KGI4 nfdi

Knowledge graphs in the context of the National Research Data Initiative (NFDI)

Daniel Mietchen; Leipzig Semantic Web Day #LSWT2025

for the project team:
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Structure of the talk

- NFDI contexts

  - NFDI - National Research Data Infrastructure

  - Base4NFDI - data infrastructure and workflows shared across NFDI consortia

  - KGI4NFDI as Basic Service in Base4NFDI
- Knowledge graphs in NFDI
- Interoperability with and between NFDI knowledge graphs
- Discussion

Introduction
NFDI - an unofficial disambiguation

NFDI (Nationale Forschungsdateninfrastruktur; National Research Data Infrastructure)
can have different meanings in different contexts

Sense 1: 🔭 A vision for a research landscape of which data are a fully integrated component
Sense 2: 💰 A research funding initiative aimed at a practical implementation of NFDI/Sense 1
Sense 3: 🧩 A set of projects funded by the NFDI/Sense 2
Sense 4: 💻 Actual infrastructure operated by NFDI/Sense 3
Sense 5: 🏛 A legal entity (e.V.) supporting any of the above
Sense 6: 👥 A community of people, institutions and others involved with any of the above

Introduction
NFDI - Vision and mission

Vision

> "NFDI: Data as a common good for excellent research,
> organised by the scientific community in Germany. "

Mission

> "**Step by step, we are improving the possibilities for using data for science and society.**
> Through our cooperation in the NFDI Association, an umbrella organisation for research data management in all branches of science is being created. In cooperation with national and international partners, we are creating the framework conditions for legally compliant, interoperable and sustainable data infrastructures that are easily accessible for researchers in their everyday work. We educate people, strengthen their competence in dealing with data and open up new career paths. "

https://www.nfdi.de/association/?lang=en

Network of consortia: **Base4NFDI**

💰2018-2028-?
  🧩2020-2025
  🧩2021-2026
  🧩2022-2027

Kornetzky et al. (2024) https://doi.org/10.5281/zenodo.14191450 . CC BY 4.0.

Base4NFDI: Data infrastructure and workflows shared across NFDI consortia

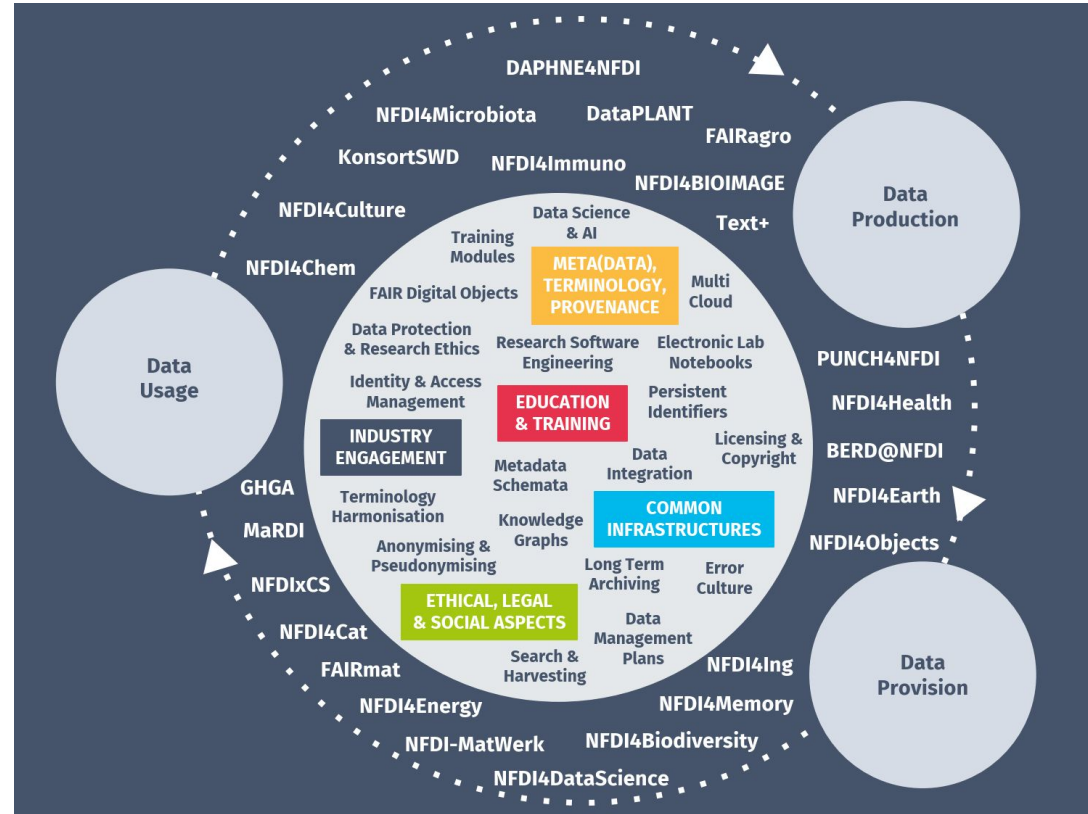- Base4NFDI funds Basic Services that are deemed useful across multiple NFDI consortia
- https://base4nfdi.de/

