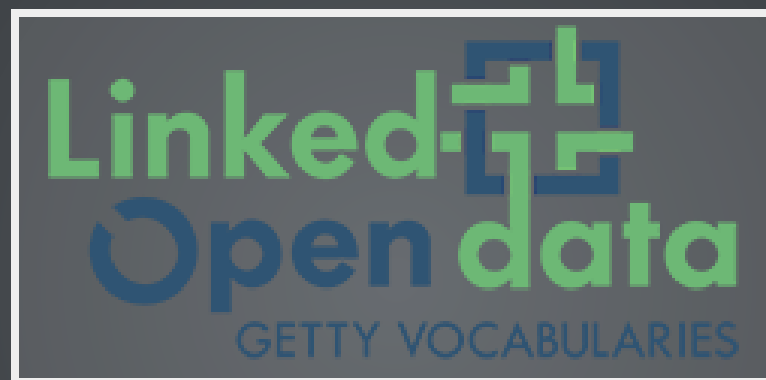


# GVP LOD: ONTOLOGIES AND SEMANTIC REPRESENTATION

Vladimir Alexiev, Data and Ontology Group, Ontotext Corp



CIDOC Congress, Dresden, Germany

2014-09-05: International Terminology Working Group

2014-09-09: Getty special session

[2D interactive version](#), [pdf](#), [slideshare](#).

Press [O](#) for overview, [H](#) for help.

Proudly made in plain text with [reveal.js](#), [org-reveal](#), [org-mode](#) and [emacs](#).

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- [Inference](#)
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# GETTY VOCABULARIES LOD

<http://vocab.getty.edu>

- Art and Architecture Thesaurus (AAT): released Feb 2014
- Thesaurus of Geographic Names (TGN): released Aug 2014

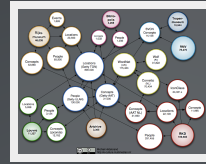
Work continues with:

- Unified List of Artist Names (ULAN)
- Cultural Object Names Authority (CONA)
- Getty Museum data
- AATA bibliography

Museum and CONA are more complex, involves LIDO/CDWA-lite XML to CIDOC CRM (RDF)

# CULTURAL HERITAGE LOD

Working at the center. (Shows thesauri only, not yet CONA/Museum data)



# ONTOTEXT SCOPE OF WORK

- Semantic/ontology development:  
<http://vocab.getty.edu/ontology>
- Contributed to [ISO 25964 ontology](#) (latest standard on thesauri). Provided implementation experience, suggestions and fixes
- Complete mapping specification
- Help implement R2RML scripts working off Getty's Oracle database, contribution to Perl implementation (RDB2RDF), R2RML extension (rrx:languageColumn)
- Work with a wide External Reviewers group (people from OCLC, Europeana, ISO 25964 working group, etc)
- GraphDB (OWLIM) semantic repository. Enterprise Edition (clustered for high-availability)
- Semantic application development (customized Forest user interface) and tech consulting
- SPARQL 1.1 compliant endpoint:  
<http://vocab.getty.edu/sparql>

# GVP LOD ARCHITECTURE

Quite straightforward



# SEMANTIC RESOLUTION & CONTENT NEGOTIATION

All GVP, AAT and TGN URLs resolve, returning human or machine readable content through content negotiation (303 redirect). Eg about the ontology:

- <http://vocab.getty.edu/ontology> : semantic URI, content-negotiated
- <http://vocab.getty.edu/ontology.html> : HTML page (application/xhtml+xml).
- <http://vocab.getty.edu/ontology.rdf> : application/rdf+xml
- <http://vocab.getty.edu/ontology.ttl> : text/turtle

Example about an AAT subject: aventurine (quartz)

# GVP VOCABULARY DATA

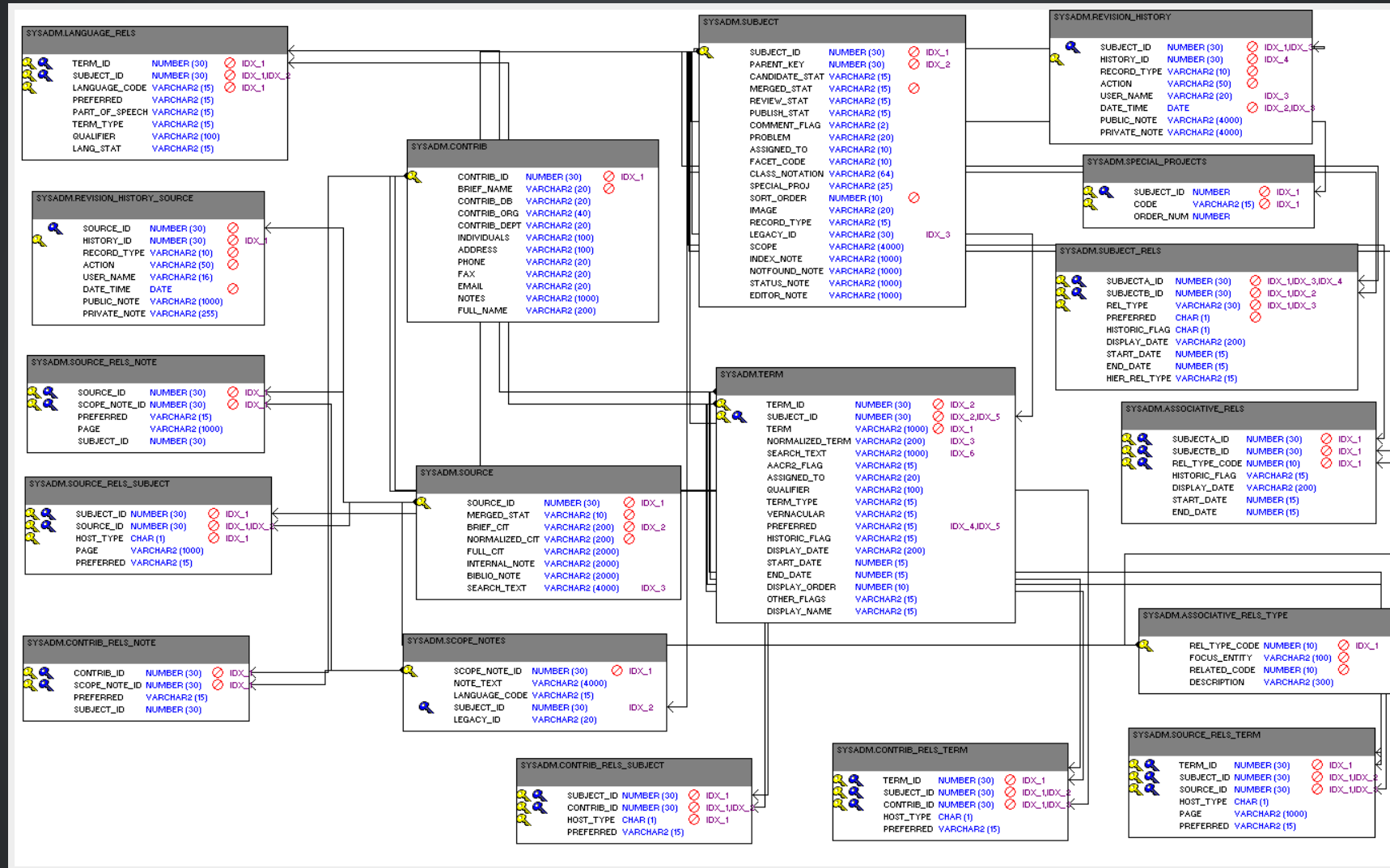
Scope includes:

- Subjects: Concepts but also non-concepts
- Terms as plain (SKOS) and rich (SKOS-XL) labels. Term characteristics
- Hierarchical relations: custom & standard, distinguish BTG,BTP,BTI
- Associative Relations
- Historic info on rels (rdf:Statement) and terms
- Obsolete subjects
- Alignment (exactMatch to LCSH)
- Sources (bibo:Document, bibo:DocumentPart with locator)
- Contributors (foaf:Agent)
- Revision history (prov:Activity)
- Thesaurus-specific data (for now: TGN place types, coordinates)

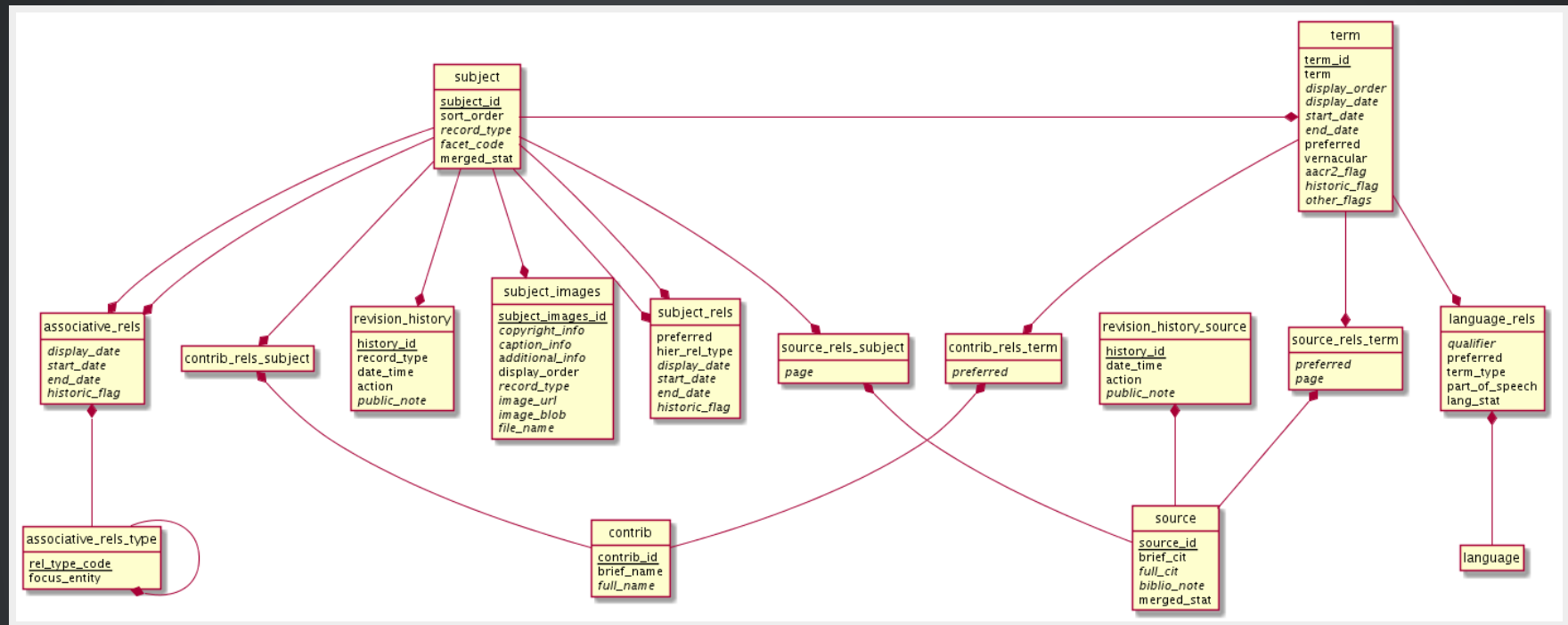
Richer than any other SKOS thesaurus I've seen



