LOD publication in the archival domain: methods and practices

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Abstract

In this paper we present a solution to better support the needs of cultural institutions in describing archival datasets using Linked Open Data (LOD) technologies. A few years after the first release of the Ontology for Archival Description (OAD) [1], we conducted a thorough analysis of the contexts and reasons why cultural institutions have chosen to publish archival LOD (e.g., the Archives of the Presidency of the Italian Republic, the Archives of the Chamber of Deputies and the Cultural Institutions of Emilia-Romagna Region), which revealed the need for further discussion on the state of ontological representation of archival information and its publication on the Web of Data. We intend to provide here an account of the main issues addressed in this area and an overview of new developments in the international context (e.g., Bibframe, Schema.org and RiC). This analysis contributed to formalize the new release of OAD, which is described in this paper. We conclude with a brief analysis of the benefits from the application of OAD.

1   Why Linked Open Data for cultural heritage?

Since the introduction of Linked Open Data technologies, we have witnessed a proliferation of cultural heritage projects that have embraced LOD's philosophy.

The institutions that publish LOD data acquire several benefits: usability, searchability, discoverability and interoperability of their information as well as the possibility to become an authoritative source of data that can be re-used by the community. Consequently, the application of LOD technologies to the cultural heritage is surely relevant because allows to enhance, enrich and promote the dissemination of information.

However, most of the promoters of such projects perceive the potential associated with these technologies as limited only to the benefits deriving from immediate visibility.

Unfortunately, there are still few organizations involved in a broader process of production and use of Linked Data, which are aware of the usefulness and benefits of applying these technologies in a medium-long time frame.

In particular, there are only few examples of LOD re-use in the cultural field. Among them the case of the Istituto per i beni artistici, culturali e naturali della Regione Emilia-Romagna (IBC) [2], thanks to its ten-year experience, has been an important point of reference and inspiration for different startups and companies that have developed applications based on information related to the heritage of Emilia Romagna [3].

The best examples of LOD publishing are based on a careful evaluation of the ontologies used to publish data. In fact, in the world of Linked Data ontologies have a fundamental role because they disambiguate data semantic by uniquely identifying concepts so that an attribution of arbitrary meaning is prevented, aspiring to the ultimate goal of Semantic Web, which is the dissemination and the creation of new knowledge.

To this aim it is fundamental to re-use, where possible, existing ontologies as recommended by the Best Practices issued by the W3C for the publication of data on the Web [4].

However, there are no widespread, stable ontologies for the archival domain, neither are there ontologies created for specific projects and environments, that can be easily adapted in order to be used in a broader context.

Therefore, the new release of OAD responds to the demand expressed by cultural institutions that needed a model to describe their archival assets.

2   Data models for the cultural heritage

A list of the data models available for describing cultural heritage is presented below, focusing on ontologies and vocabularies dedicated to the representation of archival heritage. The following is a non-exhaustive list of national and

international projects: we have selected the data models that we consider the most relevant on the basis of their use, their diffusion and their possible future developments.

2.1   CIDOC CRM

CIDOC CRM [5] is considered the most extensible domain ontology describing the cultural heritage. The project was developed in the late nineties by the CIDOC Documentation Standards Working Group (DSWG) [6] in order to encourage public institutions to improve information sharing and control exchange of cultural heritage information. It was published as an ISO standard in 2006 and updated in 2014 [7].

2.2   Europeana Data Model (EDM)

The Europeana Data Model (EDM) [8] is the data model developed in the Europeana project. EDM is an upper level ontology: it provides a schema that allows interoperability and communication between models and ontologies used to describe the datasets involved in the Europeana project, by re-using existing ontologies [9] such as ORE. In particular, Ore:Aggregation is the class used to represent a fonds, described as «[a] set of related resources (Aggregated Resources), grouped together such that the set can be treated as a single resource. This is the entity described within the ORE interoperability framework by a Resource Map» [10].

2.3   SAN

The SAN Ontology [11] is the ontology developed by the Sistema archivistico nazionale (SAN) [12], published in 2014 by the Istituto centrale per gli archivi (ICAR). The aim of the ontology is to integrate data about records, finding aids, creators of archival records, and instititutions with archival holdings.

