Practical Knowledge Graph Example

Protege,
Stardog and
Peeps

Today's exercise

1. Look at a simple ontology for information about people and their relations in Protégé
2. Look at some instance data in Protégé
3. Run the DL and rule reasoner in Protégé
4. Load the ontology and data into Stardog
5. Browse and query the resulting knowledge graph in Stardog

Preliminaries

- On your own computer (Windows, Mac, Linux)
  - Download and install Protégé
  - Download, install and configure the community edition of Stardog 5
  - Clone the 691 peeps repository

Peeps files

- The peeps repo has five files
  - **README.md**
  - **catalog-v001.xml** – protégé config file
  - **load_peeps.sh** – bash script to load peeps into stardog
  - **mypeeps.ttl** – data encoded using peeps ontology
  - **peeps.ttl** – the peeps ontology
  - **prefixes.ttl** – list of prefixes, used by stardog's query component

Separate ontology and data?

- An ontology is a knowledge graph schema
  - peeps:Man owl:disjointWith peeps:Woman .
- We talk about populating it with instance data
  - :janeDoe a peeps:Woman; foaf:givenName “Jane” .
- Good practice for real applications is to keep the ontology and data separate
  - i.e., in different files
- Hence, peeps.ttl and mypeeps.ttl

Why separate ontology and data?

- It really depends on the usecase
- Some facts are part of an ontology if they're important, unchanging knowledge
- Maybe the ontology is a one-off, and will never be used with any other data
- Maybe you added data while developing the ontology for testing and debugging
- But many ontologies are intended for reuse or to represent datasets that change frequently

