M36_Demo

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DOME 4.0

www.dome40.eu

WP1 – Demo and Update

Report and status P2

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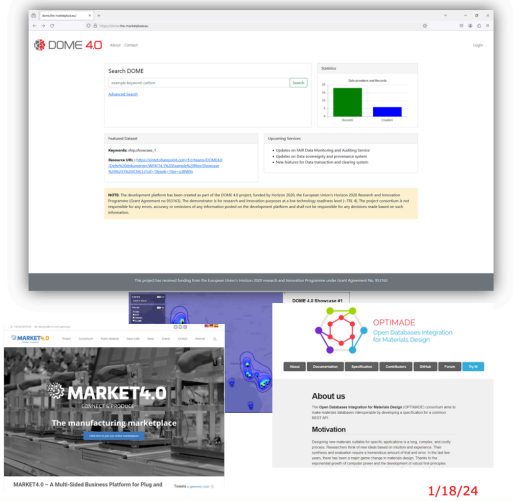
DOME 4.0 – A high level summary

DOME 4.0

- DOME 4.0 Core
  - Front end: features and external onboarding
  - Back end: semantic interoperability
- 9 B2B showcases
  - Offline development and execution
  - Online currently in progress



1 Outline

- Focus on the Semantic Discovery and Knowledge Base backend components
- Demonstrate mapping and linking of communities semantically
- Integration of third party **ontology** and *data*
  - EU data infrastructure
- Demo: Synthetic case study of the backend - linking materialsproject.org, EuroSciVoc and DOME 4.0!

2 Outline of the Steps

- Load the ontology eco system - as basis for all data and knowldge!
- Create fully semantic data sets (Tier1: compliant with DOME 4.0 data Set Ontology)
- Demonstrate Visualisation and SparQL and python query

3 Note:

This work is largely based on D3.6, it extends SimPhoNy-Future into a new Package developed specifcally with DOME requirements in mind: **Ontology_Manager**, **OntoVIS** and **sigraDB**.

DomeDataSetfrom D3.6 is in /Users/adham/dev/dome/Ontology-matters/domeo/domeo.ttl

[2]:
```
from ontology_manager.ontology_utils import OntologyManager # loading the DOME␣
↪4.0 Ontology Manager Package
from rdflib import Graph, URIRef, Namespace, Literal, BNode, collection
from rdflib.namespace import SKOS, RDF, RDFS, OWL
from datetime import date
```

[3]:
```
from rdflib.extras.external_graph_libs import rdflib_to_networkx_multidigraph,␣
↪rdflib_to_graphtool
import networkx as nx
import matplotlib.pyplot as plt
```

[4]:
```
from ontodot.ontodot import vis, random_date_time, auto_bind_namespaces,␣
↪printH, generate_uuid, generate_random_materialproject_id
from ontodot.ontodot import OntoVis
```

[5]:
```
from types import SimpleNamespace # We use simple name spaces, it is a basis␣
↪for the new SimPhpNy Future
import os, random
```

[6]:
```
dome=SimpleNamespace() # This is equivalent to a *SimPhoNy lightweight session*
```

4 Load the DOME 4.0 ecosystem CORE ontology

[7]:
```
dome.g=Graph(bind_namespaces="rdflib")  # We are using RDFLIB directly, without␣
↪any wrappers on top of it for efficiency.
dome.ns=Namespace('https://dome40.eu/semantics/dome4.0_core#')
dome.path = "/Users/adham/dev/ontology/dome/Ontology-matters/"
dome.file='dome4.0_core_tbox.ttl'
```

[8]:
```
dome.g.parse(os.path.join(dome.path, dome.file))
```

[8]:
```
<Graph identifier=N6973b87c13804d45832885c342b4caf8 (<class
'rdflib.graph.Graph'>)>
```

5 Visualise

5.0.1 *We will be available in enhanced - interactive/modern form - on the front end with final release*

