Pattern based mapping and extraction via the CIDOC CRM

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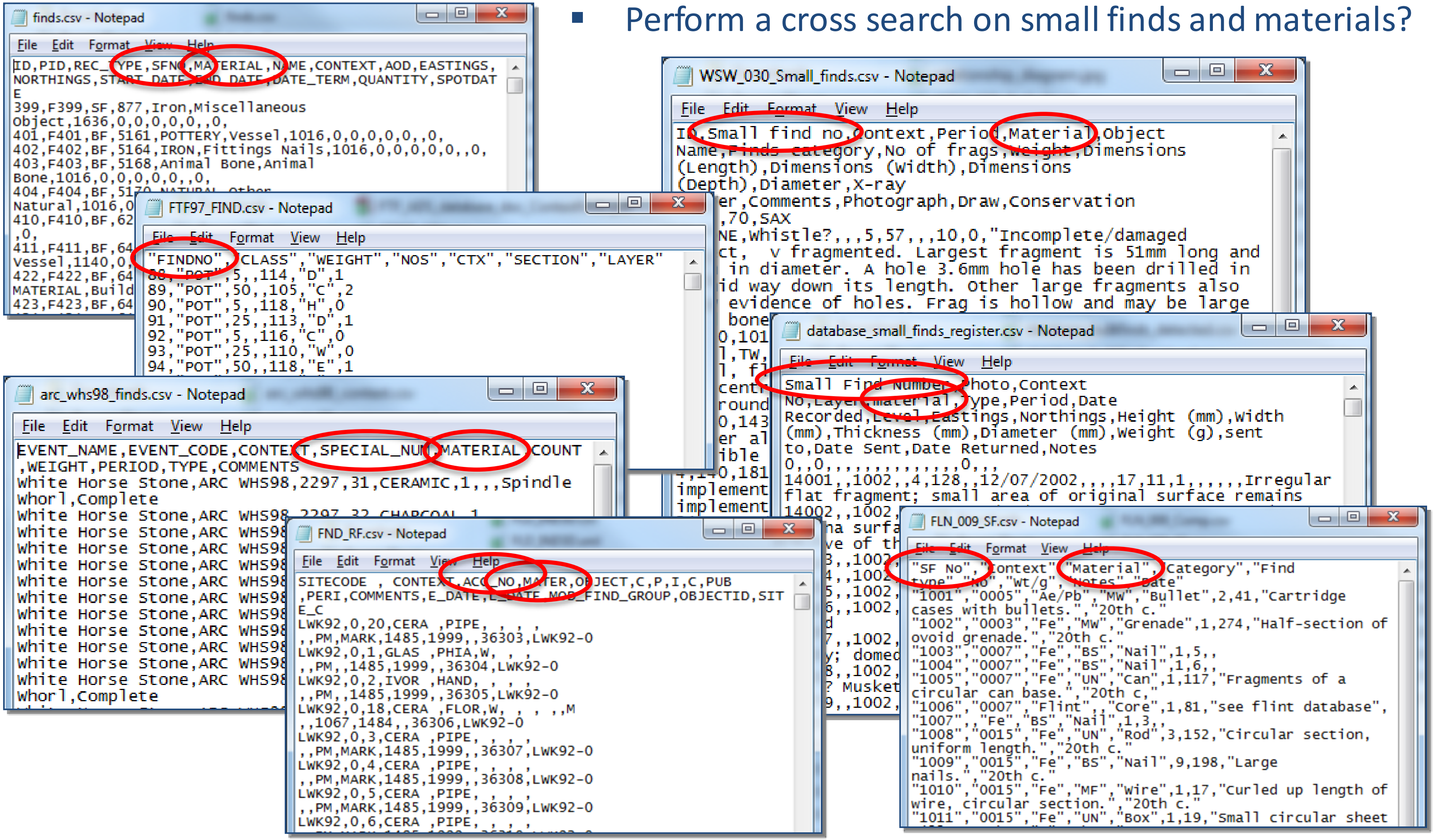
The long road to interoperability…

- Achieving interoperability requires more than just a common data model – as data compatibility occurs on 2 levels – semantic and syntactic. Ontologies / data structures deal with the semantic but not necessarily the syntactic
  - *"The CRM relies on existing syntactic interoperability and is concerned only with adding semantic interoperability"* (CIDOC CRM documentation)
- Deciding on CIDOC CRM as an integrating framework is a sensible first step on the road to interoperability – but after that there's often still a long way to go, particularly for legacy datasets

Another dataset, another schema…

- Perform a cross search on small finds and materials?



finds.csv - Notepad

```
ID,PID,REC_TYPE,SFNO,MATERIAL,NAME,CONTEXT,AOD,EASTINGS,
NORTHINGS,START_DATE,END_DATE,DATE_TERM,QUANTITY,SPOTDAT
E
399,F399,SF,877,Iron,Miscellaneous
Object,1636,0,0,0,0,0,,0,
401,F401,BF,5161,POTTERY,Vessel,1016,0,0,0,0,0,,0,
402,F402,BF,5164,IRON,Fittings Nails,1016,0,0,0,0,0,,0,
403,F403,BF,5168,Animal Bone,Animal
Bone,1016,0,0,0,0,0,,0,
404,F404,BF,5170,NATURAL,Other
Natural,1016,0
410,F410,BF,62
,0,
411,F411,BF,64
Vessel,1140,0,
422,F422,BF,64
MATERIAL,Build
423,F423,BF,64
```

FTF97_FIND.csv - Notepad

```
"FINDNO","CLASS","WEIGHT","NOS","CTX","SECTION","LAYER"
88,"POT",5,,114,"D",1
89,"POT",50,,105,"C",2
90,"POT",5,,118,"H",0
91,"POT",25,,113,"D",1
92,"POT",5,,116,"C",0
93,"POT",25,,110,"W",0
94,"POT",50,,118,"E",1
```

arc_whs98_finds.csv - Notepad

```
EVENT_NAME,EVENT_CODE,CONTEXT,SPECIAL_NUM,MATERIAL,COUNT
,WEIGHT,PERIOD,TYPE,COMMENTS
White Horse Stone,ARC WHS98,2297,31,CERAMIC,1,,,Spindle
Whorl,Complete
White Horse Stone,ARC WHS98,2297,32,CHARCOAL,1
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
White Horse Stone,ARC WHS98
Whorl,Complete
```

FND_RF.csv - Notepad

```
SITECODE , CONTEXT,ACC_NO,MATER,OBJECT,C,P,I,C,PUB
,PERI,COMMENTS,E_DATE,L_DATE,MOD_FIND_GROUP,OBJECTID,SIT
E_C
LWK92,0,20,CERA ,PIPE, , , ,
,,PM,MARK,1485,1999,,36303,LWK92-0
LWK92,0,1,GLAS ,PHIA,W, , ,
,,PM,,1485,1999,,36304,LWK92-0
LWK92,0,2,IVOR ,HAND, , , ,
,,PM,,1485,1999,,36305,LWK92-0
LWK92,0,18,CERA ,FLOR,W, , , ,,M
,,1067,1484,,36306,LWK92-0
LWK92,0,3,CERA ,PIPE, , , ,
,,PM,MARK,1485,1999,,36307,LWK92-0
LWK92,0,4,CERA ,PIPE, , , ,
,,PM,MARK,1485,1999,,36308,LWK92-0
LWK92,0,5,CERA ,PIPE, , , ,
,,PM,MARK,1485,1999,,36309,LWK92-0
LWK92,0,6,CERA ,PIPE, , , ,
```

WSW_030_Small_finds.csv - Notepad

```
ID,Small find no,Context,Period,Material,Object
Name,Finds category,No of frags,Weight,Dimensions
(Length),Dimensions (Width),Dimensions
(Depth),Diameter,X-ray
er,Comments,Photograph,Draw,Conservation
,70,SAX
NE,Whistle?,,,5,57,,,10,0,"Incomplete/damaged
ct,  v fragmented. Largest fragment is 51mm long and
 in diameter. A hole 3.6mm hole has been drilled in
id way down its length. Other large fragments also
 evidence of holes. Frag is hollow and may be large
 bone
0,101
1,TW,
1, fl
cent
round
0,143
er al
ible
,140,181
implement
implement
na surfa
ve of th
3,,1002,
4,,1002,
5,,1002,
6,,1002,
d
7,,1002,
y; domed
8,,1002,
? Musket
9,,1002,
```

database_small_finds_register.csv - Notepad

```
Small Find Number,Photo,Context
No,Layer,Material,Type,Period,Date
Recorded,Level,Eastings,Northings,Height (mm),Width
(mm),Thickness (mm),Diameter (mm),Weight (g),sent
to,Date Sent,Date Returned,Notes
0,,0,,,,,,,,,,,,,,0,,,
14001,,1002,,4,128,,12/07/2002,,,,17,11,1,,,,,,Irregular
flat fragment; small area of original surface remains
14002,,1002,
```

