρ...
Monastery of Panagia Kosmosotira - S...
Johannis Hevelii Mercurius In Sol...
Johannis Hevelii Mercurius In Sol...
Johannis Hevelii Mercurius In Sol...
Ερυθρόμορφη πελίκη - Μουσείο Αβδήρ...
Ωοειδής αρύβαλλος - Μουσείο Αβδήρ...

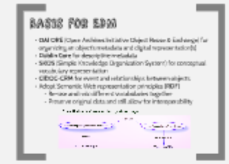
# THE EUROPEANA NETWORK



# DATA SUBMISSION TO EUROPEANA



# EDM RATIONALE



Initial model: **Europeana Semantic Elements (ESE)**

- Represents lowest common denominator for object metadata
- Forces interoperability
- Convert datasets to a “flat” data representation
- Loss of richness of the original data

**Requirements**

- Distinguish “provided objects” (painting, book, movie, etc.) from their digital representations
- Distinguish object from its metadata record
- Allow multiple records for a same object, containing potentially contradictory statements about it
- Support for objects that are composed of other objects
- Support for contextual resources, including concepts from controlled vocabularies

**Principles**

- Allow different levels of granularity
- Allow the specification of domain-specific application profiles
- Enable the re-use of existing standards

# BASIS FOR EDM

- **OAI ORE** (Open Archives Initiative Object Reuse & Exchange) for organizing an object's metadata and digital representation(s)
- **Dublin Core** for descriptive metadata
- **SKOS** (Simple Knowledge Organization System) for conceptual vocabulary representation
- **CIDOC-CRM** for event and relationships between objects
- Adopt Semantic Web representation principles (**RDF**)
  - Re-use and mix different vocabularies together
  - Preserve original data and still allow for interoperability

**"Les Misérables" was written by Victor Hugo**