

A Software Architecture for Narratives

Carlo Meghini, Valentina Bartalesi, Daniele Metilli, Filippo Benedetti

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The Problem

The traditional **search functionalities** of Digital Libraries respond to a query with a **list of digital objects** based on metadata descriptors

Often, no **semantic relation** among the returned objects is reported in the search results

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Collections Collection	ns Explore	Exhibitions Blog
REFINE YOUR SEARCH		1 - 12 of 11,362 results
COLLECTIONS All Items Art Fashion Music	*	Dante Alighieri (1825) Pezold, August Georg Wilhelm View at University of Tartu 🖻 Mi Text
MEDIA Image (6,489) Text (4,316) Sound (290) Video (254)		Dante Alighieri. Portreebüst (1900) Winkler, F. View at University of Tartu 🖻 Mi Text
Only items with links to media		Kiri Eusebio Della Lena'le (1795) Angelo Maria Bandini Soovib koopiat Dante teosest
CAN I USE IT? Free Re-use (1,716) Limited Re-use (1,916)	•	View at University of Tartu 🖻

Semantic relations can help the user obtain a more complete knowledge on the subject of the search

Narratives in Digital Libraries

Our idea is that DLs should be able to provide **narratives** to their users in addition to lists of objects We intend a **narrative** as a sequence of **events** defined by a **narrator**, each endowed with **factual aspects** (who, what, where, when), **semantic relations** (e.g. part of, causality), and related **digital objects**

Narratives would allow DLs to provide **more sophisticated information services** to their users, going beyond the current state

Our Research

In order to introduce narratives in DLs, we have developed an **ontology for narratives** using the technologies of the **Semantic Web**

The ontology is **expressed in OWL** and based on the **CIDOC CRM** standard

On top of the ontology, we have built a **software** architecture for narratives

Our main goal is to apply this work to improve the search functionality of DLs, such as Europeana

A Software Architecture for Narratives

We present a **software architecture for narratives** that allows **building narratives** as semantic networks, performing **reasoning** on them, and **publishing** the narratives online

Main Components

- I) Narrative Building and Visualising Tool (NBVT)
- 2) OWL Triplifier
- 3) Reasoner
- 4) Triple Store
- 5) Visualisation Interface

Narrative Building and Visualising Tool (NBVT)

In order to facilitate the creation of a narrative and its semantic representation by the narrator, we built a web-based **Narrative Building and Visualising Tool (NBVT)**

- NBVT allows the user to **build narratives** as sequences of events and preview the final **timeline visualisation**
- Built with HTML5, JavaScript and CouchDB
- Imports knowledge from the Wikidata knowledge base
- Open source (GPL license) and available online for free (username/password required)

NBVT Interface

LOGOUT

Dante Alighieri

ALL SAVE **Event Title** Dante Alighieri 1 Corinthians 13 A ciascun'alma pr... SEARCH CLEAR START DATE END DATE Abel-François Vil... Acheron Adrienne von Spey... PEOPLE EXPORT EVENT TYPE ORGS RELATIONS Aesop's Fables Albert I of Germa... Aeneid OBJECTS VISUALIZE ENTITIES Albertanus of Bre... Albertus Magnus Alboino I della S... CONCEPTS TRIPLIFY Drop entities here! PLACES Alcuin Alfonso Muzzarell... Alfonso X of Cast... DESCRIPTION WORKS Alfred, Lord Tenn... Alighieri Alighiero di Bell... OTHER NOTES NEW Alphonsus Maria d... Ambrose American English Marriage of Alighi... **Birth of Dante Baptism of Dante Death of Alighier Death of Bella** Education of Dante 1255 1265 26-03-1266 1270 29-09-1272 - 1277 1276 Alighiero di Bell... Alighiero di Bell... Dante Alighieri Bella degli Abati Dante Alighieri Dante Alighieri Bella degli Abati Bella degli Abati Florence Baptiste... Florence Florence Latin Florence Florence Florence Literature Philosophy

ADMIN

Triplifier and Reasoner

- The knowledge exported from NBVT is loaded into a triplifier
- The triplifier is Java-based and built on top of the OWL API.
- The triplifier generates an **OWL graph** containing our **ontology model** populated with the **narrative**
- At this stage, **reasoning** is performed on the knowledge base to perform **consistency checks** and make **inferences**, using both **OWL axioms** and **SWRL rules**
- The reasoner we adopted is **Openllet**, the successor of Pellet
- Finally, the knowledge is imported into the **Blazegraph triple** store and published online

Architecture Overview



Visualisation Interface

Three types of interactive visualisations

- Timeline
- Network graphs
- Tables

More in development (e.g. maps)

- Each visualisation is obtained through one or more
 SPARQL queries performed on the triple store
- Built with **TimelineJS** and **Vis.js** JavaScript libraries

Timeline Visualisation

DANTE ALIGHIERI

OTHER VISUALISATIONS





Beatrice Portinari image 💲

1280

Dante Meets Beatrice

Dante had fallen in love with Beatrice Portinari (known also as Bice), whom he first met when he was only nine. Years after his marriage to Gemma he claims to have met Beatrice again; he wrote several sonnets to Beatrice but never mentioned Gemma in any of his poems. The exact date of his marriage is not known: the only certain information is that, before his exile in 1301, he had three children (Pietro, Jacopo and Antonia)



Entities

Dante Alighieri • Beatrice Portinari • Florence



Graph and Table Visualisations

Graph visualisations

- Event with related entities
- Entity with related events
- Event with digital objects

Table visualisations

- Events by date range
- Primary sources



Event	Start Date	End Date
First Portraits	1883	1885
Murals painted in the Burgtheater	1886	1888
Honorary member of the University of Munich and the University of Vienna	1888	1888
Klimt received the Golden Order of Merit	1888	1888
Portrait of pianist Joseph Pembauer	1890	1890

Case Studies

Four case studies

- Life of Dante Alighieri
- Life of Gustav Klimt
- History of giant squid
- Climate change

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Explore them online: https://dlnarratives.eu/narratives.html

Conclusions

We have presented a software architecture for narratives

- The user inserts knowledge into the Narrative Building and Visualising Tool, built on top of our ontology for narratives
- A triplifier transforms the inserted knowledge into an OWL graph
- A reasoner makes inferences, generating new knowledge
- A triple store stores the final OWL graph
- A visualisation interface presents the knowledge to the final users

Future Works

- We are working to apply our architecture to the search functionality of Digital Libraries
- In particular, we have built an interface for importing
 Europeana digital objects into our narratives (we are investigating an integration with Europeana)
- We are also working on **temporal reasoning**, i.e. ordering events with uncertain dates
- We are exploring automatic extraction of events from text

Thank you

https://dlnarratives.eu