FLN_009_SF.csv - Notepad

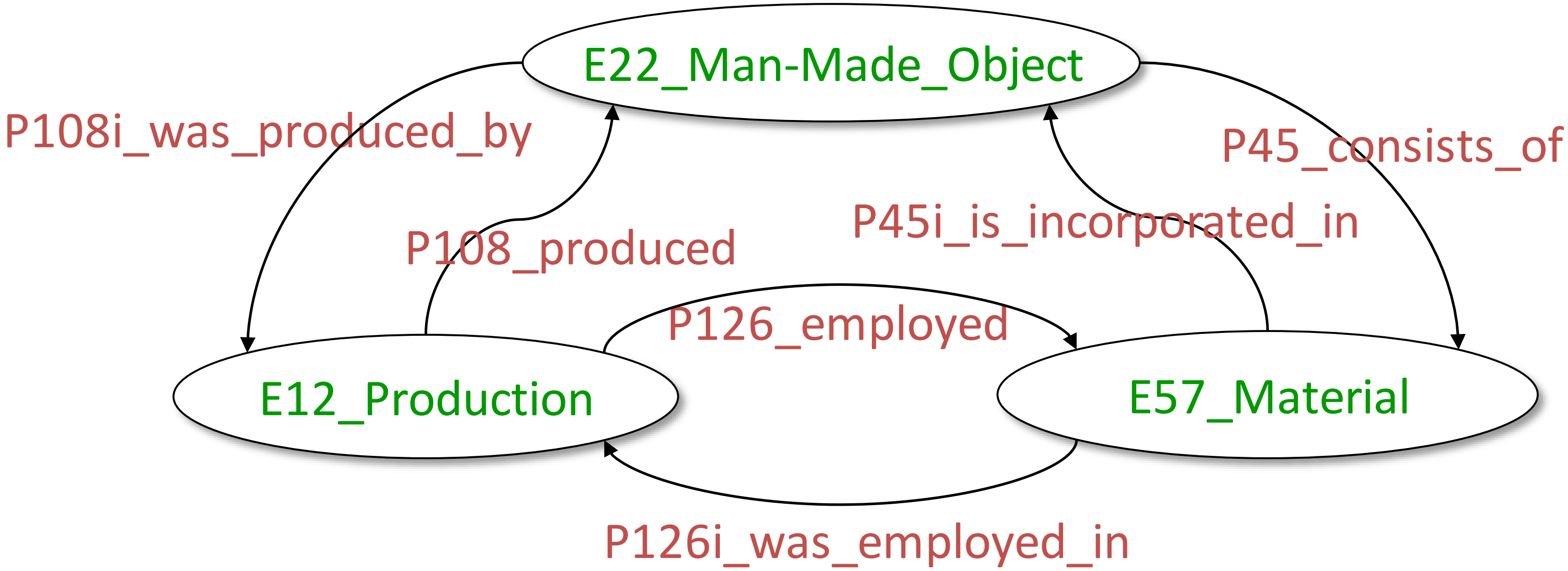
```
"SF No","Context","Material","Category","Find
type","No","Wt/g","Notes","Date"
"1001","0005","Ae/Pb","MW","Bullet",2,41,"Cartridge
cases with bullets.","20th c."
"1002","0003","Fe","MW","Grenade",1,274,"Half-section of
ovoid grenade.","20th c."
"1003","0007","Fe","BS","Nail",1,5,,
"1004","0007","Fe","BS","Nail",1,6,,
"1005","0007","Fe","UN","Can",1,117,"Fragments of a
circular can base.","20th c,"
"1006","0007","Flint",,"Core",1,81,"see flint database",
"1007",,"Fe","BS","Nail",1,3,,
"1008","0015","Fe","UN","Rod",3,152,"Circular section,
uniform length.","20th c."
"1009","0015","Fe","BS","Nail",9,198,"Large
nails.","20th c."
"1010","0015","Fe","MF","Wire",1,17,"Curled up length of
wire, circular section.","20th c."
"1011","0015","Fe","UN","Box",1,19,"Small circular sheet
```

What to model, how to model

- Do these rows represent:
  - Data from paper forms? Yes
  - Electronic database records? Yes
  - The small finds themselves? Yes
  - The results of a series of archaeological assessments? Yes
- How to approach modelling?
  - As immaterial records
  - As physical objects
  - As properties associated with a series of events (e.g. identifier assignment, production material)
- How much to include?
  - All data in all rows
  - Data to answer specific research questions and use cases
  - Administrative data (describing contemporary events) – excavation, assessment, who/when/why
  - Implicit data - *known knowns, known unknowns…* (D. Rumsfeld)
    - E.g. production event - where we may know nothing else except there must have been one

Using CIDOC CRM as an integrating framework

A small pattern to model the relationships between an object and a material. The pattern applies to all the records. It would be nice to reuse it in future



So the problem is now solved? Not quite…

Implementation issues

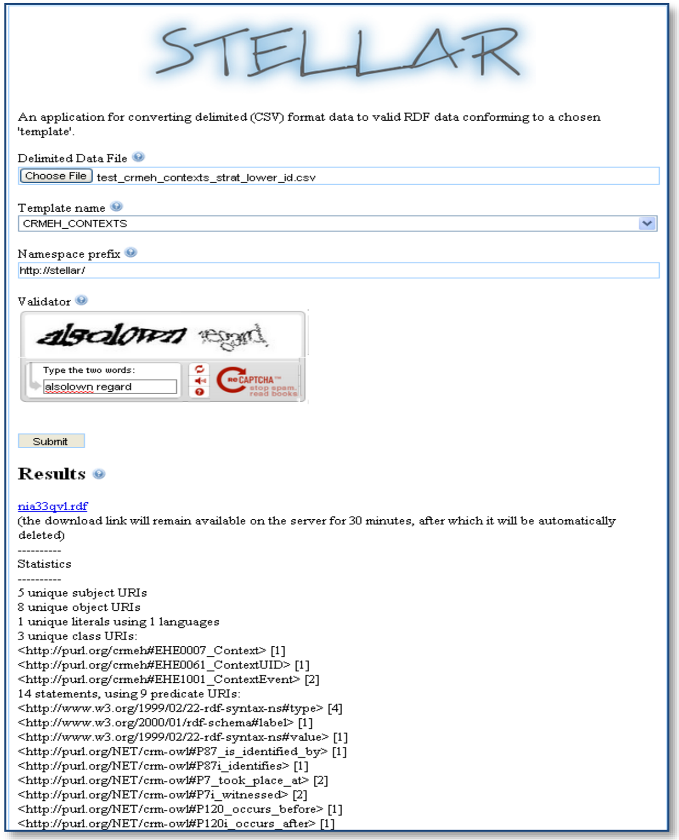
- Raw data
  - Data formats
  - Data cleansing
  - Data mapping
  - Character encoding
  - Terminology concordance
- XML syntax
  - Brackets and tags
  - Namespaces
  - Data types
- RDF syntax
  - Entities and properties
  - URI identifiers
  - Naming conventions
  - Modelling patterns

- Wider issues
  - Scope
  - Consistency
  - Repeatability
  - Coverage
  - Scalability
  - Performance
  - Versioning
  - Licensing
  - Curation
  - Discoverability
  - Documentation

for real implementations things can get complicated very quickly

STELLAR Project

- Produced tools and techniques to manage (some of) this complexity & to maintain consistency at scale



An application for converting delimited (CSV) format data to valid RDF data conforming to a chosen 'template'.

Delimited Data File: Choose File test_crmeh_contexts_strat_lower_id.csv

Template name: CRMEH_CONTEXTS

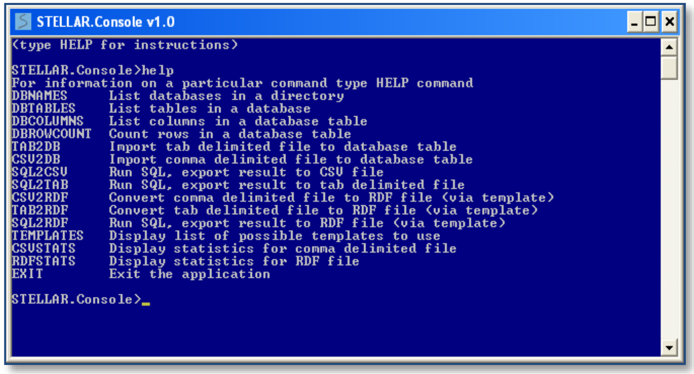
Namespace prefix: http://stellar/

Validator

Results

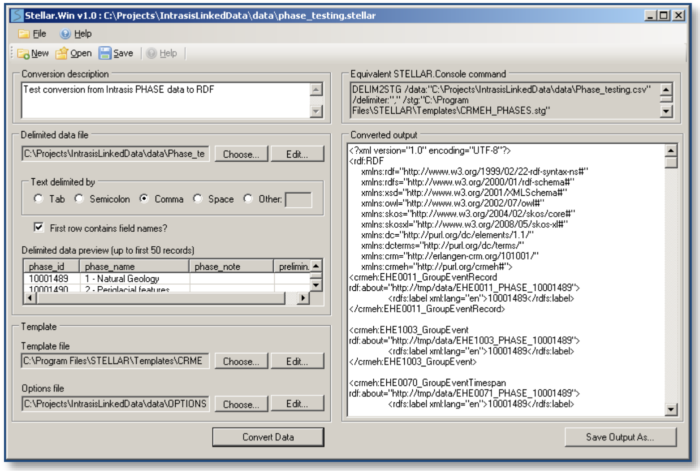
nia33qvl.rdf
(the download link will remain available on the server for 30 minutes, after which it will be automatically deleted)

```
----------
Statistics
----------
5 unique subject URIs
8 unique object URIs
1 unique literals using 1 languages
3 unique class URIs:
<http://purl.org/crmeh#EHE0007_Context> [1]
<http://purl.org/crmeh#EHE0061_ContextUID> [1]
<http://purl.org/crmeh#EHE1001_ContextEvent> [2]
14 statements, using 9 predicate URIs:
<http://www.w3.org/1999/02/22-rdf-syntax-ns#type> [4]
<http://www.w3.org/2000/01/rdf-schema#label> [1]
<http://www.w3.org/1999/02/22-rdf-syntax-ns#value> [1]
<http://purl.org/NET/crm-owl#P87_is_identified_by> [1]
<http://purl.org/NET/crm-owl#P87i_identifies> [1]
<http://purl.org/NET/crm-owl#P7_took_place_at> [2]
<http://purl.org/NET/crm-owl#P7i_witnessed> [2]
<http://purl.org/NET/crm-owl#P120_occurs_before> [1]
<http://purl.org/NET/crm-owl#P120i_occurs_after> [1]
```



