Semantic x-Lab Kick-Off

June 11, 2025

Knowledge Graph Infrastructure

Thomas Bauer - Service Steward

checkout last given KGI talk on Zenodo:
10.5281/zenodo.15487695

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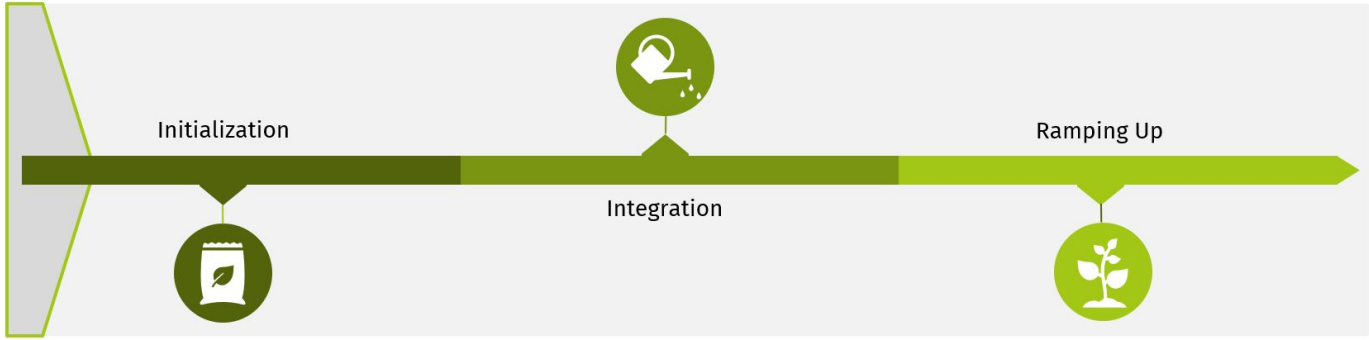
Structure of the talk

- Introduction
- Use cases
- Initialisation vs. Integration
- Getting involved

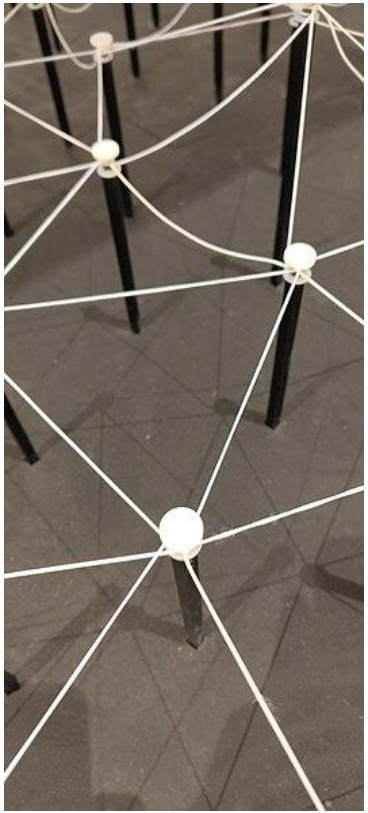
Introduction

KGI4NFDI becomes a Basic Service in Base4NFDI

- Base4NFDI funds Basic Services that are deemed useful across multiple NFDI consortia
- KGI4NFDI - **K**nowledge **G**raph **I**nfrastructure
  - provides infrastructure and services around knowledge graphs (KG)
  - is currently in its Initialization Phase (extended until Dec 2025)
  - More info at: https://kgi.services.base4nfdi.de/ and https://base4nfdi.de/projects/kgi4nfdi



Introduction
Why KGs and why KGI



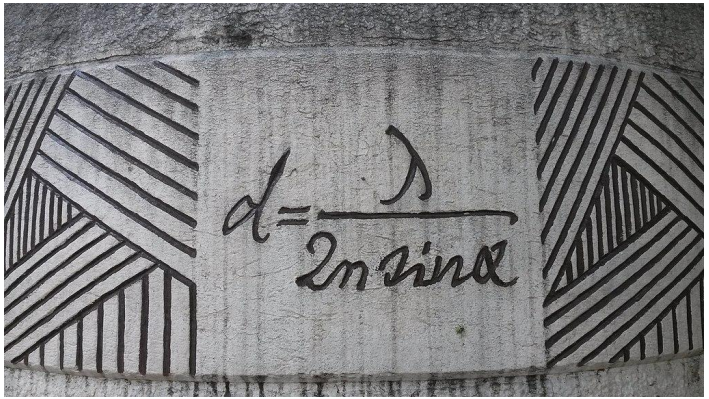
KGs are an important technology supporting **interoperability** and enabling **data exchange**:

- A KG is a **graph-structured knowledge base** containing a terminology (vocabulary or ontology) and data entities interrelated via the terminology;
- KGs are based on **semantic web technologies** (RDF, SPARQL, etc.) and are often used for agile data integration;
- KGs are already **widely used** by research data producers and managers in Germany.