[9]:
```
vis(dome.g)
```

5.1 Load the Materials Informatics Ontology (MIO)

- MIO is a new top level ontology compliant with EMMO but is optimised for practical applications
- EMMO requires heavy use of reasoners as it is built on logic,
- This poses heavy constraints on applications, as one has to deal with complex structures, e.g., composite complex classes requiring intensive inference in real time
- MIO is simple and focuses on practical applications, especially for software engineering perspective

[10]:
```
mio=Graph(bind_namespaces="rdflib")
mio.parse("/Users/adham/dev/ontology/ontology_manager/MIO/mio/mio.ttl")
```

[10]:
```
<Graph identifier=N3edc34ad292d44c0b4b7245278a635b9 (<class
'rdflib.graph.Graph'>)>
```

6 Visualise

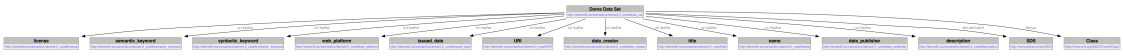
[11]:
```
vis(mio)
```

7 Advanced Visualisation and integration of ontology

We rely on RDFLIB like many other open source programs for RDF management, but augment it with additional tools both in house and external! - OntoVis, SimPhoNy-Future, Ontology Manager, SigraDB, OMI, are in house # Combine ontology from multiple resources and zoom into the data set with cross connections

[12]:
```
# Using the power of RDFLIB it is easy to combine ontology:
gc=dome.g+mio
# Using the new OntoVis: Visualisation and inspection is easy
ovis = OntoVis(gc)
```

[13]:
```
vis(ovis.zoom_in(URIRef("http://dome40.eu/semantics/dome4.0_core#data_set"), 2))
```



8 DOME 4.0 eco system supports all standard ontology

[14]:
```
# these are bindings (RDFLIB)
binds="""
@prefix domeES: <http://dome40.eu/semantics/dome4.0_core#> .
@prefix mio: <http://www.ddmd.io/mio/> .
@prefix dcat: <http://www.w3.org/ns/dcat#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix euroscivoc: <http://data.europa.eu/8mn/euroscivoc/> .
@prefix evmpo: <https://emmc.eu/semantics/evmpo/evmpo.ttl#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix http-meth: <http://www.w3.org/2011/http-methods#> .
@prefix msm: <http://iserve.kmi.open.ac.uk/ns/msm#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix xs: <http://www.w3.org/2001/XMLSchema#> .
"""
```

[15]:
```
nsbinds=auto_bind_namespaces(dome.g, binds)
```

```
g.bind(domeES, http://dome40.eu/semantics/dome4.0_core#)
g.bind(mio, http://www.ddmd.io/mio/)
g.bind(dcat, http://www.w3.org/ns/dcat#)
g.bind(dcterms, http://purl.org/dc/terms/)
g.bind(euroscivoc, http://data.europa.eu/8mn/euroscivoc/)
g.bind(evmpo, https://emmc.eu/semantics/evmpo/evmpo.ttl#)
g.bind(foaf, http://xmlns.com/foaf/0.1/)
g.bind(http-meth, http://www.w3.org/2011/http-methods#)
g.bind(msm, http://iserve.kmi.open.ac.uk/ns/msm#)
g.bind(owl, http://www.w3.org/2002/07/owl#)
g.bind(rdf, http://www.w3.org/1999/02/22-rdf-syntax-ns#)
g.bind(rdfs, http://www.w3.org/2000/01/rdf-schema#)
g.bind(skos, http://www.w3.org/2004/02/skos/core#)
g.bind(xs, http://www.w3.org/2001/XMLSchema#)
```

