

Dipartimento di Ingegneria e Scienza dell'Informazione

– KnowDive Group –

Knowdive Research Products

Phase 1

Document Data:

October 30, 2024

Reference Persons:

Aloisi Deborah, Giaretta Leonardo

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Trento, Italy

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Revision History:

Revision	Date	Author	Description of Changes
0.1	16.10.2024	Both	Document created
1.0	21.10.2024	Deborah Aloisi	Added Introduction
2.0	23.10.2024	Leonardo Giaretta	Added Domain of Interest
2.1	25.10.2024	Deborah Aloisi	Added context
2.2	26.10.2024	Both	Added Scenarios and Personas
2.3	28.10.2024	Both	Added Competency Question
2.4	28.10.2024	Both	Defined entities
2.5	29.10.2024	Leonardo Giaretta	Associate entities with CQ
2.6	30.10.2024	Both	Added ER

1 Introduction

Data has become an essential part of our lives, but without proper organization and management, it loses its value.

This project has the objective of organizing data about members, alumni, papers and other products of the Knowdive research group in a Knowledge Graph that makes it simpler to query and find information about it.

This will be accomplished using the iTelos methodology, a structured approach designed to streamline the Knowledge Graph Engineering (KGE) process and minimize development effort. The methodology is intended to assist users in addressing the challenges that arise when building purpose-specific knowledge graphs (KGs). It also facilitates the creation of reusable resources, promoting circular data reuse and thus reducing the effort required to generate new resources.

In the iTelos methodology, re-usability is a central principle in KGE, with project documentation playing a critical role in enhancing the re-usability of the resources developed throughout the project. This report aims to document both the process and methodology used, explaining the rationale behind key decisions and how resources were leveraged to achieve the project's objectives. By doing so, the documentation will serve as a valuable resource for external readers, potentially enabling them to reuse the project's outputs for other purposes.

The report is structured as follows:

- Section 2: Definition of the project's purpose and its domain of interest.

2 Purpose Definition

2.1 Informal Purpose

The final Knowledge Graph (KG) can be utilized as a general-purpose service to assist users in discovering research products (such as papers, reports, and other published outcomes) produced by the Knowdive research group at the University of Trento (DISI). This functionality can be articulated as a user request in the following form:

"A service which helps the users to query and know about all the products and the people that are working or were working in the Knowdive research group at the University of Trento"

2.2 Domain of Interest (DoI)

- Personal context : We expressed our Personal context Purpose from the point of view of a member of the Knowdive research group, as they are the category of users which have a strictly personal interest in this project. "I want a KG which collects the results of my research and available data from the projects I'm taking part into"
- Reference context: We expressed our Reference Context purpose in a dual way, in order to emphasise two different aspects of this project: the geographical aspect and the research aspect. "I want a KG which represents the distribution across the globe of Knowdive's members and projects" "I want a KG which represents the research products of the Knowdive research products"
- Personal-Reference context Through the Personal-Reference context purpose we were able to express the point of view of a non-member user. "I want a KG which allows me to access the data regarding the Knowdive group members, their research products and their projects by filtering through various criteria."
- Reference-Personal context Through the Reference-Personal context purpose we expressed the broader point of view that takes into account both member and non-member users. "I want a KG which integrates the data about members, research product and projects of the Knowdive Research Group, allowing users to consult data on various scientific topics and members of the group to organize their work results."

In term of context we define:

- Geographical boundaries: We express the spatial scope with the coordinate of the University of Trento, more precisely with the Department of Information and Computer Science

(DISI) where the Knowdive research group is officially located. The coordinate are:

Department	Latitude	Longitude	Altitude (m)
Dipartimento di Ingegneria e Scienza dell'Informazione	46.0668994	11.1481093	370

- Temporal boundaries: The scope is from the starting of the Knowdive research group in the 2006 to the current year, since a potential user could be both interested in the archived data and current and updated information.
- Domain boundaries: The project concerns the Knowdive Research Group and in particular its member, alumni, papers and other works produced.