Introduction

Basic idea of Knowledge Graphs: link individual pieces of knowledge

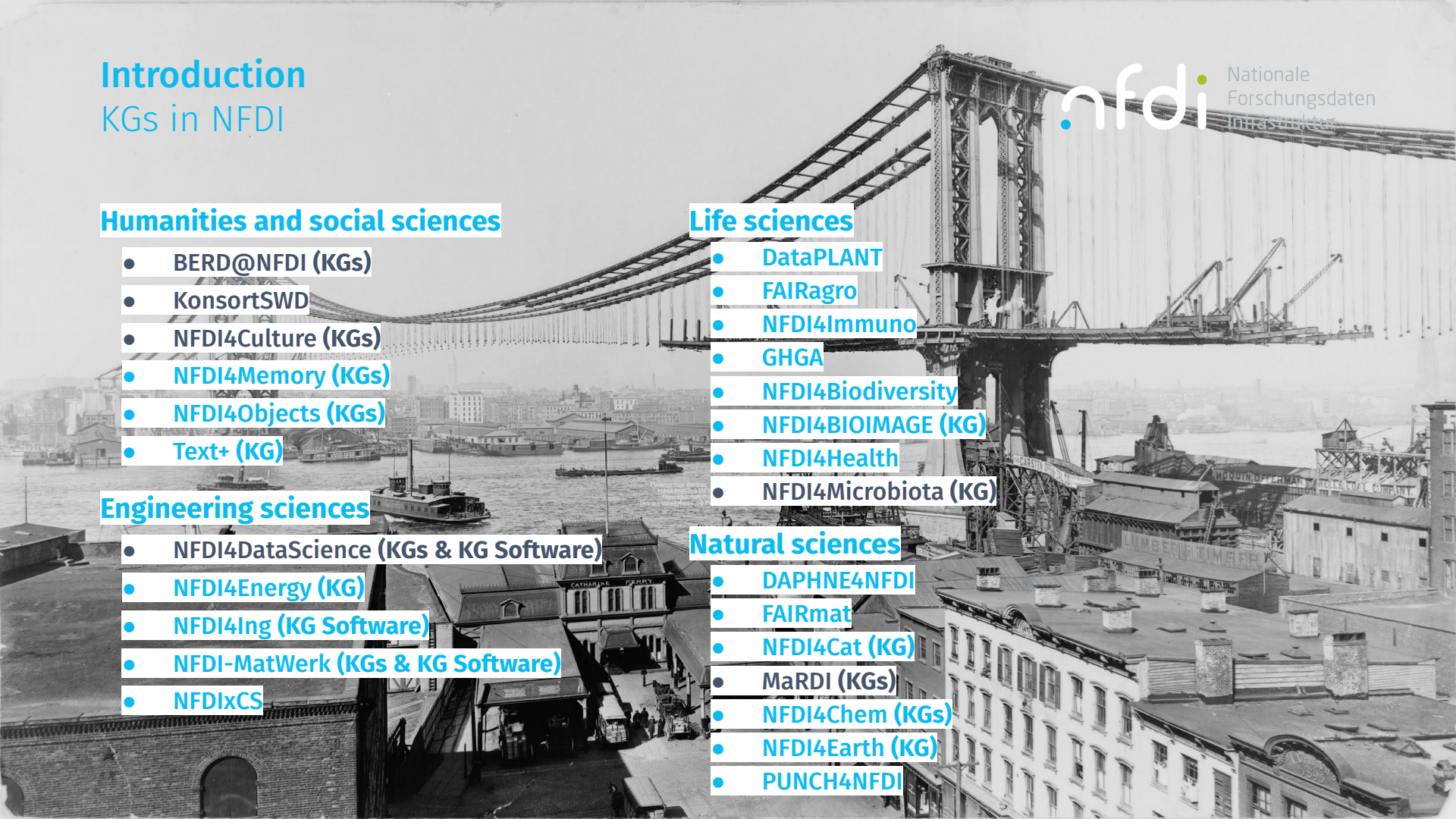
- **Which pieces of knowledge can be linked to and from this image, and how?**
  - It's a photograph of (a part of) a monument.
  - The monument depicts Latin and Greek letters.
  - The letters are part of a mathematical formula.
  - The formula represents some physical concepts.
  - The physical concepts describe a limit.
  - The limit could be circumvented by engineering.
  - The engineering got the Nobel Prize in Chemistry.
  - The chemistry is widely used in biology and medicine.
  - All of this has a history as well as material, social and data aspects, e.g.
    - the monument shares its pedestal with an earlier one
    - long before receiving the Nobel Prize, the laureates
      - faced resistance because the limit was “set in stone”
      - had been referring to the monument in their talks
    - journalists reused this image in their coverage



