GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2026-2027

Knowledge Graphs (E018160)

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0 **Study time 90 h**

Course offerings and teaching methods in academic year 2026-2027

A (semester 2)	English	Gent	practical	15.0h
			lecture	30.0h

Lecturers in academic year 2026-2027

Colpaert, Pieter	TWO6	lecturer-in-charge
De Meester, Ben	TWO6	co-lecturer
Verborgh, Ruben	TWO6	co-lecturer

Offered in the following programmes in 2026-2027	**crdts**	**offering**
Bridging Programme Master of Science in Bioinformatics(main subject Engineering)	3	A
Master of Science in Bioinformatics(main subject Engineering)	3	A
Master of Science in Computer Science Engineering	3	A
Micro-credential Knowledge Graphs	3	A

Teaching languages

English

Keywords

Semantic Web technologies, Web Querying, Linked Data, Knowledge Graphs, Open Data, Big Data, Data Spaces, FAIR, information technology, data architecture, HTTP, Solid, RDF, interoperability

Position of the course

Managing data on one machine for one specific kind of use is fairly straightforward. It is from the moment that that initial dataset needs to be shared with more than one application and needs to be combined with other datasets managed by other organizations on different machines, that more complex computer science and information technology problems arise. In this course we will deep-dive in the current state of the art in creating Knowledge on Web-Scale. Your personal data, data published publicly on the Web and data explicitly shared with you, becomes your Knowledge Graph that applications and services can use to assist you in your day to day activities.
Data scientists and engineers today claim 80% of their time goes to preparing and integrating the data: let us take you on a quest to fully automate data integration.

Contents

- Data exchange: open or shared
  - Findability, accessibility, interoperability, and reusability of data through the FAIR principles
  - Open data portals
  - The European Interoperability Framework
- The search for a universal data model
  - Linked Data and the RDF data model
  - Linked Data serializations
  - Logic with N3
- Linked Data architecture
  - Linked Data Fragments
  - Event sourcing and Linked Data Event Streams

    - RDF Stream Processing
    - The Open World Assumption
    - Conway's Law
    - Creating ontologies with RDFS and OWL
    - Making datasets discoverable with DCAT
    - Validating RDF and building application profiles with SHACL
  - Web querying
    - An introduction to SPARQL
    - Querying a data source
    - Algorithms for evaluating queries
    - Federated querying of data
    - Link traversal
  - Trust in the context of the Web

  A guest lecture by a European data-tech company or organization

Initial competences

- Being able to read HTTP messages (URL, method, body, response codes, headers...)
- Executing HTTP requests via the browser and the command-line
- Reading and writing data from/in a CSV-file, a JSON-file and relational databases
- Making small JavaScript/TypeScript programs in the browser and Node.js (reading files, performing HTTP interactions)

Final competences

1 Engage in discussion about the position, importance, and limitations of open data, shared data, and knowledge graphs.
2 Choosing the appropriate Web API
3 Modeling data as RDF graphs
4 Publishing knowledge graph on the Web from raw data
5 Designing a data architecture with fully automated data adoption and assessing trade-offs
6 Building a Linked Data vocabulary and application profile in RDF
7 Interpreting and creating SKOS, RDFS, and OWL descriptions
8 Interpreting and designing for context
9 Validating RDF data
10 Querying over heterogeneous interfaces on the Web
11 Positioning the opportunities and challenges of knowledge graphs in a specific domain.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, Practical, Peer teaching

Study material

None

References

- Aidan Hogan, Eva Blomqvist, Michael Cochez, Claudia d'Amato, Gerard de Melo, Claudio Gutierrez, Sabrina Kirrane, José Emilio Labra Gayo, Roberto Navigli, Sebastian Neumaier, Axel-Cyrille Ngonga Ngomo, Axel Polleres, Sabbir M. Rashid, Anisa Rula, Lukas Schmelzeisen, Juan Sequeda, Steffen Staab, Antoine Zimmermann (2021) Knowledge Graphs, Synthesis Lectures on Data, Semantics, and Knowledge, No. 22, 1–237, DOI: 10.2200 /S01125ED1V01Y202109DSK022, Morgan & Claypool
- Jose E. Labra Gayo, Eric Prud'hommeaux, Iovka Boneva, Dimitris Kontokostas (2018) Validating RDF Data, Synthesis Lectures on the Semantic Web: Theory and Technology, Vol. 7, No. 1, 1-328, DOI: 10.2200 /S00786ED1V01Y201707WBE016, Morgan & Claypool
- Verborgh, Ruben, and Michel Dumontier. "A Web API ecosystem through feature-based reuse." IEEE Internet Computing 22.3 (2018): 29-37.

Course content-related study coaching

- contact with the lecturers (through email and in person after appointment)
- supervised labs

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment open-book, Written assessment open-book

Examination methods in case of periodic assessment during the second examination period

Oral assessment open-book, Written assessment open-book

Examination methods in case of permanent assessment

Presentation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

- Non-periodical evaluation
  - lab assignments introduced during the lectures, that need to be submitted through Ufora
  - Peer teaching: a presentation and lecture notes will be evaluated
- Periodical evaluation
  - oral examination
  - written preparation
  - open book and open Web

Calculation of the examination mark

The final grade is the average of the two parts (exam and non-periodical evaluation).
In case the grade for any part is less than 10/20, the final grade is capped at 9/20.
In case the grade for any part is 7/20 or less, the final grade is capped at 7/20.
For students who have not passed the non-periodical evaluation, an alternative assignment is provided in the second examination period.

Facilities for Working Students

Possibility to perform an individualized version of the practical sessions, given a timely notification at the start of the semester.