2.3 Purpose Formalization

2.3.1 Scenarios definition

1. A Master's student is searching inspiration for the topic of their thesis. They want to see the publications of the Knowdive group so that they can write to a professor that works on their interested topic.
2. A company wants to employ a person with reference to the Knowdive research group, so they want to check if the credentials are correct and if he/she aligns with the position they are offering.
3. A University wants to invite member of the Knowdive research group for a seminar and are searching which member would be the best to contact.
4. A student that will move to another university wants to know if in his/her new university there is a member of the Knowdive group and if the research interests of such a member align with his/hers.
5. An Institution (such as a ranking Institution) wants to measure the growth of the Knowdive group through its research output and/or the current amount of projects its undertaking.
6. A Researcher of the Knowdive group wants to have a neatly organized aggregation of the research products made by him/her and his/hers colleagues.

2.3.2 Personas

Name	Age	Profession	Description
Carlotta	24	Student	Carlotta is approaching the end of her Master's degree, but without a thesis she can't graduate. She doesn't have a precise idea of what she want to study so she is searching inspiration on between other thesis. In doing so she ended on the Knowdive re-search group page and wants to see what they are studying
Gianpaolo	47	HR person- nel	Gianpaolo is one of the HR personnel at company X in Trentino. His company wants to develop a project correlated to a Knowledge graph but they don't have any employee that can take care of it. So his company instructed him to search for a possible candidate to hire for the project and the first idea that has come to his mind is to search for figures connected to the local University.
Mabel	35	Secretary of University	Mabel was tasked by a professor at her university to contact the Knowdive Research group to invite a member of the group to host a seminar. She wants to find who is the best person to contact for the task
Franco	23	Student	Franco is a Master's student with a personal interest in the Human Machine Symbiosis topic. He was planning to try and propose a Project course on this topic, but he doesn't know which professor may be interested. By talking with other students he discovers the existence of the Knowdive group and sets out to find a member that matches his interest.
Anna	22	Student	Anna will be soon finishing her Bachelor's degree and will be moving to another university. Having just developed a passion for Artificial Human Cognition and knowing that the Knowdive group does research on that topic, she searches for connections between the group and her future University.
Valerio	41	Institution X employee	As a part of a future analysis on the research environment in Trentino, Valerio has been tasked by the Institution X to collect data regarding the growth of the various research groups and organization of the Trentino territory. He is currently collecting data on Knowdive and needs the most precise data possible about the amount of members of the group through time, their projects and the amount of research published.
Arianna	37	Knowdive member	Arianna always liked tidy and clear aggregation of data so she want to see all the products done by her research group divided by colleague, categories and so on.

Table 1: Personas

2.3.3 Competency Question (CQs)

Persona	ID	Question
Carlotta	1.1	I'd like to know all the thesis written in collaboration with the Knowdive Research group
Carlotta	1.2	I'd want to see all Master thesis written in collaboration with the Knowdive group
Carlotta	1.3	I'm curious if the people that wrote their thesis in collaboration with the Knowdive group have any postdoctorate work.
Carlotta	1.4	Give me the topics a member of the KRG is studying
Carlotta	1.5	I've finally decided on a topic for my thesis, but I still don't know which member of the KRG to contact. I would need to have a list of all members that work on my chosen topic with the possibility to filter through role and location.
Gianpaolo	2.1	Give me all the current member of the KRG
Gianpaolo	2.2	Give me all the ex-member and their position when they left
Gianpaolo	2.3	Give me only the members that are researchers or professors
Gianpaolo	2.4	Let me search if a specific person has been part of the KRG and get their position when they left and a list of their research products and of the projects they participated in.
Mabel	3.1	Give me a list of the research topics of the KRG.
Mabel	3.2	I want to be able to find all the members of the KRG that are either a professor or a researcher that works or has worked on a given topic.
Mabel	3.3	I want to know who is the coordinator for the seminar activities
Mabel	3.4	I need to get the contact information for a specific member of the KRG.
Mabel	3.5	The person I thought of is unavailable, but I could contact one of his collaborators. I need to find all the members that have worked with him/her on the chosen topic.
Franco	4.1	I want to see all research products produced by the KRG on a specific topic.
Franco	4.2	I want to see each KRG member that has worked on a research product.
Franco	4.3	I know a professor that is part of the KRG, I want to see on which topics he/she worked on during the last years.
Franco	4.4	Are there any members that have worked with the professor I know that have also worked on the topic I prefer?
Anna	5.1	I'd like to know which KRG members are located in my future university.
Anna	5.2	I'd like a list of all non-members of the KRG that have collaborated with the group on a given topic.
Anna	5.3	I'd like a list of all ex-members of the KRG that have worked on a given topic.
Anna	5.4	I would need the location of an ex-member of KRG before he left the group.
Anna	5.5	I would like to know which courses the members of the KRG teach
Anna	5.6	I would like to know who teach the Studies in Human Behavior course

