



# DUniversity C+O+S

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# Purpose and Domain of Interest

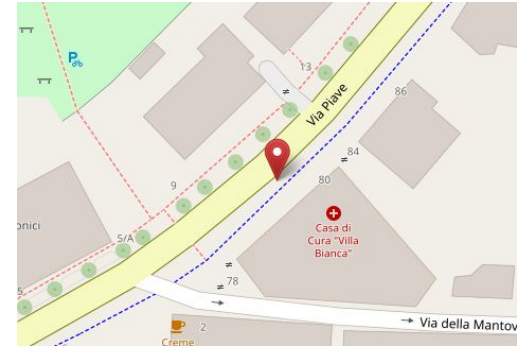
# Purpose

"A service which helps the users to query and know about the different courses being taught at the University of Trento supported by its organizational structure."

# Domain of interest



UNIVERSITÀ  
DI TRENTO



Latitude: 46.0626733  
Longitude: 11.12657322  
Altitude: 272 meters



# Resources

# Knowledge sources

## **VIVO Core Ontology**

Institutional organization  
in an academic setting

## **Academic Institution Internal Structure Ontology**

Organizational structure of  
an academic institution

## **Semantic Web for Research Communities**

Classes concerning  
persons and their  
positions in a research or  
academic setting

# Data sources



**OPENdata Trentino**

- Courses and degree programs offered by the University of Trento
- Staff of the University of Trento
- Organizational units of the University of Trento



**Esse3**

More information about the courses



**OpenStreetMap**

Geospatial data on the various university facilities



# Purpose formalization



# Scenarios

A **university student** is attending the last year of his Bachelor's degree. He/she needs to make a selection among an array of **elective subjects**, which would satisfy both his/her interests and the **credit requirements**. In order to make a choice, the student needs to navigate their course's offer. Alternatively, he/she asks **student support** for further information and clarification.

# Personas

## Anna:

- 22-year-old student
- is attending the Bachelor's degree in Civil Engineering
- needs to choose an elective subject to satisfy the credits requirements needed to complete her studies
- is interested in a course that would allow her to deepen her computer science knowledge

## Ivan:

- staff member of the office of the department of Sociology
- comes in contact with students in need of help with a variety of matters
- is often asked for information about credits needed for graduating, taxes, courses, and internships

# Competency Questions

“I need to do a course of 6 credits. Give me all the 6 credit elective courses for Civil Engineering.” - Anna

“I have some issues and need to contact my department's office either via email or phone call.” - Anna

“What are the courses common to Sociology and the Economy department?” - Ivan

# Entities extracted

Common	Core	Contextual
<ul style="list-style-type: none"><li>• University</li><li>• Student residence</li><li>• Library</li></ul>	<ul style="list-style-type: none"><li>• Department</li><li>• Professor</li><li>• Course</li><li>• Degree</li><li>• PhD student</li><li>• PhD program</li><li>• Staff member</li></ul>	<ul style="list-style-type: none"><li>• Course partition</li><li>• Teaching unit</li><li>• Degree program</li></ul>



# Inception

# Courses dataset

- **name**
- **department** = name, identifier (formatted as a list)
- **description**
- **professor** = List of professors who teach the course; givenName, familyName, identifier
- **assistant** = List of assistants for the course; givenName, familyName, identifier
- **degreeProgram**
- **webSite**

# Staff dataset

- **identifier**
- **name**
- **surname**
- **phone** (formatted as a list)
- **position** = role, unitName, unitIdentifier

# Organizational units dataset

- **identifier**
- **name**
- **unitType** = Type of unit (for instance INSTITUTIONAL BODY, ACADEMIC STRUCTURE, MANAGEMENT STRUCTURE)
- **subType** = It further specifies the type of structure (for example, institutional bodies are distinguished into governing boards and supporting boards; academic structures are distinguished into departments and centers)
- **description**
- **address**
- **phone** (formatted as a list)
- **email** (formatted as a list)
- **website** (formatted as a list)
- **unitPath** = list of identifiers of the units it depends hierarchically in the University



# Esse3 scraped data

- **id**
- **title**
- **year**
- **type\_course** = Whether the course is mandatory or elective
- **credits**
- **lesson\_type** = Modality of the lesson taught (seminar, lesson, etc.)
- **exam\_type** = Whether the exam is oral or written
- **evaluation\_type** = if the vote is final or if it's part of another exam
- **lesson\_period**
- **teaching\_units** = List of the teaching units of the course; name, activity\_type (for example 'lessons'), hours\_duration, whether it's mandatory or elective, disciplinary area, credits
- **partitions** = List of the partitions of the course; name, period (first or second semester), names of the teachers, who the tenured professor is, syllabus link

## 145919 - Knowledge and Data Integration

Anno Accademico 2022 / 2023

### 0340H - Ingegneria dell'Informazione e delle Comunicazioni

#### Ingegneria dell'Informazione e delle Comunicazioni - P0103

<b>Anno di Corso</b>	2° Anno
<b>Tipologia</b>	Affine/Integrativa
<b>Totale Crediti</b>	6
<b>Metodi Didattici</b>	Lezioni
<b>Tipo Esame</b>	
<b>Valutazione</b>	Voto Finale
<b>Periodo Didattico</b>	Primo Semestre

Scomposizione in Unità Didattiche

Unità Didattica	Tipo Attività	Durata (h)	Tipo Attività Formativa	Settore Scientifico Disciplinare	CFU
Knowledge and Data Integration	Lezioni	48	Affine/Integrativa	[ ING-INF/05 ]	6

Partizioni

Partizione	Periodo	Docente	Titolare	Syllabus (Programma attività didattica)
<a href="#">Knowledge and Data Integration - Partizione Unica</a>	Primo Semestre	<a href="#">SIMONE BOCCA</a>		
		<a href="#">FAUSTO GIUNCHIGLIA</a>	✓	

# OpenStreetMap

- **alt\_name**
- **email**
- **long\_name**
- **name**
- **name:en**
- **name:it**
- **old\_name**
- **opening\_hours**
- **phone**
- **short\_name**
- **website**
- **wheelchair** = Whether a place is accessible with a wheelchair

# Semi-formal transformation

→ ER Model

# Phase issues

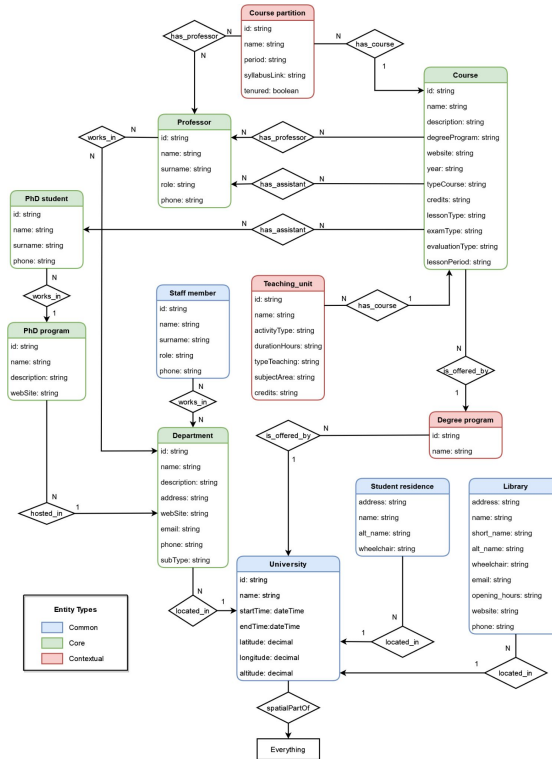
- Esse3
- OPENdata Trentino → Courses and degree programs offered by the University of Trento



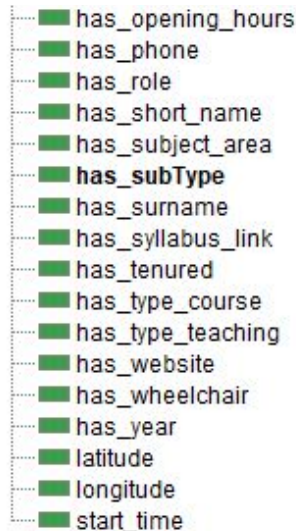
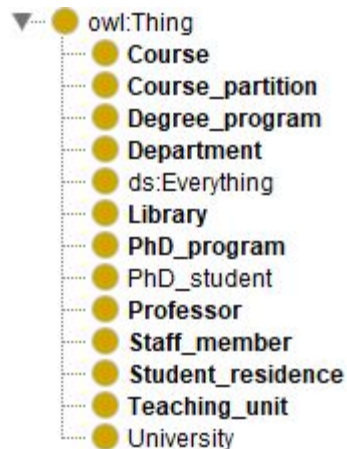
# Informal modeling

# ER Model & Teleology

[https://app.diagrams.net/#G1om0aKWek3Ow\\_Zkx9l9tXFh7kLEfs\\_A38](https://app.diagrams.net/#G1om0aKWek3Ow_Zkx9l9tXFh7kLEfs_A38)



# Datasets filtering and alignment with teleology





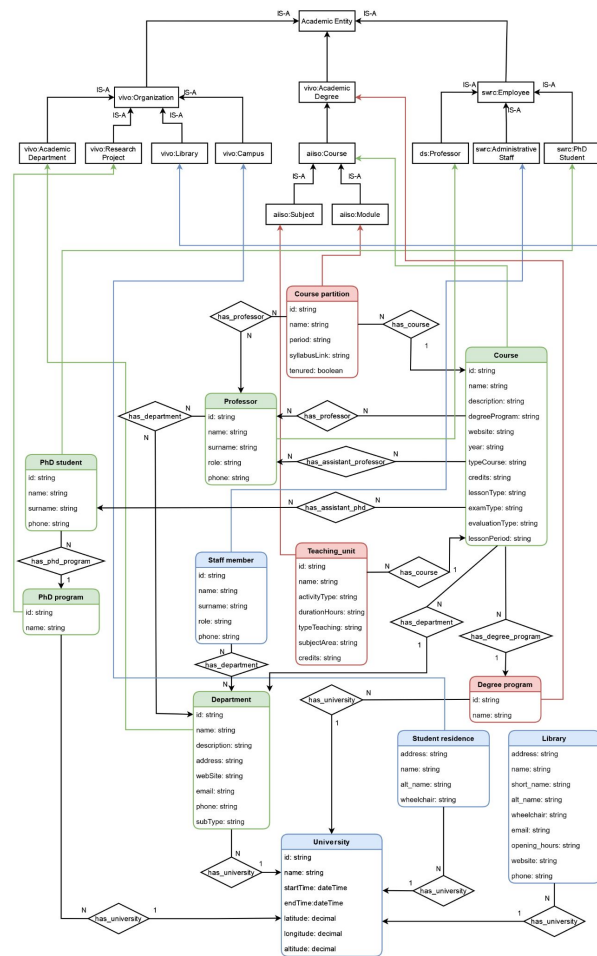
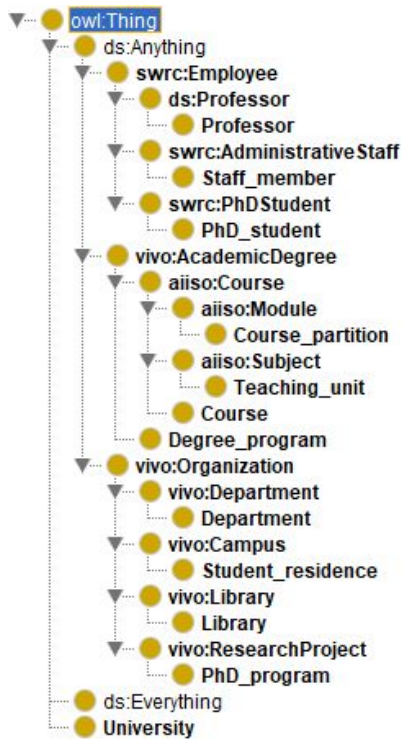


# Formal modeling

# Reference ontologies

- VIVO Core Ontology (VIVO)
- Academic Institution Internal Structure Ontology (AIISO)
- Semantic Web for Research Communities (SWRC)

# Teleontology

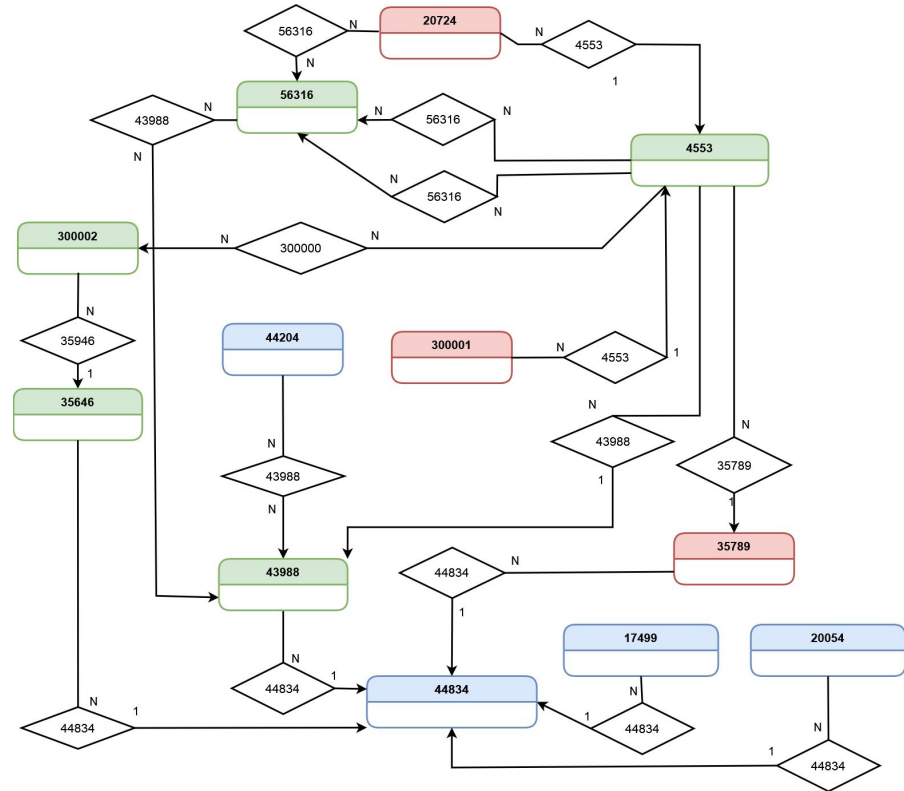


# Language annotation

## Majority of concepts had a formal representation

Among those who did not have one were:

- PhD student
- Teaching Unit





# Data Integration

# Data mapping

- Performed with Karma
- Data layer always updated with schema layer

degree\_program.json ✓ UTF-8

Model Name: degree\_program.json | Prefix: s | Base URI: http://localhost:8080/source/ | Github URL: disabled

Diagram illustrating a data mapping from a JSON file to a table structure. The JSON file is mapped to a table with columns: total, size, language, id, name, and universityId. The table contains three rows of data.

total	size	language	id	name	universityId
78	78	en	0a50925758f14b0...	Informatica (L2)	STO0000001
			e923d8a45e6743...	Ingegneria Civile (L2)	STO0000001
			ca57c2d0e58d4c1...	Behavioural and Applied Economics	STO0000001

# Evaluation metrics

- EType coverage (CQs): 1
- Property coverage (CQs): NA
- EType coverage (ROs): 1
- Property coverage (ROs): 0
- CQ coverage\*: 0.75

$$^* Cov(CQ) = \frac{|CQ_A| - |CQ_D|}{|CQ|}$$



# Exploitation



# Statistics

The total number of instances in the graph is 16068, with 121822 total statements.

EType	Instances
Course_partition_GID-20724	3720
Teaching_unit_GID-300001	3293
Course_GID-4553	2968
Staff_member_GID-44204	2905
Professor_GID-56316	1684
PhD_student_GID-300002	1109
Department_GID-43988	279
Degree_program_GID-35789	78
PhD_program_GID-35946	23
Library_GID-20054	5
Student_residence_GID-17499	3
University_GID-44834	1

# Live demo

## GraphDB Workbench



Open issues

# Issues

- Data collection
- Inconsistencies from earlier stages
- Room for improvement in performance

# Possible improvements

- Teaching language of the courses
- Timetable and physical classes of the courses
- More information about Ph.D. programs and degree programs
- Better usage of OpenStreetMap data



Thank you



# Appendix

# Semi-formal transformation

EType	Description	Data properties	Object properties
Professor	Core	<ul style="list-style-type: none"><li>- has_id: string</li><li>- has_name: string</li><li>- has_surname: string</li><li>- has_role: string</li><li>- has_phone: string</li></ul>	<ul style="list-style-type: none"><li>- works_in: Department: id</li></ul>
Course	Core	<ul style="list-style-type: none"><li>- has_id: string</li><li>- has_name: string</li><li>- has_description: string</li><li>- has_webSite: string</li><li>- has_year: string</li><li>- has_typeCourse: string</li><li>- has_credits: string</li><li>- has_lesson_type: string</li><li>- has_exam_type: string</li><li>- has_evaluation_type: string</li><li>- has_lesson_period: string</li></ul>	<ul style="list-style-type: none"><li>- is_offered_by: DegreeProgram:id</li><li>- is_offered_by: Department:id</li><li>- has_professor: Professor:id</li><li>- has_assistant: Professor:id</li><li>- has_assistant: Ph.D. student: id</li></ul>

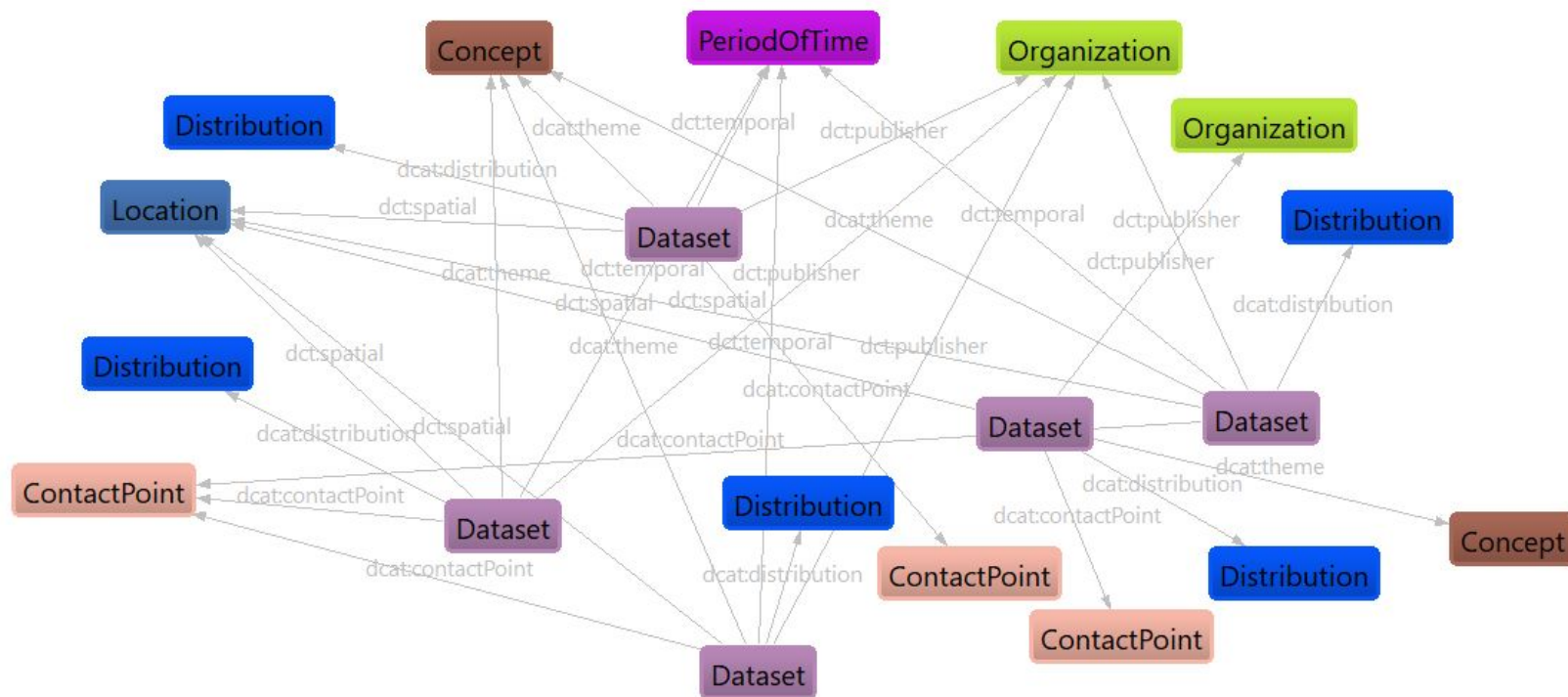


EType	Description	Data properties	Object properties
Degree program	Contextual	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> </ul>	<ul style="list-style-type: none"> <li>- is_offered_by: University:id</li> </ul>
Department	Core	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_description: string</li> <li>- has_website: string</li> <li>- has_address: string</li> <li>- has_phone: string</li> <li>- has_email: string</li> <li>- has_subType: string</li> </ul>	<ul style="list-style-type: none"> <li>- located_in: University: id</li> </ul>
Course partition	Contextual	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_period: string</li> <li>- has_syllabus: string</li> <li>- has_tenured: string</li> </ul>	<ul style="list-style-type: none"> <li>- has_course: Course:id</li> <li>- has_professor: Professor: id</li> </ul>
Teaching unit	Contextual	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_activity_type: string</li> <li>- has_duration_hours: string</li> <li>- has_type_teaching: string</li> <li>- has_subject_area: string</li> <li>- has_credits: string</li> </ul>	<ul style="list-style-type: none"> <li>- has_course: Course: id</li> </ul>

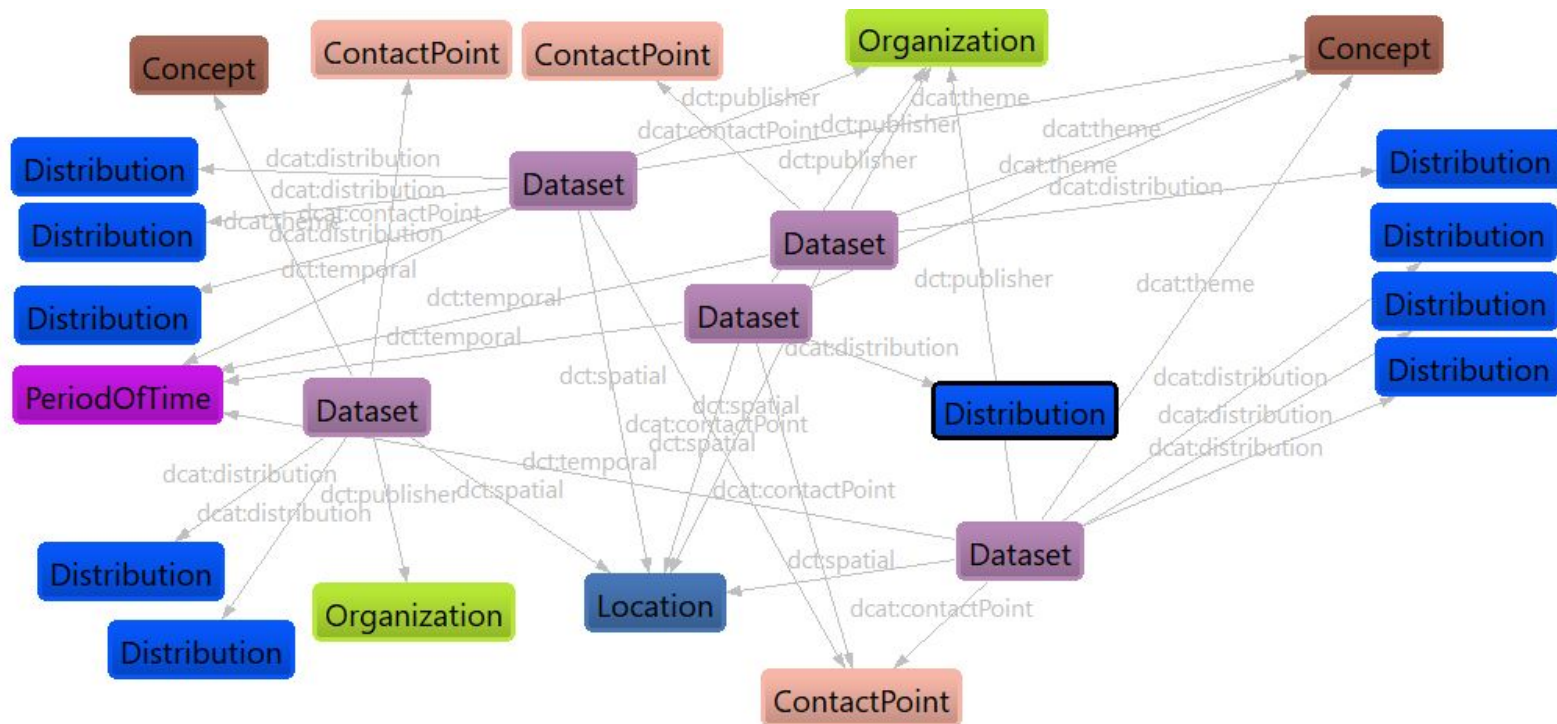
EType	Description	Data properties	Object properties
University	Common	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_latitude: string</li> <li>- has_altitude: string</li> <li>- has_longitude: string</li> <li>- has_startTime: string</li> <li>- has_endTime: string</li> </ul>	<ul style="list-style-type: none"> <li>- is_offered_by: University:id</li> </ul>
Staff member	Core	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_surname: string</li> <li>- has_role: string</li> <li>- has_phone: string</li> </ul>	<ul style="list-style-type: none"> <li>- works_in: Department: id</li> </ul>
Ph.D. student	Core	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_surname: string</li> <li>- has_phone: string</li> </ul>	<ul style="list-style-type: none"> <li>- works_in: Ph.D. Program: id</li> </ul>

EType	Description	Data properties	Object properties
Library	Common	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_address: string</li> <li>- has_name: string</li> <li>- has_alt_name: string</li> <li>- has_short_name: string</li> <li>- has_wheelchair: string</li> <li>- has_email: string</li> <li>- has_opening_hours: string</li> <li>- has_phone: string</li> <li>- has_website: string</li> </ul>	- located_in: University: id
Student residence	Common	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_address: string</li> <li>- has_name: string</li> <li>- has_alt_name: string</li> <li>- has_wheelchair: string</li> </ul>	- located_in: University: id
Ph.D. program	Common	<ul style="list-style-type: none"> <li>- has_id: string</li> <li>- has_name: string</li> <li>- has_description: string</li> <li>- has_website: string</li> </ul>	- hosted_in: Department: id

# DCAT Metadata - Inception phase



# DCAT Metadata - Informal modeling phase



# DCAT Metadata - Formal modeling phase