# AAT RELATIONAL SCHEMA



# AAT CONCEPTUAL DIAGRAM



# EXTERNAL ONTOLOGIES

Prefix	Ontology	Used for
bibo:	Bibliography Ontology	Sources
dc:	Dublin Core Elements	common
dct:	Dublin Core Terms	common
foaf:	Friend of a Friend ontology	Contributors
iso:	ISO 25946 (latest standard on thesauri)	iso:ThesaurusArray, BTG/BTP/BTI
owl:	Web Ontology Language	Basic RDF representation
prov:	Provenance Ontology	Revision history
rdf:	Resource Description Framework	Basic RDF representation
rdfs:	RDF Schema	Basic RDF representation
schema:	Schema.org	common, geo (TGN)
skos:	Simple Knowledge Organization System	Basis vocabulary representation
skosxl:	SKOS Extension for Labels	Rich labels

# AUXILIARY ONTOLOGIES

Prefix	Ontology	Used for
luc:	OWLIM's built-in Lucene	Full Text index & queries
ontogeo:	OWLIM geo-spatial extensions	Geo-spatial index & queries
ptop:	Ontotext PROTON top-level ontology	Inferencing (Extended Property Constructs)
rr:	Relational to RDF Mapping Language	Conversion Oracle->RDF
rrx:	R2RML extension	rrx:languageColumn

# DESCRIPTIVE INFO ONTOLOGIES

Prefix	Ontology	Used for
adms:	Asset Description Metadata Schema	Dataset description
cc:	Creative Commons Rights Expression Language	License rights
dcat:	Data Catalog Vocabulary	Dataset description
dctype:	DCMI Type Vocabulary	Dataset class
fmt:	RDF formats used in datasets	Formats of data dumps
sd:	SPARQL Service Description	SPARQL endpoint capabilities (future)
vaem:	Vocabulary for Attaching Essential Metadata	Not used yet
vann:	Vocabulary for annotating vocabulary descriptions	Namespace and prefix
vcard:	vCard (contact info)	Contact info
vdpp:	Vocabulary for Dataset Publication Projects	Not used yet

# GVP SEMANTIC REPRESENTATION



# GVP SEMANTIC REPRESENTATION (2)

# GVP ONTOLOGY

<http://vocab.getty.edu/ontology>, LOV Entry (10 classes, 177 props)

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### ◆ Ontologies (1):

[Getty Vocabulary Program ontology](#)

### ● Classes (10):

[AdminPlaceConcept](#) , [Concept](#) , [Facet](#) , [GuideTerm](#) , [Hierarchy](#) , [ObsoleteSubject](#) , [PhysAdminPlaceConcept](#) , [PhysPlaceConcept](#) , [Scope Note](#) , [Subject](#)

### ■ Properties (177):

[aat2000\\_related\\_to](#) , [aat2001\\_formerly\\_referred\\_to](#) , [aat2100\\_distinguished\\_from](#) , [aat2110\\_meaning-usage\\_overlaps\\_with](#) , [aat2203\\_associated\\_with](#) , [aat2205\\_causes-is\\_required](#) , [aat2206\\_caused\\_by-requires](#) , [aat2208\\_locus-setting\\_for](#) , [aat2209\\_used-located\\_in](#) , [aat2211\\_produce](#) , [aat2212\\_produced\\_by](#) , [aat2215\\_required\\_for](#) , [aat2216\\_require](#) , [aat2218\\_used-function\\_as](#) , [aat2219\\_have\\_form](#) , [aat2222\\_act\\_upon](#) , [aat2223\\_are\\_acted\\_upon](#) , [aat2281\\_have\\_counterpart](#) , [aat2285\\_practiced-studied\\_by](#) , [aat2286\\_practice-study](#) , [aat2291\\_locus-setting\\_for](#) , [aat2292\\_work-live\\_in](#) , [aat2294\\_locus-setting\\_for](#) , [aat2295\\_located\\_in](#) , [aat2311\\_performed\\_by](#) , [aat2312\\_perform](#) , [aat2315\\_used\\_by](#) , [aat2316\\_use](#) , [aat2318\\_involved\\_in](#) , [aat2319\\_involves](#) , [aat2321\\_used\\_by](#) , [aat2322\\_use](#) , [aat2325\\_created\\_by](#) , [aat2326\\_create](#) , [aat2328\\_involved\\_with](#) , [aat2329\\_involves](#) , [aat2332\\_affiliated\\_with](#) , [aat2333\\_have\\_affiliates](#) , [aat2335\\_associated\\_with](#) , [aat2336\\_has\\_associates](#) , [aat2397\\_focus\\_of](#) , [aat2398\\_focuses\\_on](#) , [aat2408\\_locus-setting\\_for](#) , [aat2409\\_takes\\_place\\_in](#) , [aat2411\\_involved\\_in](#) , [aat2412\\_involves](#) , [aat2415\\_required\\_for](#) , [aat2416\\_requires](#) , [aat2418\\_uses](#) , [aat2419\\_used\\_for](#) , [aat2421\\_locus-setting\\_for](#) , [aat2422\\_takes\\_place\\_in](#) , [aat2424\\_produced\\_by](#) , [aat2425\\_produces](#) , [aat2427\\_produced\\_by](#) , [aat2428\\_produces](#) , [aat2431\\_required\\_for](#) , [aat2432\\_requires](#) , [aat2434\\_contextualized\\_in](#) , [aat2435\\_context\\_for](#) , [aat2501\\_made-of-require](#) , [aat2502\\_material\\_for](#) , [aat2504\\_used-located\\_in](#) , [aat2505\\_locus-setting\\_for](#) , [aat2507\\_produce-process](#) , [aat2508\\_produced-processed\\_by](#) , [aat2551\\_reflect-produced\\_by](#) , [aat2552\\_reflected\\_in-produces](#) , [aat2554\\_reflects](#) , [aat2555\\_reflected\\_in](#) , [aat2557\\_reflects](#) , [aat2558\\_reflected\\_in](#) , [aat2562\\_locus-setting\\_for](#) , [aat2563\\_located\\_in](#) , [aat2601\\_posessed-by-existing\\_in](#) , [aat2602\\_possess-exist\\_in](#) , [aat2604\\_posessed-by-existing\\_in](#) , [aat2605\\_possess-exist\\_in](#) , [aat2607\\_caused-by-requires](#) , [aat2608\\_causes-required\\_for](#) , [aat2612\\_posessed-by-existing\\_in](#) , [aat2613\\_possess-exist\\_in](#) , [aat2801\\_conjuncted\\_with](#) , [aat2802\\_exemplified\\_by](#) , [aat2803\\_example\\_of](#) , [aat2805\\_contextualized\\_in](#) , [aat2806\\_provide\\_context](#) , [aat2807\\_derived\\_from\\_common\\_source](#) , [aat2809\\_coexisted\\_with](#) , [aat2811\\_preceded](#) , [aat2812\\_followed](#) , [aat2814\\_constituent\\_of](#) , [aat2815\\_composed\\_of](#) , [aat2817\\_derived-made\\_from](#) , [aat2818\\_source\\_for](#) , [aat2821\\_based\\_on](#) , [aat2822\\_basis\\_of](#) , [aat2824\\_has\\_parallel\\_with](#) , [aat2826\\_used\\_with](#) , [aat2828\\_use-require](#) , [aat2829\\_used-required\\_for](#) , [aat2831\\_associated\\_with](#) , [aat2833\\_ancestor\\_of](#) , [aat2834\\_descendant\\_of](#) , [aat2836\\_derived-made\\_from](#) , [aat2837\\_source\\_for](#) , [aat2841\\_derived-made\\_from](#) , [aat2842\\_source\\_for](#) , [aat2845\\_used-located\\_in](#) , [aat2846\\_locus-setting\\_for](#) , [aat2848\\_involved\\_in](#) , [aat2849\\_involves](#) , [aat2852\\_involved\\_with](#) , [aat2853\\_involve](#) , [aat2875\\_characteristic\\_of](#) , [aat2876\\_characterized\\_by](#) , [aat2878\\_preceded-source\\_for](#) , [aat2879\\_followed-developed\\_from](#) , [aat2881\\_reflected\\_in](#) , [aat2882\\_reflect](#) , [aat2884\\_involved\\_with](#) , [aat2885\\_involves](#) , [aat2891\\_exemplified\\_by](#) , [aat2892\\_example\\_of](#) , [aat2894\\_exemplified\\_by](#) , [aat2895\\_example\\_of](#) , [aat2900\\_miscellaneous\\_relationship](#) , [broader](#) , [broaderExtended](#) , [broaderGeneric](#) , [broaderGenericExtended](#) , [broaderInstantial](#) , [broaderInstantialExtended](#) , [broaderNonPreferred](#) , [broaderPartitive](#) , [broaderPartitiveExtended](#) , [broaderPreferred](#) , [broaderPreferredExtended](#) , [contributorAlternatePreferred](#) , [contributorNonPreferred](#) , [contributorPreferred](#) , [displayOrder](#) , [historicFlag](#) , [narrower](#) , [narrowerExtended](#) , [parentString](#) , [parentStringAbbrev](#) , [placeTypeNonPreferred](#) , [placeTypePreferred](#) , [prefLabelGVP](#) , [prefLabelLoC](#) , [qualifier](#) , [sourceAlternatePreferred](#) , [sourceNonPreferred](#) , [sourcePreferred](#) , [term](#) , [termDisplay](#) , [termFlag](#) , [termKind](#) , [termPOS](#) , [termType](#) , [tgn3000\\_related\\_to](#) , [tgn3001\\_distinguished\\_from](#) , [tgn3005\\_possibly\\_identified\\_as](#) , [tgn3101\\_adjacent\\_to](#) , [tgn3102\\_coextensive\\_with](#) , [tgn3110\\_meaning-usage\\_overlaps\\_with](#) , [tgn3201\\_capital\\_of](#) , [tgn3202\\_capital\\_is](#) , [tgn3301\\_ally\\_of](#) , [tgn3317\\_member\\_of](#) , [tgn3318\\_member\\_is](#) , [tgn3401\\_moved\\_from](#) , [tgn3402\\_moved\\_to](#) , [tgn3411\\_successor\\_of](#) , [tgn3412\\_predecessor\\_of](#) , [tgn3510\\_historical\\_connection](#)