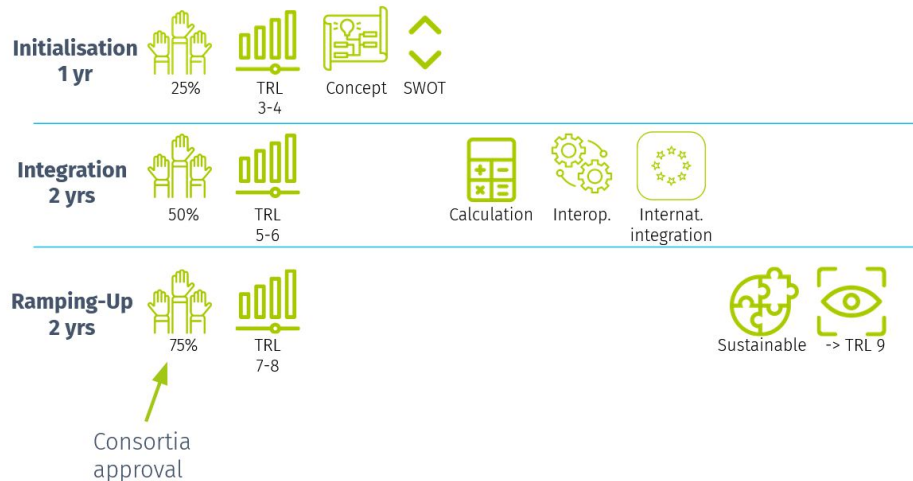Image from https://base4nfdi.de/ . CC BY 4.0.

Base4NFDI: Currently funded basic service projects

Currently in Initialisation Phase

Jupyter®4 nfdi
A central JupyterHub
for the German National Research
Data Infrastructure

Jupyter4NFDI

A central JupyterHub

- Phase started in June 2024 -

DMP4 nfdi
Data Management Plans
for the German National Research
Data Infrastructure

DMP4NFDI

Data Management Plans

- Phase started in June 2024 -

KGI4 nfdi
Knowledge Graph Infrastructure
for the German National Research
Data Infrastructure

KGI4NFDI

Knowledge Graph Infrastructure

- Phase started in June 2024 -

nfdi.software
A research software marketplace
for the German National Research
Data Infrastructure

nfdi.software

Software Marketplace

- Phase started in Nov 2024 -

RDMT4 nfdi
Research Data Management Training
for the German National Research
Data Infrastructure

RDMTraining4NFDI

*Research Data Management Training*

- Phase starts in Feb 2025 -

Currently in Integration Phase

IAM4 nfdi
Identity and Access Management
for the German National Research
Data Infrastructure

IAM4NFDI

Identity and Access Management

- Phase started in Feb 2024 -

PID4 nfdi
Persistent Identifier Services
for the German National Research
Data Infrastructure

PID4NFDI

Persistent Identifiers

- Phase started in Jan 2025 -

TS4 nfdi
Terminology Services
for the German National Research
Data Infrastructure

TS4NFDI

Terminology Services

- Phase started in Jan 2025 -

Initialisation 1 yr — 25% — TRL 3-4 — Concept — SWOT

Integration 2 yrs — 50% — TRL 5-6 — Calculation — Interop. — Internat. integration

Ramping-Up 2 yrs — 75% — TRL 7-8 — Sustainable — -> TRL 9

Consortia approval

Base4NFDI (2025) https://doi.org/10.5281/zenodo.15005396 . CC BY 4.0.