The SAN Ontology respects the terminology used in the archival domain and defines the names of classes and properties in accordance with the exchange XML Schemas CAT SAN [13].

2.4   Schema.org for Archives

Schema.org for Archives is an extension proposal of Schema.org [14], a well-known vocabulary for describing and representing cultural heritage's data. Its use is constantly growing thanks to the visibility and discoverability features of data on the Web.

Schema.org for Archives is a proposal for «enhancements to Schema.org to enable the description of Archives and their collections/contents» [15] and it is designed specifically to promote data interoperability.

Currently the model is a pending proposal of the latest Schema.org version (3.5).

2.5   RiC-O

In late 2012 «ICA charged EGAD [16] with developing a standard for the description of records based on archival principles» [17]; in 2016 the new "Records in Contexts. A Conceptual Model for Archival Description (RiC-CM)" [18] was presented in draft version. RiC-CM is a data model that aims to reconcile in a single scheme the four ICA standards (ISAD(G) [19], ISAAR [20], ISDF [21] and ISDIAH [22]) using new technologies but unfortunately it is lacking in transparency and inclusiveness [23].

In 2016, it was announced the formalization of an ontology based on this model named RiC Ontology (RiC-O). A draft version has been elaborated but is not yet publicly accessible; it is possible to consult the OWL file sending a written request and accepting the prohibition to share any material received, thus limiting the comparison with other possible users of the resource.

At the moment RIC does not appear to be an evaluable and applicable solution.

3   Ontology for Archival Description: the new release

The Ontology for Archival Description (OAD) has been developed in 2012 within the ReLOAD Project [24]. ReLOAD started in 2011 with the aim of testing the application of Semantic Web technologies to archival data using, in addition to OAD, the EAC-CPF [25] and OCSA [26] ontologies, in order to formalize a shared model for the archival description, allowing the integration of the individual descriptive units with external datasets.

In the first release of OAD, classes and properties closely reflected the structure of ISAD description areas, while in other cases properties based on the EAD schema were formalized to compensate for the elements absent in ISAD [27].

However, the model was ineffective in identifying and separating the archival resource intended as the object of the description and its descriptive instance, consequently an updating has become necessary.

The reference model in the library domain is the multi-level model FRBR [28], which has been fomalized as the Bibframe ontology [29] that organizes the bibliographic information into three core levels of abstraction (Work, Instance, Item). Similarly, we have separated the object of the description (a physical object) from its archival description in order to represent an archival resource where more descriptions and finding aids may be connected. By acting in this way, it is possible have a complex representation of the object where the different, related descriptions provide meaning to the object. The result of this operation has been the definition of the classes oad:ArchivalResource and oad:Instance (fig. 1).
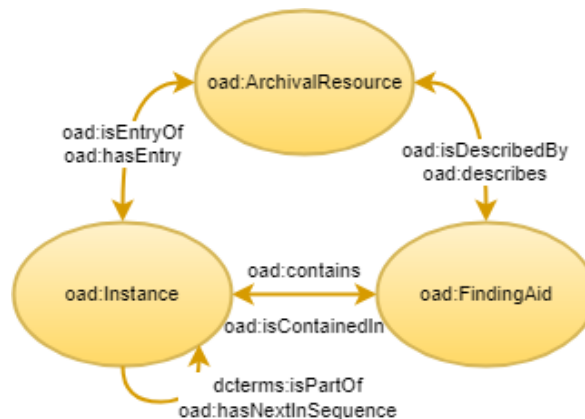
Fig. 1 – The relationship among the oad:ArchivalResource, oad:Instance and oad:FindingAid.

The oad:ArchivalResource is the 'Unit of description' described by ISAD as «[a] document or set of documents in any physical form, treated as an entity, and as such, forming the basis of a single description» [30].

However, it should be recalled that the archival resource is a living organism: as said by Michetti, Pearce-Moses, Prom and Timms «[...] an archives is a "living organism which grows, takes shape, and undergoes changes" (the Dutch Manual), the creator may have changed the organization of the materials through their life to the point that it may be difficult to fix and identify the original order. Also, the original order may have been disturbed or a different order may have been super-imposed for such a long time that it may have become integral part of the archives. In such cases it is important to recognize the difference between the original order and any subsequent received order, and to convey information about how the archives took its shape along time» [31].

