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Achieving reproducible data workflows: Lightweight tools for safe and efficient data management

C Garbers¹, M Sonntag¹, A. Koutsou¹, C J Kellner¹, J Grewe², T Wachtler¹

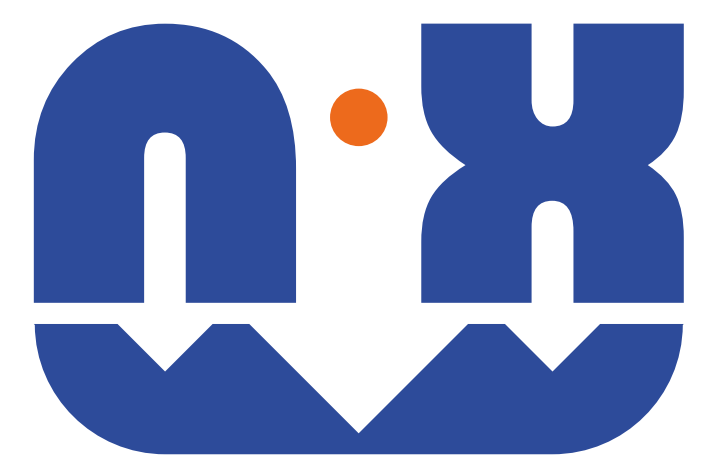
¹Ludwig-Maximilians-Univität München, Germany; ²Eberhard Karls Universität Tübingen, Germany



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Maintaining reproducible data workflows while keeping data in sync, backed up, and easily accessible from within and outside the lab is a key challenge in research. To minimize time and effort scientists have to spend on these tasks, we provide a suite of tools designed for comprehensive and versioned management of scientific data including convenient storage of data, analysis and metadata annotation for easy reproducibility, data sharing and re-usability.



**Manage data and metadata together
in an open, versatile format**

Main features

- Open data format
- Store data, analysis results, and metadata conveniently in the same file
- Descriptive associations between data, analysis results, and metadata

- Free open source libraries for multiple programming languages: C++ [1], Python [2], Matlab [3], Java [4]
- NIX IO for Neo [5]
- Enables interoperability with Neo compatible tools, e.g., the Elephant toolkit [6]



**Collect and manage all information
about your experiment**

Main features

- Open metadata format [8]
- Flexible hierarchical key-value storage
- Save to common structured formats: XML, JSON, YAML

- Terminology repository [9] for reusable definitions
- Template system for reusable metadata structures

- GUI editor [10]
- Available for macOS and Linux
- Cross-document drag-and-drop for metadata subtrees

- Export to RDF
- Query metadata using semantic web technologies



**Secure data storage, easy
collaboration and publication**

Main features

- Access data from any location
- Free storage for scientific data [11]
- Built in versioning (built on git [12])

- Platform independent
- Secure access
- Public and private repositories
- Citable data by DOIs