### ◆ Individuals (44):

[Abbreviation](#) , [Adjectival](#) , [Alternate Descriptor](#) , [Art and Architecture Thesaurus](#) , [Both](#) , [Both Singular and Plural](#) , [Chemical Name](#) , [Common term](#) , [Current](#) , [Descriptor](#) , [FIPS Code](#) , [Full term](#) , [Getty Research Institute](#) , [Historic](#) , [Historic Flag concept scheme](#) , [ISO alpha-2 code](#) , [ISO alpha-3 code](#) , [ISO numeric-2 code](#) , [ISO numeric-3 code](#) , [Jargon or Slang](#) , [Loan Term](#) , [Neologism](#) , [Noun](#) , [Official Name](#) , [Ontotext Corp](#) , [Part of Speech concept scheme](#) , [Past Participle](#) , [Plural Noun](#) , [Provisional Name](#) , [Pseudonym](#) , [Scientific or Technical term](#) , [Singular Noun](#) , [Site Name](#) , [Term Display concept scheme](#) , [Term Flag concept scheme](#) , [Term Kind concept scheme](#) , [Term Type concept scheme](#) , [Thesaurus of Geographic Names](#) , [US Postal Service Code](#) , [Use for Display](#) , [Use in Indexes/lists](#) , [Used for Term](#) , [Verbal Noun/Gerund](#) , [Vernacular](#)

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# GVP ONTOLOGY: A CLASS

## Subject (OWL Class)

[Definition](#)[In use](#)

Node in a GVP vocabulary hierarchy.

May be Facet, GuideTerm, Hierarchy, Concept, AdminPlaceConcept, PhysPlaceConcept, PhysAdminPlaceConcept, or ObsoleteSubject.

Implemented as skos:Concept or iso:ThesaurusArray and skos:Collection

### Definition

The **URI** of this class is <http://vocab.getty.edu/ontology#Subject>

This class is a super class of [AdminPlaceConcept](#) [Concept](#) [Facet](#) [GuideTerm](#) [Hierarchy](#) [ObsoleteSubject](#) [PhysAdminPlaceConcept](#) [PhysPlaceConcept](#)

### In use

This class is defined by [Getty Vocabulary Program ontology](#)

This class is used in [broader](#) [broaderExtended](#) [broaderGeneric](#) [broaderGenericExtended](#) [broaderInstantial](#) [broaderInstantialExtended](#) [broaderNonPreferred](#) [broaderPartitive](#) [broaderPartitiveExtended](#) [broaderPreferred](#) [broaderPreferredExtended](#) [narrower](#) [narrowerExtended](#) [parentString](#) [parentStringAbbrev](#) [placeTypeNonPreferred](#) [placeTypePreferred](#) [prefLabelGVP](#) [prefLabelLoC](#)

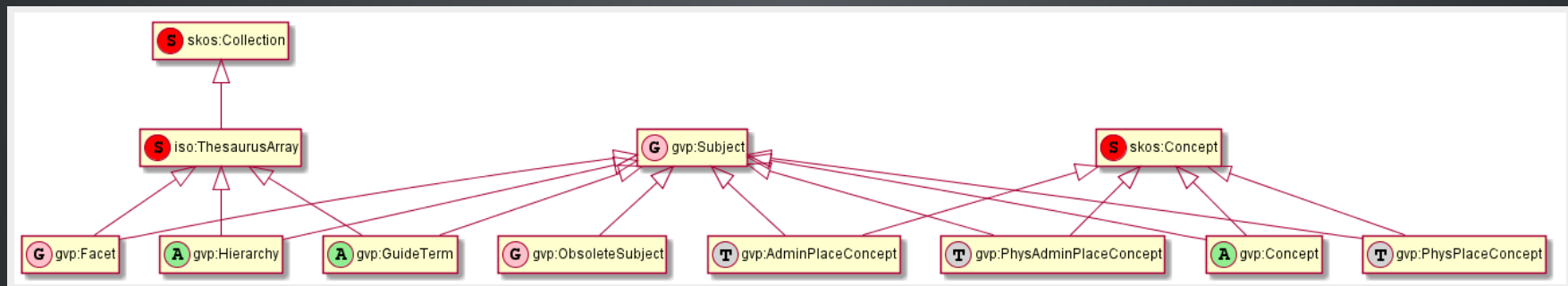
# GVP SUBJECT CLASSES

- GVP Subjects include both Concepts and non-concepts (for organizing the hierarchy, not for indexing)

We handle "impedance mismatch" with

- SKOS: restrict skos:related, infer skos:broader
- ISO: infer iso:broaderGeneric/Partitive/Instantial

S=Standard, G=GVP common, A=AAT, T=TGN



# OBSOLETE SUBJECTS

- AAT obsolete subjects are 4.4% of valid subjects, which shows a good rate of editorial actions
- Obsolete subjects may have been used in client data. In order not to leave such data hanging, we publish minimal information:

```
aat:300123456 a gvp:ObsoleteSubject; # Was made non-publishable
  skos:prefLabel "Made up subject";
  skos:inScheme aat: ;
  schema:endDate "2012-12-31T12:34:56"^^xsd:dateTime.
```

```
aat:300386746 a gvp:ObsoleteSubject; # Was merged to a dominant Subject
  skos:prefLabel "Buncheong";
  skos:inScheme aat: ;
  dct:isReplacedBy aat:300018699; # Punch'ong
  schema:endDate "2012-12-31T12:34:56"^^xsd:dateTime.
```



# HIERARCHICAL RELATIONS

Use iso:ThesaurusArray to allow Guide Terms below Concepts.  
Infer cross-threading SKOS/ISO broader relations



# KEY VALUES (FLAGS) ARE IMPORTANT

Excel-driven Ontology Generation™ (getty-codes.xls to getty-codes.ttl)

Key val can be mapped to Custom sub-class, Custom (sub-)prop, **Ontology Value** (eg <term/kind/Abbreviation>)

voca	table	field	val	ObjectProperty	Class	label	domain	range	subProperty	subClassOf	ConceptSchem
	subject	record_type	F		gvp:Facet	Facet				gvp:Subject, iso:ThesaurusArray	
AAT	subject	record_type	H		gvp:Hierarchy	Hierarchy Name				gvp:Subject, iso:ThesaurusArray	
AAT	subject	record_type	G		gvp:GuideTerm	Guide Term				gvp:Subject, iso:ThesaurusArray	
AAT	subject	record_type	C		gvp:Concept	Concept				gvp:Subject, skos:Concept	
	subject	record_type	-		gvp:ObsoleteSubject	Obsolete Subject				gvp:Subject	
TGN	subject	record_type	P		gvp:PhysPlaceConcept	Physical Place Concept				gvp:Subject, skos:Concept	
TGN	subject	record_type	A		gvp:AdminPlaceConcept	Administrative Place Concept				gvp:Subject, skos:Concept	
TGN	subject	record_type	B		gvp:PhysAdminPlaceConcept	Physical and Administrative Place Concept				gvp:Subject, skos:Concept	
	subject_rels	preferred	P	gvp:broaderPreferred		Preferred Parent	gvp:Subject	gvp:Subject	gvp:broader		
	subject_rels	preferred	N	gvp:broaderNonPreferred		Non-Preferred Parent	gvp:Subject	gvp:Subject	gvp:broader		
	subject_rels	hier_rel_type	G	gvp:broaderGeneric		Parent (Generic)	gvp:Subject	gvp:Subject	gvp:broader		
	subject_rels	hier_rel_type	P	gvp:broaderPartitive		Parent (Partitive)	gvp:Subject	gvp:Subject	gvp:broader		
	subject_rels	hier_rel_type	I	gvp:broaderInstantial		Parent (Instantial)	gvp:Subject	gvp:Subject	gvp:broader		
	term	preferred	P	gvp:prefLabelGVP		Preferred Label for GVP	gvp:Subject	skosxl:Label			
	term	aacr2_flag	Y	gvp:prefLabelLoC		Preferred Label for LoC	gvp:Subject	skosxl:Label			
	term	vernacular	V	gvp:termFlag		Term Flag	skosxl:Label	skos:Concept			term/flag/
	term	other_flags	A	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/
AAT	term	other_flags	C	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/
AAT	term	other_flags	CN	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/
AAT	term	other_flags	F	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/
AAT	term	other_flags	J	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/
AAT	term	other_flags	N	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/
AAT	term	other_flags	S	gvp:termKind		Term Kind	skosxl:Label	skos:Concept			term/kind/

```

gvp:Facet a owl:Class ;
  rdfs:isDefinedBy <http://vocab.getty.edu/ontology> ;
  rdfs:subClassOf gvp:Subject, iso:ThesaurusArray ;
  rdfs:label "Facet" ;
  rdfs:comment "One of the major divisions of a vocabulary" ;
  skos:example "Objects Facet (AAT), World (TGN)" ;
  dct:description "One of the major divisions of a vocabulary.\nExample: Objects Facet (AAT), World (TGN)".