Introduction
Key ingredients for a Knowledge Graph

- Scope
  - use cases
  - types of nodes and edges
- Data
  - data sources
  - data quality
  - data access
  - data licensing
- Metadata
  - schemas for KG entries
    - domain knowledge
    - provenance
    - mapping to external vocabularies
- Storage, Security & Performance
- Workflows
  - importing
    - data discovery
    - entity & relation extraction / mapping
    - data integration
  - curating
    - duplicate detection / disambiguation
    - updates
  - exporting
    - entity and relation mapping
  - exploring
    - browsing / searching / querying / visualizations
- ...

Introduction
KGs in NFDI



Humanities and social sciences

- BERD@NFDI (KGs)
- KonsortSWD
- NFDI4Culture (KGs)
- NFDI4Memory (KGs)
- NFDI4Objects (KGs)
- Text+ (KG)

Engineering sciences

- NFDI4DataScience (KGs & KG Software)
- NFDI4Energy (KG)
- NFDI4Ing (KG Software)
- NFDI-MatWerk (KGs & KG Software)
- NFDIxCS

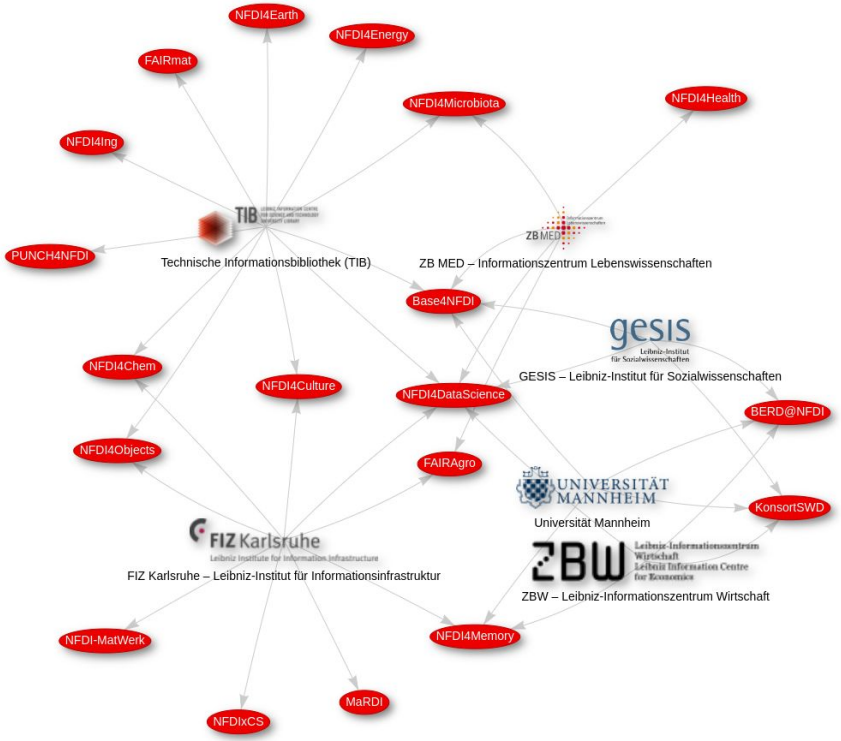
Life sciences

- DataPLANT
- FAIRagro
- NFDI4Immuno
- GHGA
- NFDI4Biodiversity
- NFDI4BIOIMAGE (KG)
- NFDI4Health
- NFDI4Microbiota (KG)

Natural sciences

- DAPHNE4NFDI
- FAIRmat
- NFDI4Cat (KG)
- MaRDI (KGs)
- NFDI4Chem (KGs)
- NFDI4Earth (KG)
- PUNCH4NFDI