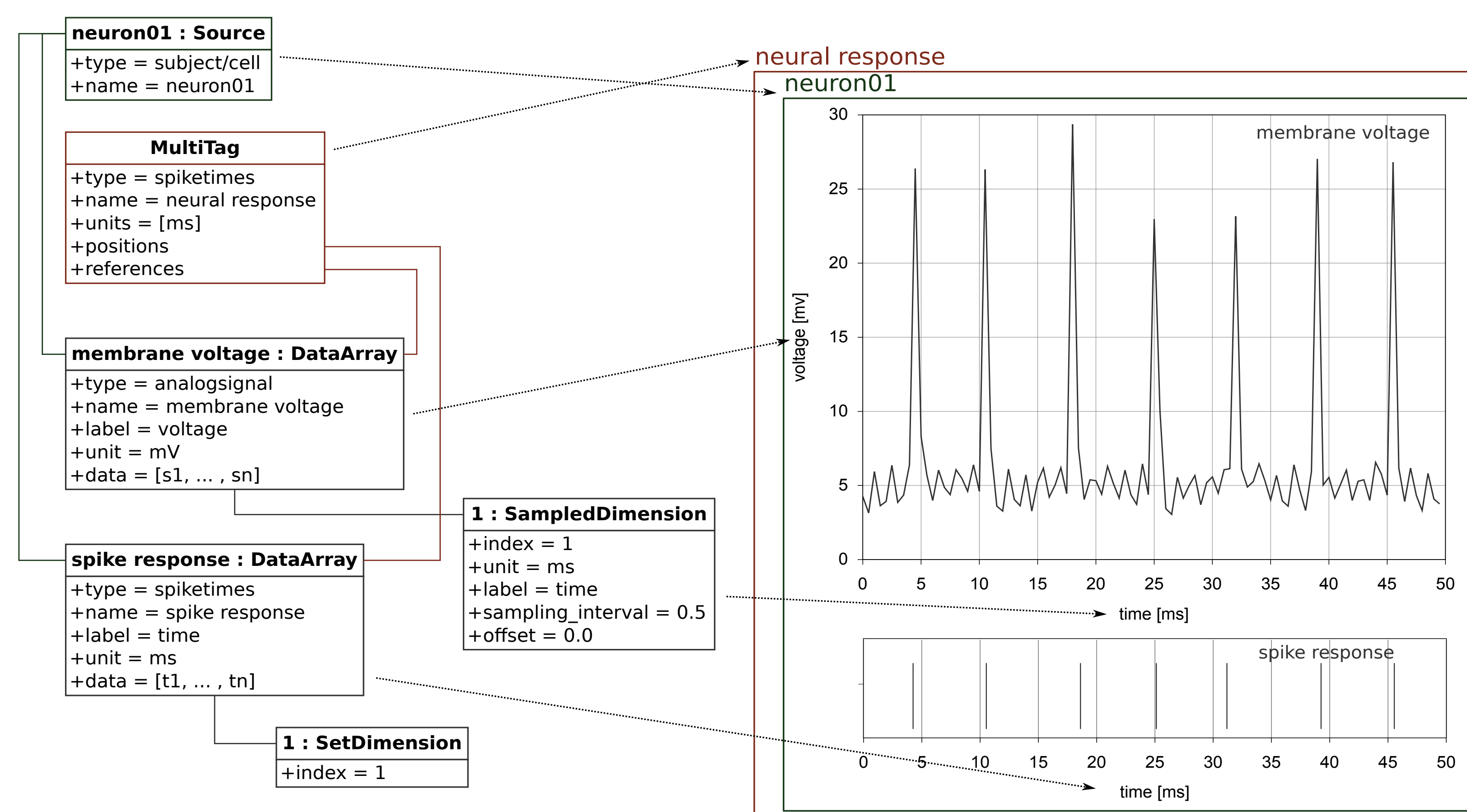
Workflow

- Browse, download, and upload data via web
- Download and upload large files via command line [13]
- Automate workflows using command line client