[16]:
```
print(nsbinds)
```

```
{'domeES': Namespace('http://dome40.eu/semantics/dome4.0_core#'), 'mio':
Namespace('http://www.ddmd.io/mio/'), 'dcat':
Namespace('http://www.w3.org/ns/dcat#'), 'dcterms':
Namespace('http://purl.org/dc/terms/'), 'euroscivoc':
Namespace('http://data.europa.eu/8mn/euroscivoc/'), 'evmpo':
Namespace('https://emmc.eu/semantics/evmpo/evmpo.ttl#'), 'foaf':
Namespace('http://xmlns.com/foaf/0.1/'), 'http-meth':
Namespace('http://www.w3.org/2011/http-methods#'), 'msm':
Namespace('http://iserve.kmi.open.ac.uk/ns/msm#'), 'owl':
Namespace('http://www.w3.org/2002/07/owl#'), 'rdf':
Namespace('http://www.w3.org/1999/02/22-rdf-syntax-ns#'), 'rdfs':
Namespace('http://www.w3.org/2000/01/rdf-schema#'), 'skos':
Namespace('http://www.w3.org/2004/02/skos/core#'), 'xs':
Namespace('http://www.w3.org/2001/XMLSchema#')}
```

9 We create now a SimPhoNy-CUDS

- CUDS: Common Universal/Unified Data Structures!
- Check the MIO and domeES ontology!

[17]:
```
cuds=SimpleNamespace() # we use now simple version, no checks for the demo of␣
 ↪ontology types
cuds.g=Graph()
cuds_collection=set()
#cuds.ds=URIRef("http://dome40.eu/semantics/dome4.0_core#data_set")
```

[18]:
```
num_data_sets=10 # the number of synthetic data sets we want to create
domeES=nsbinds['domeES']
mioNS=nsbinds['mio']
```

[19]:
```
# Since this is a demo, we make our own creator, publisher, ...
## Note we do not claim any relation to materials project by the following,␣
 ↪this is merely a demon.
# these will be instances later of a User/Dataproider etc.
random_creator = lambda: random.choice(["Perosn 1", "Person 2", "Person 3",␣
 ↪"Person 4", "Person 5"])
# these will be instances later of a User/Dataproider etc.
random_publisher = lambda: random.choice(["Company 1", "Company 2", "Company␣
 ↪3", "Company 4", "Company 5", "Nature Scientific Data", "MaterialsProject.
 ↪prg"])
random_keywords = lambda k: random.sample(s.split('\n'), random.randint(3, 6))
```

10 Let us use EuroSciVoc as True Semantic keywords!

and integrate with `MIO+domeES` ontology! - Load the EuroSciVoc ontology (mostly individuals, but with clear hierarchy) - Use SPARQL to pick all the concepts that are relevant for engineering and technology - for the demo: Make a function to select randomly 1 to 5 such semantic keywords, and add it to the dataset.

11 Attain practical and real compliance, and use of European Infrastrcutre and investments.

[20]:
```
esvoc = SimpleNamespace()
esvoc.g = Graph()
esvoc.desc = "the EuroSciVoc"
esvoc.path = "/Users/adham/dev/dome/Ontology-matters/external/
 ↪EuroSciVoc-skos-ap-eu_1.3.ttl" # Once we find and end point, we can get this␣
 ↪from teh net directly.
esvoc.g.parse(esvoc.path)
# SPARQL query to choose all elements narrower than engineering and technology.
q="""
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>

SELECT ?narrowerConcept ?narrowerLabel
WHERE {
    ?narrowerConcept skos:broader+ <http://data.europa.eu/8mn/euroscivoc/
 ↪64605fff-1946-4fd4-b021-e2e83b71dcac> .
    ?narrowerConcept skos:prefLabel ?narrowerLabel .
        FILTER(LANGMATCHES(LANG(?narrowerLabel), "en"))
}
"""
# Noe the UUID may change between versions,  need to confirm!
```

[21]:
```
# run the query
esvoc.r = esvoc.g.query(q)
```

[22]:
```
#for i in esvoc.r:
#    print(i)
printH(f" We find {len(esvoc.r)} semantic keywords relevant for technology and engineering")
```

We find 208 semantic keywords relevant for technology and engineering:
==========