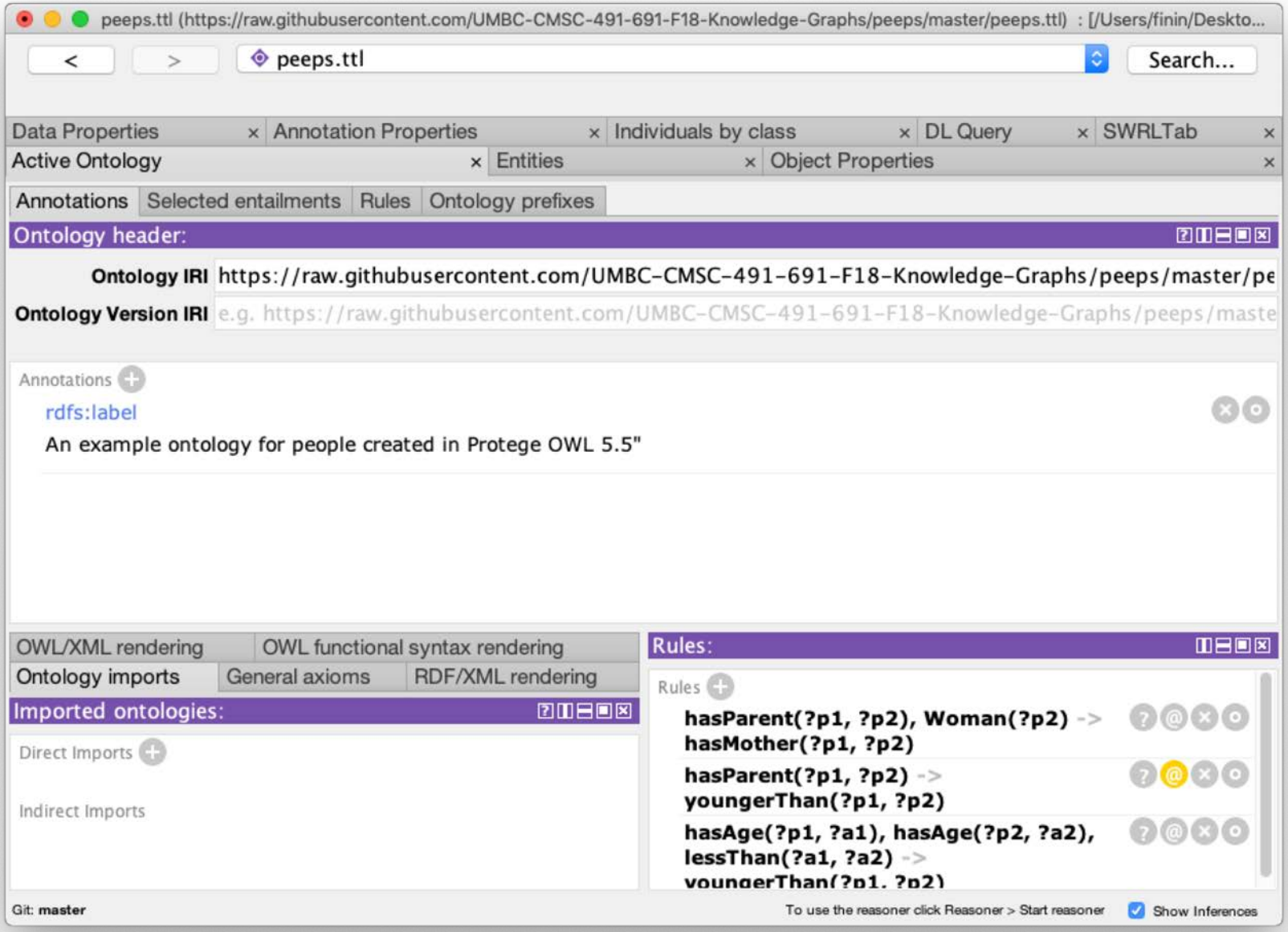
Namespaces

- Promoting reuse also entails giving the ontology and a knowledge graph that uses it with data different namespaces
- Namespace = uri = unique identifier
- Example
  - http://dbpedia.org/resource/
  - http://dbpedia.org/ontology/
- BTW, lookup prefixes at http://prefix.cc
- Ideally, the uris are ones you control and no one else will use