Valerio	6.1	I need to track how many members the KRG had through the years and who these members are.
Valerio	6.2	I need to track the amount of research products produced by the KRG through the years and fetch the appropriate identifying data about each of those products.
Valerio	6.3	I need to be able to track in which years a current or past member of the KRG has been part of the group, how many and which research products he/she produced during that time.
Valerio	6.4	I need to track the amount of research products on a given topic that has been produced on a given topic and fetch the appropriate identifying data about each of those products.
Valerio	6.5	I need to track the status and duration of each project in which the KRG has participated.
Valerio	6.6	For each project, i need to extract all the Universities and Institutions that have partnered with the KRG.
Arianna	7.1	I'd like to have a list of all the research products of the KRG, ordered by date.
Arianna	7.2	I'd like to know, for each project in which the KRG has taken a part in, which members have worked on it.
Arianna	7.3	For each member of the KRG, I would like to have a list of his/her research products.
Arianna	7.4	I want to know in which years a member of the KRG was active the most
Arianna	7.5	I want to know which topic is more researched based on related works created

Table 2: CQs

CQ ID	Common entities	Core Entities	Contextual entities
1.1		Research Product	
1.2		Research Product	
1.3	Person	Research Product	
1.4	Person	Member, Research Topic	
1.5	University, Role	Member, Research Topic	
2.1		Member	
2.2	Role	Alumni	
2.3	Role	Member	
2.4	Role	Member, Research Product, Project	
3.1		Research Topic	
3.2	Role	Member, Research Topic	
3.3	Role	Member	
3.4	Role	Member	
3.5		Member, Research Topic	
4.1		Research Product, Research Topic	
4.2		Member, Research Product	

4.3		Member, Research Topic	
4.4		Member, Research Topic	
5.1	University	Member	
5.2	Person	Research Topic, Research Product	
5.3		Alumni, Research Topic	
5.4	University	Alumni	
5.5	University	Member	Course
5.6	Univeristy	Member	Course
6.1		Member, Alumni	
6.2		Research Product	
6.3		Member, Alumni, Research Product	
6.4		Research Product, Research Topic	
6.5		Project	
6.6	University	Project	
7.1		Research Product	
7.2		Project, Member	
7.3		Member, Research Product	
7.4		Member, Project, Research Product	Course
7.5		Research Topic, Research Product	

Table 3: Entities related to CQs

2.3.4 Concepts identification

In a knowledge graph, entities represent real-world objects and are instances of Entity Types (ETypes), which define the types of real-world objects. This section categorizes ETypes based on their popularity categories: Common, Core, and Contextual.

Common entities

Common entities consist of resources that contain information relevant across multiple contexts or domains of interest. While not directly tied to the user's Purpose, they are essential for supporting it within the knowledge graph.

For this project, the identified common entities are:

- University
- Person
- Role (Professor, Researcher, etc...)

Core entities

Core entities are those that contain essential information about the key aspects central to the Purpose, forming the foundational data necessary to construct the knowledge graph. These entities are harder to locate and less reusable than common entities.

For this project, the identified core entities are:

- Member
- Alumni
- Research Product (Thesis, Papers, Reports, etc...)
- Research Topic
- Project

Contextual entities

Contextual entities are those that encompass resources containing specific, often unique information directly related to the user's Purpose. These resources are designed to add distinctive value, setting the application apart from competitors. While core resources are essential for creating a functional application, contextual resources provide a competitive edge. Typically, they are not reusable and often need to be created from scratch.