STELLAR.Console v1.0

```
(type HELP for instructions)

STELLAR.Console>help
For information on a particular command type HELP command
DBNAMES      List databases in a directory
DBTABLES     List tables in a database
DBCOLUMNS    List columns in a database table
DBROWCOUNT   Count rows in a database table
TAB2DB       Import tab delimited file to database table
CSV2DB       Import comma delimited file to database table
SQL2CSV      Run SQL, export result to CSV file
SQL2TAB      Run SQL, export result to tab delimited file
CSV2RDF      Convert comma delimited file to RDF file (via template)
TAB2RDF      Convert tab delimited file to RDF file (via template)
SQL2RDF      Run SQL, export result to RDF file (via template)
TEMPLATES    Display list of possible templates to use
CSVSTATS     Display statistics for comma delimited file
RDFSTATS     Display statistics for RDF file
EXIT         Exit the application

STELLAR.Console>_
```



Stellar.Win v1.0 : C:\Projects\IntrasisLinkedData\data\phase_testing.stellar

Conversion description: Test conversion from Intrasis PHASE data to RDF

Delimited data file: C:\Projects\IntrasisLinkedData\data\Phase_te

Text delimited by: ○ Tab ○ Semicolon ● Comma ○ Space ○ Other:

☑ First row contains field names?

Delimited data preview (up to first 50 records)

phase_id	phase_name	phase_note	prelimin.
10001489	1 - Natural Geology		
10001490	2 - Periglacial features		

Template

Template file: C:\Program Files\STELLAR\Templates\CRME

Options file: C:\Projects\IntrasisLinkedData\data\OPTIONS

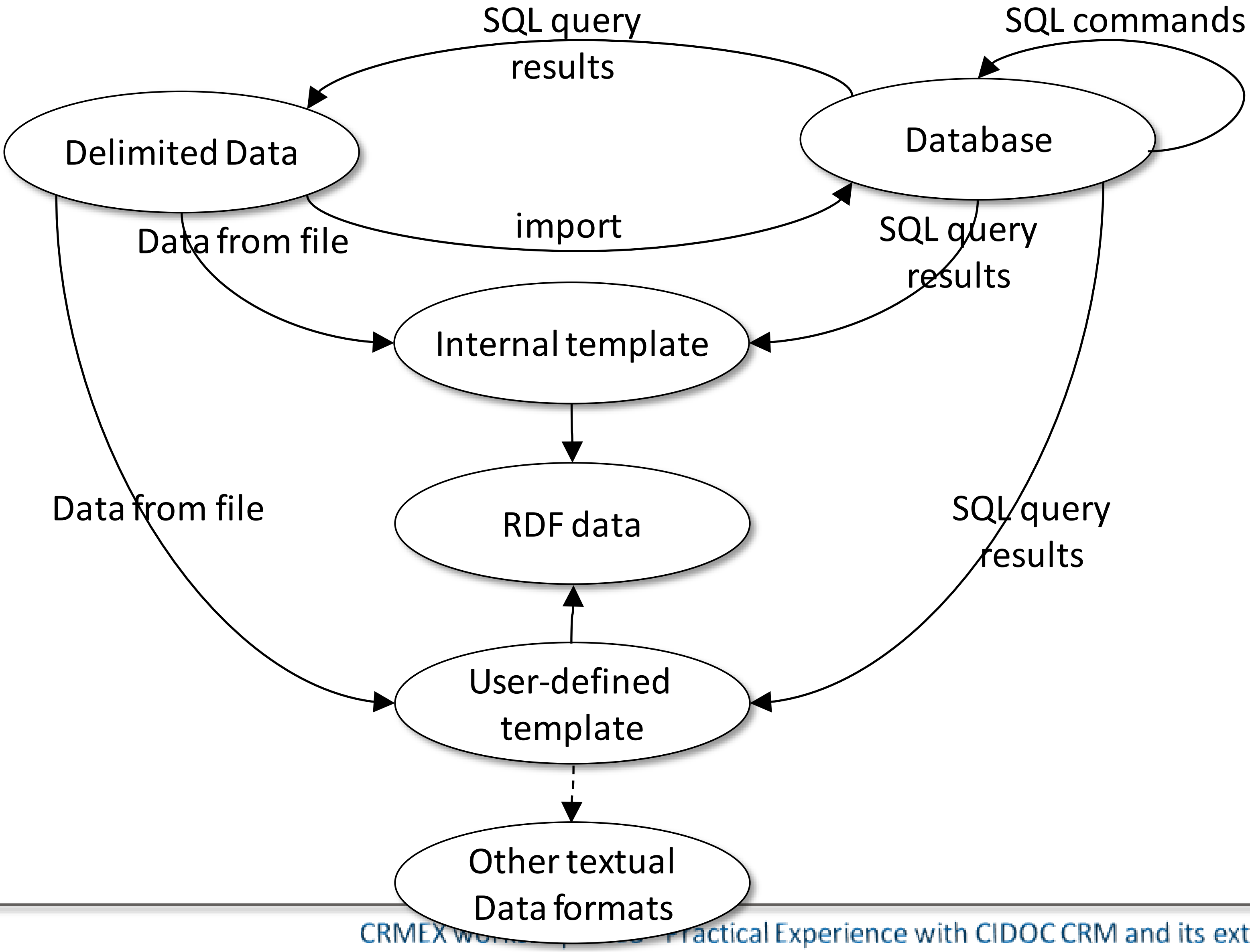
Equivalent STELLAR.Console command

```
DELIM2STG /data:"C:\Projects\IntrasisLinkedData\data\Phase_testing.csv"
/delimiter:"," /stg:"C:\Program
Files\STELLAR\Templates\CRMEH_PHASES.stg"
```

Converted output

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
    xmlns:owl="http://www.w3.org/2002/07/owl#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#"
    xmlns:skosxl="http://www.w3.org/2008/05/skos-xl#"
    xmlns:dc="http://purl.org/dc/elements/1.1/"
    xmlns:dcterms="http://purl.org/dc/terms/"
    xmlns:crm="http://erlangen-crm.org/101001/"
    xmlns:crmeh="http://purl.org/crmeh#">
<crmeh:EHE0011_GroupEventRecord
rdf:about="http://tmp/data/EHE0011_PHASE_10001489">
        <rdfs:label xml:lang="en">10001489</rdfs:label>
</crmeh:EHE0011_GroupEventRecord>

<crmeh:EHE1003_GroupEvent
rdf:about="http://tmp/data/EHE1003_PHASE_10001489">
        <rdfs:label xml:lang="en">10001489</rdfs:label>
</crmeh:EHE1003_GroupEvent>

<crmeh:EHE0070_GroupEventTimespan
rdf:about="http://tmp/data/EHE0071_PHASE_10001489">
        <rdfs:label xml:lang="en">10001489</rdfs:label>
```

STELLAR data conversions



STELLAR templates

- Templates implement predefined data patterns, facilitate consistent data conversion and handle lower-level syntactic issues
- Template fields provide a layer of abstraction - allowing us to deal with the data at a higher level, and in a modular fashion
- Templates can create inverse relationships, fully formed paths *and* shortcuts - enabling more flexible querying without necessarily requiring extensive reasoning capability
- Doesn’t have to be one way or the other - can model both shortcut paths and more detailed representations within same data
- Can orient to higher level ‘query model’ by developing specialised custom shortcuts (e.g. stratigraphic relationships)
- Can model CRM E55 type hierarchies and express SKOS concepts – again not one thing or the other, not violating compatibility of either model

Using STELLAR templates to produce RDF

```
// HEADER template is output once at start of processing
HEADER(options) ::= <<
        <?xml version="1.0"?>
        <rdf:RDF
        xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
        xmlns:crm="http://www.cidoc-crm.org/cidoc-crm/">
>>

// RECORD template is output once per data row
RECORD(options, data) ::= <<
        <crm:E22_Man-Made_Object rdf:about="http://myexample/E22_$data.id$" />
        <crm:E12_Production rdf:about="http://myexample/E12_$data.id$" />
        <crm:E57_Material rdf:about="http://myexample/E57_$data.material$" />

        <rdf:Description rdf:about="http://myexample/E22_$data.id$">
        <crm:P45_consists_of rdf:resource="http://myexample/E57_$data.material$" />
        <crm:P108i_was_produced_by rdf:resource="http://myexample/E12_$data.id$" />
        </rdf:Description>

        <rdf:Description rdf:about="http://myexample/E57_$data.material$">
        <crm:P45i_is_incorporated_in rdf:resource="http://myexample/E22_$data.id$" />
        <crm:P126i_was_employed_in rdf:resource="http://myexample/E12_$data.id$" />
        </rdf:Description>

        <rdf:Description rdf:about="http://myexample/E12_$data.id$">
        <crm:P108_has_produced rdf:resource="http://myexample/E22_$data.id$" />
        <crm:P126_employed rdf:resource="http://myexample/E57_$data.material$" />
        </rdf:Description>
>>