```

# ASSOCIATIVE RELATIONS ARE VALUABLE

More Excel-driven Ontology Generation™ (assoc-rels.xls to assoc-rels.ttl)

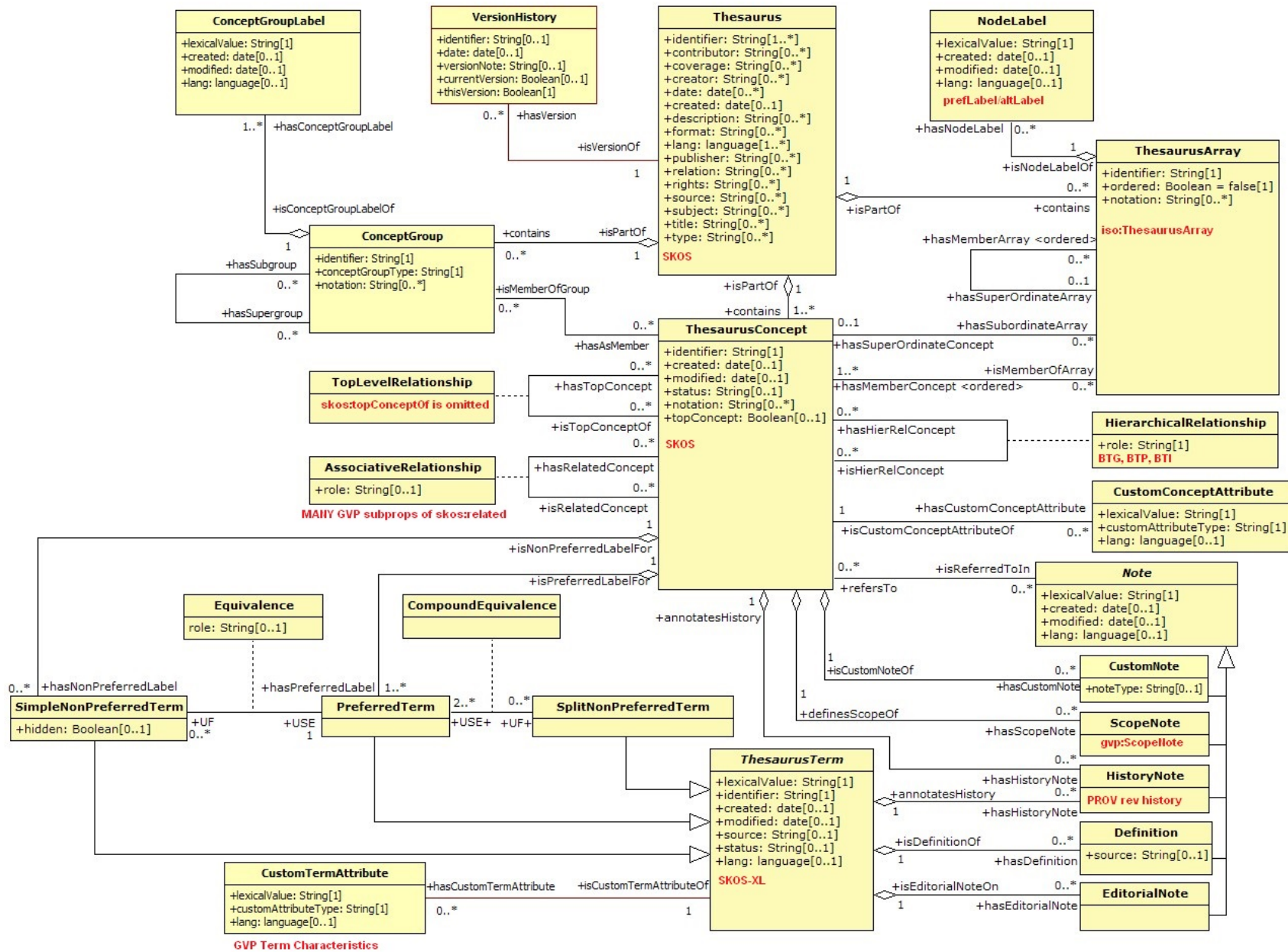
- Relations come in owl:inverseOf pairs (or owl:SymmetricProperty self-inverse)
- Should we make a subproperty hierarchy?

fcode	lcode	domain (C1)	LOD frel	range (C2)	LOD irel	Editor frel - From C1 to C2	Editor irel - From C2 to C1	fexample	lexample
2000		any	related to	any		any - related to - any	same	<i>gulf red</i> is related to <i>light red (pigment)</i>	<i>light red (pigment)</i> is related to <i>gulf red</i>
2001		any	formerly referred to	any		any - formerly referred - any	same	<i>gigues</i> formerly referred to <i>fiddles</i>	<i>fiddles</i> formerly referred to <i>gigues</i>
2100		any	distinguished from	any		any - distinguished from - any	same	<i>historic farms</i> are distinguished from <i>abandoned farms</i> ; <i>naive art</i> is distinguished from <i>outsider art</i>	<i>abandoned farms</i> are distinguished from <i>historic farms</i> ; <i>outsider art</i> is distinguished from <i>naive art</i>

```

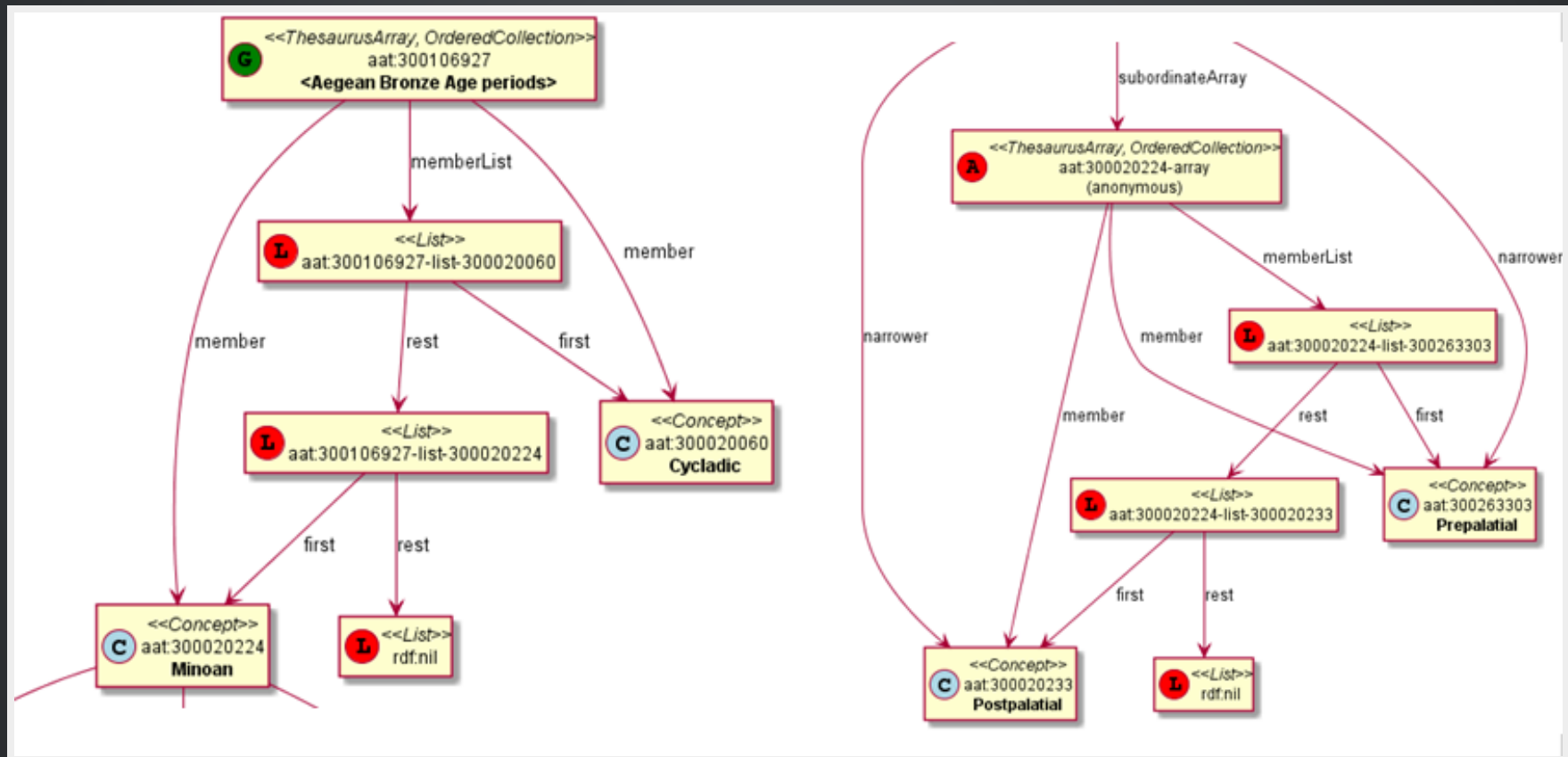
gvp:aat2000_related_to a owl:ObjectProperty;
  rdfs:subPropertyOf skos:related;
  rdfs:domain skos:Concept; rdfs:range skos:Concept;
  # domain "any"; range "any";
  dc:identifier "2000";
  skos:prefLabel "aat2000_related_to";
  dc:title "related to - any";
  skos:example "gulf red is related to light red (pigment)";
  skos:scopeNote "generic relationship, not explained" ;
  dct:description ""any - related to - any; generic relationship, not explained.
  Example: gulf red is related to light red (pigment)"" .
gvp:aat2000_related_to a owl:SymmetricProperty.
  
```

# ISO 25946: LATEST STANDARD ON THESAURI



# USE OF ISO:THESAURUSARRAY IN GVP

Use for ordered children. Novelty: if parent is Concept, use anonymous array. Careful crafting of URLs to make rdf:List





# CONTRIBUTION TO ISO 25946

- Contributed to [ISO 25946 ontology \(LOV entry\)](#)
- First industrial use of ISO 25946
- Defined appropriate combinations of BTG, BTP, BTI relations (first formally defined in ISO).