[23]:
```
esvoc.r_formated = [{'IRI': str(row.narrowerConcept), 'Label': str(row.narrowerLabel)} for row in esvoc.r]
esvoc.random = lambda r: random.sample([[r_['IRI'], r_['Label']] for r_ in r], random.randint(2, 6))
for i in range(3):
    print(esvoc.random(esvoc.r_formated))
```

```
[['http://data.europa.eu/8mn/euroscivoc/c2a8caf5-4ee8-43ff-a3cd-bae7430e4e18',
'supercomputers'],
['http://data.europa.eu/8mn/euroscivoc/0085a6d1-0b32-479f-a560-0cbf6cffee9b',
'astronautical engineering'],
['http://data.europa.eu/8mn/euroscivoc/8d83b645-355f-4cf1-abf3-ce4cd3172c34',
'radio frequency'],
['http://data.europa.eu/8mn/euroscivoc/abadc19a-13ab-4bc6-951b-8f12226b3e8b',
'cognitive radio']]
[['http://data.europa.eu/8mn/euroscivoc/ece8d70d-2311-4d6d-ae12-473fc5c09a5d',
'sustainable architecture'],
['http://data.europa.eu/8mn/euroscivoc/e4062af9-fc49-4826-9bdb-e549f3f0f191',
'food technology'],
['http://data.europa.eu/8mn/euroscivoc/eeb88fa8-7b5a-440f-a3c9-add16c6b5cd2',
'mobile radio']]
[['http://data.europa.eu/8mn/euroscivoc/7b002931-b33d-4f72-87db-4ae7db02e938',
'bioleaching'],
['http://data.europa.eu/8mn/euroscivoc/c835a32d-04c8-493b-9644-203414287c92',
'composites'],
['http://data.europa.eu/8mn/euroscivoc/e4062af9-fc49-4826-9bdb-e549f3f0f191',
'food technology'],
['http://data.europa.eu/8mn/euroscivoc/53d318ec-2f1b-41e4-8317-24b35f9a9120',
'structural engineering'],
['http://data.europa.eu/8mn/euroscivoc/f08d8dbc-70a6-4d8c-8f83-62e58a17bf2d',
'food safety'],
['http://data.europa.eu/8mn/euroscivoc/7f86cf31-2001-4f17-8941-3318bb68bc21',
'marine energy']]
```