KGI4NFDI as Basic Service in Base4NFDI

- KGI4NFDI - **K**nowledge **G**raph **I**nfrastructure

  - is currently in its Initialization Phase

  - provides cross-disciplinary infrastructure and services around knowledge graphs (KG)

    - runs NFDI knowledge graph registry

    - supports technological diversity

    - provides examples and guidelines

    - aligns with other Basic Services, e.g. TS4NFDI, which handles terminology services

  - more info at: https://kgi.services.base4nfdi.de/ and https://base4nfdi.de/projects/kgi4nfdi
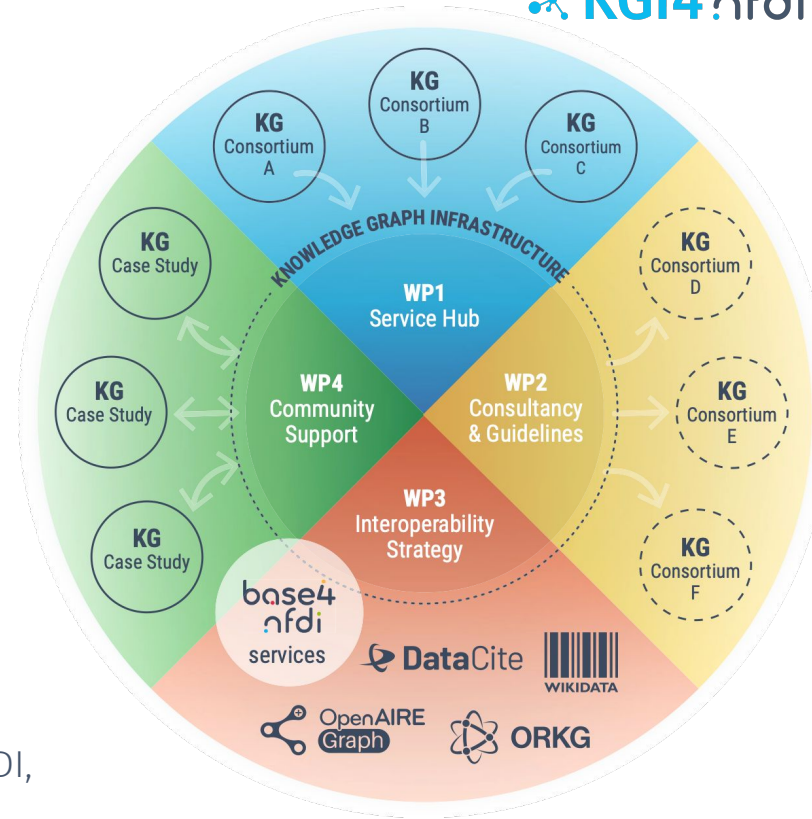
Introduction
KGs in NFDI consortia

