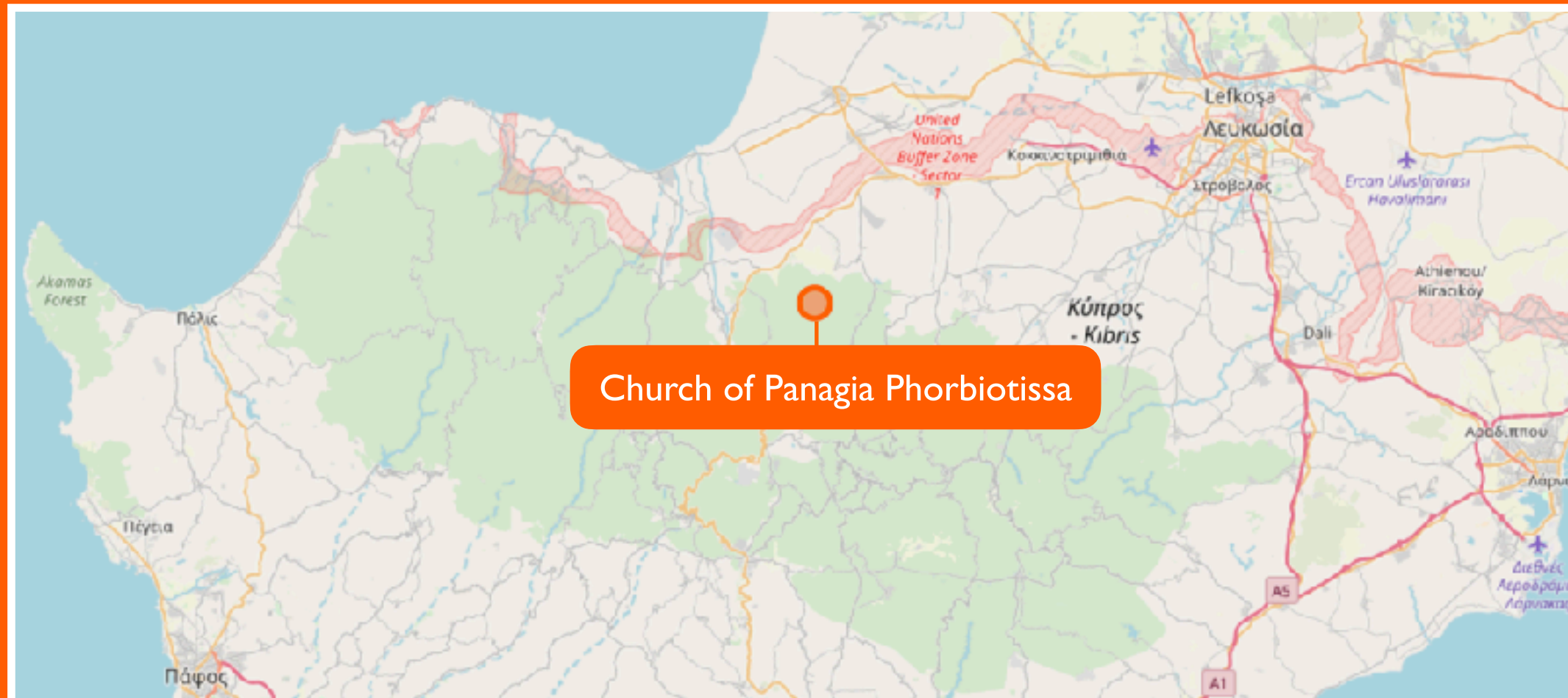


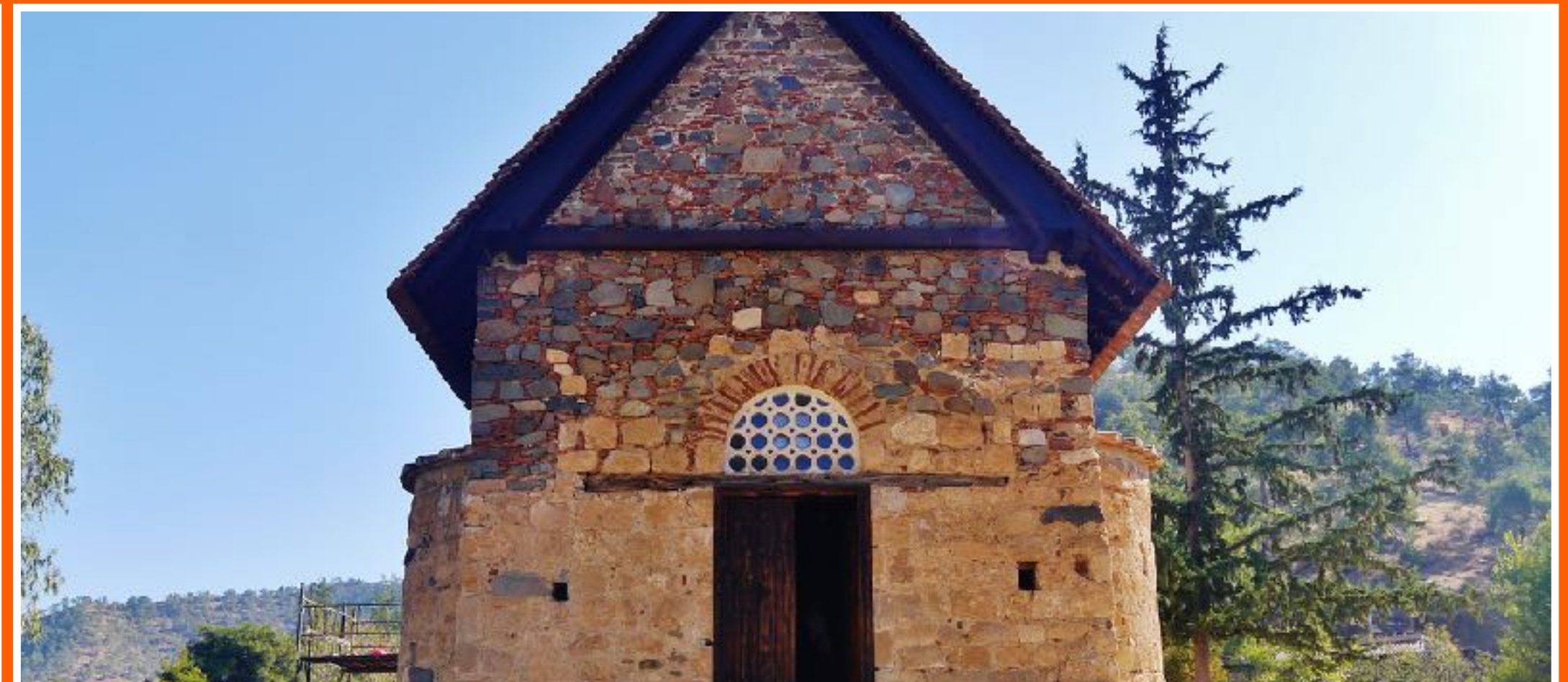
MEDIATING ACCESS TO CIDOC CRM DATA USING RAGS

Nicola Carboni, School of Information Sciences





Map of the island of Cyprus with location of the church



Church of Panagia Phorbiotissa , Cyprus

Carboni, N.; de Luca, L. An Ontological Approach to the Description of Visual and Iconographical Representations. *Heritage* 2019, 2, 1191-1210. <https://doi.org/10.3390/heritage2020078>

Carr, Annemarie Weyl, and Andreas Nicolaidès. 2012. *Asinou Across Time*. Washington, D.C: Dumbarton Oaks Research Library and Collection.

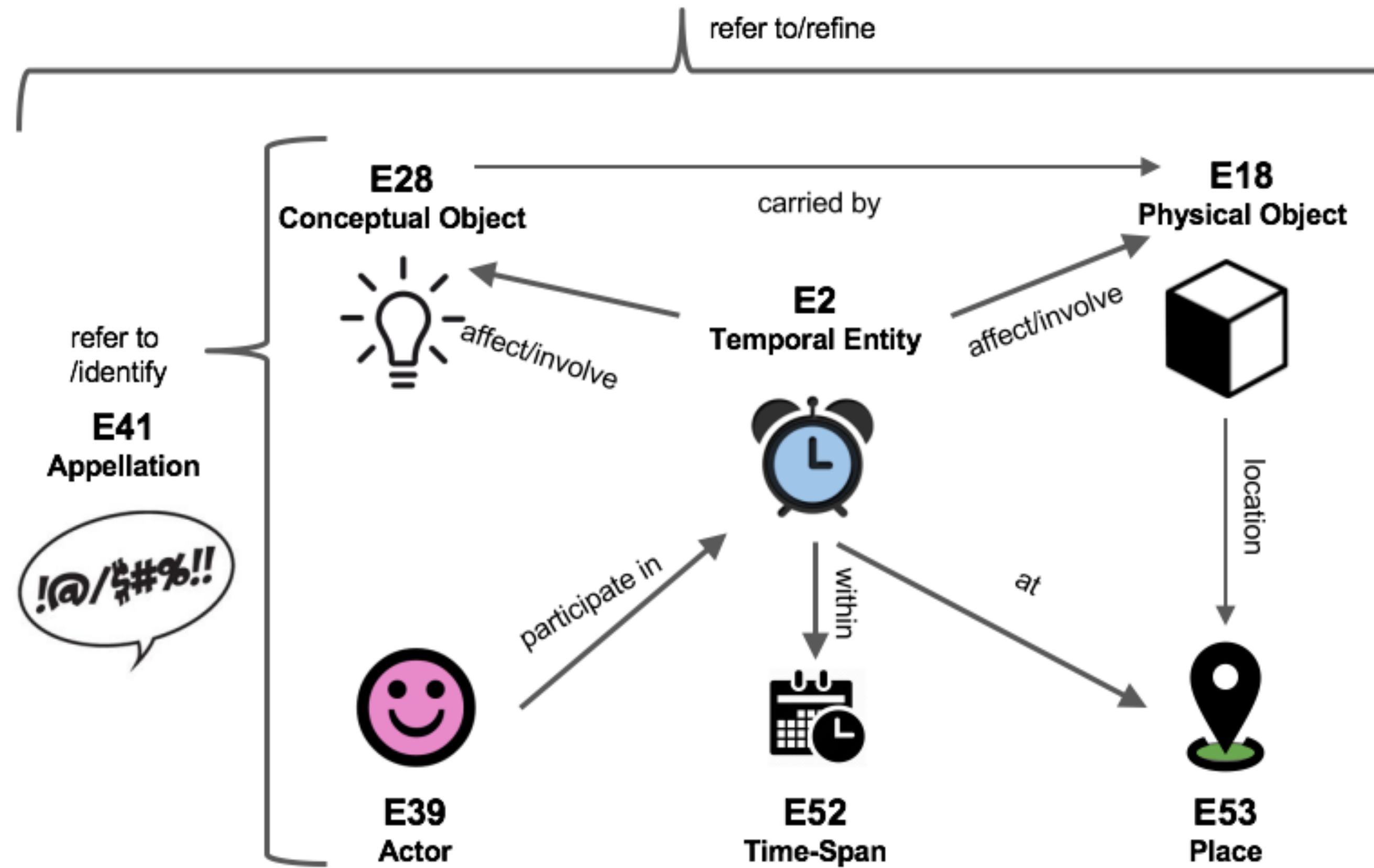
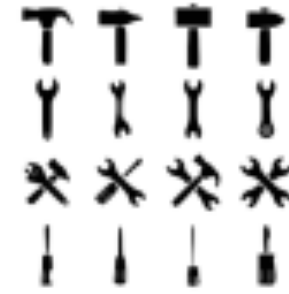


CIDOC CRM

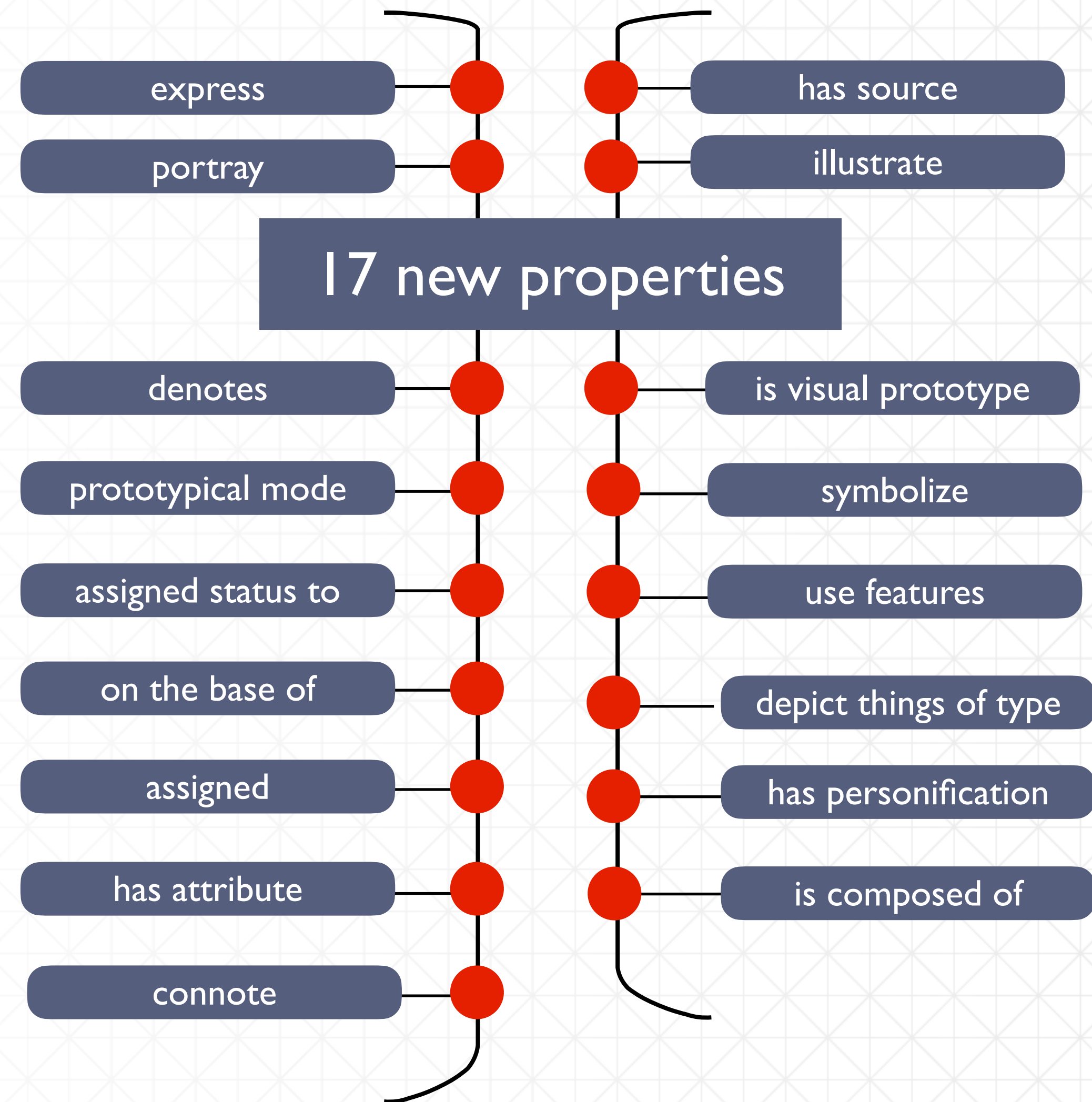
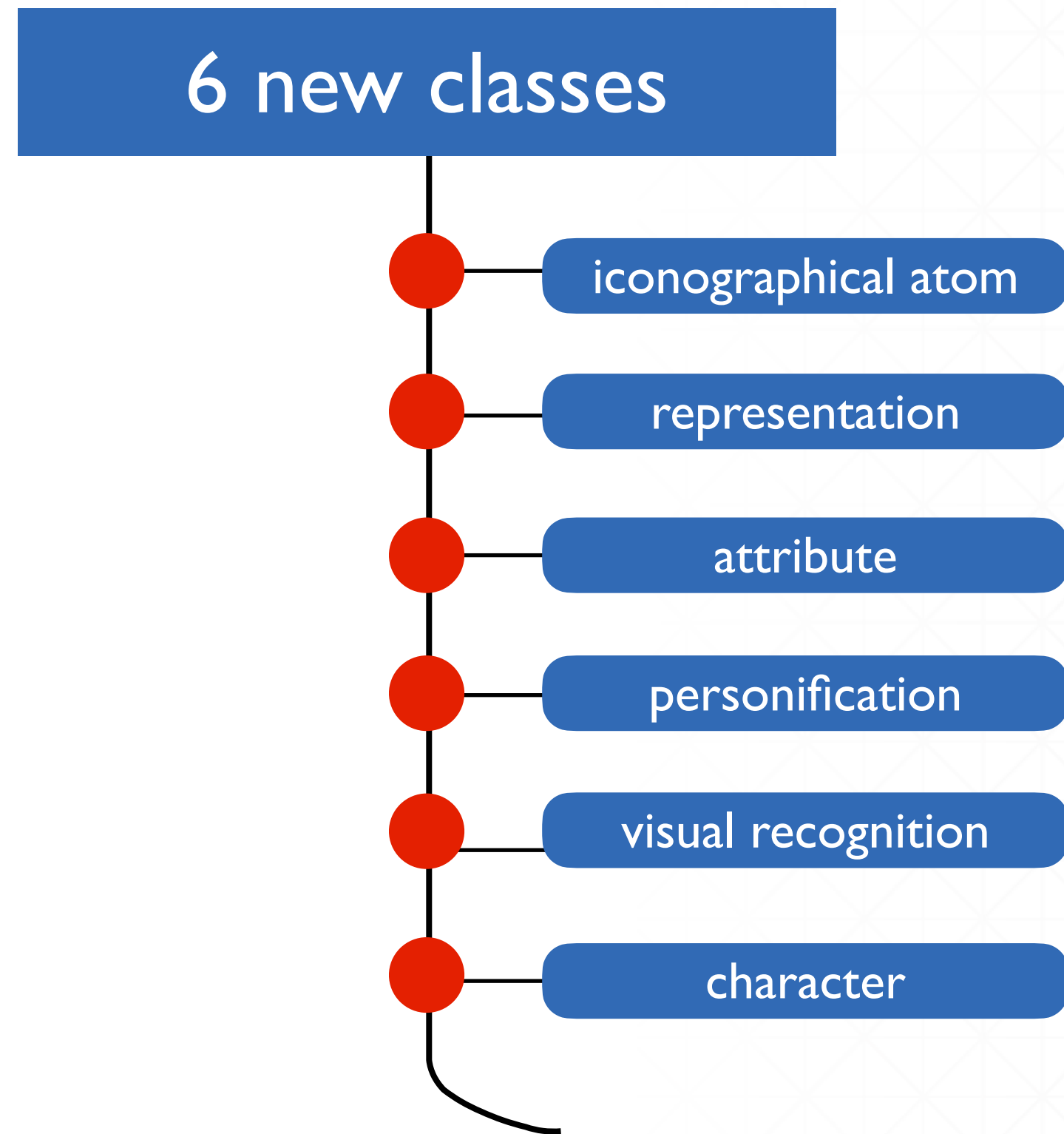
CONCEPTUAL
REFERENCE
MODEL



E55
Type



CRM Extension / VIR

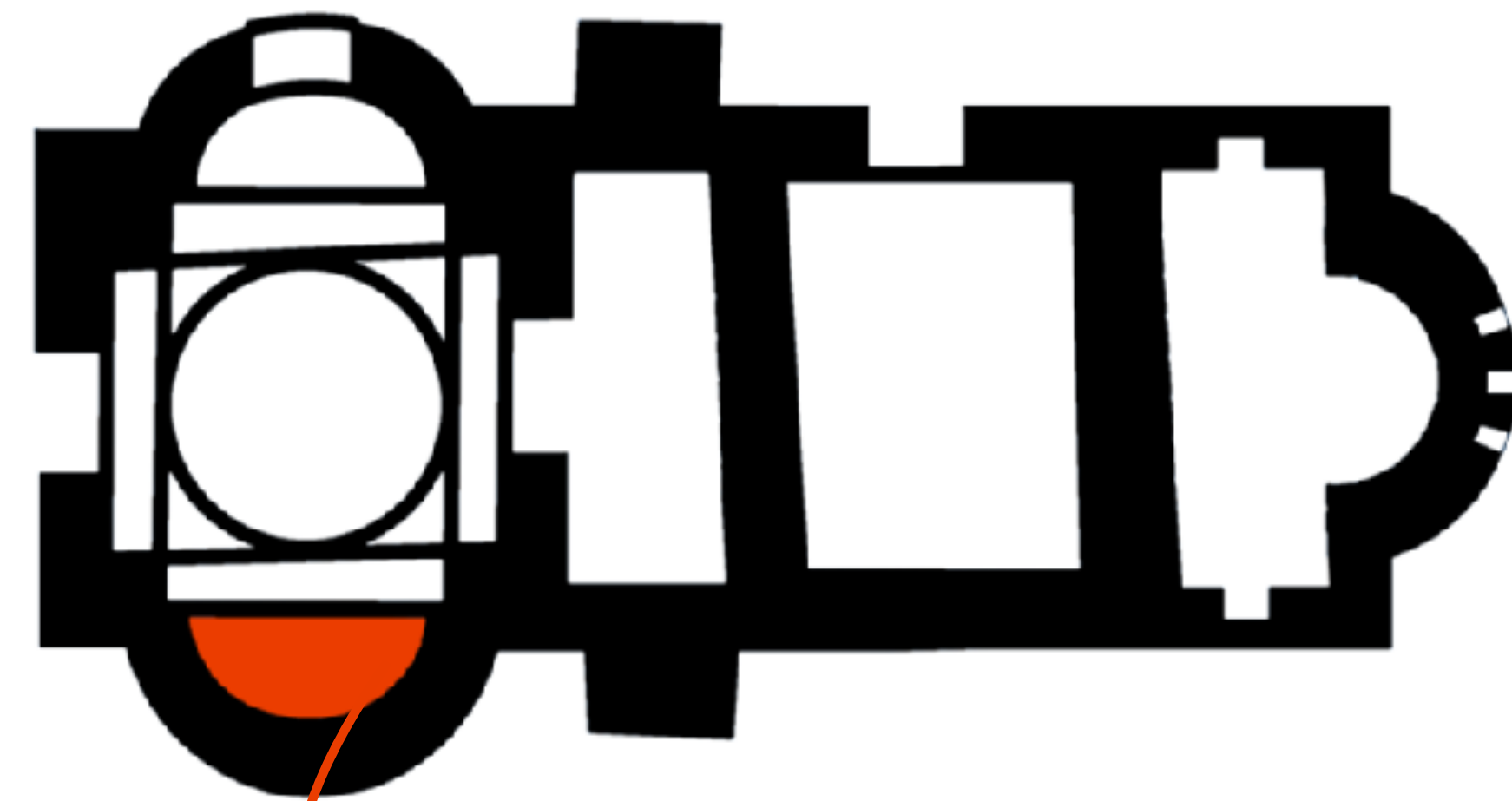


<https://w3id.org/vir/>





panel of the Virgin of Mercy south lunette, Narthex, Church of Panagia Phorbiotissa, Cyprus

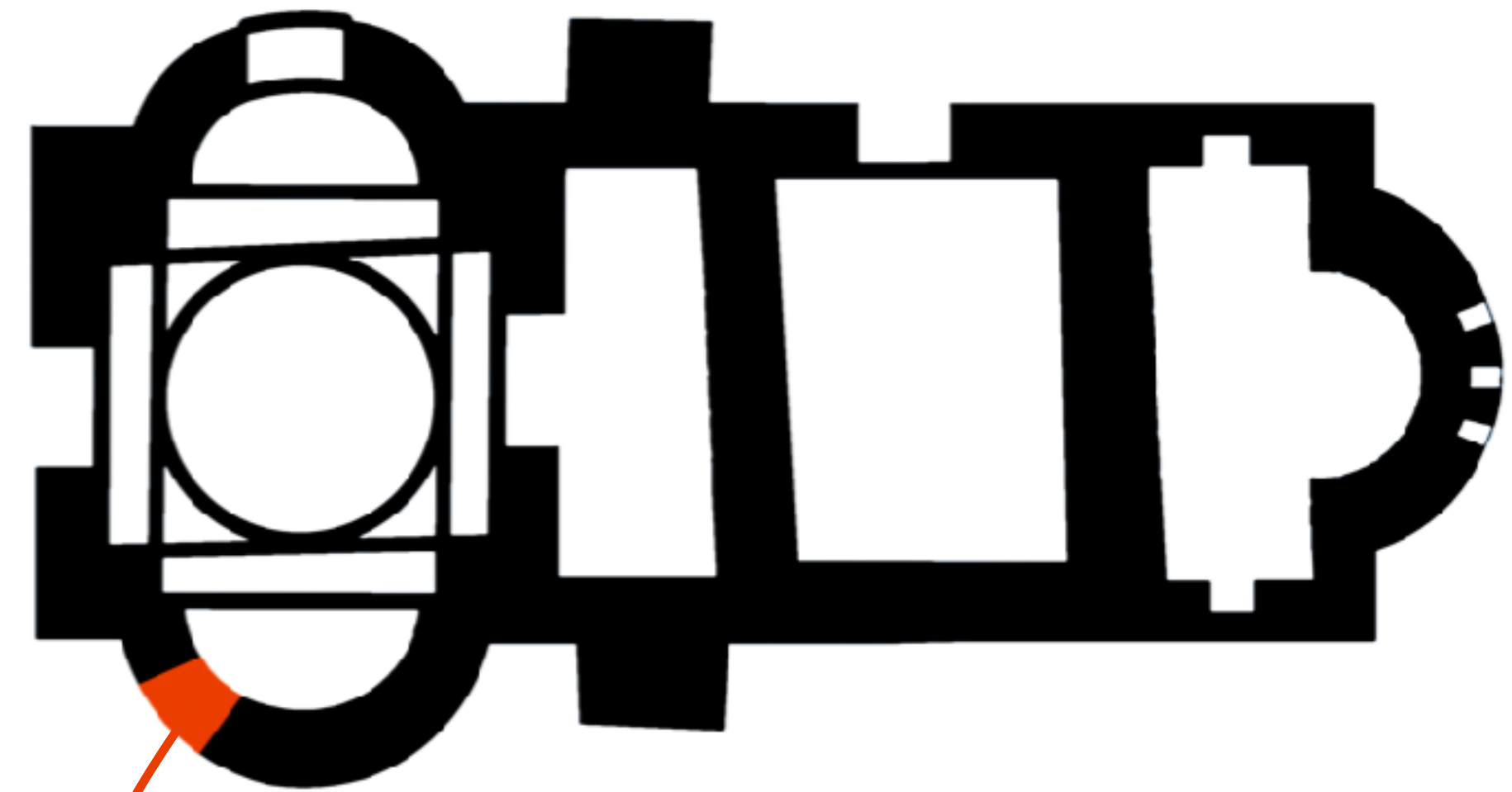


position of the panel of the virgin of Mercy

position of the panel of the virgin of Mercy, Narthex, Church of Panagia Phorbiotissa, Cyprus



panel of Anastasia & Anastasia, south lunette, Narthex, Church of Panagia Phorbiotissa, Cyprus



position of the panel of Anastasia & Anastasia

position of the panel of Anastasia & Anastasia, Narthex, Church of Panagia Phorbiotissa, Cyprus

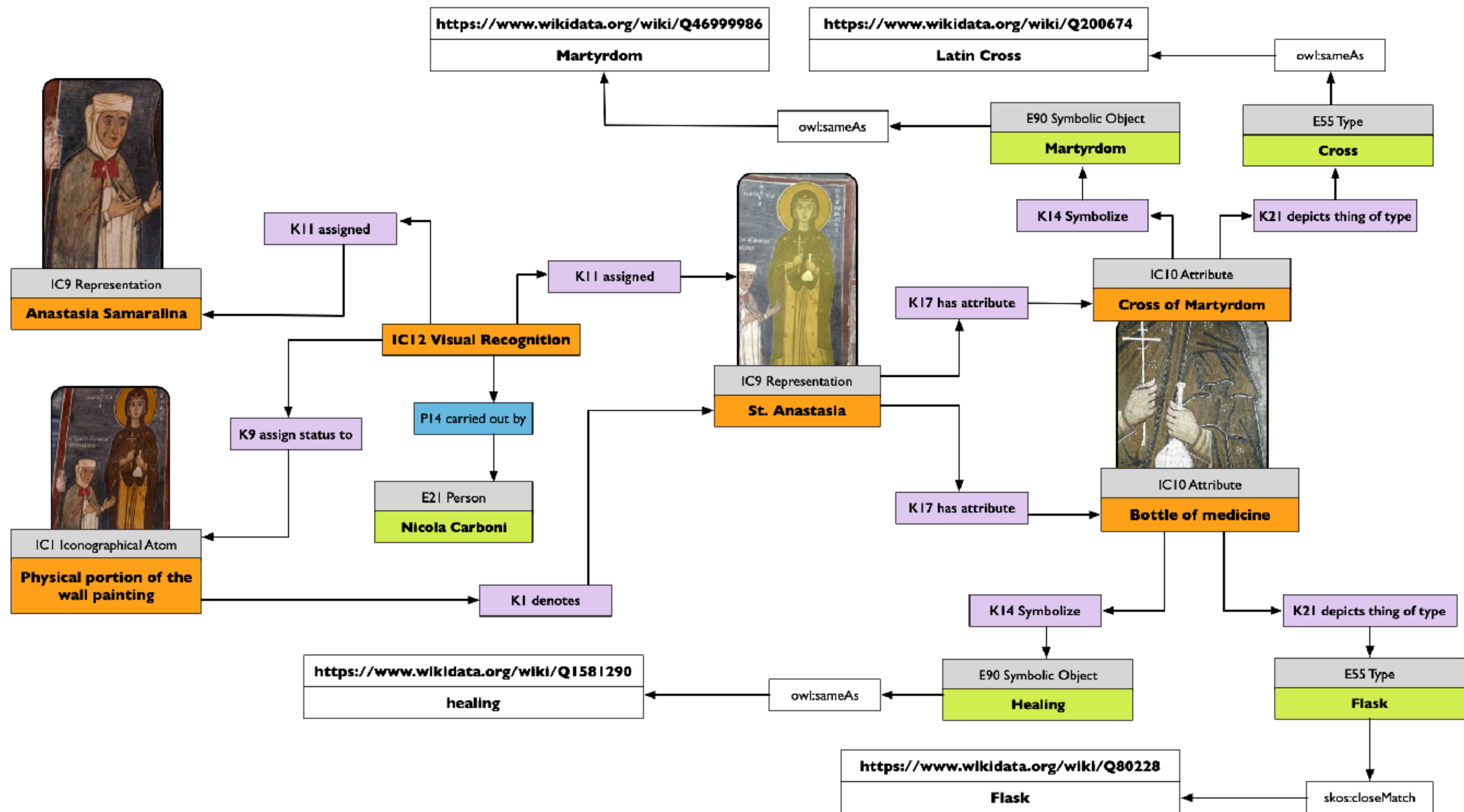
Legenda

VIR Class

VIR Property

CRM class

CRM property





collective torments as they appear in the souther arc of the narthex of Asinou

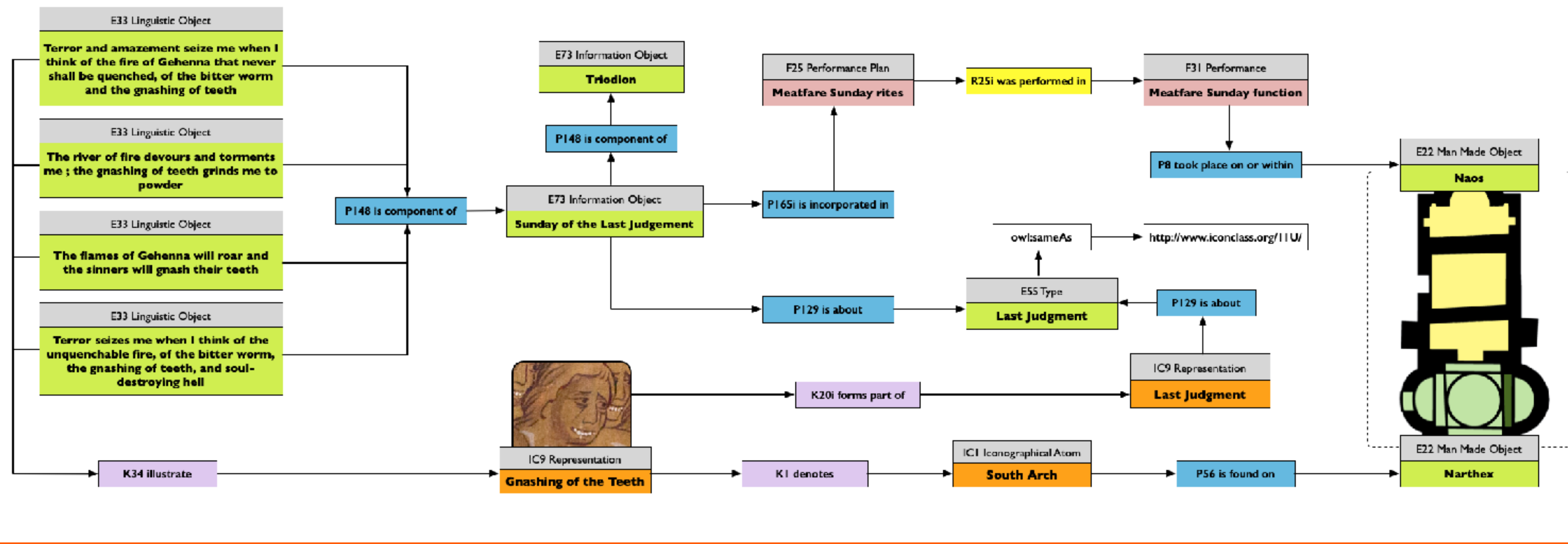
Legenda

VIR Class

VIR Property

CRM class

CRM property



SPARQL



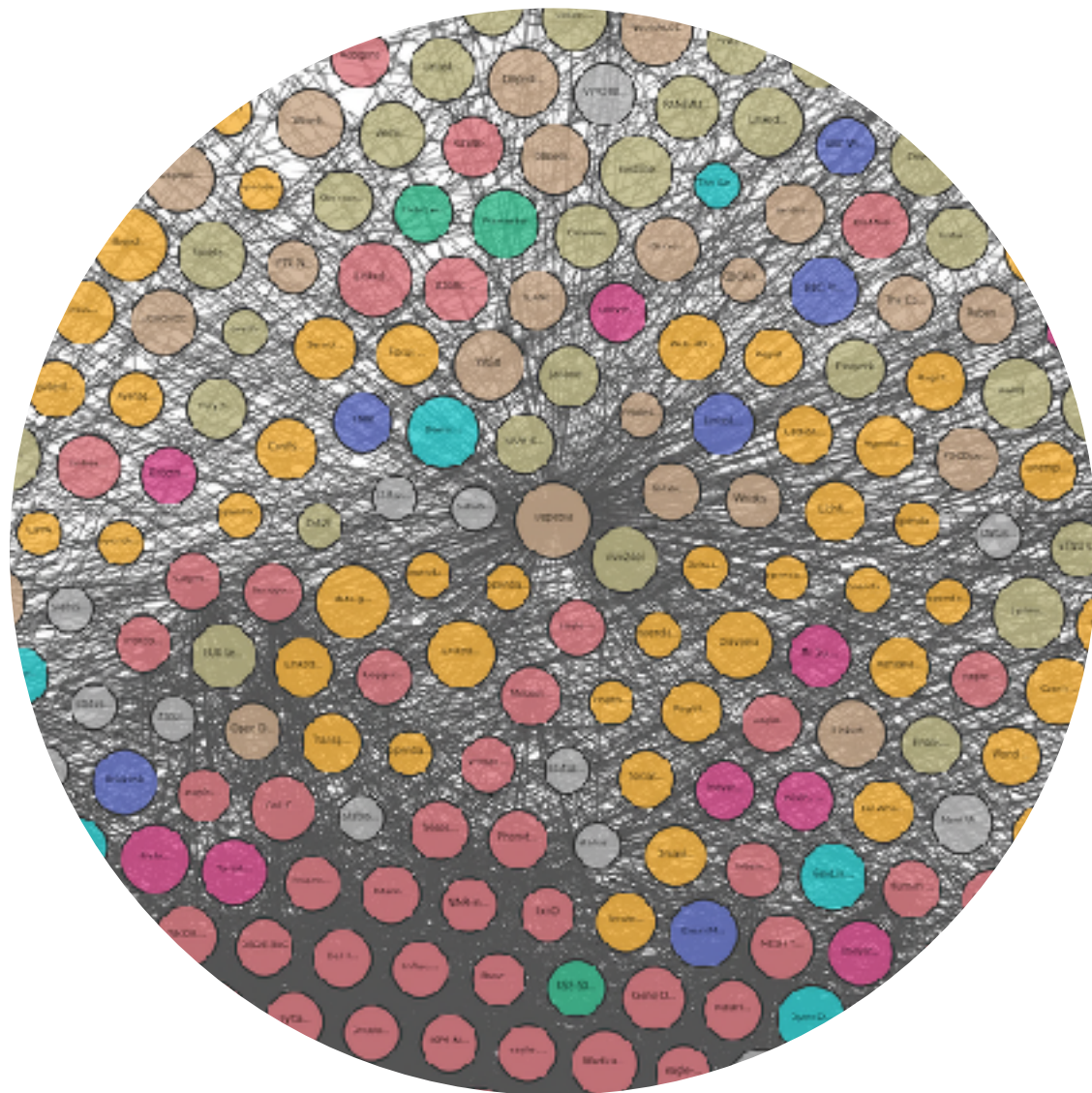
```
PREFIX vir: <http://w3id.org/vir#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>
SELECT ?label WHERE {
  ?artwork rdf:type vir:IC1_Iconographical_Atom ;
    crm:P108i_was_produced_by ?activity ;
    rdfs:label ?label .

  ?activity rdf:type crm:E12_Production ;
    crm:P117_occurs_during ?period .

  ?period rdfs:label ?labelPeriod .

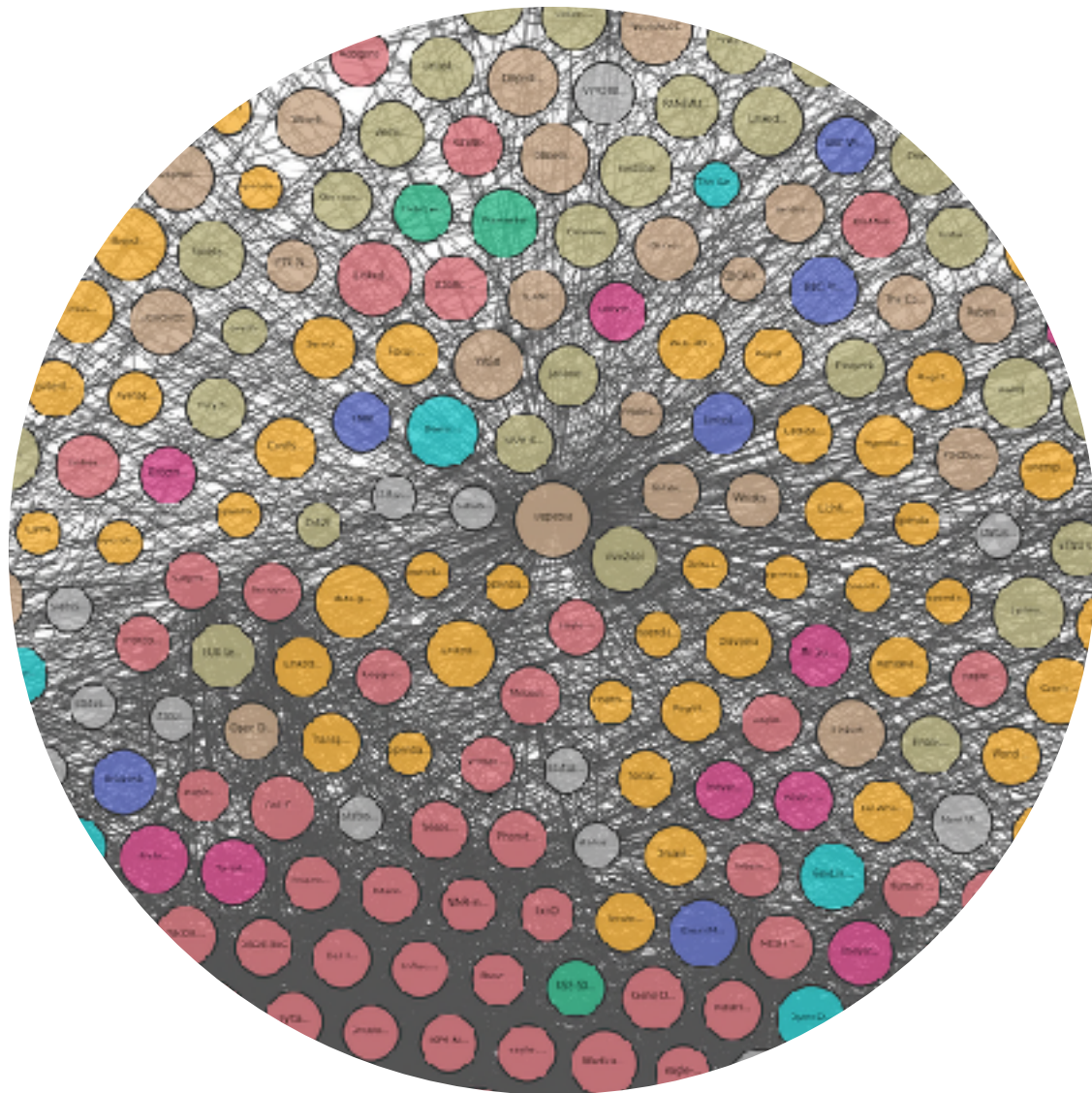
  FILTER regex(str(?labelPeriod), "lusignan", "i")
}
```

LD problems



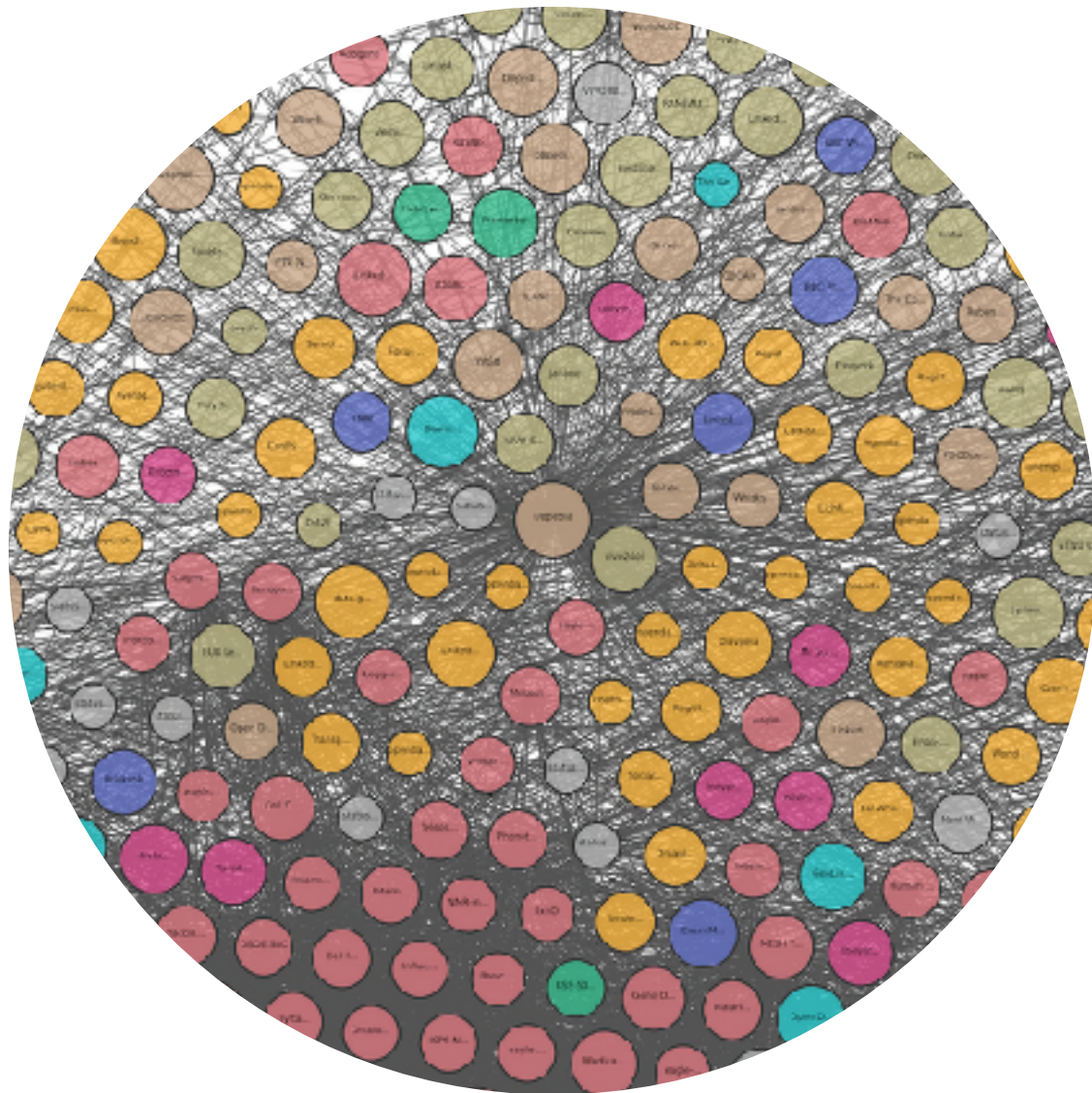
- Linked Data are difficult to **create**
 - Ontologies are inherently difficult
 - **Divergent** expressions built into the ontology (specifically CRM)
 - Create a **disconnect** between source data and ontology
 - Datification require curation
- Linked Data are difficult to **maintain**
 - resources, knowledge, people

Linked Data problems



- Significant effort, little retribution.
- Linked Data are specifically difficult to **query**
 - Aimed at developers/technical users
 - Leave out many practitioners / domain experts

Linked Data problems

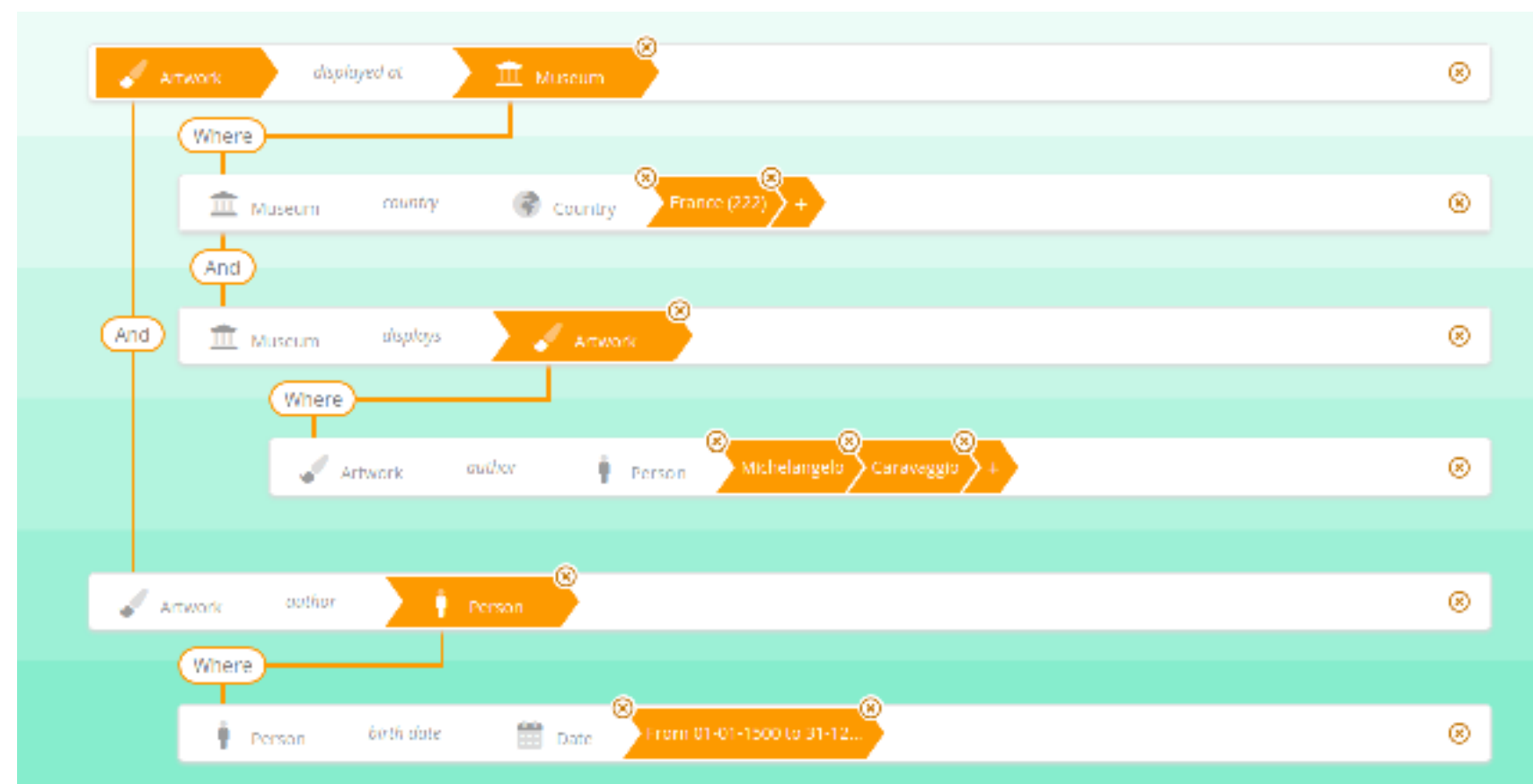


- structurally accessible, published, and linked according to open standards
- interpretively opaque to those who lack the specialized knowledge

Projections

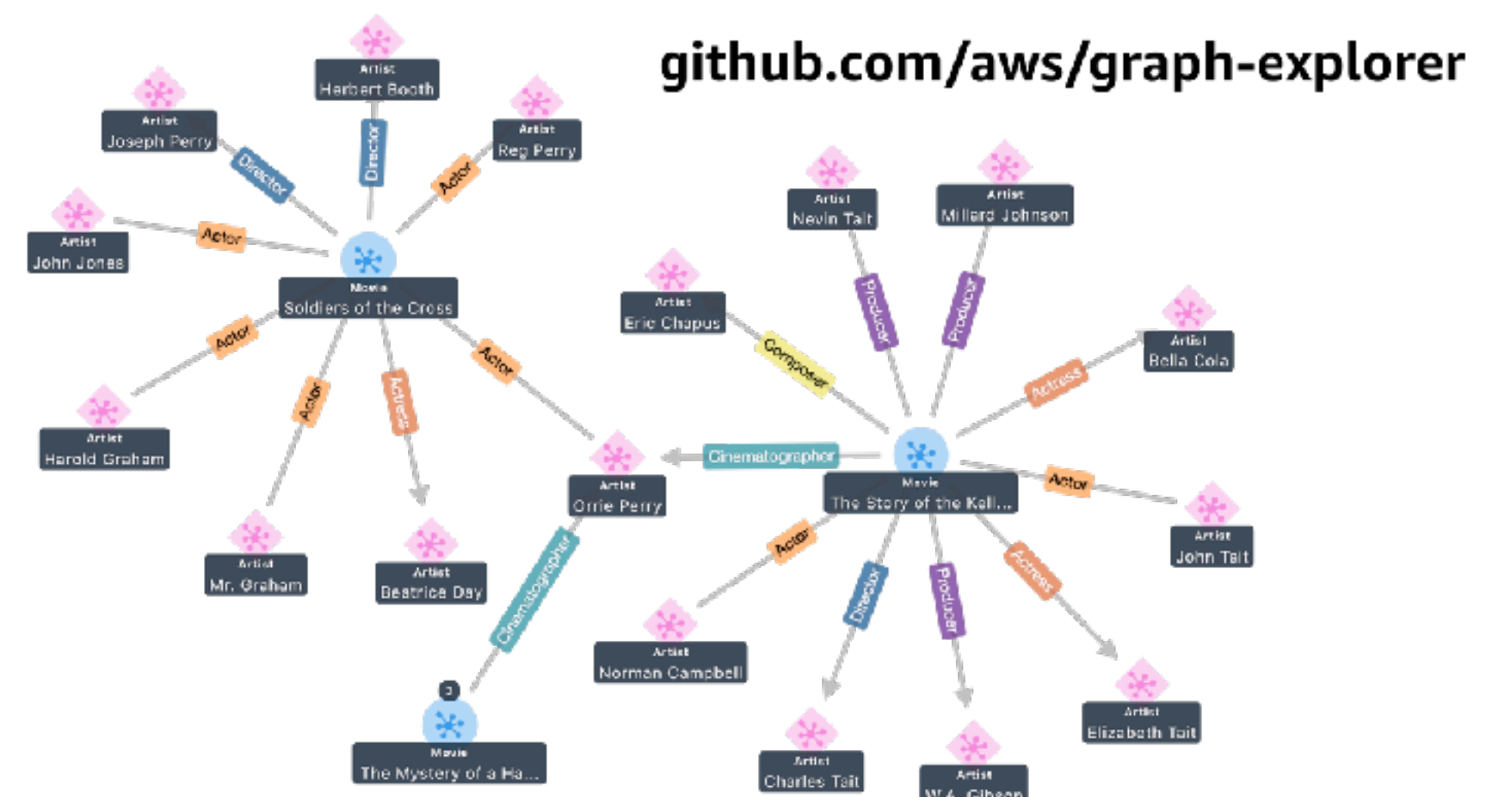
Data-Language driven

- Translate syntax of query into a visual easy to use interface
- User is forced to follow the logic of RDF/ SPARQL



Data-Structure driven

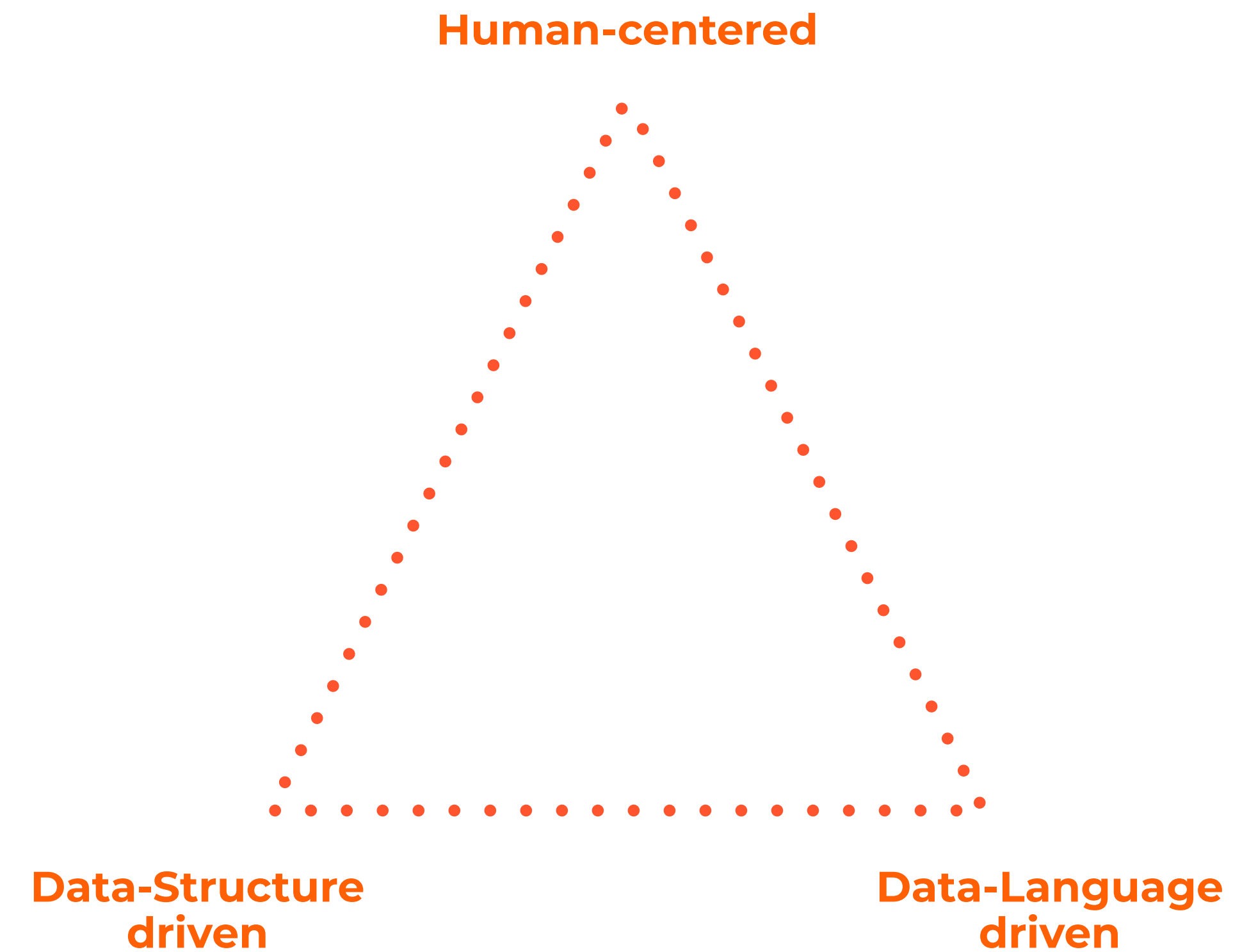
- Translate the structure of the data into a visual easy to use interface
- User is forced to follow the structure of the data



Mediations

Human-centered mediation

- instead of requiring the user to adapt to the logic of the data, we adapt the data to the logic of the user's inquiry



LLMs

- Rapid advancements in recent years have made conversational interfaces widely adopted
- Well suited for natural language question-answering tasks
- Strong performances in
 - Cross-lingual **translation**
 - Content **summarization** and reformulation



LLMs to SPARQL vs RAG

- **LLMs to SPARQL:**

- The model generates formal queries from natural language input
- Performs well on simple schemas, but struggles with event-based ontologies such as CIDOC-CRM
- Returns structured data, requiring further interpretation

- **RAGs:**

- Relevant portions of the data are retrieved and injected into the model's context
- Grounds the model's response in the actual source data
- Produces natural language answers directly



```
PREFIX vir: <http://w3id.org/vir/...>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm#>
SELECT ?label WHERE {
  ?artwork rdf:type vir:IC1_Iconogr...
  crm:P108i_was_produced_by ?acti...
  rdfs:label ?label .
  ?activity rdf:type crm:E12_Produ...
  crm:P117_occurs_during ?perio...
  ?period rdfs:label ?labelPer...
}
```

which paintings depict geneva?

ings in the retrieved data depict Geneva. These include:

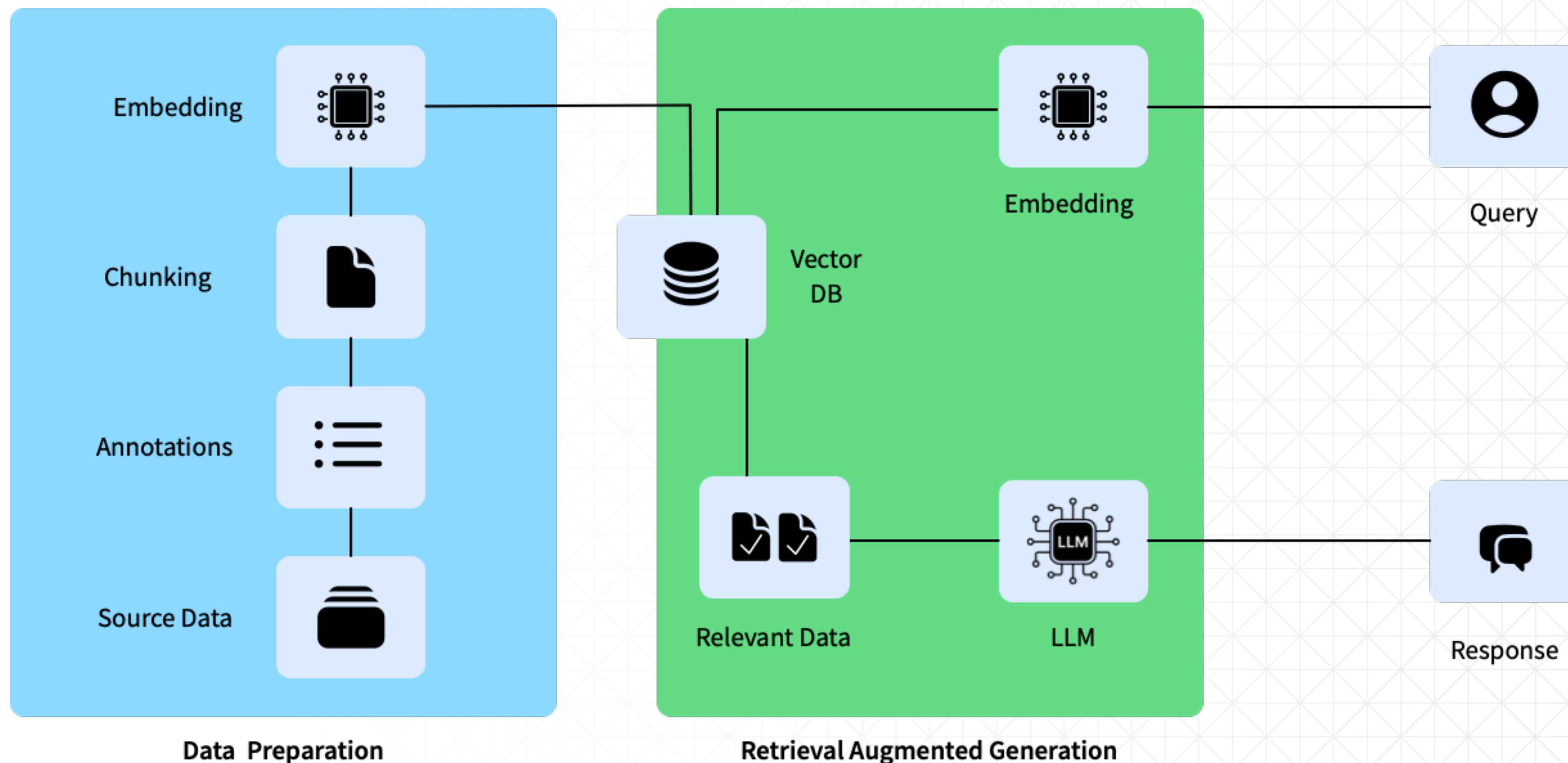
ve et le Salève vus des fortifications": This painting captures of Geneva along with the Salève mountain from the city's ations. It offers a scenic depiction of the city in relation to its surroundings.

le de Genève. Paysage d'hiver": This artwork presents a ndscape of Lake Geneva, showcasing the city's lakeside area cold season. It includes elements like a boat and a cart, picturesque winter scene.

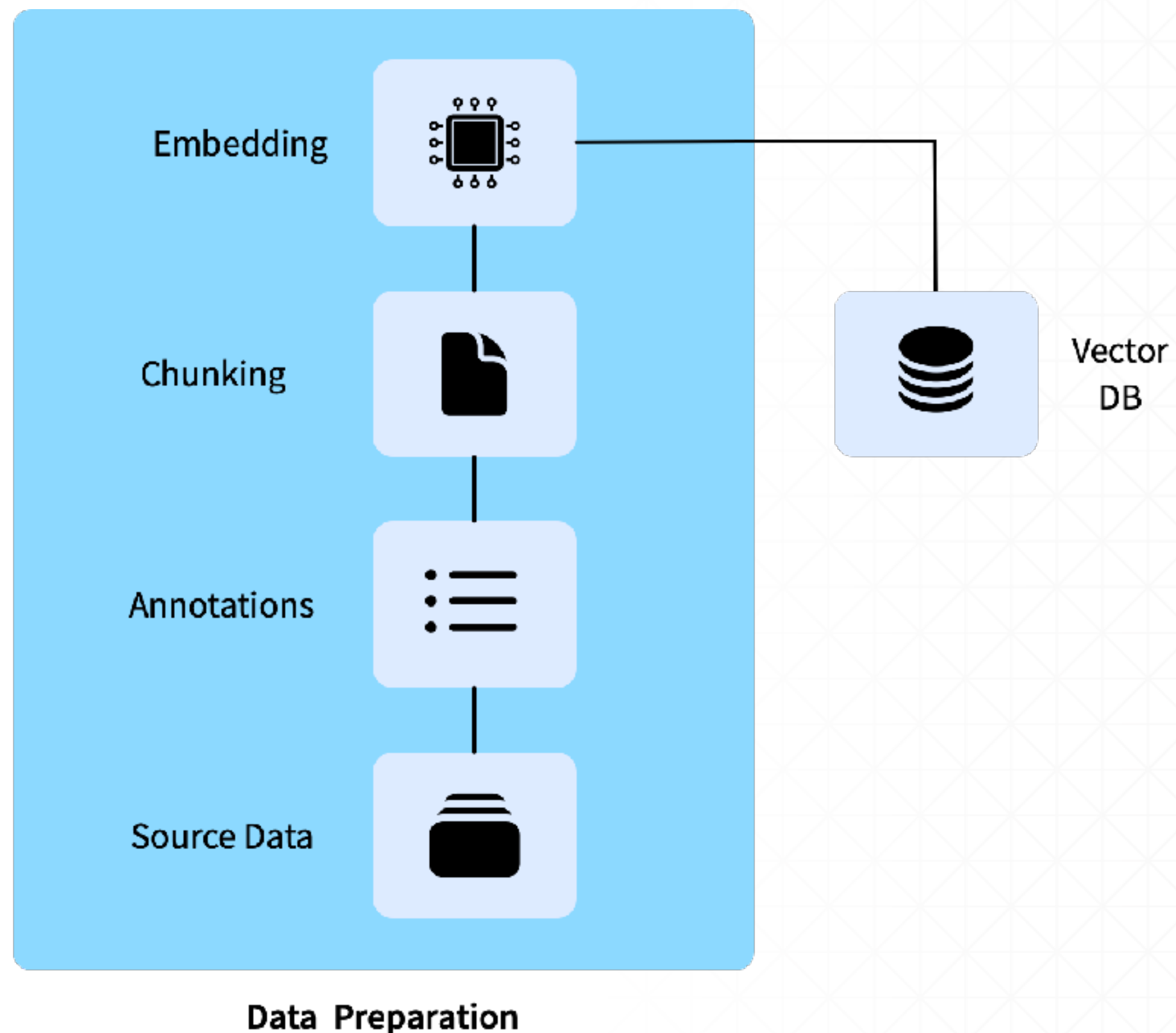
Genève prise du bord du lac à Plonjeon": This painting offers a view of Geneva from the lake's edge, capturing the city from a water...



Retrieval-Augmented Generation (RAG)

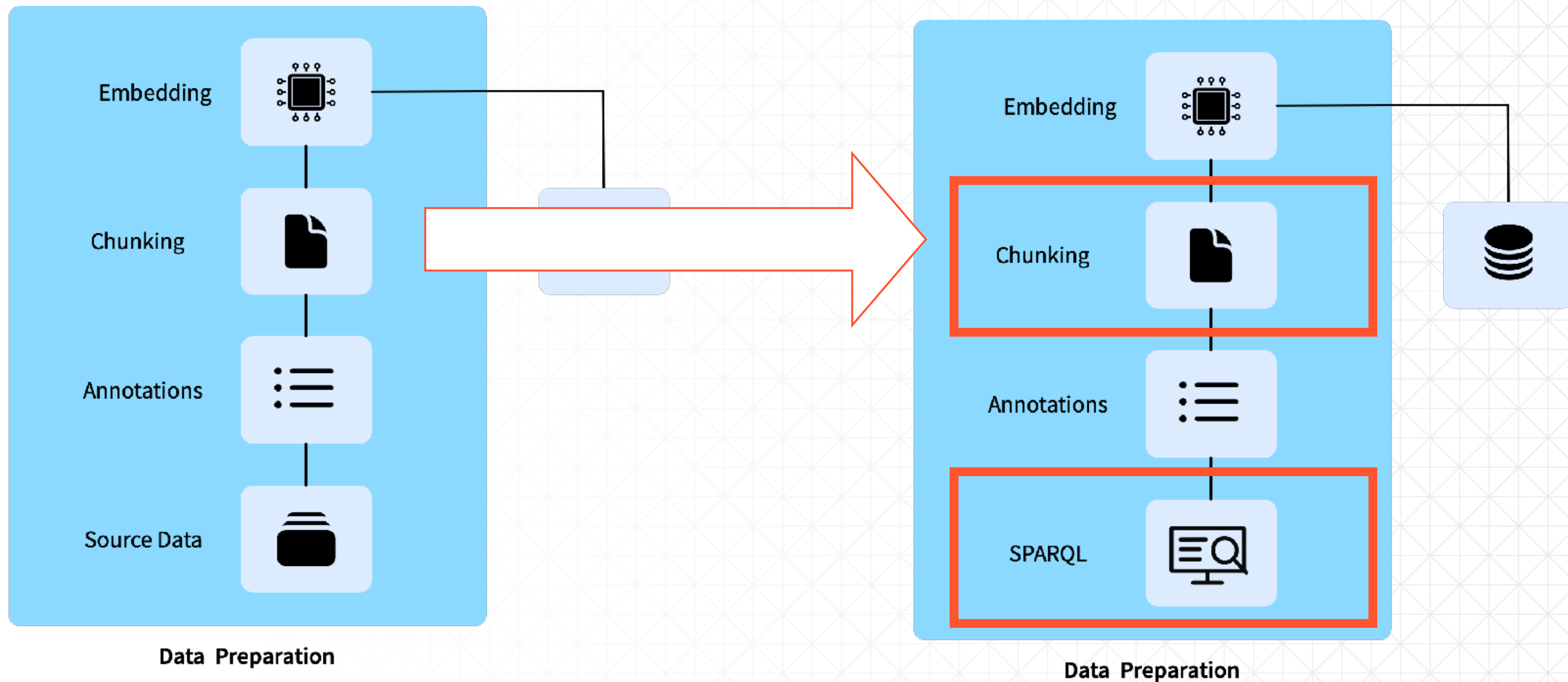


Retrieval-Augmented Generation (RAG)



During different sections of this contribution we will refer to one church which we adopted as a use case, the church of Panagia (Mother of God) Phorbiotissa in Cyprus (Fig. 6), commonly known as Asinou, because it was built in the now vanished village and river with the name Asine. The church, built in the picturesque setting of the lower Troodos mountain in central Cyprus, around twenty kilometres from Nicosia, and served the monastery of Mother of God ton Phorbion. The internal walls of the church are richly decorated (Fig. 7) and displays a wide variety of frescoes ranging from twelfth (foundation) to the early seventeenth century, reflecting and documenting the life of an Orthodox monastery during three different regimes and status. When the first frescoes appeared in the church, Cyprus was an essential piece for the Byzantine naval power. In 1191 the island was conquered by Lusignan family, and it becomes a colony of Venice in 1474 until the Ottoman conquest of 1570/71. During these years, the church has been

Retrieval-Augmented Generation (RAG)



Data Extraction and Relationship Summarisation

- From the **ontologies**
 - Parse the formal schema to extract core structural elements: class hierarchies, taxonomic relations, domain and range constraints, and descriptive labels
 - Serialise each component as JSON for downstream processing
- Based on a **dataset**
 - Traverse the knowledge graph to extract all entities and their connecting properties
 - Build a relationship summary that captures the actual patterns present in the data
- Generate **natural language descriptions** by converting graph patterns into textual statements that describe the documented entities and their connections



Retrieval-Augmented Generation (RAG)

Anastasia Saramalina

URI: <https://data.iconography.art/semantics/icon/e1ce4ed8-24b1-4dff-8922-8ae984457ed7>

Types

- Visual Item

Properties

- **Label:** Anastasia Saramalina

Relationships

- Painting of Anastasias has type Mural Painting
- Anastasia Saramalina has attribute porphyria
- Anastasia Saramalina has attribute neck rectangular patches
- Patches has broader term clothing
- Anastasia Saramalina has attribute T-shaped garment
- T-shaped garment depict things of type clothing
- Anastasia Saramalina has attribute headdress
- South lunette forms part of Asinou
- Painting of Anastasias has modified Asinou
- Painting of Anastasias occurs during Lusignan
- Anastasias forms part of South lunette
- Anastasias is found on Panagia Phorbiottisa
- Painting of Anastasias has modified Panagia Phorbiottisa
- Anastasias is found on Asinou
- clothing is same as 300266639
- neck rectangular patches depict things of type Patches
- Panagia Phorbiottisa was produced by Construction of Asinou
- South lunette has current location place
- Panagia Phorbiottisa is identified by Παναγία Φορβιώτισσα / Παναγία της Ασίνου
- Panagia Phorbiottisa has type Church

South Lunette

URI: <https://data.iconography.art/semantics/physical/de49f3db-2863-4c66-8fe3-5cb7c6a7f985>

Types

- E22_Man-Made_Object

Properties

- **Label:** South lunette

Relationships

- Anastasias is found on South lunette
- South lunette forms part of Narthex
- South lunette has type Apse
- Apse is same as Q170463
- Narthex forms part of Panagia Phorbiottisa
- Saint George forms part of South lunette
- South lunette forms part of Asinou
- Panagia Phorbiottisa was produced by Construction of Asinou
- Panagia Phorbiottisa is identified by Παναγία Φορβιώτισσα / Παναγία της Ασίνου
- Panagia Phorbiottisa has type Church
- Narthex forms part of Asinou
- Anastasias forms part of South lunette
- Saint Anastasia is denoted by Anastasias
- Latin Donor is denoted by Virgin of Mercy
- Christ child is denoted by Virgin of Mercy
- Anastasia Saramalina is denoted by Anastasias
- Headdress of Anastasia Saramalina is denoted by Anastasias
- Panagia Phorbiottisa is same as Q30773293
- Virgin of Mercy forms part of South lunette
- Madonna della misericordia is denoted by Virgin of Mercy

C1.Object --{ (P130F.shows_features_of)^[0,n] OR (P130B.features_are_also_found_on)^[0,n] }->
C1.Object:

{**C1.Object** -- { (P46F.is_composed_of)^[0,n] OR (P106F.is_composed_of)^[0,n] OR
(P148F.has_component)^[0,n] }-> **C1.Object**:

{**E24.Physical_Man-Made_Thing** -- P62F.depicts -> **E53.Place**:

{**E53.Place**--(P89B.contains)^[0,n] -> **E53.Place** [--P2F.has_type ->
E55.Type]
}

Tzompanaki, K., & Doerr, M. (2012). Fundamental Categories and Relationships for intuitive querying CIDOC-CRM based repositories.



URI: <https://chi.ischool.illinois.edu/ds/visual/atom/b103bf9-8b37-4e76-bb19-ec9af40f9a43>

Label: "Gnashing of the teeth"

Type: Human-Made Thing

[Thing] Gnashing of the teeth

Label: Gnashing of the teeth

****Has met****: Fiery stream, west lunette, Saint George, Individual torments, 1115-01-01 to 1115-12-31, South lunette, Donor couple, Naos, Saint Mamas, Donor

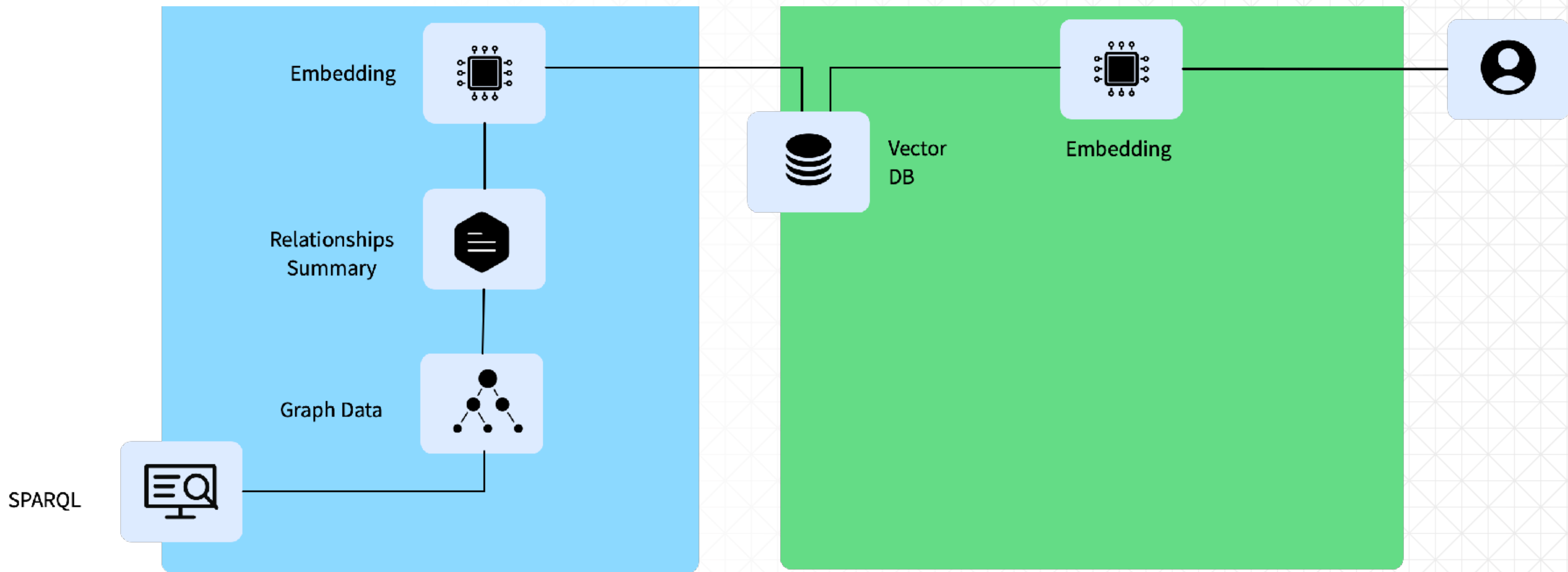
****Found or acquired at****: Nikitari, Panagia Phorbiottisa, Cyprus

****Modified in****: Painting cycle of 1332/33 (Mural Painting).

****Was modified at time****: 1332-01-01 to 1333-12-31.

****Is referred to by****: Canticle one, Canticle six, Canticle seven, Canticle five, vesper of the Saturday of the Soul, Matthew passage.

****Is identified by****: Gnashing of the teeth

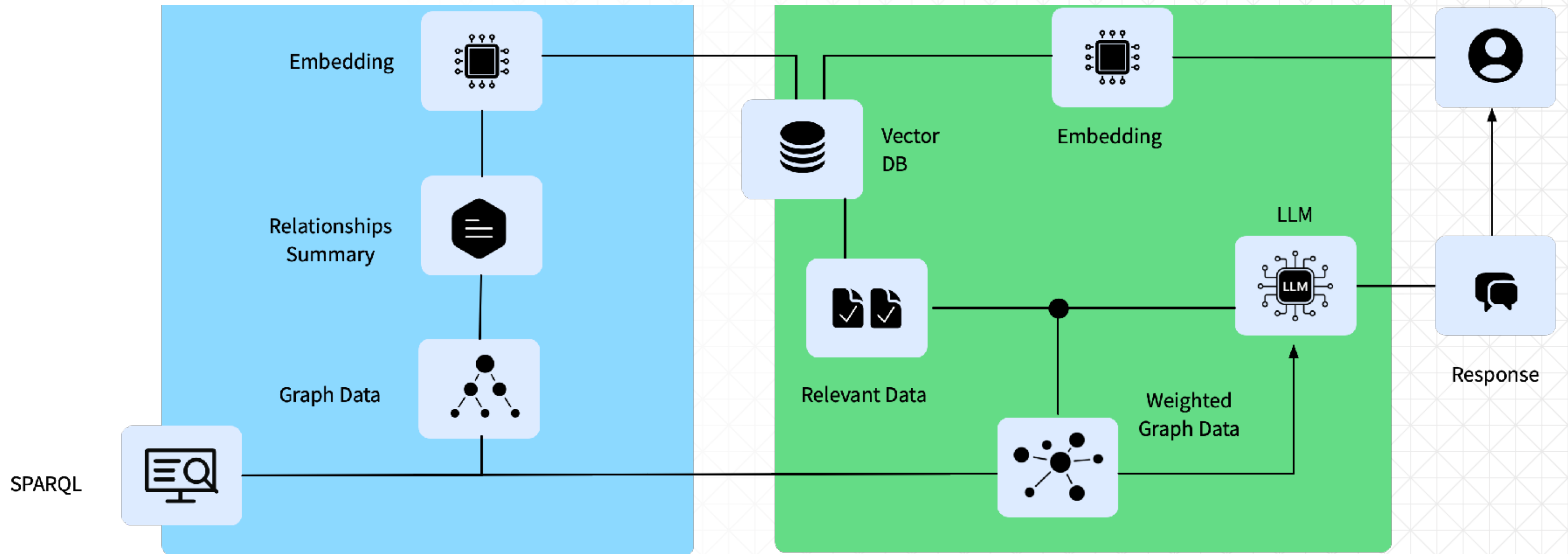


Retrieval-Augmented Generation (RAG)

- PPR (Personalized Page Rank) for Retrieval for ranking results
- PPR for contextualize results
- Pagerank for enumeration
- Shortest path distance for improving LLM answering



RAG over RDF



Modular

RAG

```
PREFIX vir: <http://w3id.org/vir#>  
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>  
PREFIX rd: <http://www.w3.org/ns/rdf-schema#>  
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>  
SELECT ?label  
WHERE {  
  ?activity rdf:type crm:E12_Production ;  
  rdfs:label ?label .  
}
```

SPARQL

Data-Language
Driven Interface



CIDOC-CRM Knowledge Graph



Asinou Dataset Chatbot

Asinou Church

Active

Hello! I'm your Asinou Dataset assistant. I can answer questions about the Asinou church, its frescoes, iconography, and cultural heritage. How can I help you today?

Ask about Asinou church, frescoes, iconography...

Send

Example questions:

- Where is Panagia Phorbiottisa located?
- What churches in Cyprus have Last Judgment iconography?

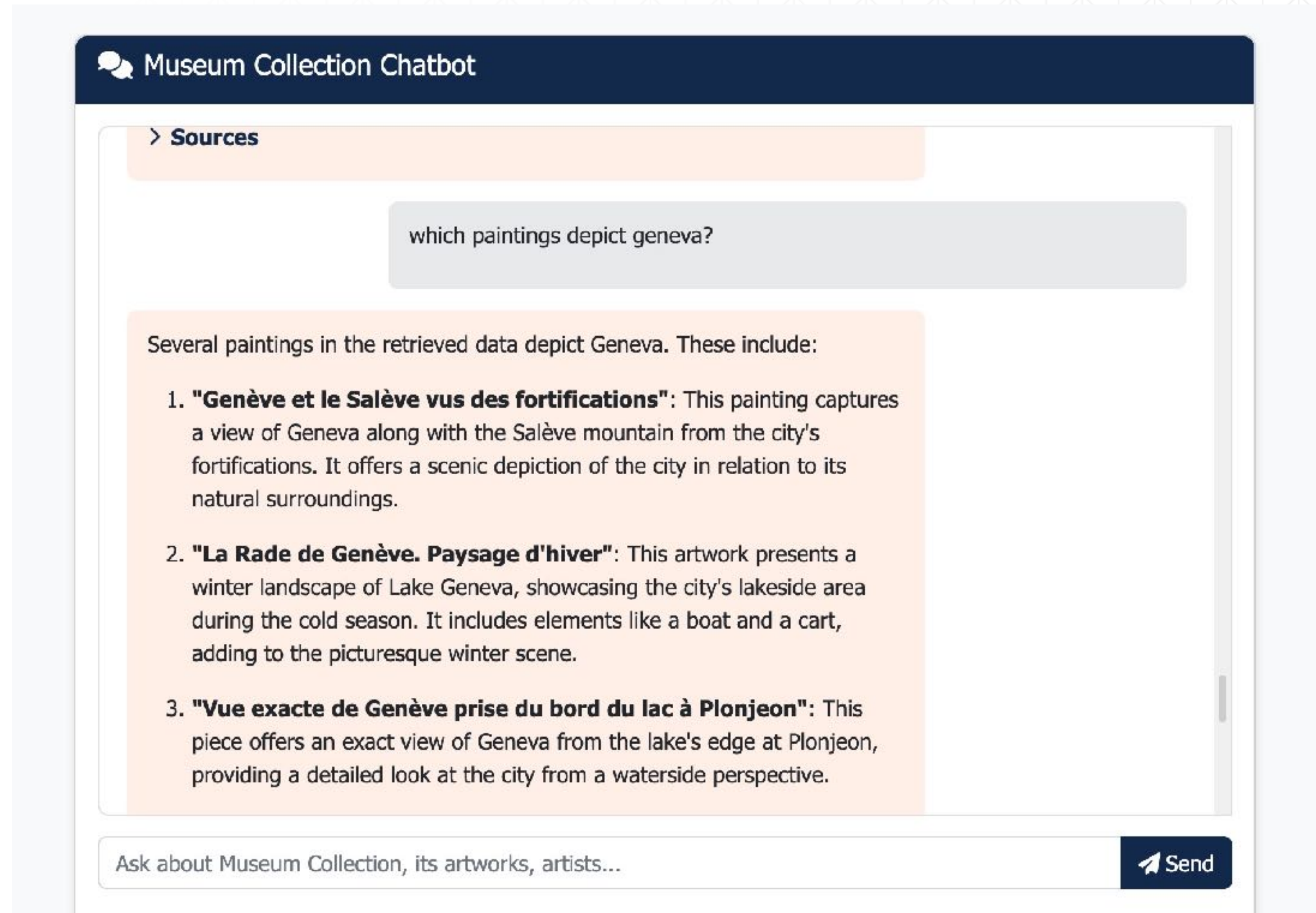
Explore Entities

15

● THING	5
Gnashing of the teeth	#1
Panagia Phorbiottisa	#2
Holy trinity	#3
Holy spirit	#4
Anastasia of Sirmium	#5
● PLACE	5
Nikitari	#1
Cyprus	#2
Panagia Phorbiottisa	#3
Pediada	#4
Kalopanayiotis	#5
● EVENT	5



Museum Chatbot



Museum Collection Chatbot

> Sources

which paintings depict geneva?

Several paintings in the retrieved data depict Geneva. These include:

1. **"Genève et le Salève vus des fortifications"**: This painting captures a view of Geneva along with the Salève mountain from the city's fortifications. It offers a scenic depiction of the city in relation to its natural surroundings.
2. **"La Rade de Genève. Paysage d'hiver"**: This artwork presents a winter landscape of Lake Geneva, showcasing the city's lakeside area during the cold season. It includes elements like a boat and a cart, adding to the picturesque winter scene.
3. **"Vue exacte de Genève prise du bord du lac à Plonjeon"**: This piece offers an exact view of Geneva from the lake's edge at Plonjeon, providing a detailed look at the city from a waterside perspective.

Ask about Museum Collection, its artworks, artists... Send



Modular

RAG

```
PREFIX vir: <http://w3id.org/vir#>  
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>  
PREFIX rd: <http://www.w3.org/2001/rdf-schema#>  
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>  
SELECT ?label  
WHERE {  
  ?artwork crm:P101 ?label .  
  crm:P101 rdfs:label ?label .  
  ?activity rdf:type crm:E12_Production ;
```

SPARQL

Data-Language
Driven Interface



CIDOC-CRM Knowledge Graph



Conclusion

- Perfect? No
 - Limited number of document retrieved per query (20)
 - Long conversation about the same document decay the context
- However, it is a **first step** towards novel interfaces for exploring art historical digital information and towards transforming cultural institution into **accessible repositories of knowledge.**



Thank you!

carboni@illinois.edu