For this project, the identified contextual entities are:

- Course

2.3.5 ER model definition

The entities previously defined are now used to construct the draft of a possible ER model. The model is going to be improved in the next phase during the information gathering.

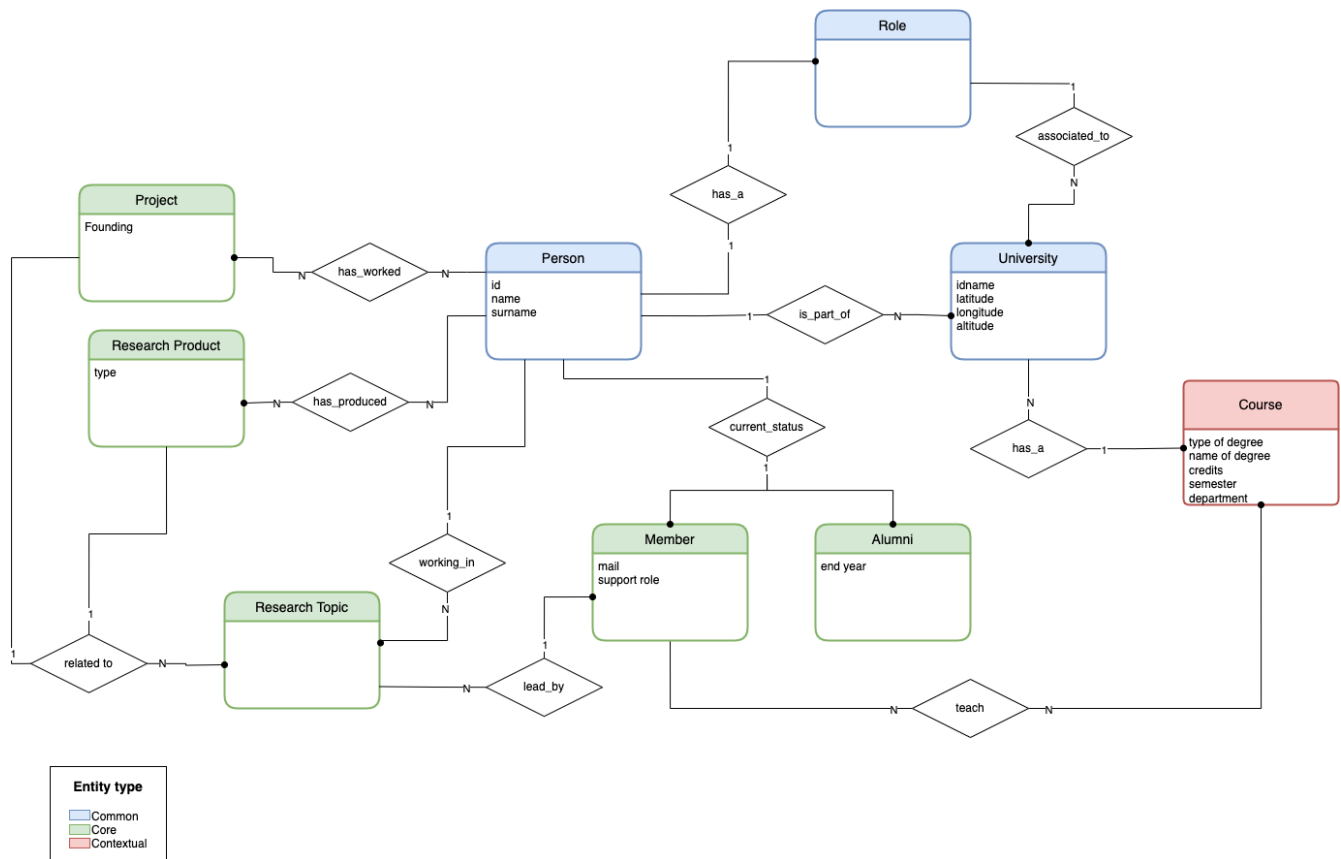


Figure 1: Entity-Relation diagram