[24]:
```
for i in range(1, num_data_sets + 1):
    cuds.ds = URIRef(f"{domeES}DS_{i}")
    cuds.uri = URIRef(f"{domeES}DS_{i}")
    cuds.g.add((cuds.ds, RDF.type, domeES.data_set))

    # Add the required DOME 4.0 Data Set Ontology attributes
```

```
# These are cuds.add(spo triplet)
# cuds.uri = URIRef(f"http://materialsproject.org/data/calc_{i}")

mpid=generate_random_materialproject_id()
#uri = URIRef("https://next-gen.materialsproject.org/materials/mp-19149")
uri=URIRef(f"https://next-gen.materialsproject.org/materials/{mpid}")
cuds.g.add( (uri, RDF.type, domeES.URI) )
cuds.g.add((cuds.ds, domeES.hasPart, uri))

printH(f"this is a DOME 4.0 Data Set: {cuds.ds}")
printH(f"this Data Set point to: {uri}")

wp = URIRef("https://next-gen.materialsproject.org/")
cuds.g.add( (wp, RDF.type, domeES.web_platform) )
cuds.g.add((cuds.ds, domeES.hasPart, wp))

dc = URIRef(f"{domeES}/{generate_uuid()}")
cuds.g.add( (dc, RDF.type, domeES.issued_date) )
the_date=Literal(random_date_time())
cuds.g.add( (cuds.ds, domeES.hasPart, dc) )
cuds.g.add( (dc, mioNS.hasValue, the_date) )

dc = URIRef(f"{domeES}/{generate_uuid()}")
cuds.g.add( (dc, RDF.type, domeES.description) )
the_value=Literal("This is a description that will change later")
cuds.g.add( (cuds.ds, domeES.hasPart, dc) )
cuds.g.add( (dc, mioNS.hasValue, the_value) )

dc = URIRef(f"{domeES}/{generate_uuid()}")
cuds.g.add( (dc, RDF.type, domeES.data_creator) )
the_value=Literal(random_creator())
cuds.g.add( (cuds.ds, domeES.hasPart, dc) )
cuds.g.add( (dc, mioNS.hasValue, the_value) )

dc = URIRef(f"{domeES}/{generate_uuid()}")
cuds.g.add( (dc, RDF.type, domeES.license) )
the_value=Literal("CC-BY 4.0")
cuds.g.add( (cuds.ds, domeES.hasPart, dc) )
cuds.g.add( (dc, mioNS.hasValue, the_value) )


dc = URIRef(f"{domeES}/{generate_uuid()}")
cuds.g.add( (dc, RDF.type, domeES.data_publisher) )
the_value=Literal(random_publisher())
cuds.g.add( (cuds.ds, domeES.hasPart, dc) )
cuds.g.add( (dc, mioNS.hasValue, the_value) )
```

```
    dc = URIRef(f"{domeES}/{generate_uuid()}")
    cuds.g.add( (dc, RDF.type, domeES.title) )
    the_value=Literal("this is a title placeholder")
    cuds.g.add( (cuds.ds, domeES.hasPart, dc) )
    cuds.g.add( (dc, mioNS.hasValue, the_value) )


    # get some semantic EUROSCIVOC keywords for demo
    ks=esvoc.random(esvoc.r_formated)
    for k in ks:
        print(k[1])
        dc = URIRef(k[0])
        cuds.g.add( (dc, RDF.type, domeES.semantic_keyword) )
        cuds.g.add( (dc, RDFS.label, Literal(k[1]) ))
        cuds.g.add( (cuds.ds, domeES.hasPart, dc) )

   # g.add((data_set_uri, mio.hasPart, domeES.syntactic_keyword))
```

```
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_1:
================================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-77:
================================================================================
food safety
telecommunications
environmental biotechnology
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_2:
================================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-91:
================================================================================
other engineering and technologies
environmental engineering
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_3:
================================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-27:
================================================================================
computer hardware
architecture engineering
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_4:
================================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-113:
================================================================================
electrodialysis
civil engineering
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_5:
================================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-75:
================================================================================
```

```
solar thermal
electric power generation
geothermal energy
tidal energy
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_6:
==========================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-39:
============================================================================
solar energy
fossil energy
natural gas
urban engineering
chemical process engineering
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_7:
==========================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-131:
============================================================================
reverse osmosis
subtractive manufacturing
microtechnology
environmental engineering
drones
electronic engineering
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_8:
==========================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-84:
============================================================================
fossil energy
urban engineering
geological engineering
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_9:
==========================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-45:
============================================================================
metabolic engineering
wearable medical technology
this is a DOME 4.0 Data Set: http://dome40.eu/semantics/dome4.0_core#DS_10:
==========================================================================
this Data Set point to: https://next-gen.materialsproject.org/materials/mp-27:
============================================================================
hydrogen energy
mechatronics
nanocrystals
radar
WiFi
```

Any data set (given as a IRI in general) **can be a DOME 4.0 Data Set**, this is simply achieved with the following line:

```
g.add((someURI, RDF.type, domeES.data_set))
```

[25]:
```
gc=cuds.g+dome.g+mio
ovis = OntoVis(gc)
```

[26]:
```
vis(ovis.zoom_in(URIRef("http://dome40.eu/semantics/dome4.0_core#DS_2"), 3))
```

[27]:
```
inspect_iri=URIRef("http://dome40.eu/semantics/dome4.0_core#DS_2")
q="""
SELECT ?predicate ?object
WHERE {
    <http://dome40.eu/semantics/dome4.0_core#DS_2> ?predicate ?object .
}
"""
DS99 = Graph()
r=gc.query(q)
for i in r:
    DS99.add((inspect_iri, i.predicate, i.object))
    q2 = f"""
    SELECT ?predicate ?object
    WHERE {{
        <{i.object}> ?predicate ?object .
    }}
    """
    r2 = gc.query(q2)
    for j in r2:
        DS99.add((j.object, j.predicate, j.object))
        print(j.object, j.predicate, j.object)
```

```
http://dome40.eu/semantics/dome4.0_core#data_creator
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#data_creator
Perosn 1 http://www.ddmd.io/mio/hasValue Perosn 1
environmental engineering http://www.w3.org/2000/01/rdf-schema#label
environmental engineering
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://dome40.eu/semantics/dome4.0_core#title http://www.w3.org/1999/02/22-rdf-
syntax-ns#type http://dome40.eu/semantics/dome4.0_core#title
this is a title placeholder http://www.ddmd.io/mio/hasValue this is a title
placeholder
http://dome40.eu/semantics/dome4.0_core#data_publisher
```