// FOOTER template is output once at end of processing
FOOTER(options) ::== <<
        </rdf:RDF>
>>
```

•Templates are just text files. May be copied, edited, exchanged, disseminated

•XML/RDF syntax and namespace details are handled within the template

•User input is simple tabular delimited textual data with named fields that will be recognised by the template, e.g.:

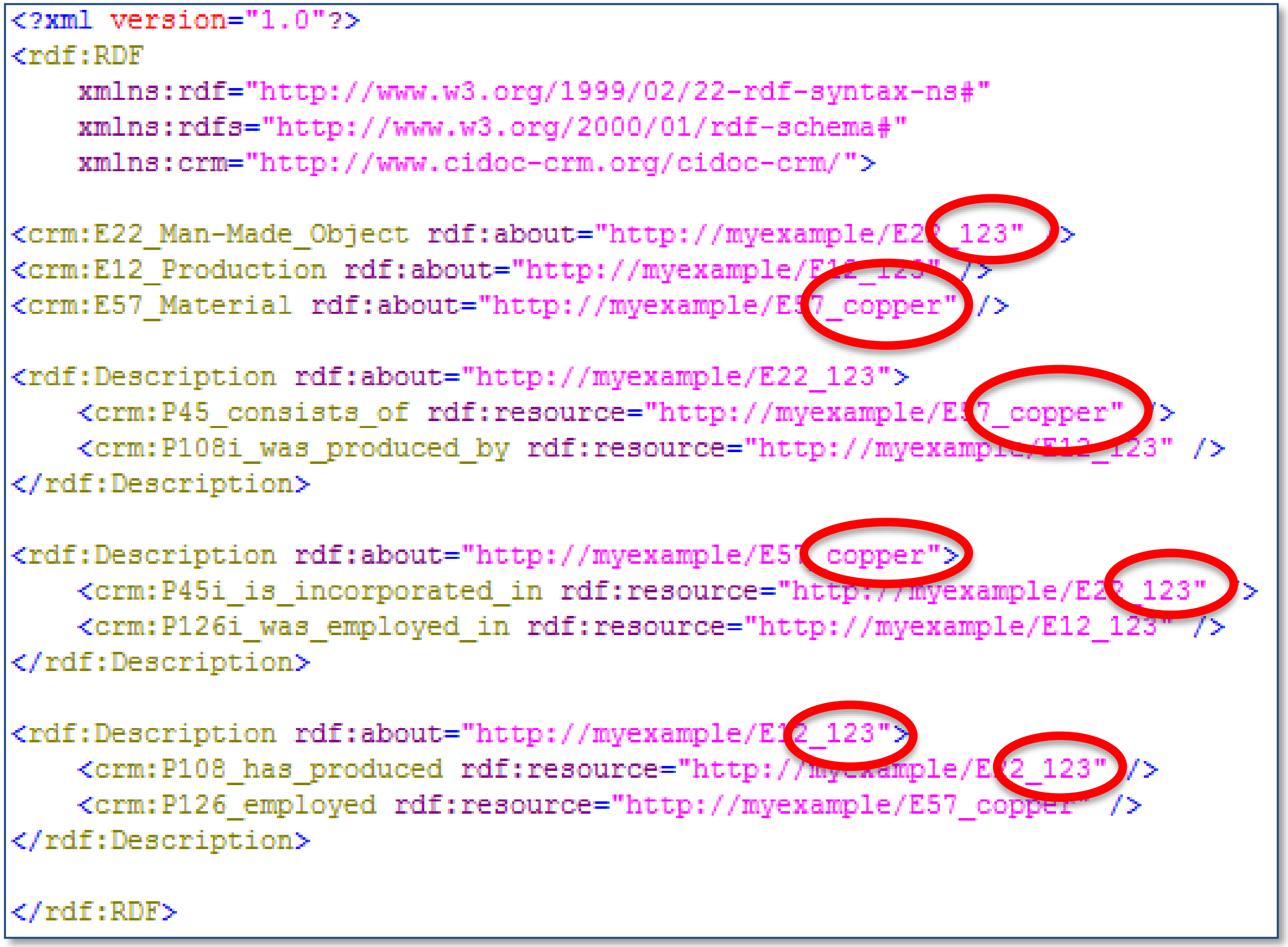
```
id, material
123, copper
234, gold
345, silver
```

•Predefined patterns of entities, properties and inverse properties are created by the template. Tabular data populates placeholders ($$) at runtime

•Output is consistent and repeatable

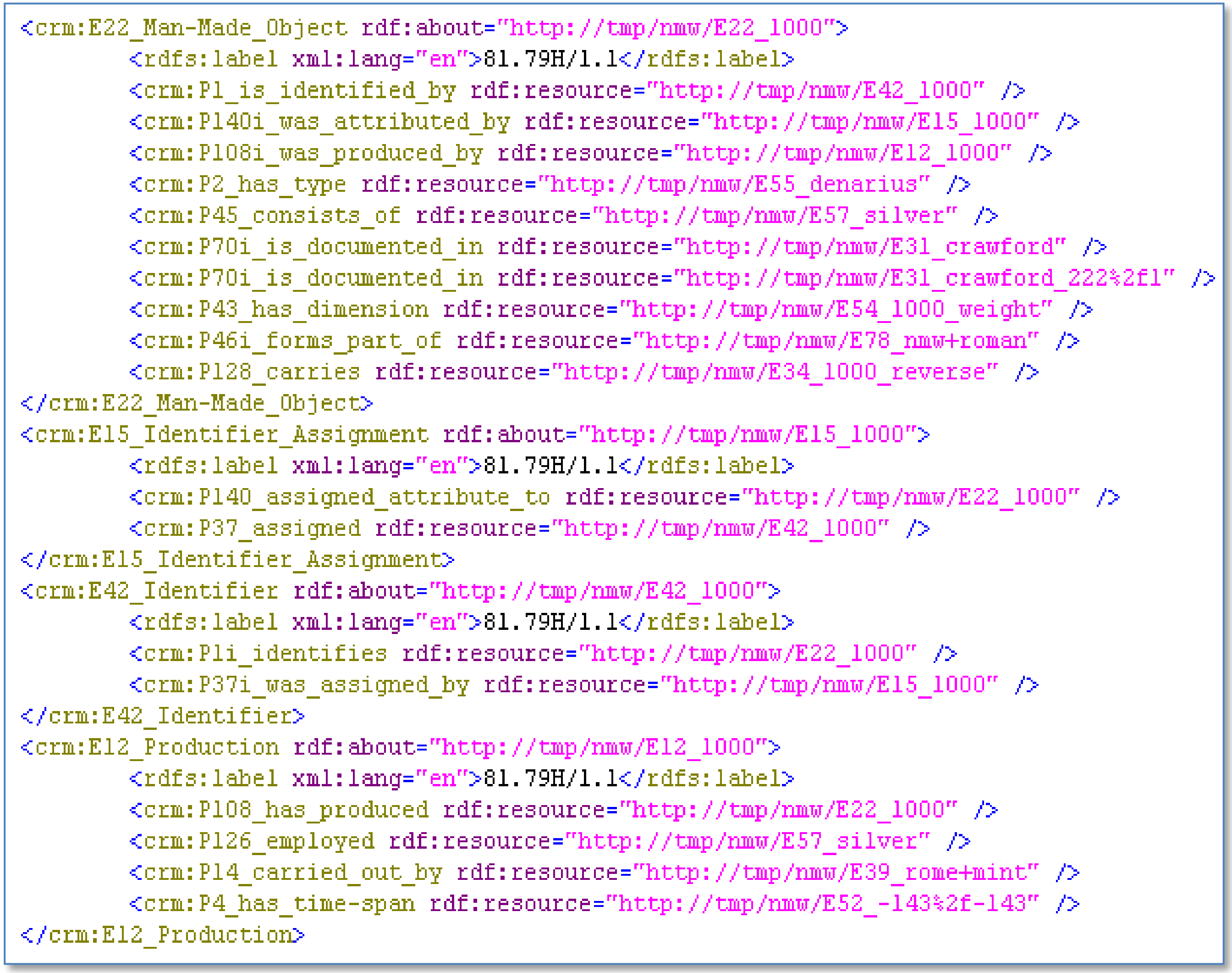
Resultant RDF - example

- Placeholders replaced with (XML encoded) data from named columns



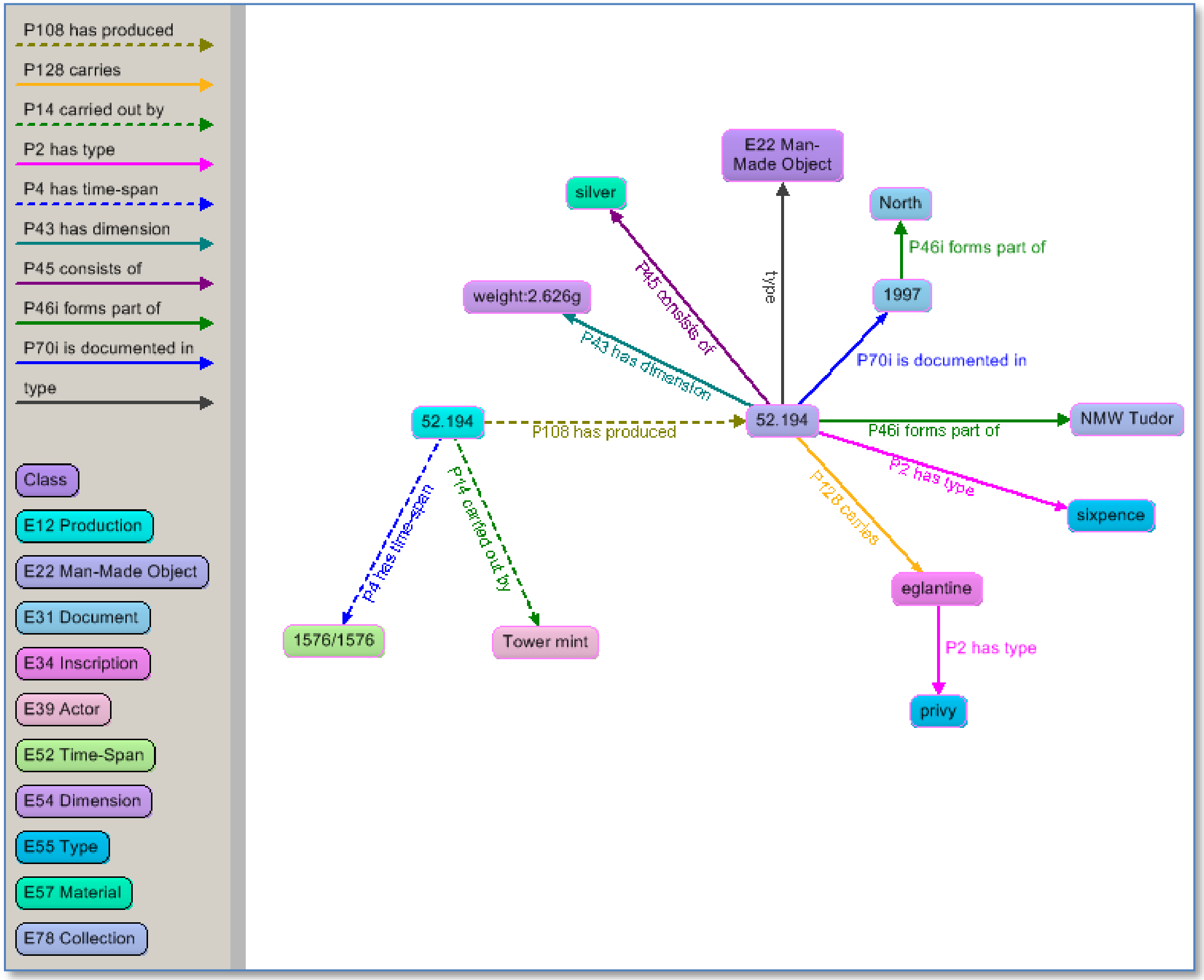
```
<?xml version="1.0"?>
<rdf:RDF
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:crm="http://www.cidoc-crm.org/cidoc-crm/">

<crm:E22_Man-Made_Object rdf:about="http://myexample/E22_123" />
<crm:E12_Production rdf:about="http://myexample/E12_123" />
<crm:E57_Material rdf:about="http://myexample/E57_copper" />

<rdf:Description rdf:about="http://myexample/E22_123">
    <crm:P45_consists_of rdf:resource="http://myexample/E57_copper" />
    <crm:P108i_was_produced_by rdf:resource="http://myexample/E12_123" />
</rdf:Description>

<rdf:Description rdf:about="http://myexample/E57_copper">
    <crm:P45i_is_incorporated_in rdf:resource="http://myexample/E22_123" />
    <crm:P126i_was_employed_in rdf:resource="http://myexample/E12_123" />
</rdf:Description>

<rdf:Description rdf:about="http://myexample/E12_123">
    <crm:P108_has_produced rdf:resource="http://myexample/E22_123" />
    <crm:P126_employed rdf:resource="http://myexample/E57_copper" />
</rdf:Description>

</rdf:RDF>
```

Data conversion extract (NMW) using STELLAR templates



```
<crm:E22_Man-Made_Object rdf:about="http://tmp/nmw/E22_1000">
        <rdfs:label xml:lang="en">81.79H/1.1</rdfs:label>
        <crm:P1_is_identified_by rdf:resource="http://tmp/nmw/E42_1000" />
        <crm:P140i_was_attributed_by rdf:resource="http://tmp/nmw/E15_1000" />
        <crm:P108i_was_produced_by rdf:resource="http://tmp/nmw/E12_1000" />
        <crm:P2_has_type rdf:resource="http://tmp/nmw/E55_denarius" />
        <crm:P45_consists_of rdf:resource="http://tmp/nmw/E57_silver" />
        <crm:P70i_is_documented_in rdf:resource="http://tmp/nmw/E31_crawford" />
        <crm:P70i_is_documented_in rdf:resource="http://tmp/nmw/E31_crawford_222%2f1" />
        <crm:P43_has_dimension rdf:resource="http://tmp/nmw/E54_1000_weight" />
        <crm:P46i_forms_part_of rdf:resource="http://tmp/nmw/E78_nmw+roman" />
        <crm:P128_carries rdf:resource="http://tmp/nmw/E34_1000_reverse" />
</crm:E22_Man-Made_Object>
<crm:E15_Identifier_Assignment rdf:about="http://tmp/nmw/E15_1000">
        <rdfs:label xml:lang="en">81.79H/1.1</rdfs:label>
        <crm:P140_assigned_attribute_to rdf:resource="http://tmp/nmw/E22_1000" />
        <crm:P37_assigned rdf:resource="http://tmp/nmw/E42_1000" />
</crm:E15_Identifier_Assignment>
<crm:E42_Identifier rdf:about="http://tmp/nmw/E42_1000">
        <rdfs:label xml:lang="en">81.79H/1.1</rdfs:label>
        <crm:P1i_identifies rdf:resource="http://tmp/nmw/E22_1000" />
        <crm:P37i_was_assigned_by rdf:resource="http://tmp/nmw/E15_1000" />
</crm:E42_Identifier>
<crm:E12_Production rdf:about="http://tmp/nmw/E12_1000">
        <rdfs:label xml:lang="en">81.79H/1.1</rdfs:label>
        <crm:P108_has_produced rdf:resource="http://tmp/nmw/E22_1000" />
        <crm:P126_employed rdf:resource="http://tmp/nmw/E57_silver" />
        <crm:P14_carried_out_by rdf:resource="http://tmp/nmw/E39_rome+mint" />
        <crm:P4_has_time-span rdf:resource="http://tmp/nmw/E52_-143%2f-143" />
</crm:E12_Production>
```

“Gruff” visualisation – entities and properties

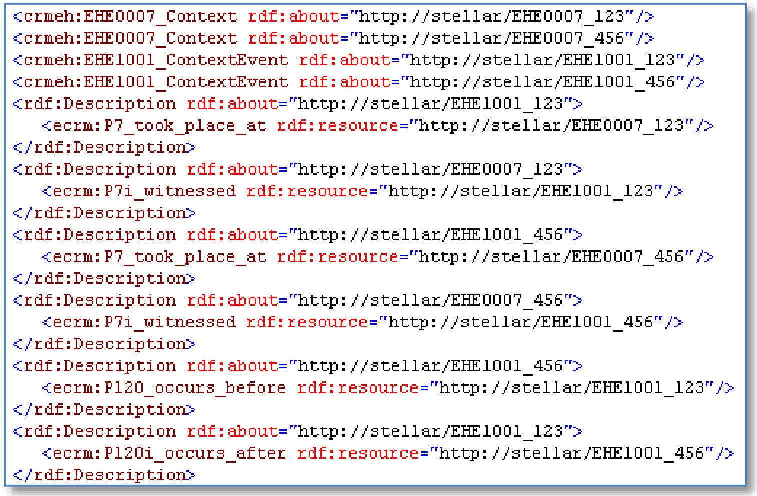


(Object 52.194 from the NMW Tudor numismatics collection)

Templates create shortcuts and hide complexity...

context_id	strat_lower_id
123	456

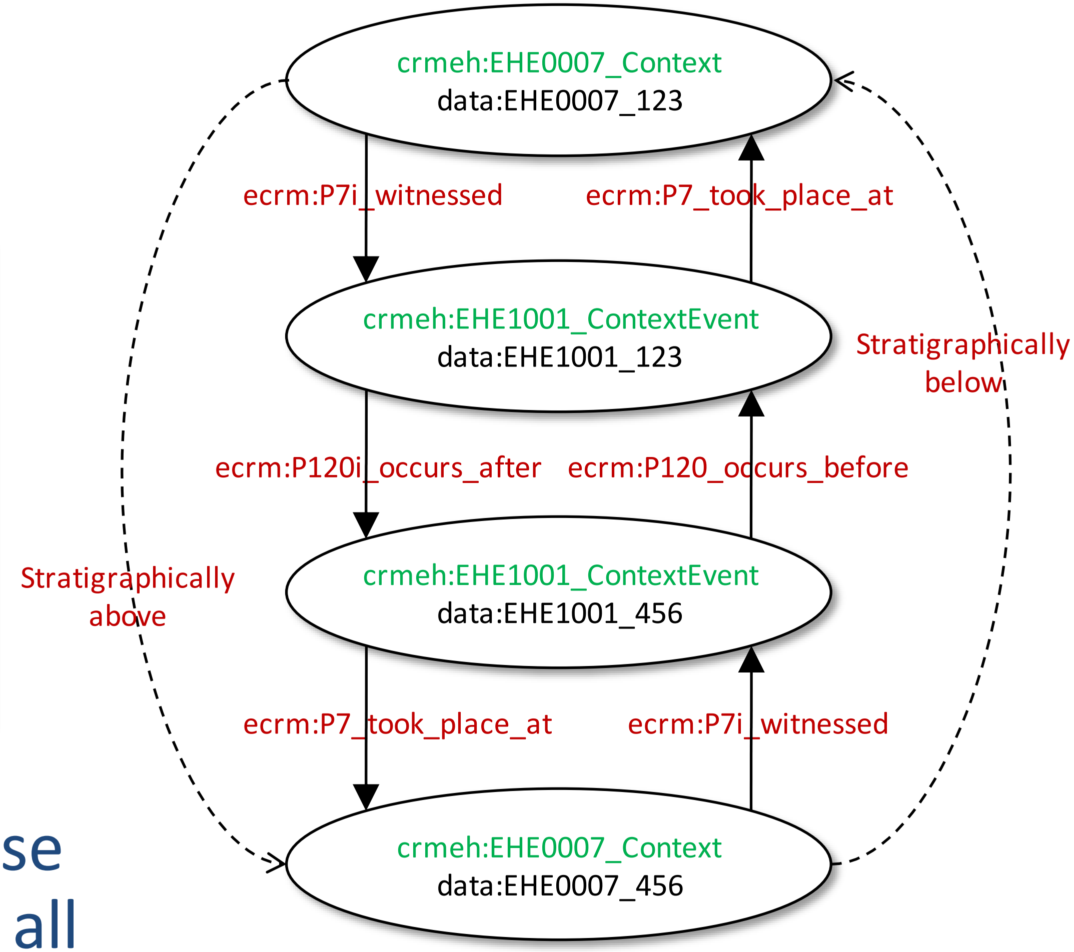
Template input



```
<crmeh:EHE0007_Context rdf:about="http://stellar/EHE0007_123"/>
<crmeh:EHE0007_Context rdf:about="http://stellar/EHE0007_456"/>
<crmeh:EHE1001_ContextEvent rdf:about="http://stellar/EHE1001_123"/>
<crmeh:EHE1001_ContextEvent rdf:about="http://stellar/EHE1001_456"/>
<rdf:Description rdf:about="http://stellar/EHE1001_123">
   <ecrm:P7_took_place_at rdf:resource="http://stellar/EHE0007_123"/>
</rdf:Description>
<rdf:Description rdf:about="http://stellar/EHE0007_123">
   <ecrm:P7i_witnessed rdf:resource="http://stellar/EHE1001_123"/>
</rdf:Description>
<rdf:Description rdf:about="http://stellar/EHE1001_456">
   <ecrm:P7_took_place_at rdf:resource="http://stellar/EHE0007_456"/>
</rdf:Description>
<rdf:Description rdf:about="http://stellar/EHE0007_456">
   <ecrm:P7i_witnessed rdf:resource="http://stellar/EHE1001_456"/>
</rdf:Description>
<rdf:Description rdf:about="http://stellar/EHE1001_456">
   <ecrm:P120_occurs_before rdf:resource="http://stellar/EHE1001_123"/>
</rdf:Description>
<rdf:Description rdf:about="http://stellar/EHE1001_123">
   <ecrm:P120i_occurs_after rdf:resource="http://stellar/EHE1001_456"/>
</rdf:Description>
```

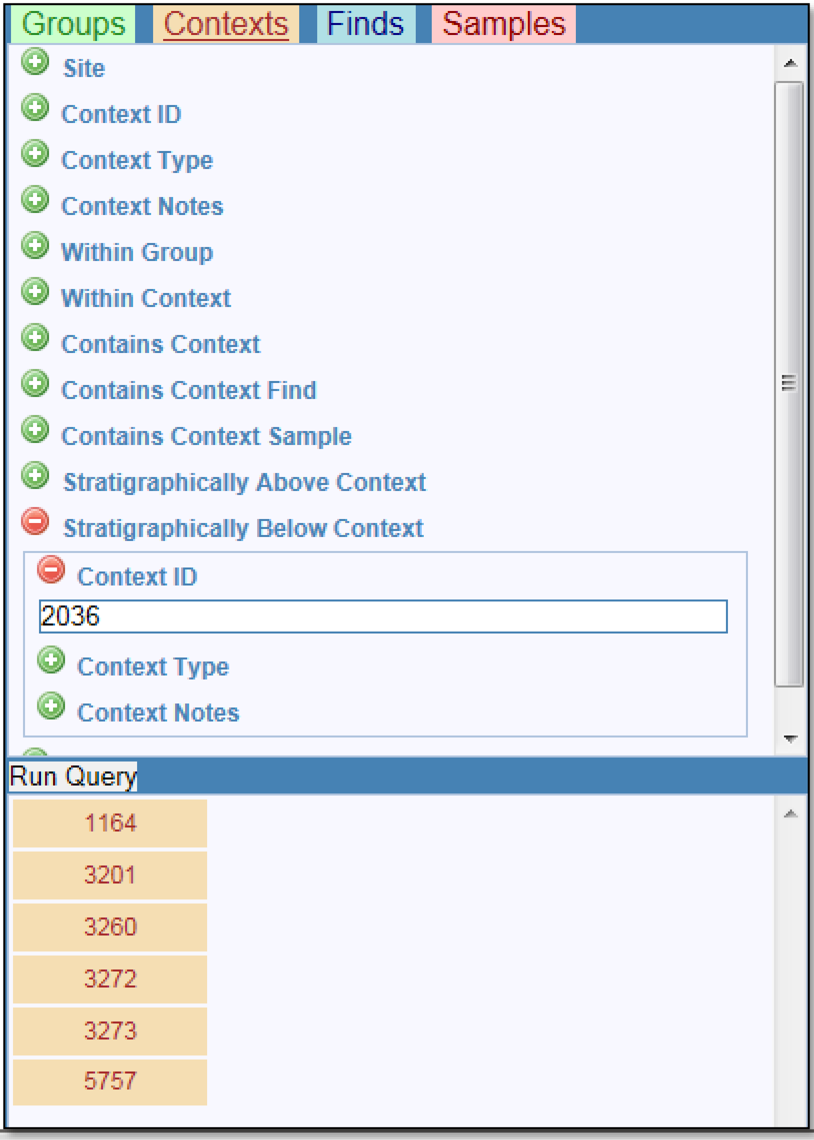
Template output

Intermediate entities, inverse properties and shortcuts all generated by the template



Data modelled

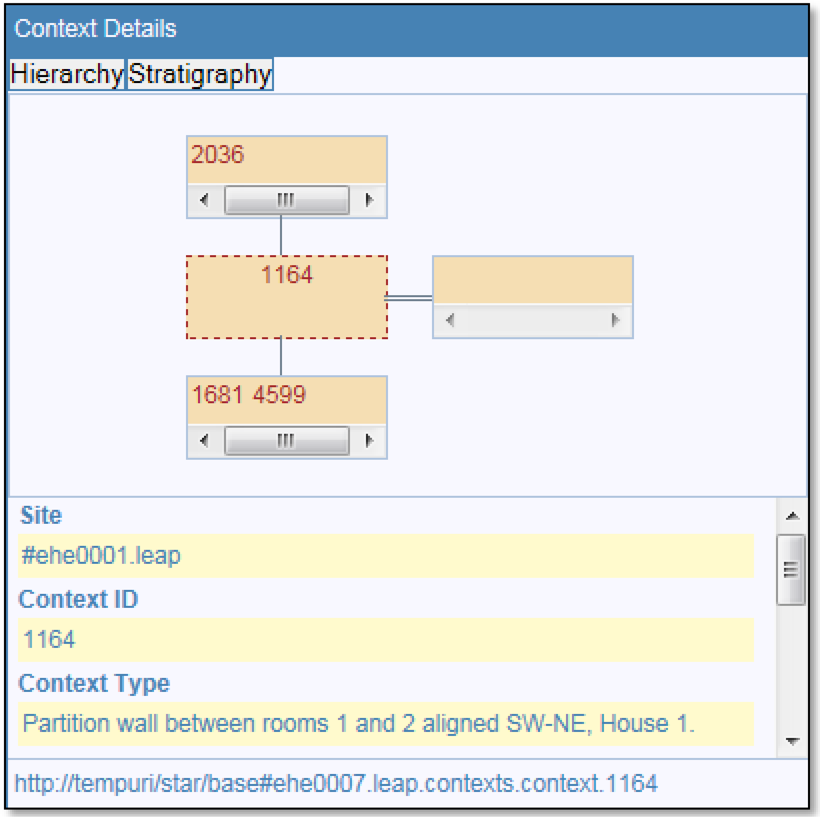
… just as user interfaces hide complexity



- ⊕ Site
- ⊕ Context ID
- ⊕ Context Type
- ⊕ Context Notes
- ⊕ Within Group
- ⊕ Within Context
- ⊕ Contains Context
- ⊕ Contains Context Find
- ⊕ Contains Context Sample
- ⊕ Stratigraphically Above Context
- ⊖ Stratigraphically Below Context
  - ⊖ Context ID: 2036
  - ⊕ Context Type
  - ⊕ Context Notes

Run Query

1164
3201
3260
3272
3273
5757



Site
#ehe0001.leap

Context ID
1164

Context Type
Partition wall between rooms 1 and 2 aligned SW-NE, House 1.

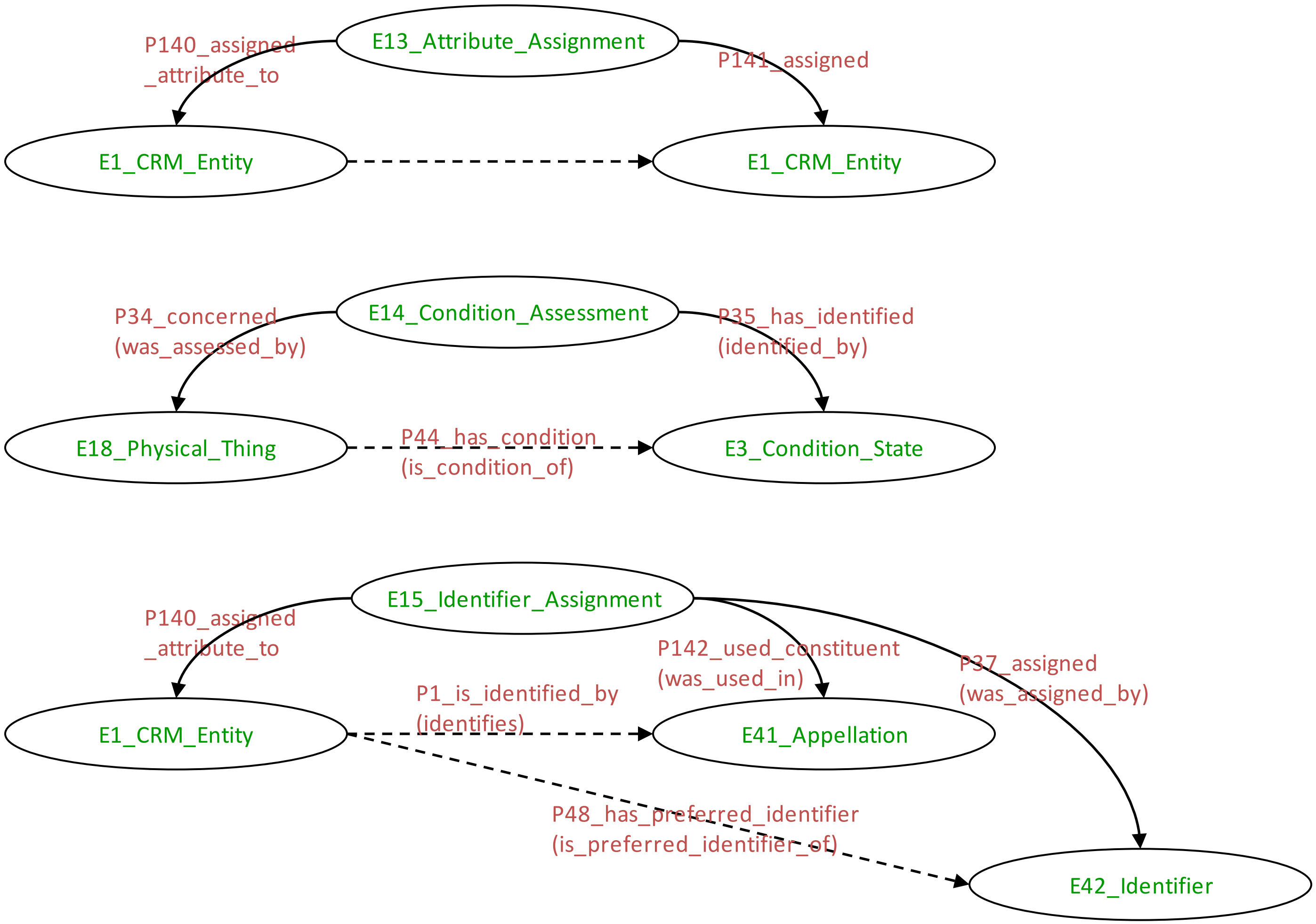
http://tempuri/star/base#ehe0007.leap.contexts.context.1164

STAR project query builder
- generates and issues SPARQL queries in the background

CRM Shortcuts

- Fully elaborated property paths in CRM event based model can be verbose
- CRM allows for certain ‘shortcut’ properties
- Reasoners could not automatically substitute between fully formed path and shortcut path without additional machine readable information
- Templates can model both alternative paths simultaneously

CRM Shortcuts



Summary

- Different mappings can potentially pose significant problems for semantic interoperability (cf BRICKS).
- Reasoning is an important possibility for CRM and there will be cases where clearly needed.
- However do not need to create unnecessary alternative paths for similar data
- Pragmatic approach: combine developments in reasoning with efforts at consensus on patterns for CRM mappings and guidelines.

Summary

- Mapping and extraction process is inherently complex, needs tools to maintain consistency at scale, and repeatable workflow
- Templates can simultaneously model multiple alternate paths (e.g. shortcuts) and alternate representations (e.g. E55 Type / SKOS Concept)
- Templates handle lower level syntax issues and implement predefined patterns of data - improving consistency and hiding complexity – if we can just agree on the patterns (!)

Future?

- Agreement on implementation details?
- Agreement on mapping patterns and guidelines?
- Possible to state purpose of a mapping exercise?
- Registries of mapping patterns?
- Core metadata for mapping patterns?

Pattern based mapping and extraction via the CIDOC CRM

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([1]University of South Wales, [2]English Heritage, [3]Archaeology Data Service)

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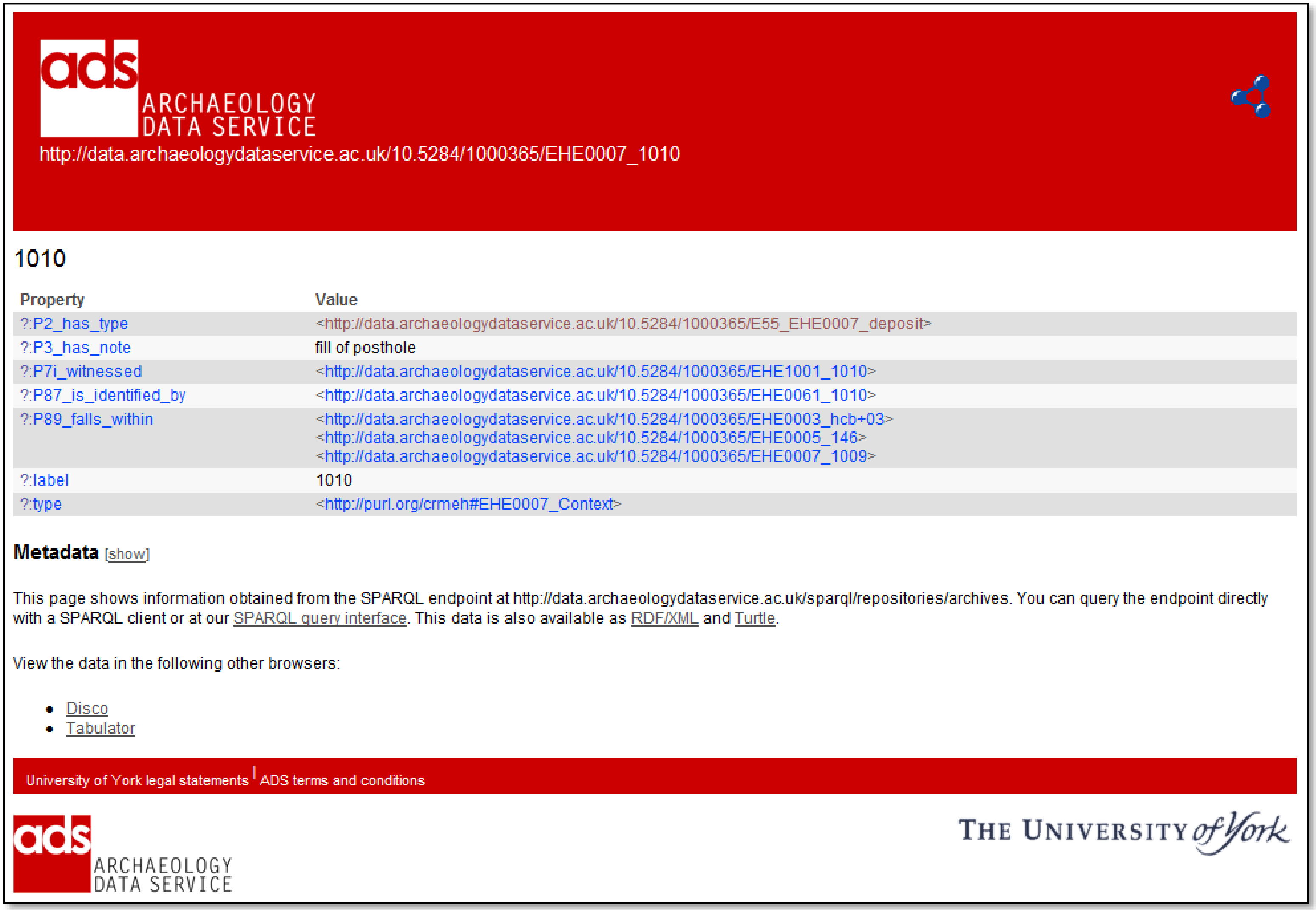
Archaeology Data Service (ADS) Linked Data



ARCHAEOLOGY DATA SERVICE
http://data.archaeologydataservice.ac.uk/10.5284/1000365/EHE0007_1010

1010

Property	Value