On Compositionality of ISO 25964 Hierarchical Relations (BTG, BTP, BTI), V.Alexiev, J.Lindenthal, A.Isaac. [Draft paper](#), [Presentation](#) at [NKOS 2014](#) Workshop at DL 2014, London, 12 Sep 2014

	BTGx	BTPx	BTIx
BTGx	BTGE: numerous examples	BTPE: beak irons BTG anvil components BTP <anvils and anvil accessories>	no
BTPx	BTPE: anvil components BTP <anvils and anvil accessories> BTG <forging and metal-	BTPE: Sofia BTP Bulgaria BTP Europe	no: Sofia BTP Bulgaria BTI country, but Sofia

# TERMS

## Support both SKOS (plain) and SKOS-XL (rich) labels

```
aat:300198841 a skos:Concept , gvp:Subject , gvp:Concept ;
  skos:prefLabel "rhyta"@el-latn , "rhyta"@en , "rhytons"@es , "rhytons"@fr ,
  "rytons"@nl ;
  skos:altLabel "rhyta"@es , "rhyton"@es , "rhyton"@en , "rhyton"@el-latn ...;
  skosxl:prefLabel aat_term:1000198841-en , aat_term:1000198841-el-Latn ...;
  skosxl:altLabel aat_term:1000198841-es , aat_term:1000297235-en ...
```

## Rich info in SKOS-XL:

```
aat_term:1000198841-en a skosxl:Label ;
  dc:identifier "1000198841" ;
  dct:language aat:300388277 , gvp_lang:en ; # owl:sameAs
  dct:contributor aat_contrib:10000000 , aat_contrib:10000131 , aat_contrib:10
000088 ;
  skosxl:literalForm "rhyta"@en ; ##### with Qualifier if applic
able
  gvp:term "rhyta"@en ; ##### no qualifier
  gvp:displayOrder "1"^^xsd:positiveInteger ;
  gvp:termType <http://vocab.getty.edu/aat/term/type/Descriptor> ; ##### Descr/
AltDescr/UseFor
  gvp:termPOS <http://vocab.getty.edu/aat/term/POS/PluralNoun> ; ##### Part o
f Speech
  gvp:contributorPreferred aat_contrib:10000000 , aat_contrib:10000088 ;
  gvp:contributorNonPreferred aat_contrib:10000131 ;
  gvp:sourcePreferred aat_source:2000024811 , aat_source:2000051089-term-10001
98841...;
  dct:source aat_source:2000024811 , aat_source:2000052946 , aat_source:200004
9728...;
```



# LANGUAGES

**IANA Language Subtag Registry:** 9000 registrations (broken down by Type and Scope):

- 7769 languages
- 227 extlangs, e.g. ar-az (Uzbeki Arabic)
- 116 language collections, e.g. bh (Bihari languages)
- 62 macrolanguages, e.g. zh (Chinese), cr (Cree)
- 4 special languages, e.g. und (Undetermined)
- 162 scripts, eg Latn (Latin), Japn (Japanese)
- 301 regions, e.g. US (United States), 021 (Northern America)
- 61 variants
- 67 redundant
- 26 grandfathered

# CUSTOM LANGUAGE TAGS

Despite the richness of IANA tags, we had to define new tags, using several extension mechanisms:

# SOURCES

## bibo:Document or bibo:DocumentPart

```
aat_source:2000051089 a bibo:Document;  
  dc:identifier "2000051089"  
  bibo:shortTitle "AATA database (2002-)";  
  dct:title "Getty Conservation Institute (GCI). database of AATA Online... 20  
02-. "  
aat_source:2000051089-term-1000198841 a bibo:DocumentPart;  
  dct:isPartOf aat_source:2000051089;  
  bibo:locator "128257 checked 26 January 2012".
```

## Applied to subject, term, scopeNote:

```
aat:300198841 # subject (rhyta)  
  dct:source aat_source:2000030301-subject-300198841;  
  dct:source aat_source:2000052378.  
aat_term:1000198841-en # term "rhyta"@en  
  gvp:sourceNonPreferred aat_source:2000049728;  
  dct:source aat_source:2000051089-term-1000198841.  
aat_scopeNote:34904 # scopeNote  
  dct:source aat_source:2000046502.
```

# CONTRIBUTORS

## foaf:Agent

```
aat_contrib:10000131 a foaf:Agent;  
  dc:identifier "10000131";  
  foaf:nick "CDBP-DIBAM";  
  foaf:name "Centro de Documentación de Bienes Patrimoniales...".
```

## Applied to subject, term, scopeNote:

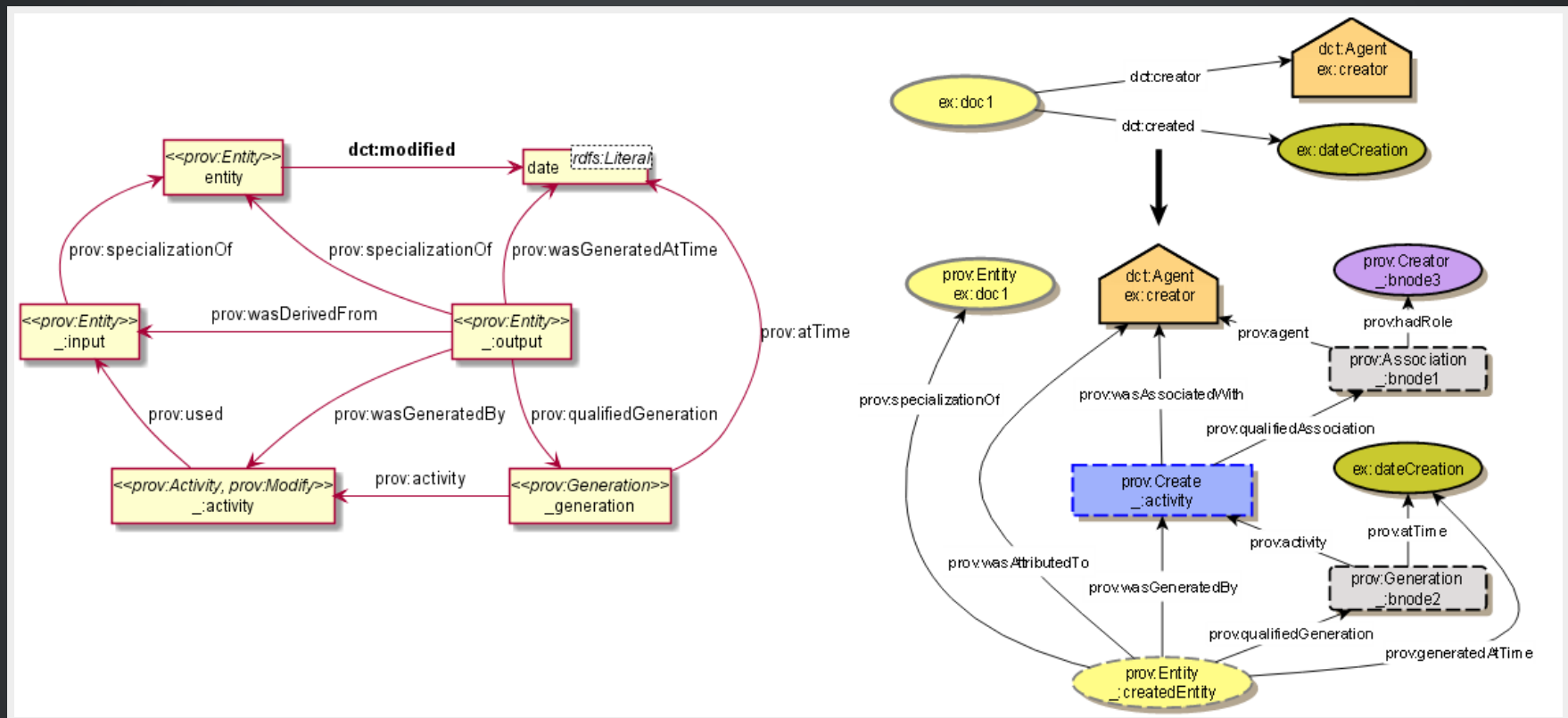
```
aat:300198841 # subject "rhyta"  
  dct:contributor aat_contrib:10000131;  
  dct:contributor aat_contrib:10000000.  
aat_term:1000198841-en # term "rhyta"@en  
  gvp:contributorNonPreferred aat_contrib:10000131;  
  gvp:contributorPreferred aat_contrib:10000000.  
aat_scopeNote:34904 # scopeNote  
  dct:contributor aat_contrib:10000000.
```

# HISTORIC INFO

Includes dates of applicability, historicFlag, comment. Applied to terms; relations, place types (using rdf:Statement)

```
aat_term:1000002693-en a skosxl:Label;  
  skosxl:literalForm "lambruscatura"@en ;  
  gvp:historicFlag <http://vocab.getty.edu/historic/historic> ;  
  schema:startDate "0900"^^xsd:gYear ;  
  schema:endDate "1700"^^xsd:gYear ;  
  rdfs:comment "Medieval term for wainscoting".  
  
aat_rel:300020271-aat2812_followed-300020269 a rdf:Statement;  
  rdf:subject      aat:300020271;          # Second Dynasty (Egyptian)  
  rdf:predicate    gvp:aat2812_followed;  
  rdf:object       aat:300020269;          # First Dynasty (Egyptian)  
  rdfs:comment     "Second Dynasty began ca. 2775 BCE";  
  schema:startDate "-2785"^^xsd:gYear;  
  schema:endDate   "-2765"^^xsd:gYear.  
  
tgn:7011179-placeType-300008347 a rdf:Statement;  
  rdf:subject      tgn:7011179;          # Siena  
  rdf:predicate    gvp:placeTypePreferred;  
  rdf:object       aat:300008347;        # inhabited place  
  rdfs:comment     "settled by Etruscans (flourished 6th century BCE)";  
  schema:startDate "-0800"^^xsd:gYear;  
  gvp:displayOrder "1"^^xsd:positiveInteger.
```

# PROVENANCE ONTOLOGY



PROV considers that `prov:Modify` uses an unknown old entity "`_input`" and generates an unknown new entity "`_output`", both being specializations of the entity under consideration. Need to use `prov:Generation` so we can use `prov:atTime` and reflect that the modification is a `prov:InstantaneousEvent`.