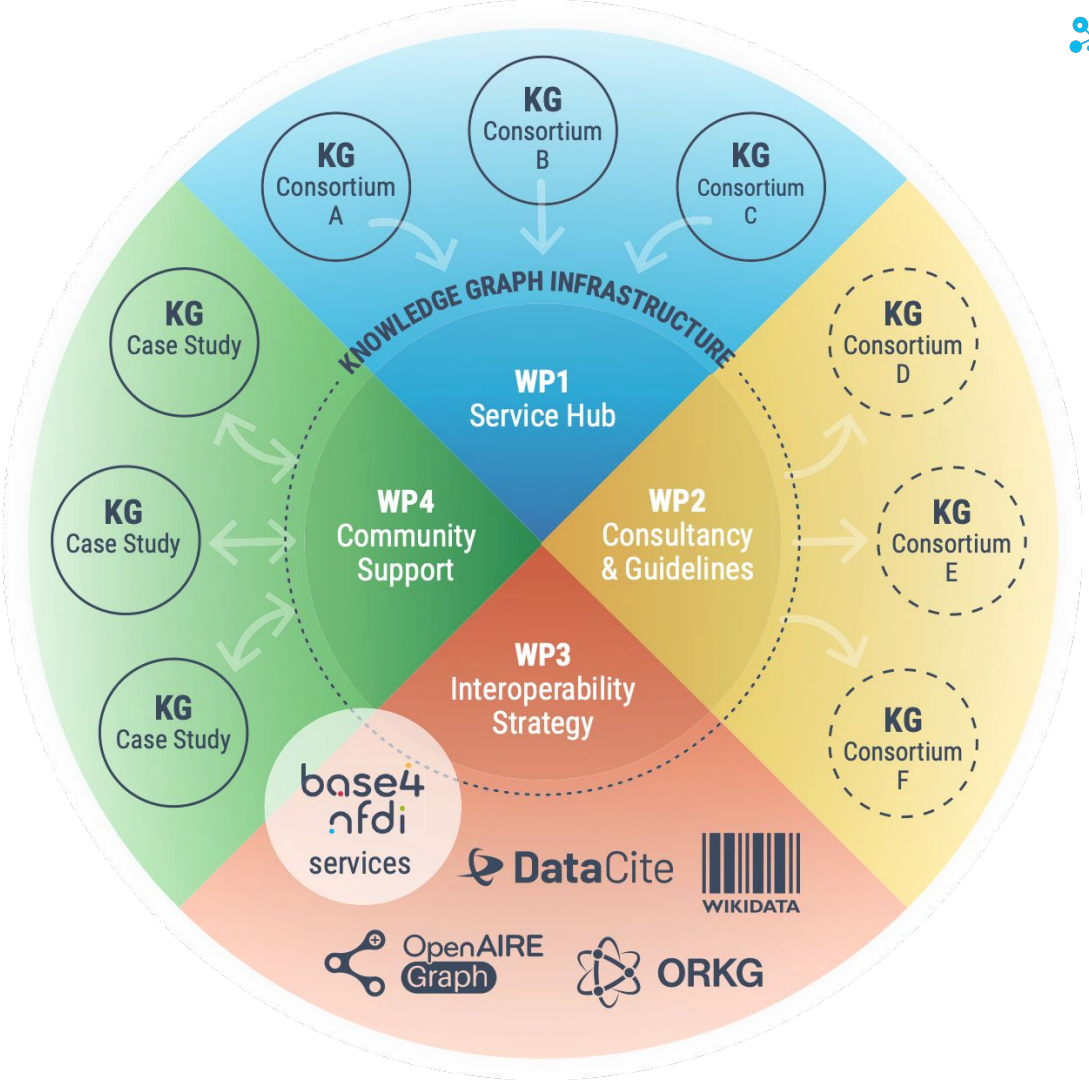
KGI4NFDI
Project Team location



- FIZ Karlsruhe (MaRDI)
- GESIS (NFDI4DataScience)
- TIB (NFDI4Culture)
- Uni Mannheim Library (BERD@NFDI)
- ZB MED (NFDI4Microbiota)
- ZBW (KonsortSWD)

Initialisation Phase

Setting things up



Use Cases
Personas

Aleena

First year Postdoc Researcher in Bioinformatics

Aleena works remotely at the University of Cologne. Her scholarly interests are interdisciplinary and she enjoys contributing to citizen science projects like Wikidata. She has some experience using KGs but wants to learn more.