?:P2_has_type	<http://data.archaeologydataservice.ac.uk/10.5284/1000365/E55_EHE0007_deposit>
?:P3_has_note	fill of posthole
?:P7i_witnessed	<http://data.archaeologydataservice.ac.uk/10.5284/1000365/EHE1001_1010>
?:P87_is_identified_by	<http://data.archaeologydataservice.ac.uk/10.5284/1000365/EHE0061_1010>
?:P89_falls_within	<http://data.archaeologydataservice.ac.uk/10.5284/1000365/EHE0003_hcb+03> <http://data.archaeologydataservice.ac.uk/10.5284/1000365/EHE0005_146> <http://data.archaeologydataservice.ac.uk/10.5284/1000365/EHE0007_1009>
?:label	1010
?:type	<http://purl.org/crmeh#EHE0007_Context>

Metadata [show]

This page shows information obtained from the SPARQL endpoint at http://data.archaeologydataservice.ac.uk/sparql/repositories/archives. You can query the endpoint directly with a SPARQL client or at our SPARQL query interface. This data is also available as RDF/XML and Turtle.

View the data in the following other browsers:

- Disco
- Tabulator

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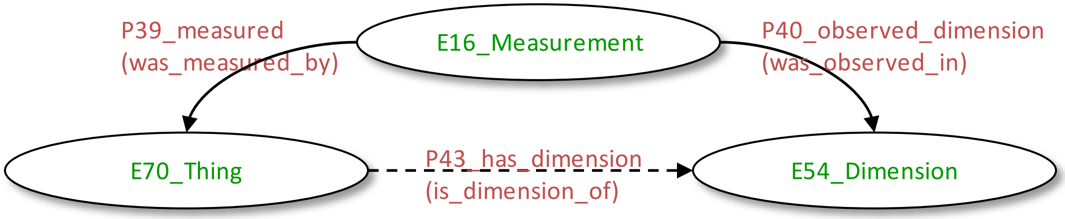
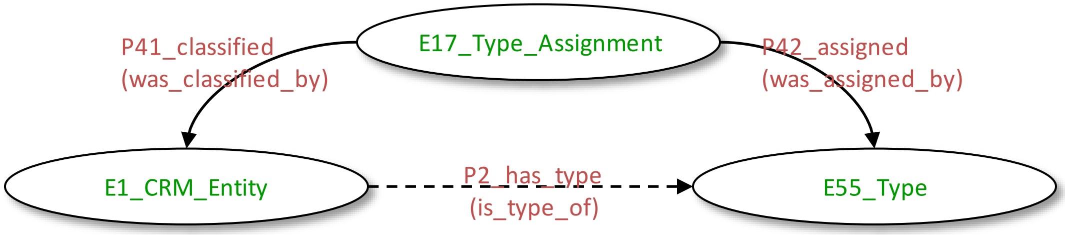
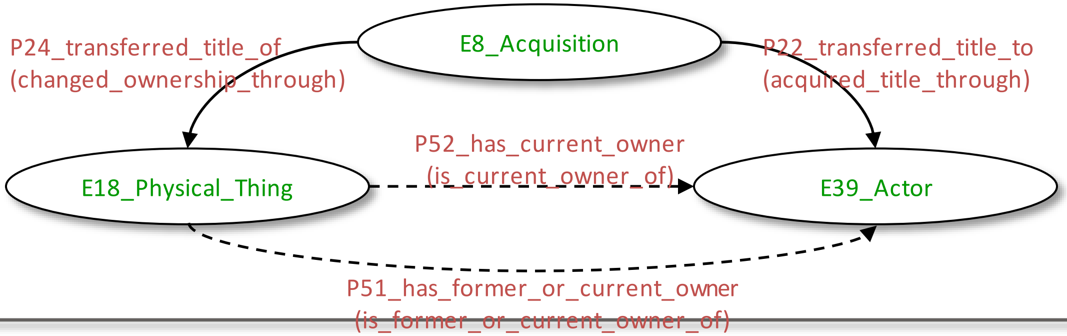
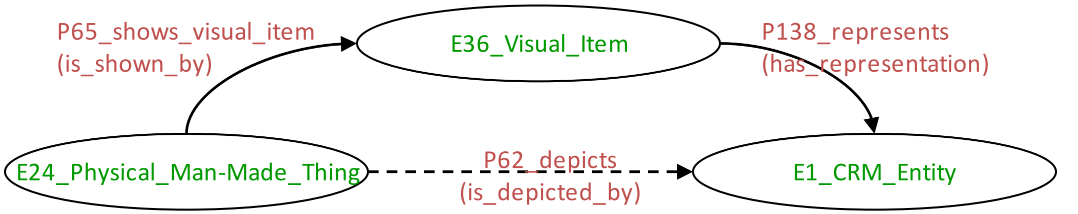
CRM Shortcuts

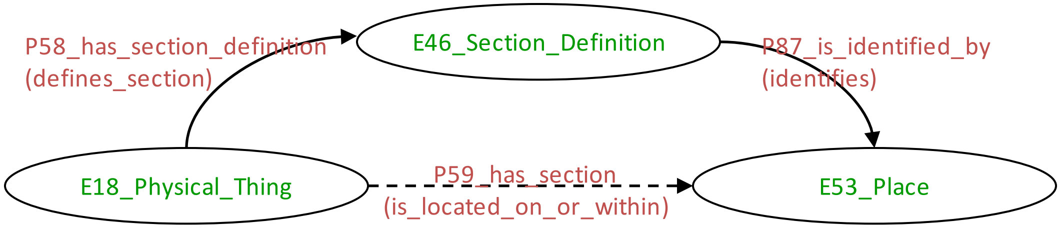


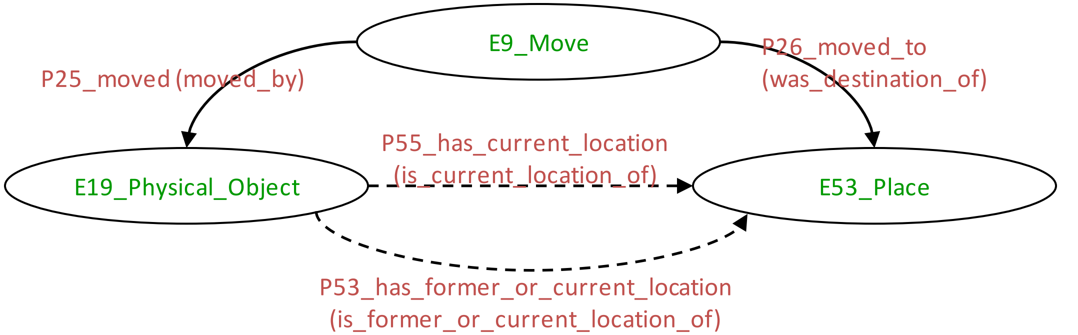




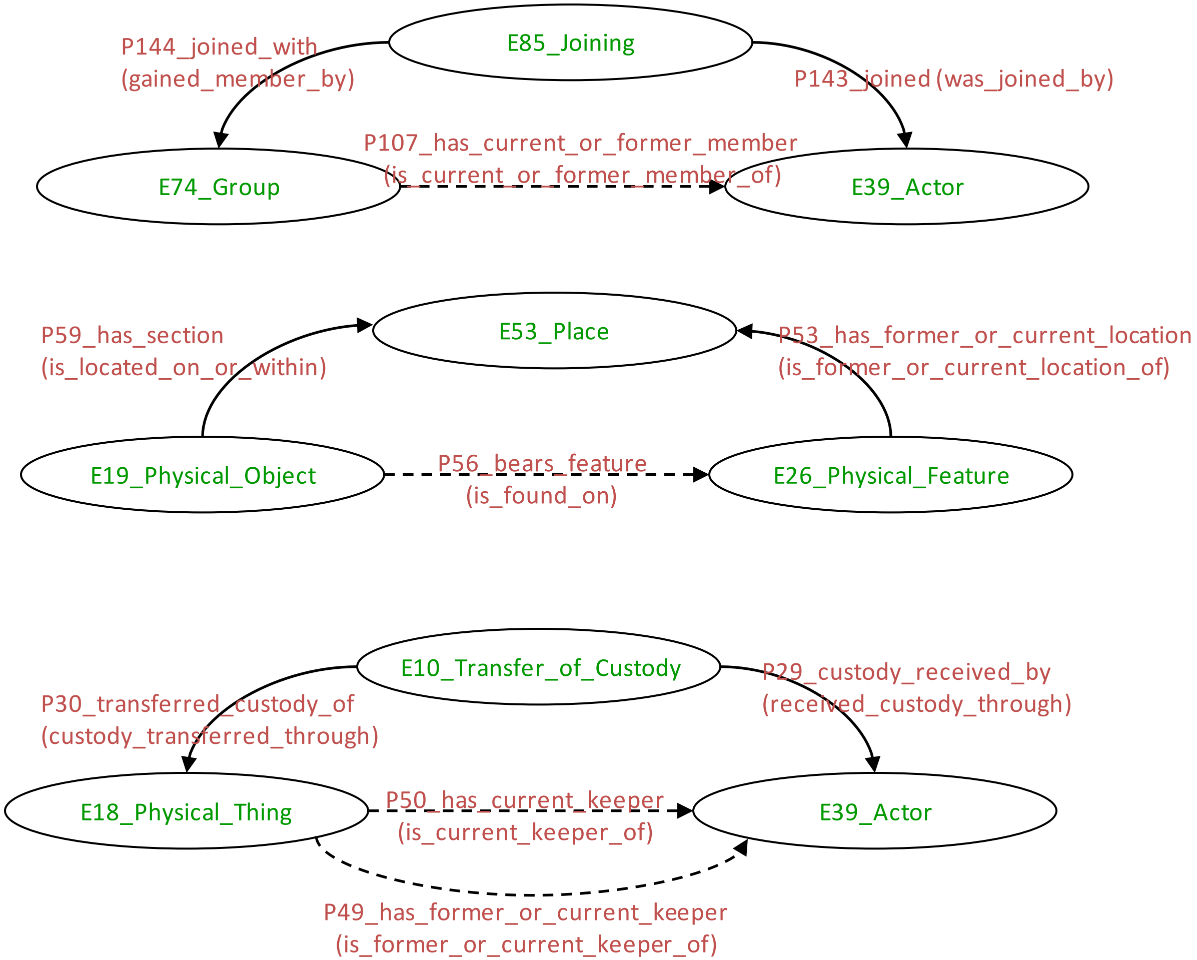
CRM Shortcuts (3 of 4)







CRM Shortcuts (4 of 4)


E85_Joining
P144_joined_with
(gained_member_by)
P143_joined (was_joined_by)
P107_has_current_or_former_member
(is_current_or_former_member_of)
E74_Group
E39_Actor
E53_Place
P59_has_section
(is_located_on_or_within)
P53_has_former_or_current_location
(is_former_or_current_location_of)
E19_Physical_Object
P56_bears_feature
(is_found_on)
E26_Physical_Feature
E10_Transfer_of_Custody
P30_transferred_custody_of
(custody_transferred_through)
P29_custody_received_by
(received_custody_through)
E18_Physical_Thing
P50_has_current_keeper
(is_current_keeper_of)
E39_Actor
P49_has_former_or_current_keeper
(is_former_or_current_keeper_of)