http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#data_publisher
Company 1 http://www.ddmd.io/mio/hasValue Company 1
http://dome40.eu/semantics/dome4.0_core#web_platform
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#web_platform
http://dome40.eu/semantics/dome4.0_core#description
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#description
This is a description that will change later http://www.ddmd.io/mio/hasValue
This is a description that will change later
http://dome40.eu/semantics/dome4.0_core#URI http://www.w3.org/1999/02/22-rdf-
syntax-ns#type http://dome40.eu/semantics/dome4.0_core#URI
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
other engineering and technologies http://www.w3.org/2000/01/rdf-schema#label
other engineering and technologies
CC-BY 4.0 http://www.ddmd.io/mio/hasValue CC-BY 4.0
http://dome40.eu/semantics/dome4.0_core#license
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#license
http://dome40.eu/semantics/dome4.0_core#issued_date
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#issued_date
2024-10-03T16:11:04.494639 http://www.ddmd.io/mio/hasValue
2024-10-03T16:11:04.494639
http://dome40.eu/semantics/dome4.0_core#web_platform
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#web_platform
http://dome40.eu/semantics/dome4.0_core#data_creator
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#data_creator
http://dome40.eu/semantics/dome4.0_core#syntactic_keyword
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#syntactic_keyword
http://dome40.eu/semantics/dome4.0_core#license http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#license
http://dome40.eu/semantics/dome4.0_core#name http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#name
http://dome40.eu/semantics/dome4.0_core#description
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#description
http://dome40.eu/semantics/dome4.0_core#issued_date
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#issued_date
http://dome40.eu/semantics/dome4.0_core#URI http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#URI

```
http://dome40.eu/semantics/dome4.0_core#data_publisher
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#data_publisher
http://dome40.eu/semantics/dome4.0_core#title http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#title
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
A dome specific representation of a Semantic Data Set
http://www.w3.org/2000/01/rdf-schema#comment A dome specific representation of a
Semantic Data Set
http://www.ddmd.io/mio/SDS http://www.w3.org/2000/01/rdf-schema#subClassOf
http://www.ddmd.io/mio/SDS
Dome Data Set http://www.w3.org/2000/01/rdf-schema#label Dome Data Set
http://www.w3.org/2002/07/owl#Class http://www.w3.org/1999/02/22-rdf-syntax-
ns#type http://www.w3.org/2002/07/owl#Class
```

[28]:
```
for s, p, o in DS99:
    print(s, p, o)
```

```
Perosn 1 http://www.ddmd.io/mio/hasValue Perosn 1
this is a title placeholder http://www.ddmd.io/mio/hasValue this is a title
placeholder
http://dome40.eu/semantics/dome4.0_core#issued_date
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#issued_date
http://dome40.eu/semantics/dome4.0_core#URI http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#URI
http://dome40.eu/semantics/dome4.0_core#name http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#name
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart https://next-
gen.materialsproject.org/
other engineering and technologies http://www.w3.org/2000/01/rdf-schema#label
other engineering and technologies
2024-10-03T16:11:04.494639 http://www.ddmd.io/mio/hasValue
2024-10-03T16:11:04.494639
http://dome40.eu/semantics/dome4.0_core#web_platform
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#web_platform
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://dome40.eu/semantics/dome4.0_core#/deac7486-443e-4562-bf46-8dac13fdb214
http://dome40.eu/semantics/dome4.0_core#data_creator
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#data_creator
http://www.w3.org/2002/07/owl#Class http://www.w3.org/1999/02/22-rdf-syntax-
ns#type http://www.w3.org/2002/07/owl#Class
```