During its lifetime the archival object could be described by several finding aids and be subject to revisions. Therefore, it is necessary to separate the object from its description thus allowing the connection to multiple descriptions: «[i]n the digital era, many orders are possible, and there may be no single original order» [32].

The description is realized through the descriptive entry of the archival resource that corresponds to Archival description as defined by ISAD: «[t]he creation of an accurate representation of a unit of description and its component parts, if any, by capturing, analyzing, organizing and recording information that serves to identify, manage, locate and explain archival materials and the context and records systems which produced it. This term also describes the products of the process» [33].

Furthermore, in order to represent any kind of change involving the archival object, such as accruals and new acquisitions, the concept of event has been introduced, re-using the class lode:Event as domain of the object property lode:involved (fig. 2) [34].

Moreover, other classes and properties have been modified:

- the datatype property oad:extentAndMedium have been transformed in the n-ary relation pattern oad:hasExtentAndMedium;
- the class oad:ExtentAndMedium has been formalized and linked to a skos:Concept through the object property oad:hasExtentType;
- the object property oad:isContainedIn and its inverse property oad:contains have been modeled in order to link a descriptive entry to the finding aid in which it is contained;
- the functional property oad:describes and its inverse object property oad:isDescribedBy have been created in order to link an archival resource to the finding aid that describes it;
- the object property oad:isEntryOf and its inverse property oad:hasEntry have been modeled in order to link an archival resource to its descriptive entry;
- the object property oad:isProducedBy is a new property that links an archival resource to its creator;

- the object property oad:hasNextInSequence has been formalized in order to link a descriptive entry to its next in sequence.

Fig. 2 – The graphical representation of the OAD ontology.

The classes oad:custody, oad:production and oad:uod have been deprecated: the first two have been deprecated because their description had been integrated in the new EAC-CPF Ontology release [35], while oad:uod has been replaced by oad:ArchivalResource. On the basis of the same pattern of reasoning, the object property oad:has_relatedUnitOfDescription has been translated in oad:hasRelatedInstance.

The object properties oad:hasAccessPointPlace, oad:hasAccessPointFamily, oad:hasAccessPointCorporateBody and oad:hasAccessPointPerson have been deprecated and only the superproperty oad:hasAccessPoint is still in use because a more generic property allows linking a resource to many different access points, for example to a subject which was not provided in a previous version.

Also the object properties oad:has_production, oad:has_custody, oad:has_entity, oad:hasNameOfCreator and the datatype properties oad:extentAndMedium and oad:archivistsNote have been deprecated.

3.1 Case studies

The proposal illustrated above has been developed in 2018 and has been adopted in various archival projects aimed at explaining and developing the cultural heritage.

In addition to the ontology chosen as the basis of description, such projects have in common the creation of access and publication websites, semantically improved thanks to the integration of resources connected to the LOD Cloud [36]. Below we will present a summary of the main features of the projects that have adopted the new version of OAD.

Archivio storico della Camera dei Deputati

During the makeover of the website of the Chamber of Deputies' archival documentation [37], the possibility of accessing the data of the documentary heritage as LOD was added (fig. 3), which improved and integrated the datasets already published by the Chamber itself. In particular, the corporate bodies that are records creators are linked to the competent Parliamentary bodies.

Thanks to the alignments with information already published on the Open Data Portal of the Chamber of Deputies [38], in particular with the Parliamentary commissions, it is possible to retrieve information about the composition of the Commissions across the Legislature, improving and enriching data with external sources.

As it regards the archival datasets, 41311 archival resources, 20 finding aids and 93 creators of resources are exposed on the Web using the OAD ontology. Data are accessible and available by a SPARQL endpoint.

Fig. 3 – An archival resource's entry with highlighted connection to its raw data and to the Parliamentary commission (creator of the resource).

Complessi archivistici degli Istituti culturali emiliano-romagnoli

IBC shares cultural heritage data in LOD format since 2012 [39] and is one of the authors, as well as the main interlocutor, of the considerations which led to the new release of OAD [40].