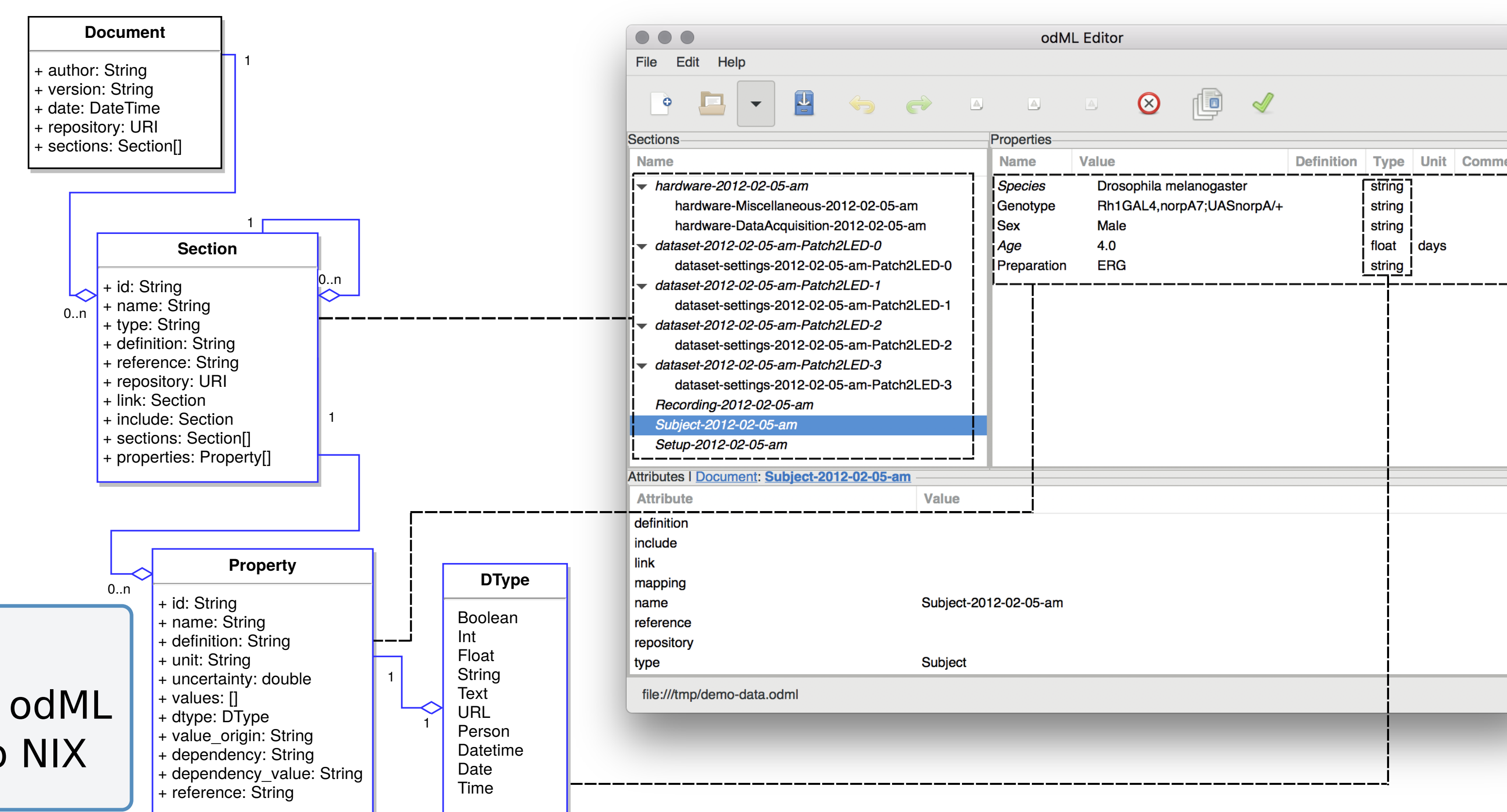
Collaboration

- User management
- User Access Levels
- On and offsite collaboration

The NIX data model



The odML Metadata format



Interoperable:

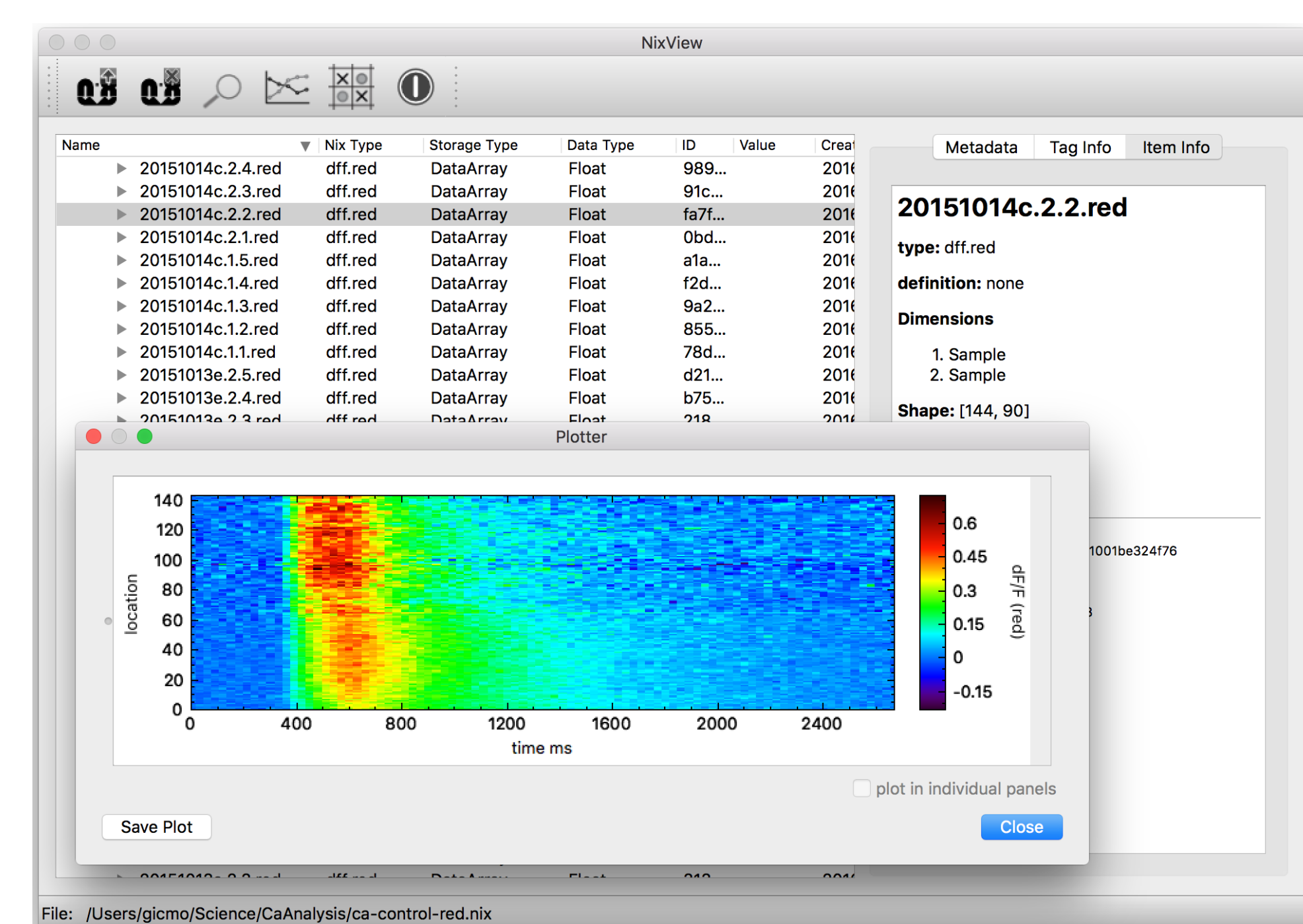
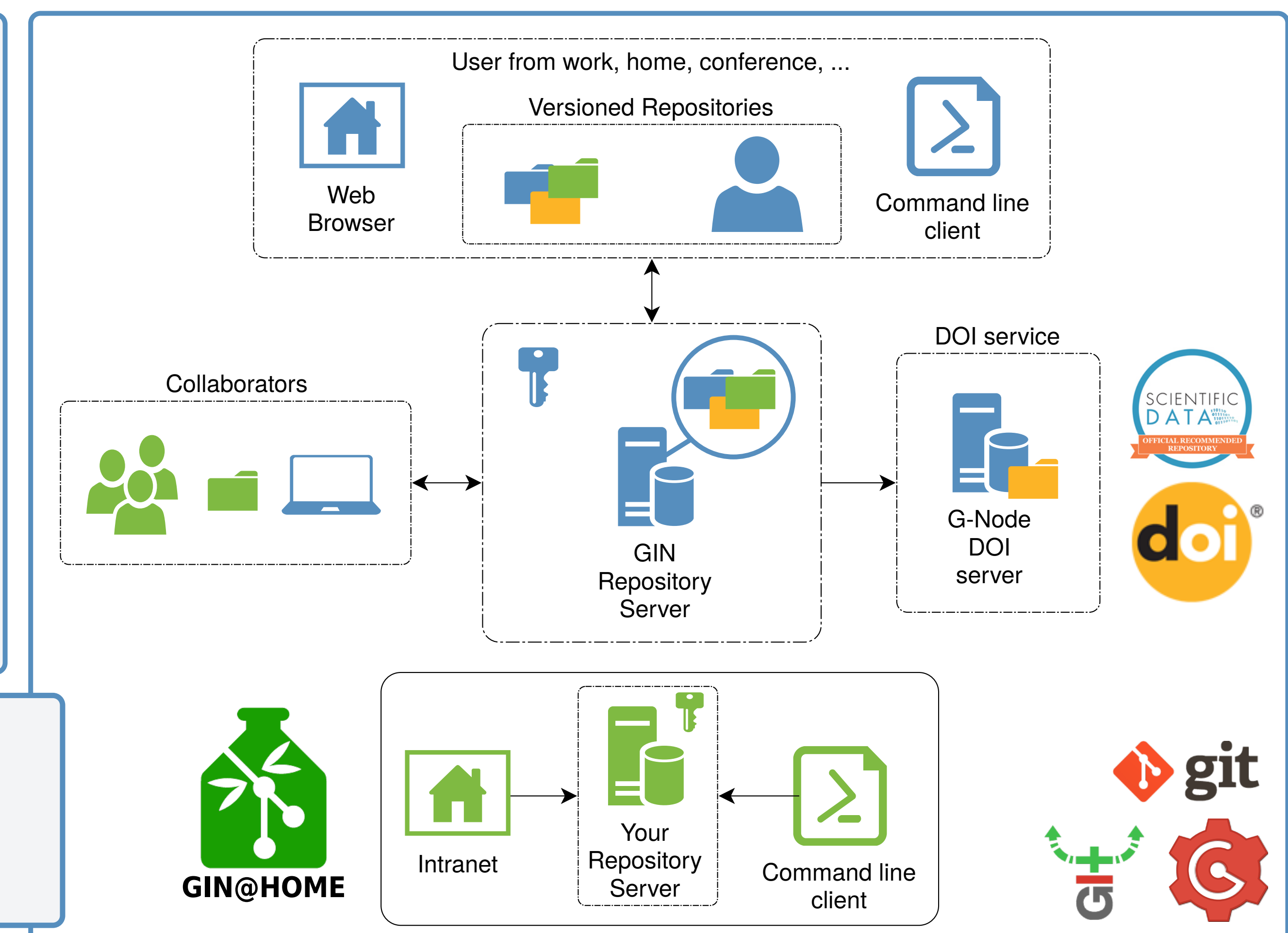
- NIX metadata to odML
- import odML into NIX