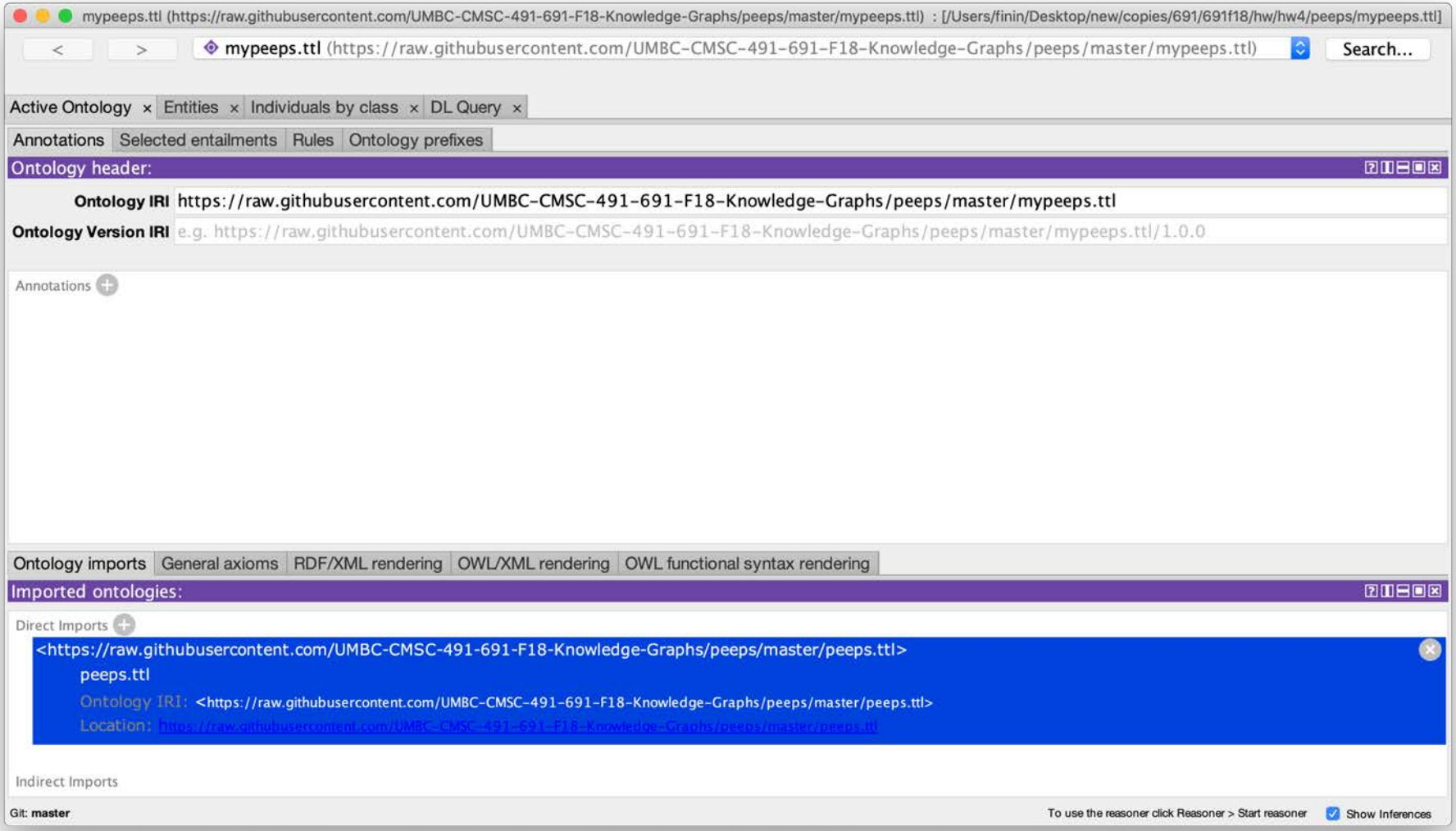
Namespace best practice

- Ideally, the namespace should resolve to a file containing the ontology or data
  - Maybe not the data if it's big or proprietary
- Enables other ontologies to **import and use** yours just from its URI
- If you don't control a long-lived URI …
  - You might use a file on github
  - You might use purl to create a "permanent url" that redirects to the current location