In the last publication in 2018 data about archival records and the archival records' creators were exposed (fig. 4), enriching further the datasets of the cultural institutes or sites already published. Some numbers can help understanding: 3179 archival resources, 1007 creators of archival records (corporate bodies, persons and families), 415 archives' holder and 4014 finding aids. Data can be accessed by a SPARQL endpoint.

Fig. 4 – An example of an oad:ArchivalResource connected to five oad:FindingAid resources.

Archivio storico della Presidenza della Repubblica

The Portal Archivio storico della Presidenza della Repubblica [41] has been published on 2 June 2018 with the aim of preserving, enhancing and sharing the memory of the Archives of the Presidency of the Italian Republic (ASPR), as part of a broad process of innovation of communication strategies and enhancement of the archival heritage. Thousands of resources in Linked Data format as well as the ontologies used to describe the domain can be accessed from the Portal ASPR LOD (fig. 5) [42].

Fig. 5 – The access page to ASPR LOD.

The OAD ontology has been used in combination with ASPR ontologies [43] in order to describe the complexity of this specific knowledge domain (fig. 6), given the huge variety of information sources. Some numbers can help figuring the complexity of the heritage preserved: 11800 archival resources, 75 creators of archival resources, 71164 events (e.g., audiences and public commitments), 1729 official visits and travels, 6081 speeches, 25111 images about Italian history from Monarchy to Republic. Also initiatives held by historical archive are described and available in LOD format.
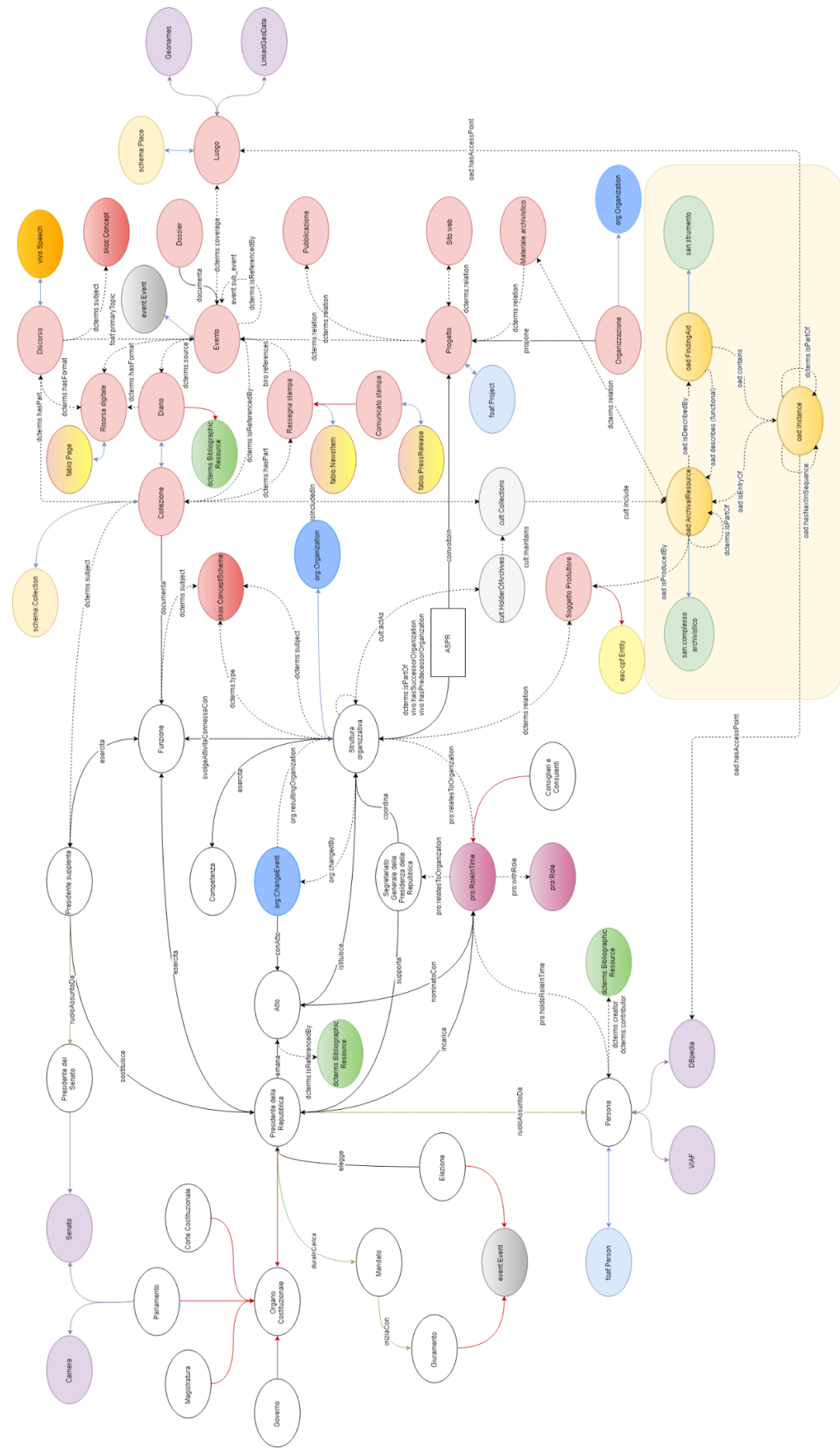
Fig. 6 – The OAD ontology inserted in ASPR domain.

Archivi della scienza

The Portal Archivi della Scienza [44] has been published on February 2019 for the purpose of providing an open tool for the enhancement of Italian scientific and technological heritage. It provides access to the archives of scientific research institutions and to scientists' personal papers.

The Portal is fed by RDF data coming from archival records, their creators and institutions with archival holdings (in accordance with the models defined in the Culturalis project [45]). It is enriched thanks to the interconnection with the SAN's LOD Portal (fig. 7) and with the data exposed by Ministry of Cultural Heritage about cultural institutes or sites, becoming the first national example of direct reuse of authoritative content. RDF data are modeled using OAD ontology and they will be available by a SPARQL endpoint in the next few months.

The Portal gives access to over 1500 archives of scientists and institutions stored in over 200 italian institutes, produced by 379 creators (persons, families and corporate bodies).

When possible, for each creators and holders of archives are provided triples alignment to VIAF and Wikidata.

Fig. 7 – An archival resource's entry with highlighted connection to others authoritative resources.

4   The benefits of the revised version of OAD

OAD meets the requirements of the cultural institutions mentioned above, which has allowed the publication of archival information on the Web of Data.

Furthermore, OAD is aligned with ISAD and is inspired by FRBR for the distinction between the object of the description and its description.

The success of a model of description depends surely on its usability: by their nature, ontologies have to describe analytically a knowledge domain in order to bring out peculiarities about it but, at the same time, models have to be flexible enough in order to be really usable. For this reason, with the latest release of OAD, the aim is to meet archival tradition's needs and tries to mediate with solutions not usable, not well-known or low specificity.

In summary, OAD presents some relevant features that support its wide adoption in the archival domain:

- it describes the archival domain accurately;
- it provides a very simple representation, which does not limit the possibilities of a granular analysis though;
- it is mapped onto ISAD;
- it provides both a high level description and a detailed description;

- it has semantic alignements with other domain ontologies;
- it is already adopted by many cultural institution in Italy;
- it establishes a distinction between the archival resource intended as the object of the description and its descriptive instance.

In conclusion, we hope that our proposal will be widely adopted and shared in order to promote the interoperability of archival resources and reach the ultimate goal of the Semantic Web, that is, the enrichment of information assets.

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Appendix

The table below lists the classes, properties and datatypes of the revised version of OAD, including the deprecated elements.