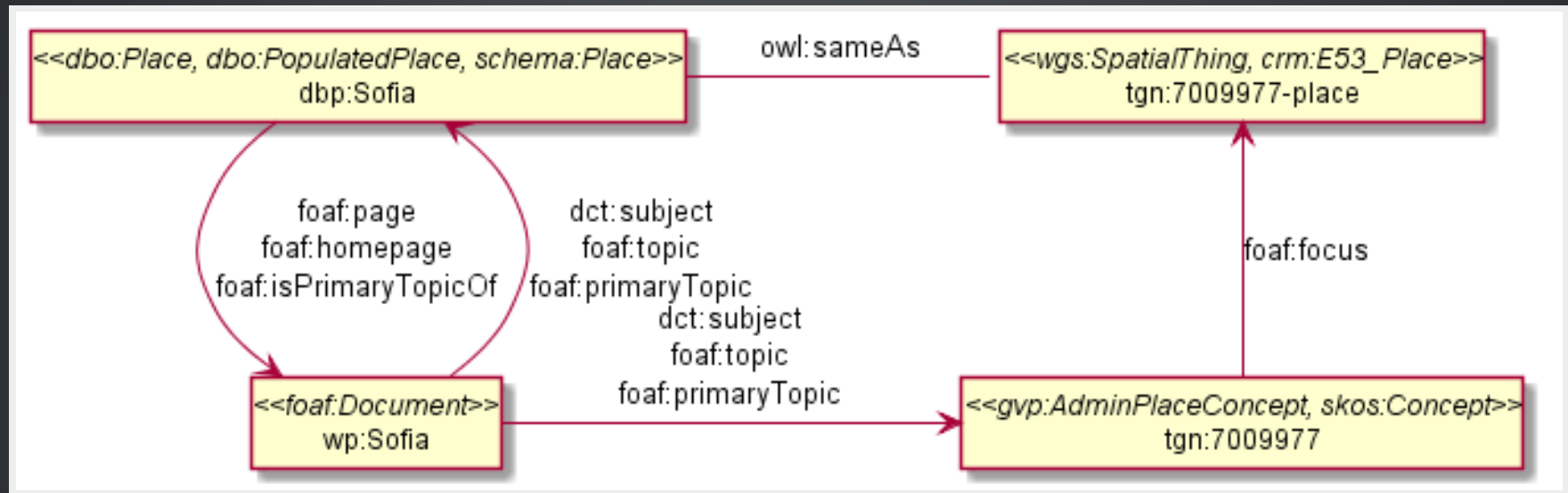
# REVISION HISTORY

PROV is too complex, so we simplify:

```
aat:300018699
  skos:changeNote aat_rev:12345, aat_rev:12346, aat_rev:12347;
  prov:wasGeneratedBy aat_rev:12345;
  dct:created "2014-01-02T01:02:03"^^xsd:dateTime;
  dct:modified "2014-01-03T01:02:03"^^xsd:dateTime;
  dct:issued "2014-01-04T01:02:03"^^xsd:dateTime.
aat_rev:12345 a prov:Activity, prov:Create;
  dc:type "created";
  prov:startedAtTime "2014-01-02T01:02:03"^^xsd:dateTime.
aat_rev:12346 a prov:Activity, prov:Modify;
  prov:used aat:300018699;
  dc:type "term added";
  dc:description "leggings, puttee (1000248060)";
  prov:startedAtTime "2014-01-03T01:02:03"^^xsd:dateTime.
aat_rev:12347 a prov:Activity, prov:Publish;
  prov:used aat:300018699;
  dc:type "issued";
  prov:startedAtTime "2014-01-04T01:02:03"^^xsd:dateTime.
```

# TGN SPECIFICS: CONCEPT-PLACE DUALITY

Duality between Concept and its denotation (ala VIAF, UK BL, FR BnF, SE KB...)

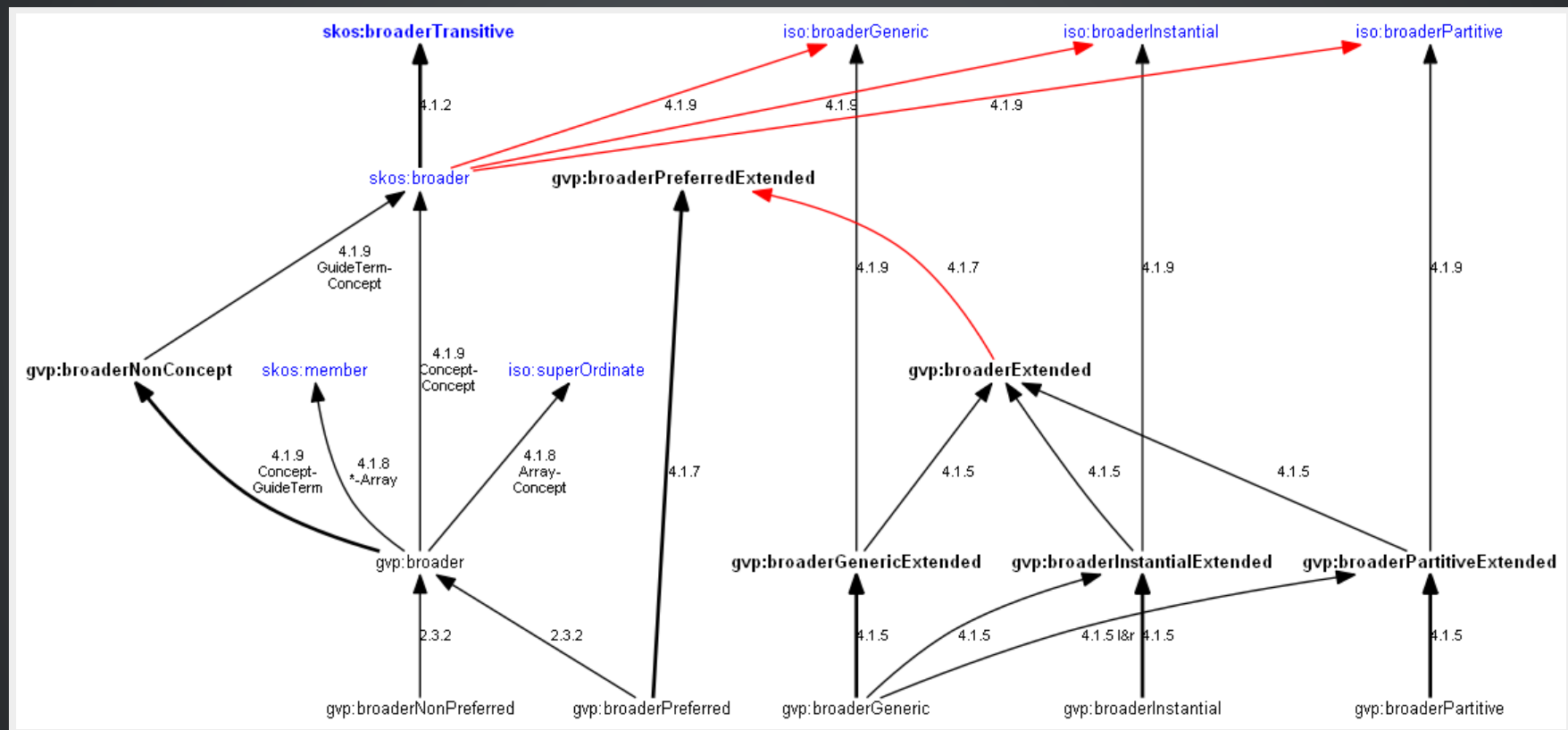


# TGN SEMANTIC REPRESENTATION

Adds place types (TGN->AAT), Concept-Place duality, coordinates

# INFERENCE

Hierarchical Relations (GVP->Standard) inference:  
blue=standard, black=GVP, bold=closure, red=restriction



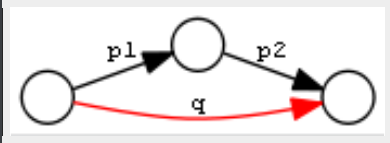
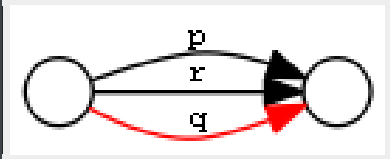
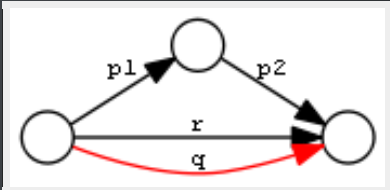
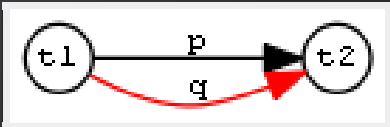
# EXTENDED PROPERTY CONSTRUCTS

- TGN is much bigger: AAT: 10M, TGN: 94M (explicit statements)
- We infer 60M statements (1.58x expansion ratio)
- To do this quickly (on biweekly refresh), we decided to use OWLIM Rules
- While OWL2 has very powerful class constructs, its property constructs are quite weak
- **Extending OWL2 Property Constructs**: several extensions that we found useful

$p_N$  = premises,  $r$  = restriction (just another premise),  $t_N$  = types,  
 $q$  = conclusion



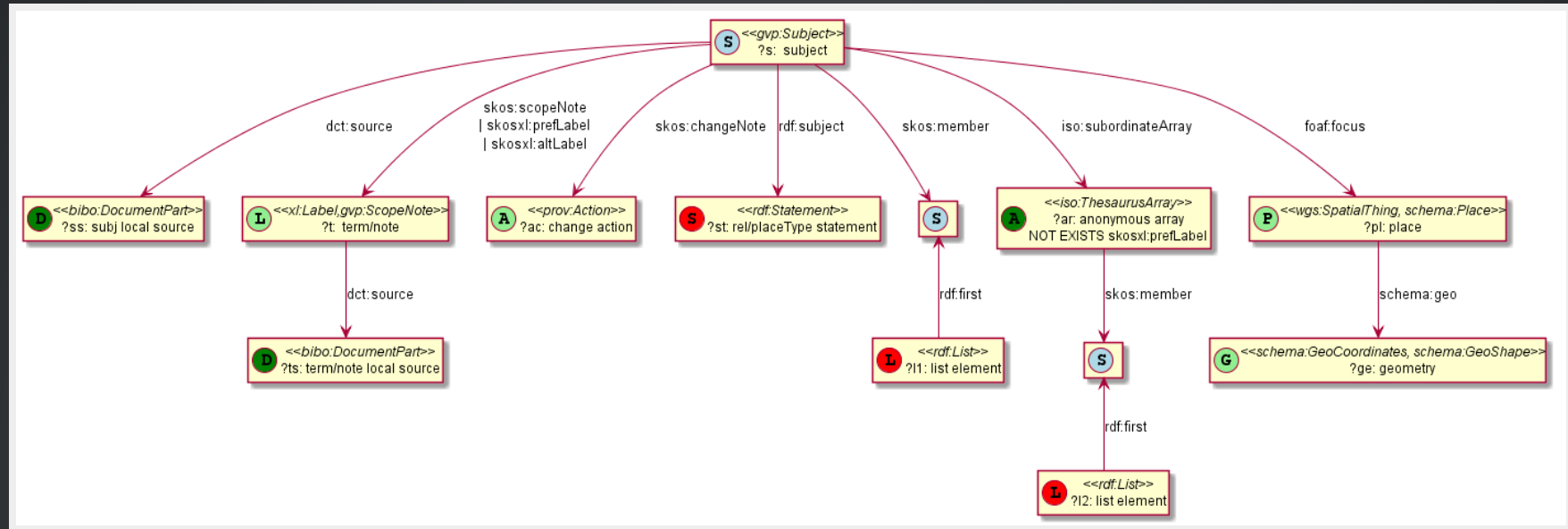
# EXTENDED PROPERTY CONSTRUCTS (2)

name	prop path	construct	illustration
PropChain	$q \leq p1 / p2$	Chain of fixed length 2	
PropRestr	$q \leq p \ \& \ r$	Conjunction (restriction by property)	
PropChainRestr	$q \leq (p1 / p2) \ \& \ r$	Chain and restriction by property	
TypeRestr	$q \leq [t1] p [t2]$	Restriction by two typechecks	

# REDUCED SKOS INFERENCE

Eliminate redundant props (World has 1.2M narrowerTransitive, 2.4M semanticRelation). Break inference at red ovals

# CONSTRUCT QUERY: GET & CACHE ALL DATA FOR SUBJECT



# DOCUMENTATION

## Getty Vocabularies: Linked Open Data

Very detailed: 100 pages! Linkable anchors:

 [vocab.getty.edu/doc/#Full\\_Text\\_Search](http://vocab.getty.edu/doc/#Full_Text_Search)

### Semantic Representation

Version: 2.0  
Last updated: 19 Aug 2014  
HTML version: <http://vocab.getty.edu/doc/> (for link  
PDF version: <http://vocab.getty.edu/doc/gvp-lod.pdf>  
Formerly at: <http://www.getty.edu/research/tools>  
Initial version: Vladimir Alexiev, Joan Cobb, Greg  
Updates: Vladimir Alexiev, Joan Cobb

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<a href="#">1.2.1.5 Version 2.0</a>	<a href="#">1.8.4 BIBO</a>	<a href="#">2.7.5 Language Dual URLs</a>
<a href="#">1.2.1.6 Future Versions</a>	<a href="#">1.8.5 FOAF</a>	<a href="#">2.8 Term</a>
<a href="#">1.2.2 External Review Process</a>	<a href="#">1.8.6 PROV</a>	<a href="#">2.8.1 Term Characteristics</a>
<a href="#">1.2.3 Providing Feedback</a>	<a href="#">1.8.6.1 dct:modified</a>	<a href="#">2.8.2 Importance of the Vernacular Flag</a>
<a href="#">1.2.4 Disclaimer</a>	<a href="#">1.8.6.2 dct:creator+dct:created</a>	<a href="#">2.9 Scope Note</a>
<a href="#">1.3 Abbreviations</a>	<a href="#">1.8.7 Geographic Ontologies</a>	<a href="#">2.10 Identifiers</a>
<a href="#">1.4 RDF Turtle</a>	<a href="#">1.8.7.1 W3C WGS Geo Ontology</a>	<a href="#">2.11 Notations</a>
<a href="#">1.5 Prefixes</a>	<a href="#">1.8.7.2 Schema.org Geographic Features</a>	<a href="#">2.12 Source</a>
<a href="#">1.5.1 External Prefixes</a>	<a href="#">1.9 GVP Ontology</a>	<a href="#">2.12.1 Local Sources</a>
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	<a href="#">2.2 Subject</a>	<a href="#">2.14.1 Applying to Terms</a>
	<a href="#">2.2.1 Subject Types</a>	<a href="#">2.14.2 Applying to Relations and Place Types</a>
	<a href="#">2.3 Subject Hierarchy</a>	<a href="#">2.15 Revision History</a>
	<a href="#">2.3.1 Standard Hierarchical Relations</a>	<a href="#">2.15.1 Revision History Representation</a>
	<a href="#">2.3.2 GVP Hierarchical Relations</a>	<a href="#">2.15.2 Revision History for Subject</a>
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	<a href="#">2.4 Sort Order</a>	<a href="#">3.1 TGN Overview</a>
	<a href="#">2.4.1 Sorting with Thesaurus Array</a>	<a href="#">3.2 TGN Place Types</a>
	<a href="#">2.4.1.1 skos:member Structure</a>	<a href="#">3.3 Concept vs Place Duality</a>
	<a href="#">2.4.1.2 skos:memberList Structure</a>	<a href="#">3.3.1 Cons of the Dual Approach</a>
	<a href="#">2.4.1.3 Full Representation</a>	<a href="#">3.3.2 Co-reference and Co-denotation</a>

# DOC PRODUCTION

Edit in Word. Spellcheck, link check (below). Print as PDF. Save as Compact HTML, HtmlTidy, rewrite with original images.

## Getty Vocabularies: LOD

### Semantic Representation

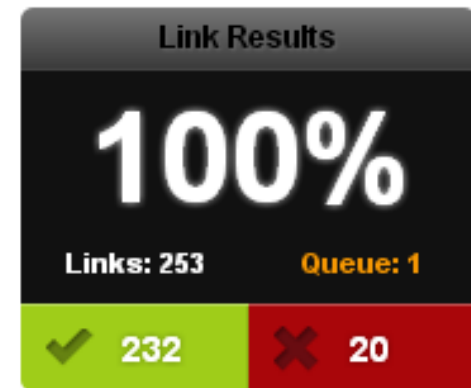
Version: 2.0

Last updated: 15 Jun 2014

HTML version: <http://vocab.getty.edu/doc/> 500 (for linking)

PDF version: <http://vocab.getty.edu/doc/gvp-lod.pdf> 500 (for printing)

Formerly at: [http://www.getty.edu/research/tools/vocabularies/lod/aat\\_semantic\\_representation.pdf](http://www.getty.edu/research/tools/vocabularies/lod/aat_semantic_representation.pdf)



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###### [1.2.2 External Review Process](#)

###### [1.2.3 Providing Feedback](#)

###### [1.2.4 Disclaimer](#)

##### [1.3 Abbreviations](#)

Benefit: printable PDF and linkable HTML




# SAMPLE QUERIES

Lots of them! The (!) says "read the documentation first". As part of helpdesk support, we're tracking usage and adding samples.

Sample queries:

[Append predefined namespaces:](#)

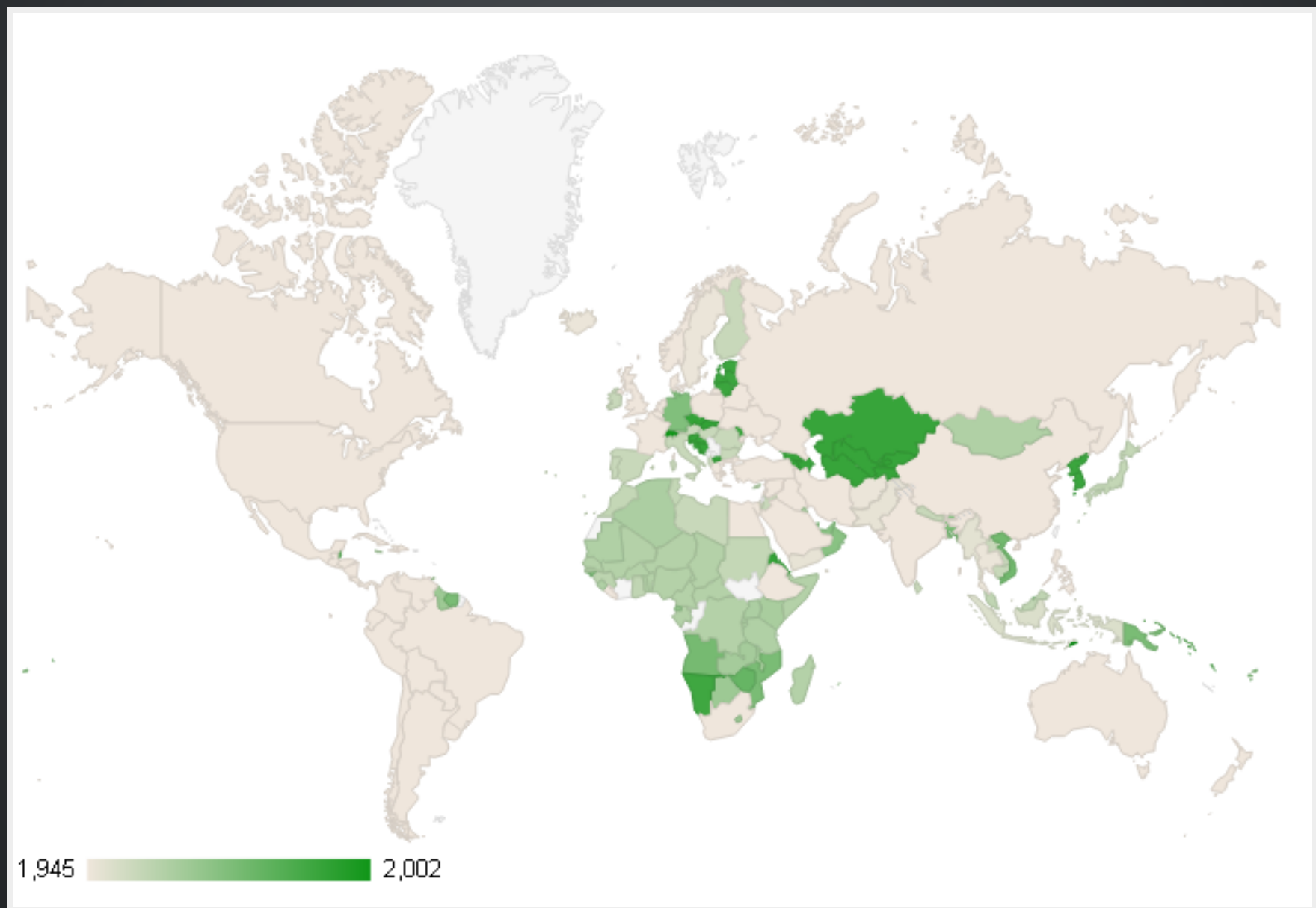
 SPARQL Select template, [5.1.1 Top-level Subjects](#), [5.1.2 Descendants of a Given Parent](#), [5.1.3 Subjects by Contributor Id](#), [5.1.4 Subjects by Contributor Abbrev](#), [5.1.5 Preferred Ancestors](#), [5.1.6 Full Text Search Query](#), [5.1.7 Find Person Occupations by broaderExtended](#), [5.1.8 Find Person Occupations by Double FTS](#), [5.1.9 Find Quartz Timepieces by Double FTS](#), [5.1.10 Find Subject by Exact English PrefLabel](#), [5.1.11 Find Subject by Language-Independent PrefLabels](#), [5.1.12 Find Subject by Any Label](#), [5.1.13 Find Terms by Language Tag](#), [5.1.14 Find Ordered Subjects](#), [5.1.15 Find Ordered Hierarchies](#), [5.1.16 Get Subjects in Order](#), [5.1.17 Find Contributors by Vocabulary](#), [5.1.18 Find Sources by Vocabulary](#), [5.2.1 Subject Preferred Label](#), [5.2.2 All Data for Terms of Subject](#), [5.2.3 Preferred and Vernacular Terms](#), [5.2.4 Scientific Names by Language](#), [5.2.5 Scientific Names not in English and Latin](#), [5.2.6 All Data For Subject](#), [5.2.7 Historic Information on Relations](#), [5.2.8 Historic Information of Terms](#), [5.2.9 Preferred Terms for Contributors](#), [5.2.10 Preferred Terms for Sources](#), [5.2.11 Concepts Related by Particular Associative Relation](#), [5.2.12 Languages and ISO Codes](#), [5.2.13 Language URLs](#), [5.3.1 Places by Type](#), [5.3.2 Places, with English or GVP Label](#), [5.3.3 Places by Direct and Hierarchical Type](#), [5.3.4 Breakdown of Sovereign States by Type](#), [5.3.5 Inhabited Places That Were Sovereign States](#), [5.3.6 Places by Type and Parent Place](#), [5.3.7 Places by Type, with placeTypePreferred](#), [5.3.8 Places by Triple FTS](#), [5.3.9 Places by FTS Parents](#), [5.3.10 Capitals by Type](#), [5.3.11 Capitals by Association](#), [5.3.12 Members of the European Union](#), [5.3.13 Members of the United Nations](#), [5.3.14 Geo Chart with SPARQL](#), [5.3.15 Column Chart with SPARQL](#), [5.3.16 Countries and Capitals By Type and Containment](#), [5.3.17 Places by Coordinate Bounding Box](#), [5.3.18 Places Within Bounding Box](#), [5.3.19 Places by Type Within Bounding Box](#), [5.3.20 Places Outside Bounding Box \(Overseas Possessions\)](#), [5.3.21 Places Nearby Each Other](#), [5.4.1 Descriptive Info from VOID](#), [5.4.2 Number of Entities from VOID](#), [5.4.3 Number of Local Sources \(Dynamic\)](#), [5.4.4 Number of Global Sources \(Dynamic\)](#), [5.4.5 Number of Terms per Language](#), [5.4.6 Number of AAT Revision Actions](#), [5.5.1 Ontology Classes and Properties](#), [5.5.2 Ontology Values](#)

# SAMPLE QUERY: BAR CHART WITH SPARQL

Number of members of the UN per year. [See doc](#) or [jsfiddle](#) with it

# SAMPLE QUERY: GEO CHART WITH SPARQL

When each nation joined the UN. [See doc](#) or [jsfiddle](#) with it.



# SAMPLE QUERY: OVERSEAS POSSESSIONS OF THE NETHERLANDS

```
# 5.3.20 Places Outside Bounding Box (Overseas Possessions)
select ?place ?name ?lat ?long {
  ?place skos:inScheme tgn: ;
  foaf:focus [wgs:lat ?lat; wgs:long ?long];
  gvp:prefLabelGVP [xl:literalForm ?name];
  gvp:broaderPartitiveExtended [rdfs:label "The Netherlands"@en]
  filter (!(50.787185 <= ?lat && ?lat <= 53.542265 && 3.389722 <= ?long && ?lo
ng <= 7.169019))}
```

Results for [# 5.3.20 Places...](#) (100 of 596)

Download

place	name	lat	long
<a href="#">tgn:7256571</a>	Back Off Bay@nl	17.45	-62.95
<a href="#">tgn:7005674</a>	Philipsburg	18.05	-63.0833
<a href="#">tgn:1011622</a>	Basora, Punta	12.4167	-69.85

# GVP LOD USAGE

People started using AAT and TGN right after their release

- AAT Concept selection (usually by autocompletion): EADitor, xEAC, VRA Editor, MODES, DIGIMUS, Drupal Web Taxonomy
- TGN Place selection: same as above; Portable Antiquities ([finds.org.uk](http://finds.org.uk)), Nomisma, Kerameikos
- Visualization: Hierarchies with d3js, LOD with lodlive.it
- Semantic enrichment: Europeana (Rijksmuseum, Museo Galileo, Erfgoedplus.be), Partage Plus (Art Nouveau to Europeana)

Vocab	Actual	Potential
AAT	9	6
TGN	3	
ULAN		1

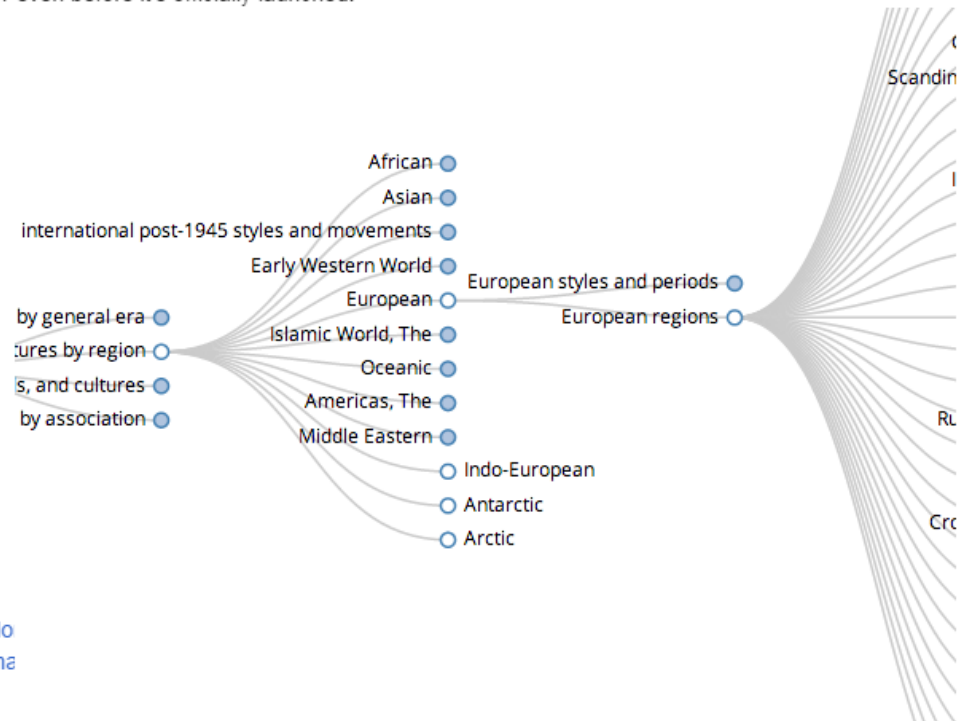


# USAGE STORIES

## Usage Stories (internal confluence)

Short descriptions of ways to make use of AAT once it is launched as LOD. Or even before it's officially launched!

- **AAT Actual Usage**
  - Use 1 Integrating EADitor with Getty linked data AAT
  - Use 2 Using AAT in VRA XForms editor
  - Use 3 Visualizing Hierarchies with d3js
  - Use 4 Visualizing with en.lodlive.it
  - Use 5 AAT as a MODES web termlist
  - Use 6 AAT as Categories in Wikidata Visual Arts project
  - Use 7 AAT Classification in DIGIMUS
    - DIGIMUS object (Astrolabe)
    - DIGIMUS Material
    - DIGIMUS Period
    - Comments to DIGIMUS
  - Use 7 Drupal Web Taxonomy plugin for Getty vocabularies
  - Use 8 AAT in Europeana
  - Use 9 AAT in Partage Plus
- **AAT Potential Usage**
  - Story 1 Using GVP LOD in embedded photo metadata
  - Story 2 LOD for sharing public information
  - Story 3 Joining collections
  - Story 4 Current use of controlled vocabularis enabled future explo
  - Story 5 Enriching an entire culture data ecosystem like Europeana
  - Story 6 Using GVP LOD for Digital Art History
- **TGN Actual Usage**
  - Use 21 TGN in the Portable Antiquities Scheme
  - Use 22 TGN in Nomisma and Kerameikos
  - Use 23 TGN as GeoJSON
- **ULAN Potential Usage**
  - Story 41 Analyze ULAN Networks



# THANKS FOR YOUR TIME!

<mailto:vladimir.alexiev@ontotext.com>