Andreas

Second year PhD Researcher in Sociology

Andreas is a PhD student at the University of Mannheim. He is interested in exploring large corpora of available sociological survey data. Andreas is comfortable using standard software for statistics and analysis, but wants to explore more innovative methods particularly in terms of discovery and data reuse.

Alexandra

Senior Data Steward for Engineering Data Domain

Alexandra works at a Leibniz Centre and is responsible for data collections in the Engineering domain. She is responsible for integrating the data in her institute to other national and international initiatives and is keen to explore the potential of KGs for this task.

Lisa

Junior Developer in a research lab

Lisa is an MA graduate in CS, working in a research lab at a Leibniz Institute. She works closely with scientists and enjoys working on services that support innovation in science. She lacks industry experience, but is passionate about open source software and contributes to several projects in volunteer capacity.

Luca

Senior Developer in a research lab

Luca is semantic web expert working in a research lab at a Fraunhofer Institute. He runs a big KG project and is eager to improve it and see how others use it. He is involved in various expert committees and wants to make knowledge and best practice sharing more effective.

Use Cases
The KGI Service Hub

Aleena

When I

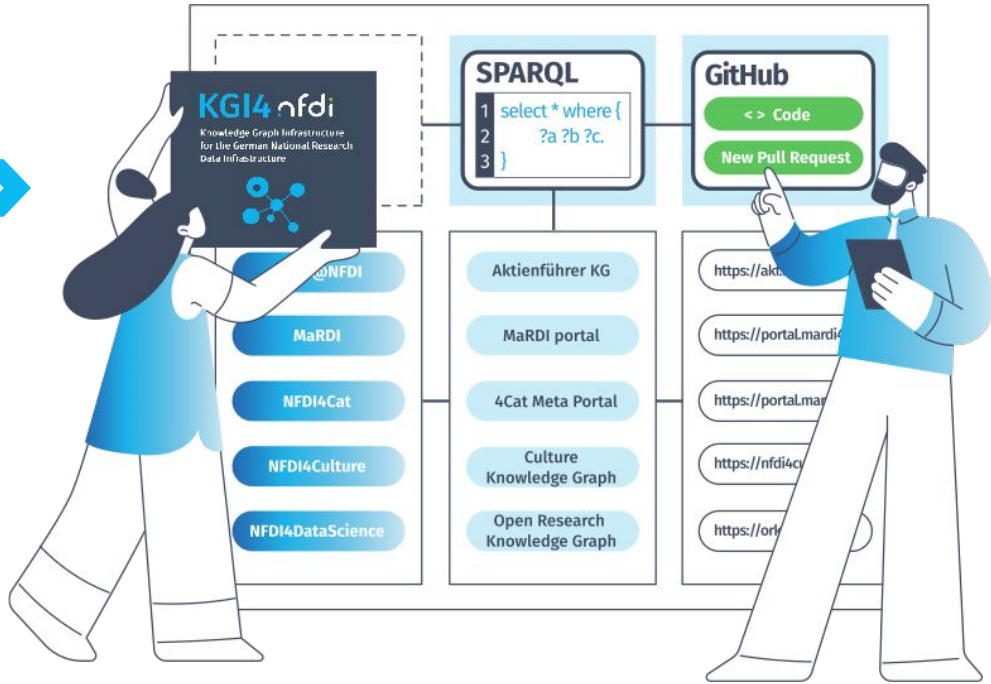
am looking for existing knowledge graphs in the domain of Bioinformatics,

I need / I wish

I need a centralised registry of knowledge graphs.