Name	Definition	Status
Classes		
oad:AdministrativeAndBiographicalHistory	The class represents the administrative and biographical history.	stable
oad:ArchivalResource	oad:ArchivalResource is the class that represents the object of the description (i.e., a single document or a set of document).	new, unstable
oad:custody	Deprecated since 2 august 2018.	deprecated
oad:EadElement	Deprecated since 2 august 2018.	deprecated
oad:ExtentAndMedium	The class represents the description about extent and medium.	new, unstable
oad:FindingAid	The class represents the finding aid.	stable
oad:Instance	The class represents the descriptive entry of an archival resource.	new, unstable
oad:LevelOfDescription	The class represents the archival description level.	stable
oad:Place	The class represents a physical place.	stable
oad:production	Deprecated since 2 august 2018.	deprecated
oad:PublicationNote	The class represents a bibliography.	stable
oad:UoD	Deprecated since 2 august 2018.	deprecated
Object properties		
oad:contains	Inverse property of oad:isContainedIn.	new, unstable
oad:describes	This functional property links a finding aid to the	new, unstable

	archival resource described.	
oad:isContainedIn	The property represents the relationship between an instance and the finding aid in which it is contained.	new, unstable
oad:isDescribedBy	Inverse property of oad:describes.	new, unstable
oad:isEntryOf	The property links an instance to an archival resource.	new, unstable
oad:isProducedBy	The property links the archival resource described to the entity responsible for the production of the resource.	new, unstable
oad:hasAccessPoint	The property represents an access point.	stable
oad:hasAccessPointCorporateBody	Deprecated since 2 august 2018.	stable
oad:hasAccessPointFamily	Deprecated since 2 august 2018.	stable
oad:hasAccessPointPerson	Deprecated since 2 august 2018.	stable
oad:hasAccessPointPlace	Deprecated since 2 august 2018.	stable
oad:hasAdministrativeAndBiographicalHistory	The property links and instance to information about administrative and biographica history.	stable
oad:hasCustody	Deprecated since 2 august 2018.	deprecated
oad:hasEntity	Deprecated since 2 august 2018.	deprecated
oad:hasEntry	Inverse property of oad:isEntryOf.	new, unstable
oad:hasExtentAndMedium	The property links an instance to information about extent and medium.	new, unstable
oad:hasExtentType	The property represents an extent type and it is related to a skos vocabulary.	new, unstable
oad:hasFilePlan	The property links an instance to a classification system.	stable
oad:hasFindingAid	Deprecated since 2 august 2018.	deprecated
oad:hasLanguageScriptsOfMaterial	The property links an instance to its language information.	stable
oad:hasLevel	The property links an archival resource to its level of description.	stable
oad:hasNameOfCreator	Deprecated since 2 august 2018.	deprecated
oad:hasNextInSequence	The property links an instance to the following sibling.	new, unstable
oad:hasPublicationNote	The property links an instance to its bibliography information.	stable
oad:hasProduction	Deprecated since 2 august 2018.	deprecated
oad:hasRelatedInstance	The property links two or more instances related.	stable
oad:hasRepository	Deprecated since 2 august 2018.	deprecated
oad:useEadElement	Deprecated since 2 august 2018.	deprecated
Datatype properties		

oad:accruals	The property represents an expected increase.	stable
oad:appraisalDestructionAndSchedulingInformation	The property represents appraisal, destruction and scheduling information.	stable
oad:archivistsNote	Deprecated since 2 august 2018	deprecated
oad:archivalHistory	The property represents information about the history of the instance.	stable
oad:conditionsGoverningAccess	The property represents condition governing access of the instance.	stable
oad:conditionsGoverningReproduction	The property represents condition governing reproduction of the instance.	stable
oad:date	The property represents a date.	stable
oad:existenceAndLocationOfCopies	The property represents the existence and location of copies.	stable
oad:existenceAndLocationOfOriginals	The property represents the existence and location of originals.	stable
oad:extentAndMedium	Deprecated since 2 august 2018	deprecated
oad:immediateSourceOfAcquisitionOrTransfer	The property represents an immediate source of acquisition or transfer.	stable
oad:note	The property represents information that cannot be accommodated in any of the other properties.	stable
oad:otherlevel	The property represents an otherlevel of description.	stable
oad:physicalCharacteristicsAndTechnicalRequirements	The property represents physical characteristics and technical requirements.	stable
oad:referenceCode	The property represents an identification code of the described resource.	stable
oad:scopeAndContent	The property represents the scope and the content of the described resource.	stable
oad:systemOfArrangement	The property represents the internal structure, the order and/or the system of classification of the described resource.	stable
oad:title	The property represents the name shown in a description.	stable