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

Use Cases
The KGI Service Hub

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.
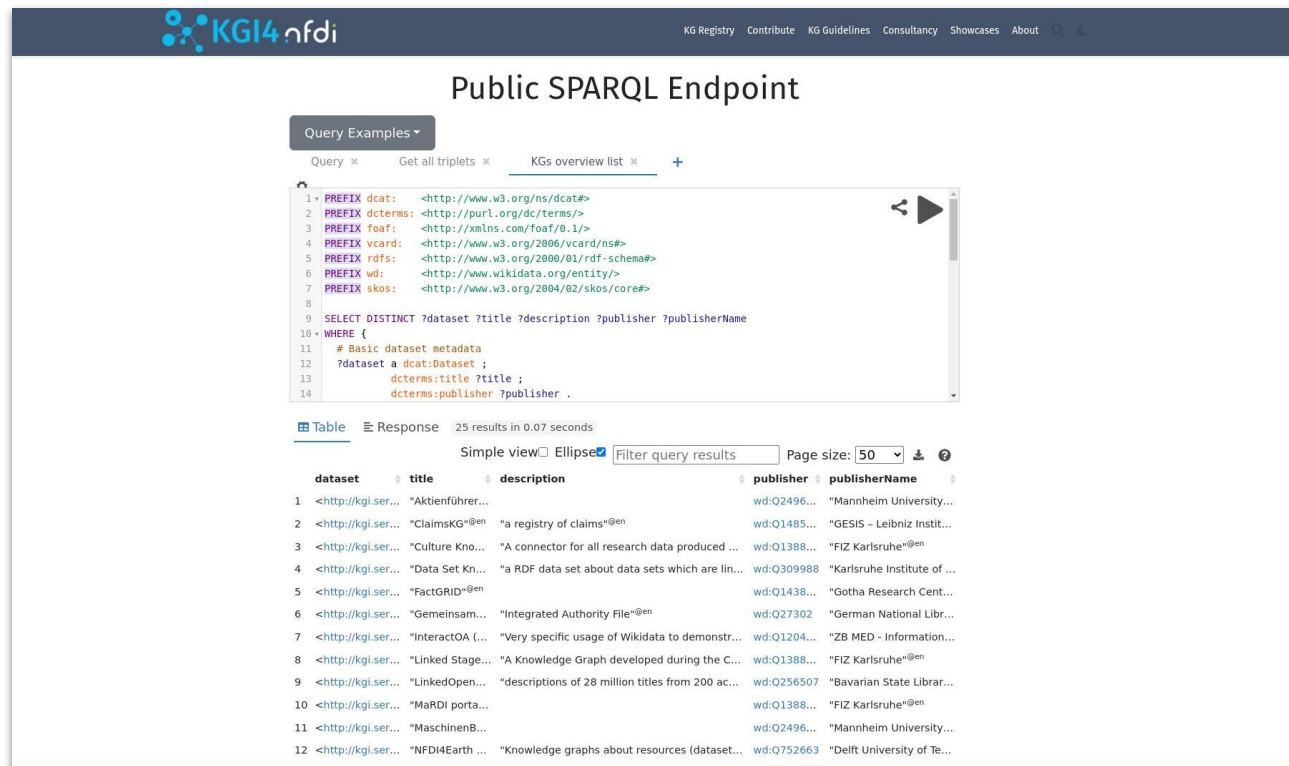
I am frustrated when

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

Aleena
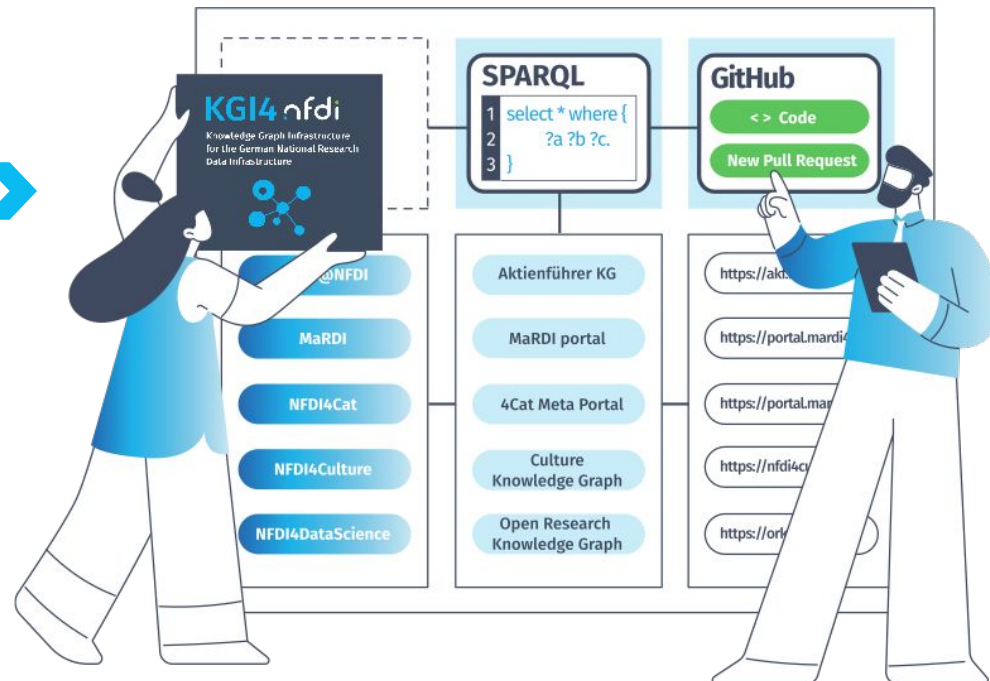
⭐ **Registry of KGs in NFDI**

⭐ **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 (NFDI) KGs?