CC-BY 4.0 http://www.ddmd.io/mio/hasValue CC-BY 4.0
environmental engineering http://www.w3.org/2000/01/rdf-schema#label
environmental engineering
http://dome40.eu/semantics/dome4.0_core#issued_date
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#issued_date
Dome Data Set http://www.w3.org/2000/01/rdf-schema#label Dome Data Set
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://data.europa.eu/8mn/euroscivoc/14e75836-6f05-46f9-9c82-ca12468b0452
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://dome40.eu/semantics/dome4.0_core#/bc845dd9-c77a-458a-aea6-57408c488588
http://dome40.eu/semantics/dome4.0_core#license
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#license
This is a description that will change later http://www.ddmd.io/mio/hasValue
This is a description that will change later
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://dome40.eu/semantics/dome4.0_core#/f41305a4-6862-419c-96ae-ab685aef22b4
http://dome40.eu/semantics/dome4.0_core#description
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#description
http://dome40.eu/semantics/dome4.0_core#web_platform
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#web_platform
http://dome40.eu/semantics/dome4.0_core#syntactic_keyword
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#syntactic_keyword
http://dome40.eu/semantics/dome4.0_core#data_publisher
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#data_publisher
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://dome40.eu/semantics/dome4.0_core#/ad874460-c0b2-4457-b200-3b899b762cf4
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://dome40.eu/semantics/dome4.0_core#/e56f921c-883f-44c3-bf90-f4af5713b06a
http://dome40.eu/semantics/dome4.0_core#title http://www.w3.org/1999/02/22-rdf-
syntax-ns#type http://dome40.eu/semantics/dome4.0_core#title
Company 1 http://www.ddmd.io/mio/hasValue Company 1
http://dome40.eu/semantics/dome4.0_core#DS_2 http://www.w3.org/1999/02/22-rdf-
syntax-ns#type http://dome40.eu/semantics/dome4.0_core#data_set
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart https://next-
gen.materialsproject.org/materials/mp-91
http://dome40.eu/semantics/dome4.0_core#semantic_keyword

```
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://dome40.eu/semantics/dome4.0_core#/1b77a25d-2402-44d1-80d6-b5454f7b3fef
http://dome40.eu/semantics/dome4.0_core#DS_2
http://dome40.eu/semantics/dome4.0_core#hasPart
http://data.europa.eu/8mn/euroscivoc/531bd18a-eedd-4345-8b2f-5464f96615f8
http://dome40.eu/semantics/dome4.0_core#data_publisher
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#data_publisher
http://dome40.eu/semantics/dome4.0_core#title http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#title
http://dome40.eu/semantics/dome4.0_core#license http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#license
http://dome40.eu/semantics/dome4.0_core#description
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#description
http://www.ddmd.io/mio/SDS http://www.w3.org/2000/01/rdf-schema#subClassOf
http://www.ddmd.io/mio/SDS
A dome specific representation of a Semantic Data Set
http://www.w3.org/2000/01/rdf-schema#comment A dome specific representation of a
Semantic Data Set
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://www.ddmd.io/mio/hasPart
http://dome40.eu/semantics/dome4.0_core#semantic_keyword
http://dome40.eu/semantics/dome4.0_core#URI http://www.w3.org/1999/02/22-rdf-
syntax-ns#type http://dome40.eu/semantics/dome4.0_core#URI
http://dome40.eu/semantics/dome4.0_core#data_creator
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://dome40.eu/semantics/dome4.0_core#data_creator
```

[29]:
```
vis(DS99)
```

[30]:
```
q = """
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX domeES: <http://dome40.eu/semantics/dome4.0_core#>

    SELECT ?s ?p ?o ?oLabel
    WHERE {
        ?s ?p ?o .
        ?o rdfs:label ?oLabel .
        ?o rdfs:label "medical engineering" .
```

```
        }
"""
```

[31]:
```
r=gc.query(q)
```

[32]:
```
for i in r:
    print(i)
```

[ ]:

[ ]:

[ ]: