Vocabularies as Linked Data:
SENESCHAL and HeritageData.org

University of Leicester and Historic England
Heritage Practice Training Course
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AHRC funded STAR, STELLAR and SENESCHAL Projects
http://hypermedia.research.southwales.ac.uk/kos/star/
http://hypermedia.research.southwales.ac.uk/kos/stellar/
http://hypermedia.research.southwales.ac.uk/kos/SENESCHAL/

Arts & Humanities Research Council | ads ARCHAEOLOGY DATA SERVICE | Historic England | University of South Wales Prifysgol De Cymru

Outline of Content

1. Overview of relevant Linked Data technologies
2. SENESCHAL project & Linked Data
3. LOD Vocabulary developments
4. HeritageData.org - Forum for Info Standards in Heritage (FISH)

Questions and Discussion - All

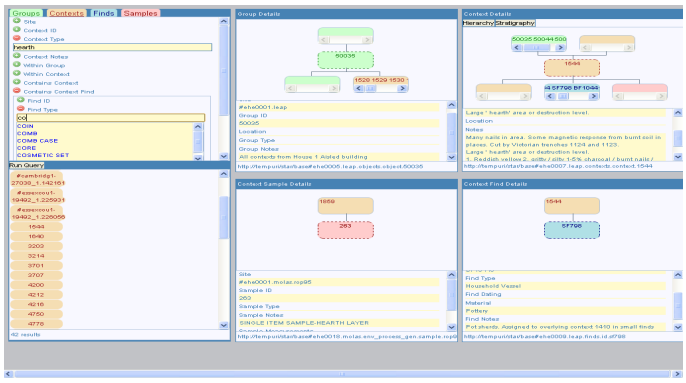
Linking - The Archaeological Archipelagos

Linked Data?
What's in it for Us & What do we need this for?

- Better shared understanding of *existing* information
- Enabling more complex and accurate Semantic Web searching by both Archaeologists & non-domain experts
- Wider Access and re-use of info by interested Public, Community Groups, Students, Researchers, *et al*
- Relating archaeology to other domains
  - E.g. Natural sciences, Biology, Anthropology, Environmental studies
- SKOS and W3C web standards enable standardisation & interoperability with other Linked Data online

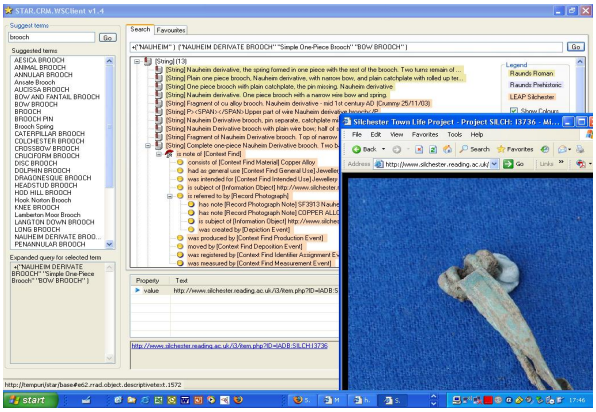


Background to *Vocabulary issues* that emerged in STAR project interface for cross-search of integrated data



Internet Archaeology Vol 30 (2011) http://intarch.ac.uk/journal/issue30/tudhope_index.html

Prototype Controlled Vocabulary searching



The SENESCHAL Project - Overview

- **seneschal** n. *Historical*
  "The steward or major-domo of a medieval great house"
- 12 month AHRC funded project: March 2013 → February 2014
- University of South Wales (formerly Glamorgan) and ADS with Project Partners including, RCAHMS, RCAHMW, EH/HE
- Knowledge Exchange based on enhanced vocabulary services
- Make it significantly easier for data providers to index their data with uniquely identified (machine readable) controlled terminology – ie semantically enriched and compatible with Linked Data.
- Make it easier for vocabulary providers to make their vocabularies available as Linked Data. HE Thesauri and RCAHMS/W thesauri as exemplar cases.

The SENESCHAL Project – Deliverables

- Controlled vocabularies online
  - Vocabularies from HE, RCAHMS, RCAHMW
  - Conversion to a common standard format (SKOS)
  - Persistent globally unique identifiers for every concept
  - Made available online as Linked Open Data
  - Also downloadable data files and listings
- Web services
  - Facilitate concept searching, browsing, suggestion, validation
- Tools to use controlled vocabularies
  - Browser-based 'widget' user interface controls
  - Search, browse, suggest, select concepts
- Case studies
  - Legacy data to thesaurus alignment
  - Thesaurus to thesaurus alignment
  - Third party use of project outcomes

Problem: Semi-controlled vocabularies…

Deposit Colour			Deposit Texture	Deposit Compaction
(Reddy) Brown	Dark orange/brown	Orangy brown, very light	Firm	Plastic
9Reddy) brow				cky
Brown				y (wet)
Brown red				y/firm
Brown/redd				s
Dark brown				
Dark brown				
Dark grey b				
Dark orange				
Dark orange				
darker patch				
Dark orange loam		Yellow brown		
		Yellow/orange brown		

"…another of my examples has something about some flint that is 'snuff coloured' & I don't know if I've ever seen snuff, let alone know what colour it is, or might have been over 150 years ago, and I would think it would make sense to take some kind of integrated approach from the outset,…." [G. Carver]

For data entry: Semi-controlled vocabularies represent a useful compromise somewhere between descriptive & controlled vocabularies, ***the best of both worlds!***

For data retrieval: ***The worst of all worlds*** *(Re. find all the iron age post holes)*

This problem arises from trying to do two different things within a single input field. Should do both, but separately ***– 1) describe using free text description fields,*** *and* ***2) index using controlled index fields***

Try using CONTROLLED Vocabularies online

Vocabularies from Historic England
- Archaeological Sciences
- Building Materials
- Components
- Event Type
- Evidence
- FISH Archaeological Objects
- Maritime Craft Type
- Monument Type
- Periods

Vocabularies from RCAHMS
- •Archaeological Objects Thesaurus (Adapted version of the FISH Archaeological Objects Thesaurus)
- •Maritime Craft Thesaurus
- •Monument Type Thesaurus (Multilingual - includes Scottish Gaelic translations)

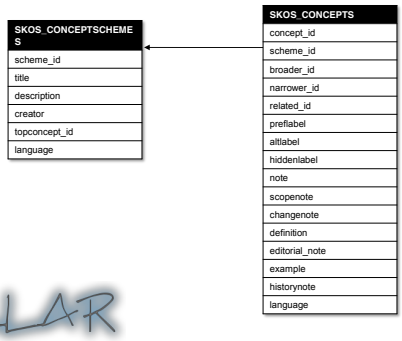
Vocabularies from RCAHMW
- •Monument Type Thesaurus
- •Period

Moving from term based towards concept based indexing
- •Start to create links between concepts… between vocabularies… between datasets… between sites… between countries
- •Alignment from legacy data to persistent concept identifiers
- •Alignment between thesauri
- •True interoperability of (multilingual) cultural heritage resources

STELLAR Project Tools - SKOS Template

SKOS = Simple Knowledge Organisation System

Using SKOS - W3C standard for Web-based Terminologies



STELLAR

RDF – Resource Description Framework

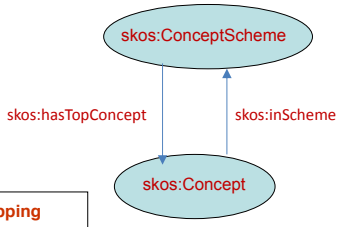
- Data exported to an RDF Triple Store (big database)
- RDF triples in the form of:
- Subject – Predicate – Object

- Entity – Relationship – Entity
- Class – Property – Class
- SKOS is W3C standard format for data representation & Exchange
- The boxes in the diagram show each Entity that is joined to another Entity by a Relationship i.e. forms a Triple

SKOS Concepts v Term Hierarchies

Semantic
- broader
- narrower
- related

Documentation
- note
- changeNote
- Definition
- editorialNote
- Example
- historyNote
- scopeNote



Mapping
- broadMatch
- narrowMatch
- relatedMatch
- closeMatch
- exactMatch

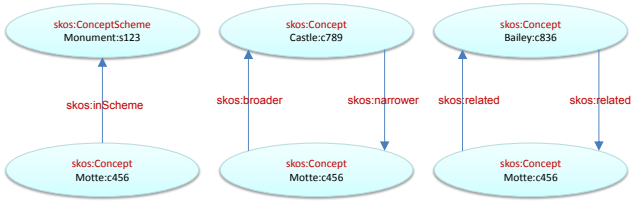
Labelling
- prefLabel
- altLabel
- hiddenLabel

SKOS_CONCEPTS – scheme_id, broader_id, related_id

concept_id	scheme_id
c456	s123

concept_id	broader_id
c456	c789

concept_id	related_id
c456	c836

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<rdf:Description rdf:about="http://stellar/c456">
  <skos:inScheme rdf:resource="http://stellar/s123"/>
</rdf:Description>
```

```
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</rdf:Description>
<rdf:Description rdf:about="http://stellar/c789">
  <skos:narrower rdf:resource="http://stellar/c456"/>
</rdf:Description>
```

```
<skos:Concept rdf:about="http://stellar/c456"/>
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  <skos:related rdf:resource="http://stellar/c789"/>
</rdf:Description>
<rdf:Description rdf:about="http://stellar/c789">
  <skos:related rdf:resource="http://stellar/c456"/>
</rdf:Description>
```

Concepts: Accommodating colloquial terms

Dr. Johnson: (proudly) "*Here it is sir, the very cornerstone of English scholarship. This book contains every word in our beloved language.*"

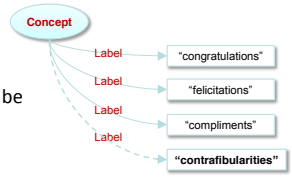
Blackadder: "*every single one sir? [..] In that case I hope you will not object if I also offer my most enthusiastic ... **contrafibularities**.*"

Dr. Johnson: "*What?*"

Blackadder: "***contrafibularities** sir – it is a common word down our way.*"

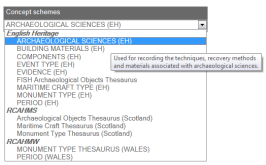
Dr. Johnson: (flustered and scribbling) "*Damn…*"

Blackadder's mischievous suggestion may be a new *term,* but it is not a new *concept*.
It fits into the existing concept structure, further enriching the entry vocabulary.



Thanks to Ceri Binding for this slide – and others

Voacabulary Widgets – e.g. for OASIS

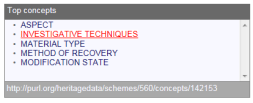


(scheme list)

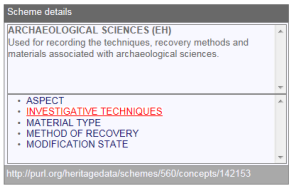
- Scheme list
- Scheme details
- Top concepts
- Composite control

More Widget details on HeritageData.org

(scheme details)



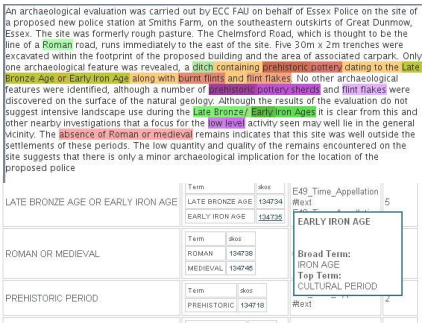
(top concepts)



(composite control)

STAR - Semantic Technologies for Archaeological Resources

Natural Language Processing (NLP)



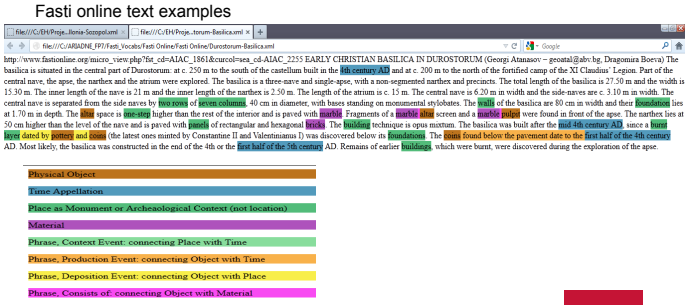
- **NLP Information Extraction (IE) of Concepts from OASIS GL Reports such as**
- **Place**
- **Period**
- **Object**
- **Utilise semantic annotation XML files**
- **Using SKOS RDF versions of thesauri concepts.**

With thanks to Andreas Vlachidis

University of South Wales
Prifysgol De Cymru

ARIADNE FP7 project R&D work
NLP using SKOS vocabularies

Fasti online text examples



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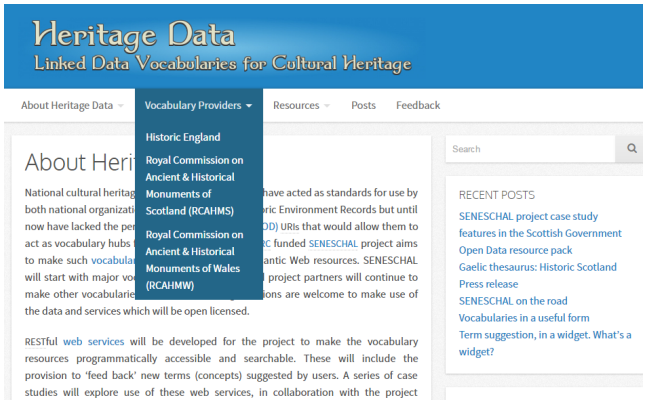
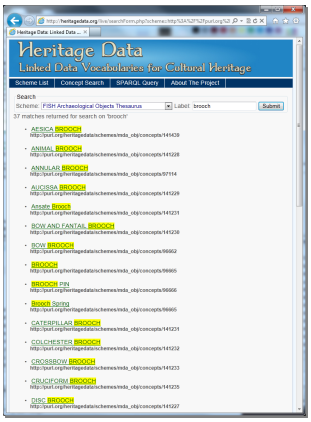
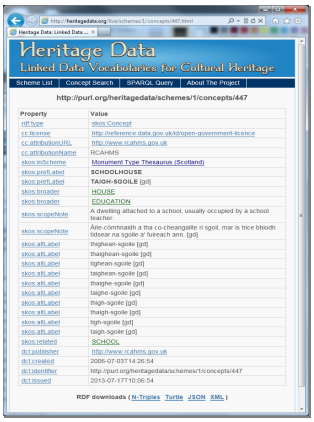
LOD Heritage Vocabularies: http://heritagedata.org



Thesaurus searching and browsing





Typical alignment problems encountered

- Simple spelling errors
  - POSTHLOLE", "CESS PITT", "FURRROWS", FLINT SCRAPPER"
- Alternate word forms
  - "BOUNDARY"/"BOUNDARIES", "GULLEY"/"GULLIES"
- Prefixes / suffixes
  - "RED HILL (POSSIBLE)", "TRACKWAY (COBBLED)", "CROFT?", "CAIRN (POSSIBLE)", "PORTAL DOLMEN (RE-ERECTED)"
- Nested delimiters
  - "POTTERY, CERAMIC TILE, IRON OBJECTS, GLASS"
- Terms not intended for indexing
  - "NONE", "UNIDENTIFIED OBJECT", "N/A", "NA", "INCOHERENT"
- Terms that would not be in (any) thesauri
  - "WOTSITS PACKET", "CHARLES 2ND COIN", "ROMAN STRUCTURE POSSIBLY A VILLA", "ST GUTHLACS BENEDICTINE PRIORY", "WORCESTER-BIRMINGHAM CANAL", "KUNGLIGA SLOTTET", "SUB-FOSSIL BEETLES"
- More specific phrases
  - "SIDE WALL OF POT WITH LUG", "BRICK-LINED INDUSTRIAL WELL OR MINE SHAFT", "ALIGNMENT OF PLATFORMS AND STONES"

Data alignment - R&D approach

- *Levenshtein* edit distance algorithm
  - Measures optimal number of character edits required to change one string into another
  - Accommodates small spelling differences/errors
- Bulk alignment process
  - Compares each value to all terms from specified thesaurus – obtain best textual match
  - Similarity threshold introduced to suppress low scoring matches. Levenshtein algorithm will always produce a match, even if it is a bad one!
  - Periods require an additional approach due to mixed formats (named periods, numeric ranges etc.)

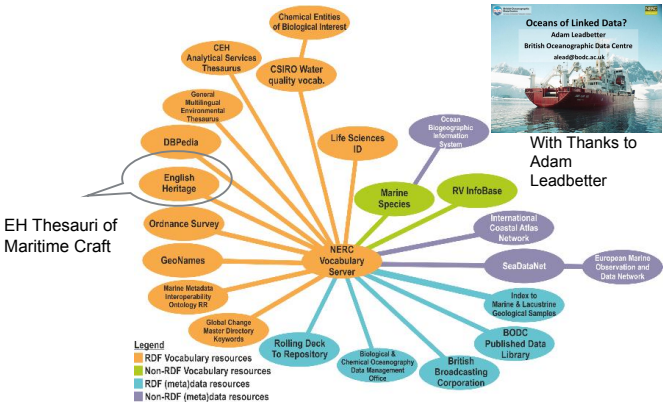
Data Alignment Results – Monument Types

Data value	Highest scoring match	Score
ABBEY FOUNDATIONS	Foundation	74%
AXE FACOTRY	Axe Factory	90%
BOUNDARIES	BOUNDARY	77%
BOUNDARY	BOUNDARY	100%
BUIED SOIL HORIZON	BURIED SOIL HORIZON	97%
CAIRN	CAIRN	100%
CAIRN (POSSIBLE)	CAIRN	100%
CAIRNN	CAIRN	90%
CESS PITT	CESS PIT	94%
CHAMBERED TOM	CHAMBERED TOMB	96%
COMERCIAL	COMMERCIAL	94%
CROFT?	CROFT	90%
CUP-MARKED STONE	CUP MARKED STONE	93%
DICTH	DITCH	80%
ENCLSOURE	ENCLOSURE	88%
EXTRACTION PIT	EXTRACTIVE PIT	85%
EXTRACTIVE PIT	EXTRACTIVE PIT	100%

Data value	Highest scoring match	Score
FEATURE – COBBLED SURFACE	Cobbled Surface	75%
GULLEY	GULLY	90%
GULLIES	GULLY	66%
HILL FORT	HILLFORT	94%
HILLFORT	HILLFORT	100%
IINEAR SYSTEM	LINEAR SYSTEM	92%
MEDIEVAL CASTLE / FORTIFIED MANOR RUINS	FORTIFIED MANOR HOUSE	60%
PARIS CHURCH	PARISH CHURCH	96%
PASSAGE GRACE	PASSAGE GRAVE	92%
PORTAL DOLMEN (RE-ERECTED)	PORTAL DOLMEN	100%
POSTHLOLE	POST HOLE	88%
PRIORY? WALL	Priory Wall	95%
RED HILL (POSSIBLE)	RED HILL	100%
ROMAN STRUCTURE POSSIBLY A VILLA	TRAINING STRUCTURE	52%
SOIL FILLED PIT	RIFLE PIT	66%
ST GUTHLACS BENEDICTINE PRIORY	Benedictine Priory	75%
STONE ALIGMENT	STONE ALIGNMENT	96%
TRACKWAY (COBBLED)	TRACKWAY	100%
WORCESTER-BIRMINGHAM CANAL	ORNAMENTAL CANAL	52%

Opportunities

E.g. British Oceanographic Data Centre - LOD

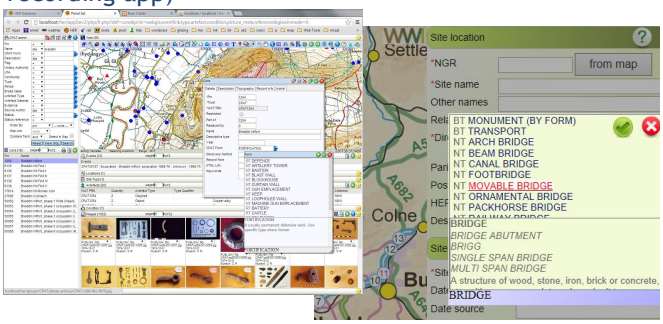


With Thanks to Adam Leadbetter

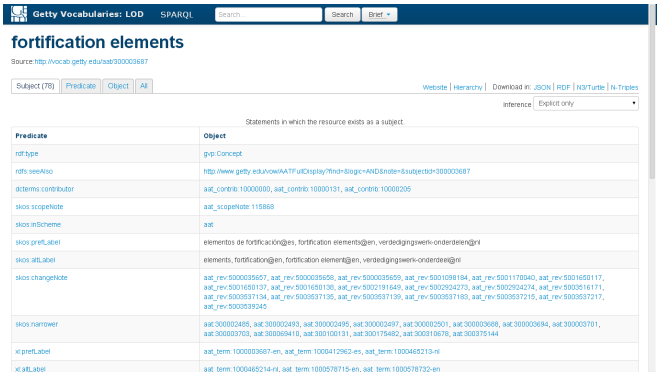
EH Thesauri of Maritime Craft

Opportunities

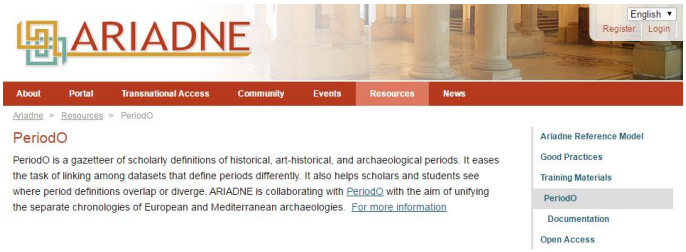
Clwyd-Powys (Wales) Archaeological Trust (SENESCHAL widgets embedded into HER application and mobile field recording app)



Vocab Cross-ref Opportunities!
Getty A&AT Vocab as LOD



ARIADNE project using Getty A&AT LOD as “Hub”

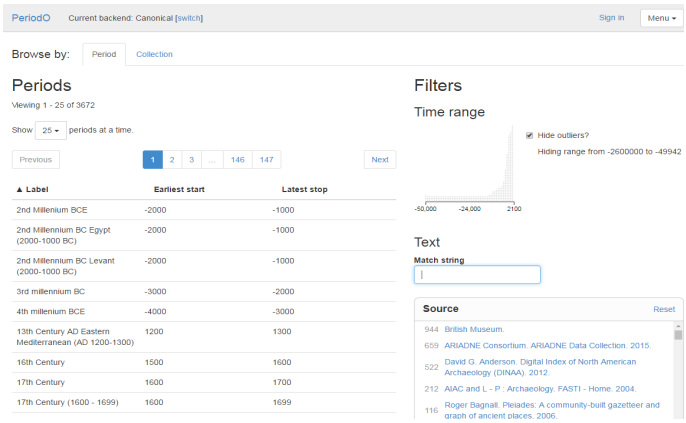


http://www.ariadne-infrastructure.eu/

PeriodO

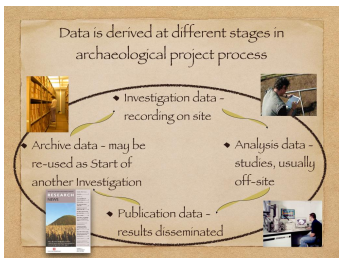
A gazetteer of period definitions for linking and visualizing data.

http://perio.do/



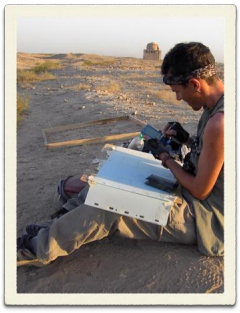
Stages for making Data Open

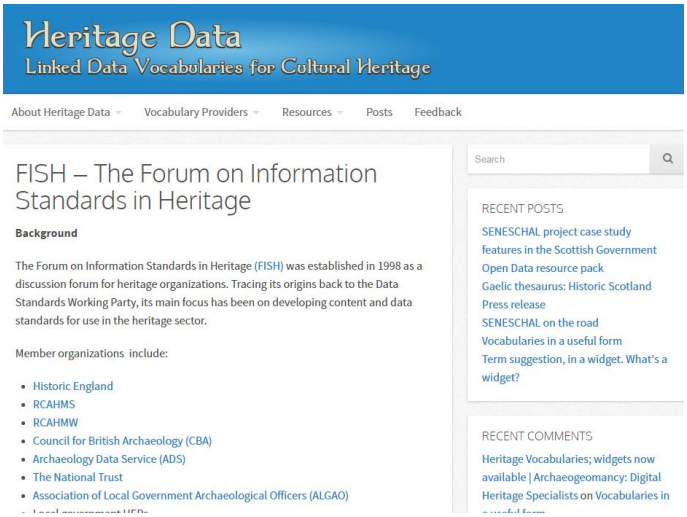
- LOD may blur existing boundaries as (Big) data integration becomes more dynamic
- STAR outcomes suggest still 4 key stages for coherent data integration in the Archaeological Research Cycle.
- Excavation archive stage
- Results of Analysis
- "Final" Publication
- Integrated Archive for new Research



Open Archaeological Data somewhere on/over the horizon?

- Different archaeological recording systems share common conceptual frameworks and semantic relationships
- By conceptualising common relationships in our different data sets at a broad level and ***aligning*** vocabularies of shared reference terms we can cross-search data for patterns and broader answers to related research questions
- The technologies are being developed in other domains (e.g. Biology) but is there a common will for ***sharing*** archaeological data ***Openly*** for ***re-use*** in the interests of improving research methods?





Heritage Data
Linked Data Vocabularies for Cultural Heritage

http://www.heritagedata.org/

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