- Search/ find / describe existing KGs
  - within NFDI
  - within your fields ([biodiversity example](#))
  - 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
- Tell us about any of the above and how it interacts with your workflows
- …

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 normalization rules should be applied, and where and how should they be stored?
- What if different KGs have conflicting information on "the same" entity?
- How do we identify "the same" concept or relationship across KGs?
- How to leverage initiatives like the Scientific Knowledge Graphs Interoperability Framework (SKG-IF)?
- How to standardize workflows for dumps, subsetting or propagation of curation events?
- How to federate queries at scale?

- It's a photograph of (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 …
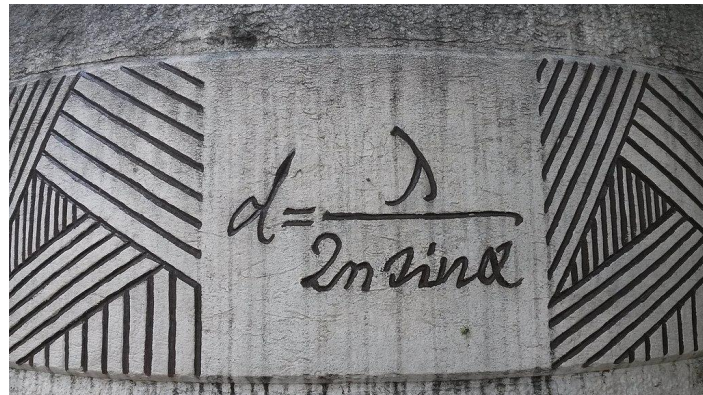
Integration Phase
Provisional Plans

- **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
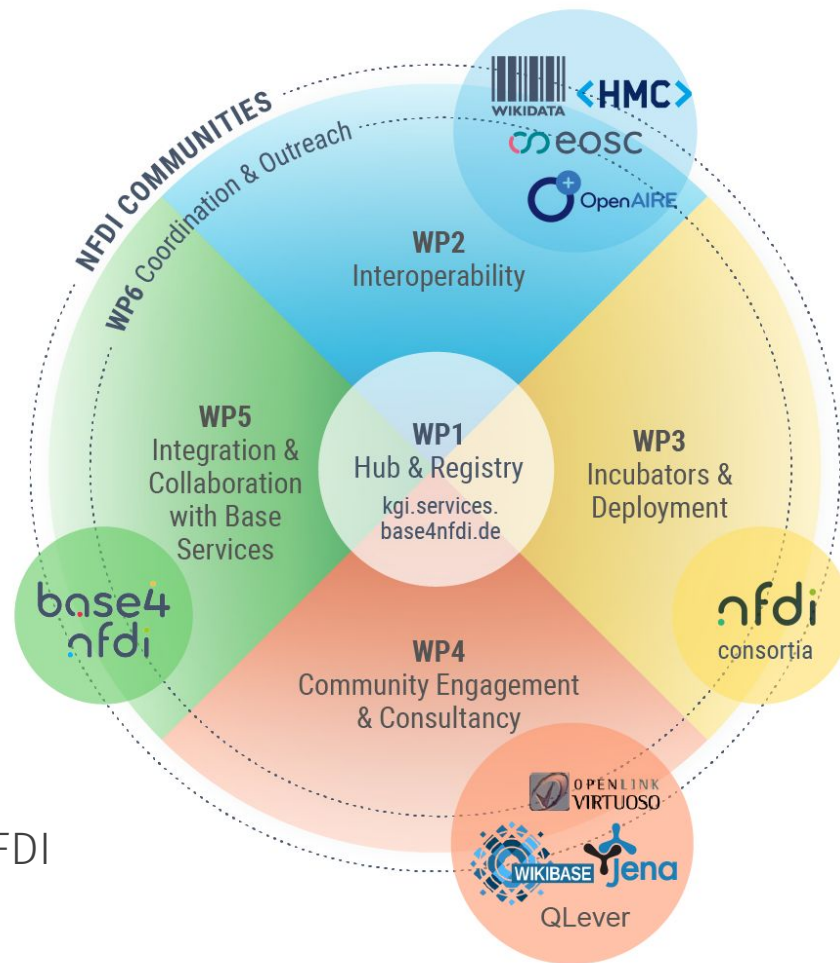
Get involved

⭐ 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

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

Thank you!
Questions?

KGI4 ∩fdi

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🌐 **base4nfdi.de/projects/kgi4nfdi**

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