I am frustrated when

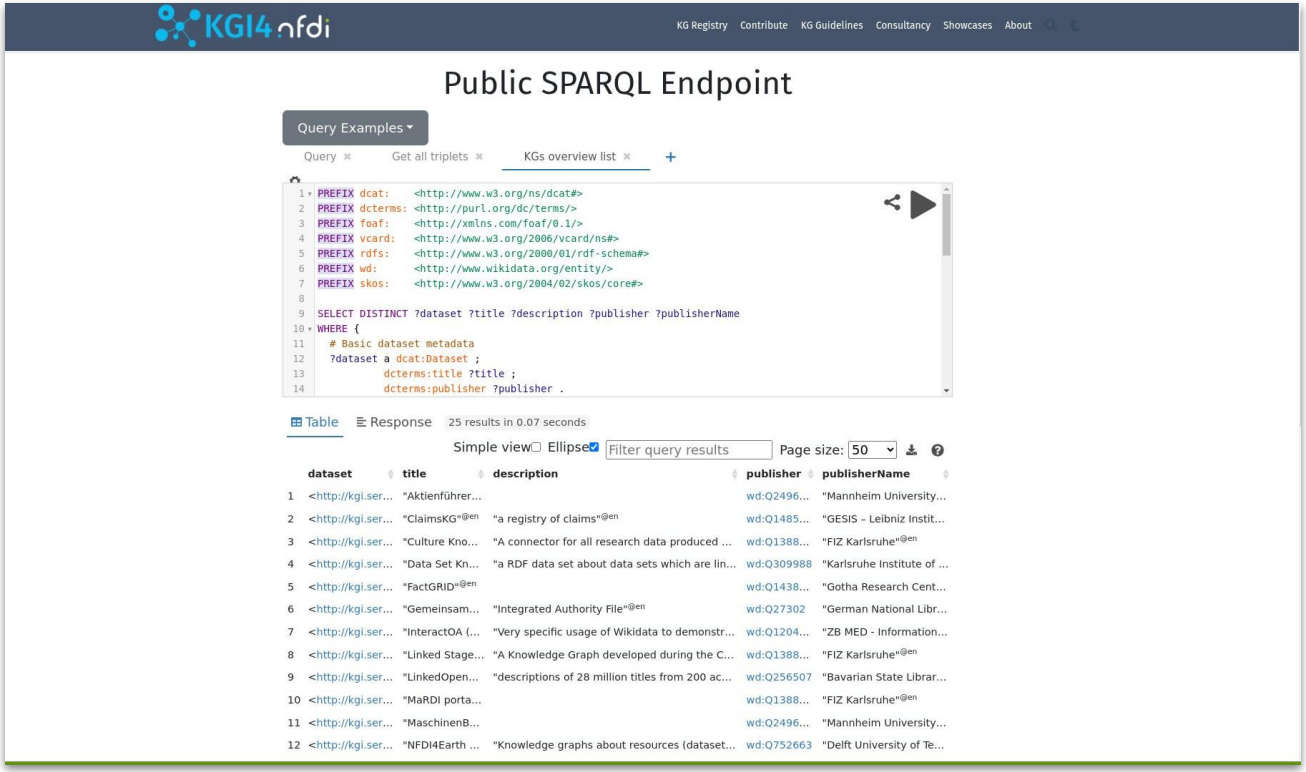
I don't know what question to ask in the query interface and how best to formulate it.



- **Registry of KGs in NFDI**
- **Search and query platform**
- **Query examples to get started**

Use Cases

Example query: List of NFDI KGs registered in the KG Registry

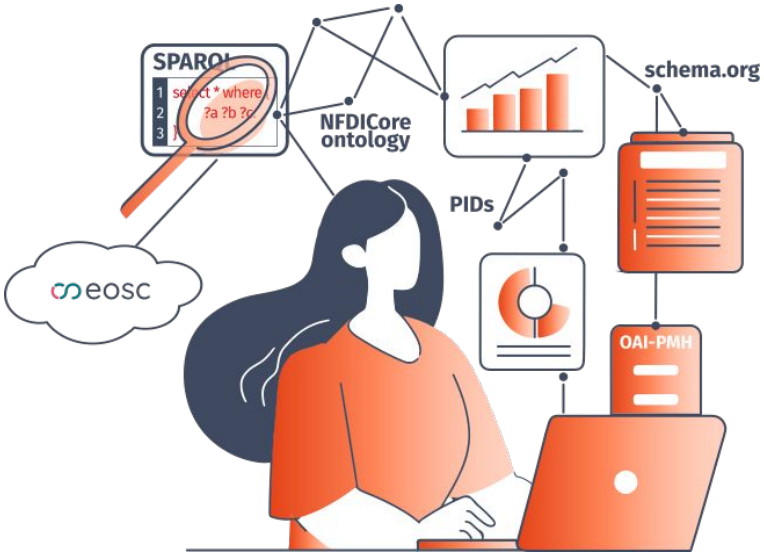


https://kgi.services.base4nfdi.de/kg_registry/

Use Cases

How can you interact with KGs?

- Find existing KGs
  - within NFDI
  - within your fields
  - in general
  - starting from a specific piece of knowledge
- Use existing KGs
  - alone
  - in combination
    - with each other
    - with other resources
      - including other Basic Services
- Deploy your own KG
- Increase the interoperability of your KG with other KGs
- …



Use Case
Deploy your own KG

Lisa

When I

am deciding which KG technology to deploy,

I need / I wish

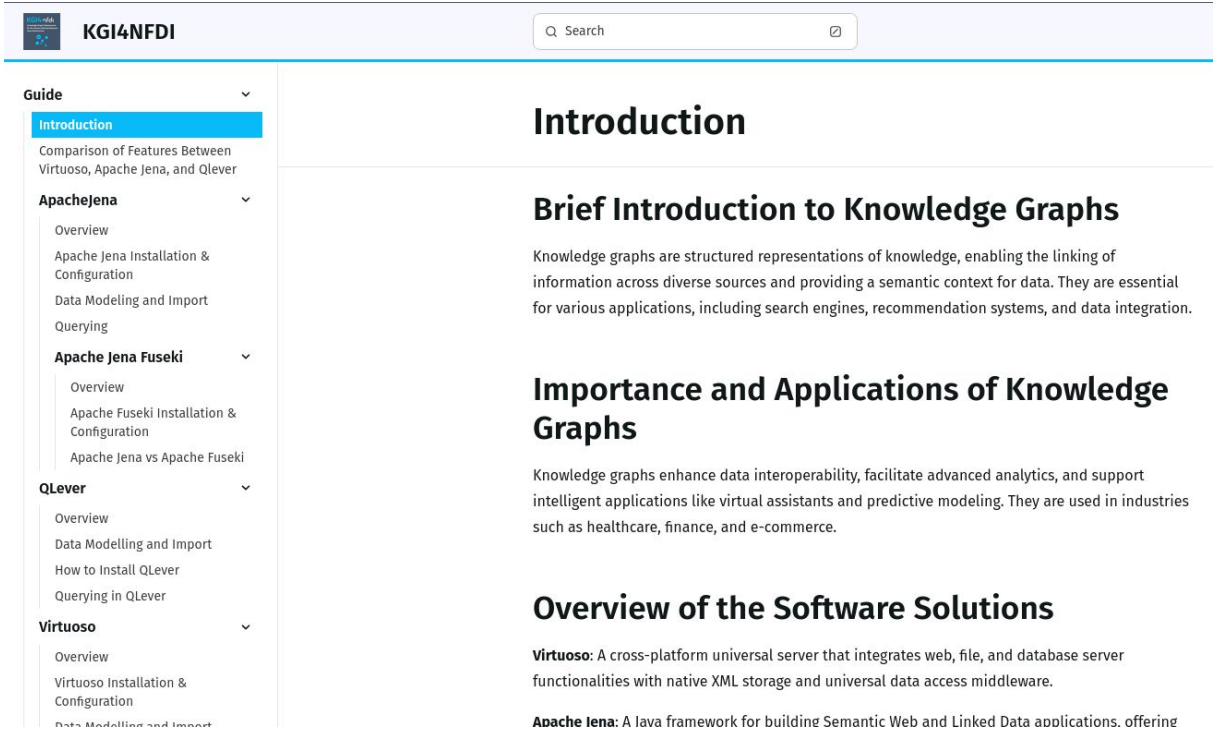
an overview of existing tools with clear indication of advantages & disadvantages of each tool.

I am frustrated when

there is not enough documentation to support less experienced users of these technologies.

- **Several tool options to choose from**
- **Guidance docs and deployment pipelines**
- **Consulting service**

KGI Guidelines



- https://kgi4nfdi.github.io/Guidelines/
- https://kgi4nfdi.github.io/Guidelines/tutorial/

Facets of Cross-Disciplinarity in KGs

Types of relevant questions

- Which KGs should (or do) hold which knowledge about an entity?
- How should the details be modeled within and across KGs?
- What if different KGs have conflicting information on “the same” entity?
- How do we identify “the same” concept or relationship across KGs?
- How can KGI leverage other Basic Services, and vice versa?

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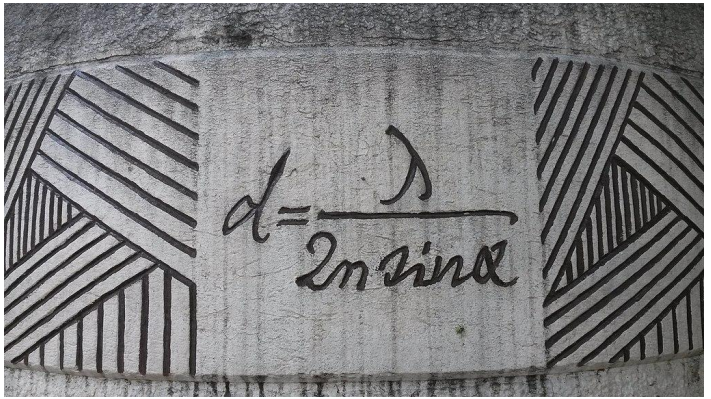
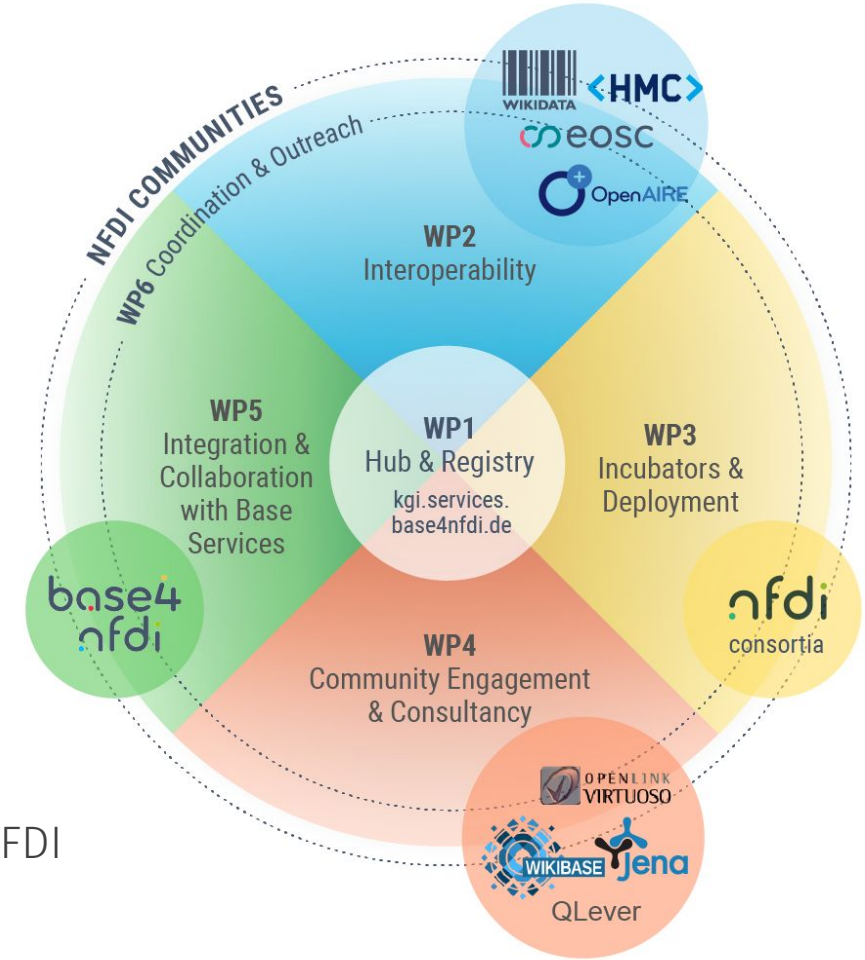


Integration Phase
Provisional Plans

- Run incubator projects
- Extend the registry
- Enrich the hub
- Benchmark KG technologies
- Harmonize metadata
- Streamline deployment
- Integration with Base Services
- Community engagement
- Consultancy
- Provide training
- Documentation and reporting
- Coordination within and beyond NFDI



Get involved

More info at: https://kgi.services.base4nfdi.de/ and https://base4nfdi.de/projects/kgi4nfdi

- Share KG-related use cases
  - integration needs
  - existing KGs in your domains (example)
  - data models for KG entries
  - ...
- Take-advantage of consulting opportunities
  - Plan an incubator project
  - Attend open consulting sessions (third Wednesday of the month, 3pm)
  - Access training resources
  - ...
- Explore KGI resources and provide feedback
  - KGs in the registry
  - Virtuoso & Jena KG Guidelines
  - MaRDI meets 4Memory
  - FAIRJupyter

Thank you!
Questions?


kgi4nfdi@lists.nfdi.de


base4nfdi-servicestewards@lists.nfdi.de for general inquiries


base4nfdi.de/projects/kgi4nfdi

base4nfdi Basic Services for NFDI

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