Upcoming features

- Format validation
- BIDS, odML, NIX
- custom formats
- CI for scientific data, run automated tests for scripts and data integrity.
- automated export of odML to RDF

odML files in gin:

- indexed and searchable
- treeview rendering for convenient exploration



- **NixView** [7] Cross-platform GUI viewer
- Available for Windows, macOS, and Linux
- Convenient exploration of both data and metadata of NIX files
- Raw data can be browsed via tabular display and easily exported to CSV
- Facilitates plotting support for a large variety of raw data as well as the export of plots

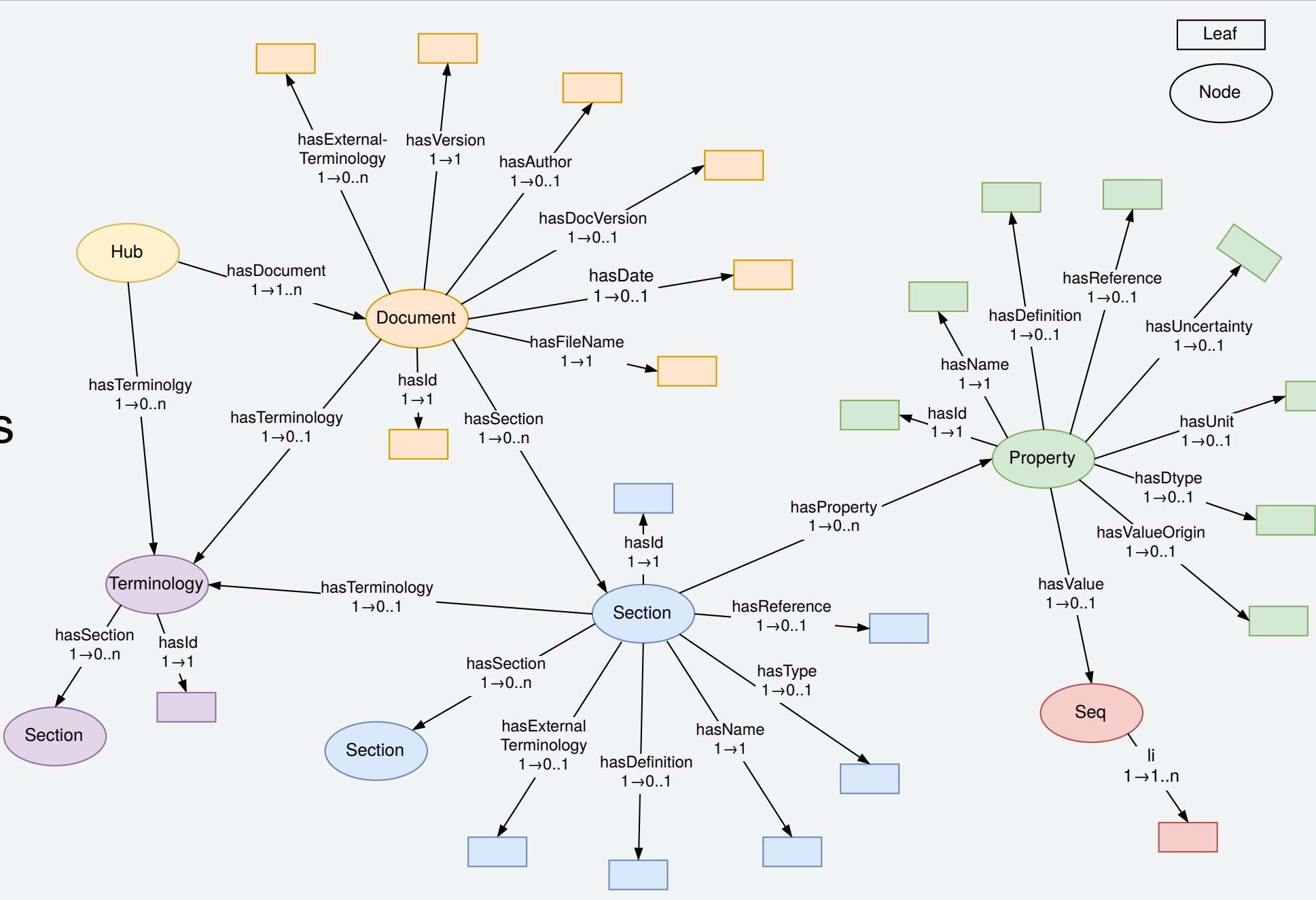
<https://meta.g-node.org>

RDF schema for the odML data model

Extend the basic odML OWL ontology by subclassing the basic odML flavored RDF to

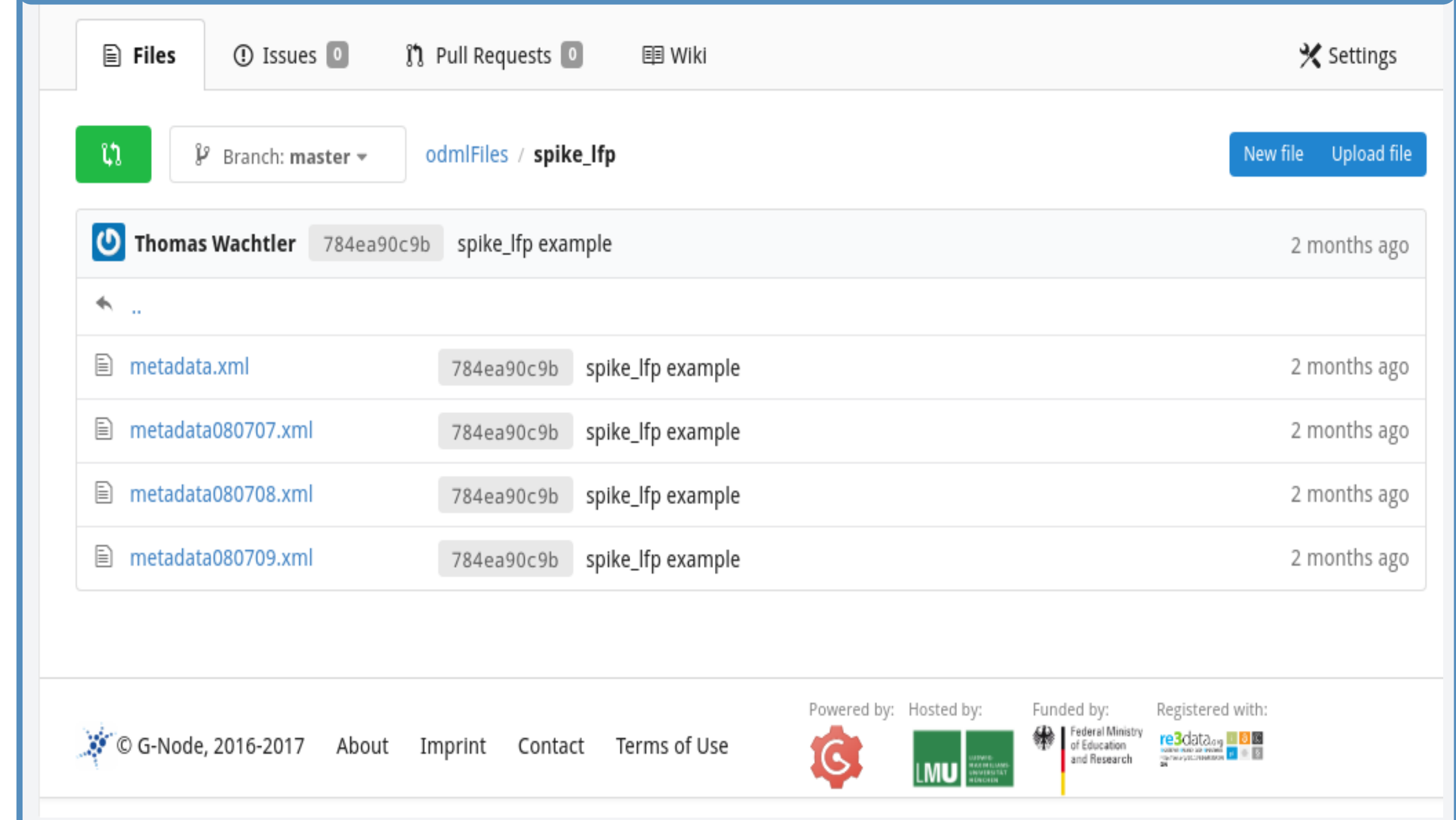
- retain your own metadata structure and terms even in RDF.
- enable more specific SPARQL queries for your needs while enabling general searches through odML terms.

The meta.g-node.org server provides access to diverse metadata datasets based on the odML flavored RDF format. All datasets are publicly available and searchable by SPARQL via API and web



<https://gin.g-node.org>

GIN Web



Resources

Contact: dev@g-node.org

- [1] <https://github.com/G-Node/nix>
- [2] <https://github.com/G-Node/nixpy>
- [3] <https://github.com/G-Node/nix-mx>
- [4] <https://github.com/G-Node/nix-java>
- [5] <http://neuralensemble.org/neo>
- [6] <http://neuralensemble.org/elephant>
- [7] <http://bendalab.github.io/NixView>
- [8] Grewe et al (2011), Frontiers in Neuroinformatics 5:16
- [9] <http://www.g-node.org/projects/odml/terminologies>
- [10] <https://github.com/G-Node/odml-ui>
- [11] <https://gin.g-node.org>
- [12] <https://git-scm.com>
- [13] <https://web.gin.g-node.org/G-Node/Info/wiki/gin-cli>