Peeps.ttl in Protégé



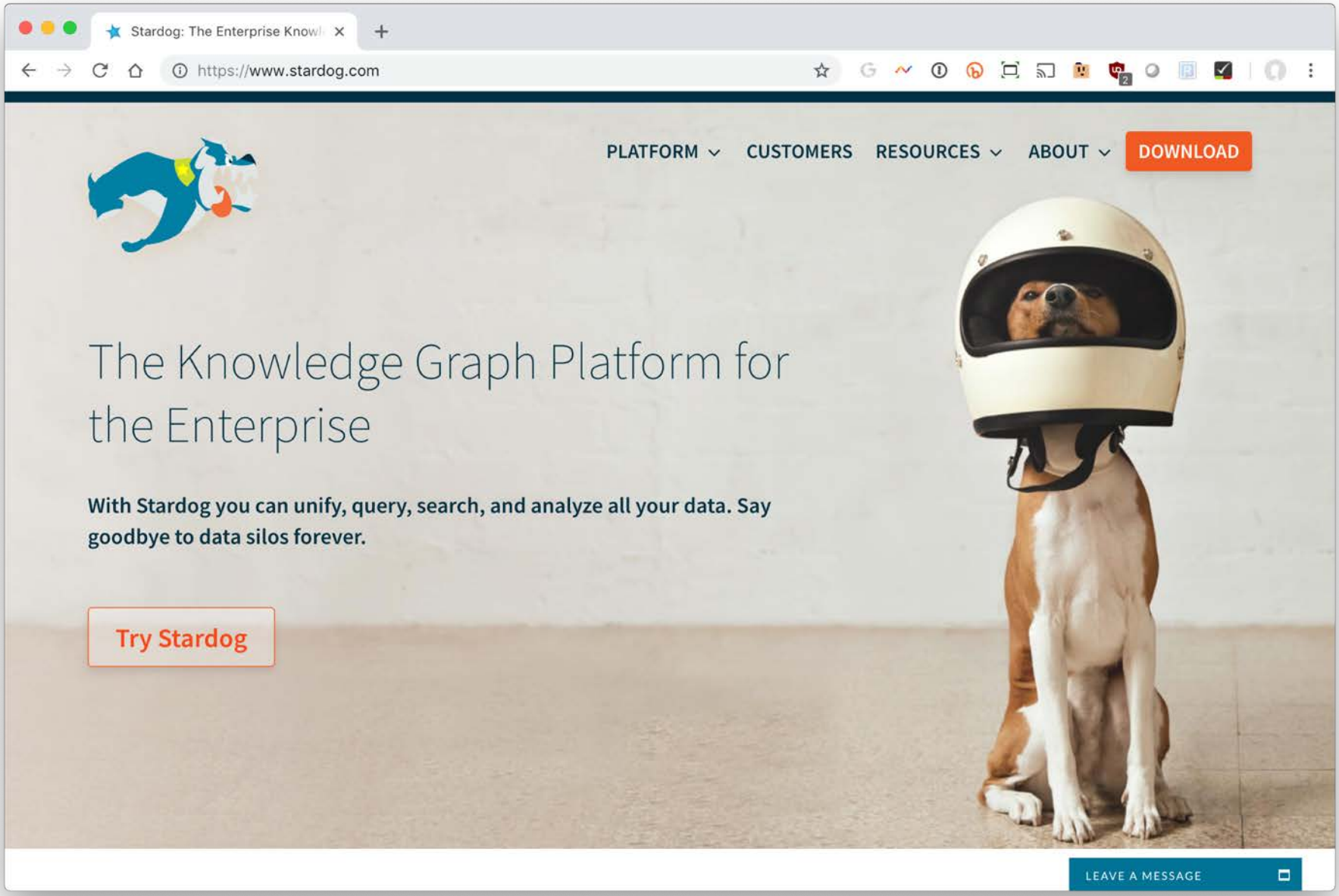
Mypeeps.ttl


mypeeps.ttl (https://raw.githubusercontent.com/UMBC-CMSC-491-691-F18-Knowledge-Graphs/peeps/master/mypeeps.ttl) : [/Users/finin/Desktop/new/copies/691/691f18/hw/hw4/peeps/mypeeps.ttl]
mypeeps.ttl (https://raw.githubusercontent.com/UMBC-CMSC-491-691-F18-Knowledge-Graphs/peeps/master/mypeeps.ttl)
Search...
Active Ontology
Entities
Individuals by class
DL Query
Annotations
Selected entailments
Rules
Ontology prefixes
Ontology header:
Ontology IRI
https://raw.githubusercontent.com/UMBC-CMSC-491-691-F18-Knowledge-Graphs/peeps/master/mypeeps.ttl
Ontology Version IRI
e.g. https://raw.githubusercontent.com/UMBC-CMSC-491-691-F18-Knowledge-Graphs/peeps/master/mypeeps.ttl/1.0.0
Annotations
Ontology imports
General axioms
RDF/XML rendering
OWL/XML rendering
OWL functional syntax rendering
Imported ontologies:
Direct Imports
<https://raw.githubusercontent.com/UMBC-CMSC-491-691-F18-Knowledge-Graphs/peeps/master/peeps.ttl>
peeps.ttl
Ontology IRI: <https://raw.githubusercontent.com/UMBC-CMSC-491-691-F18-Knowledge-Graphs/peeps/master/peeps.ttl>
Location:
Indirect Imports
Git: master
To use the reasoner click Reasoner > Start reasoner
Show Inferences

When to import an ontology

- In Protégé, we import an ontology if we want a reasoner to understand its vocabulary
- It does not add the ontology to the file that will be saved
- Plus: the knowledge may be important or essential in testing
- Minus: big ontologies may add a lot of useless data
- Here mypeeps.ttl imports peeps, but not foaf or schema

Stardog Graph Platform



Stardog Graph Platform

- Stardog is easy to install and use, but rich in features
- It has a Web interface, good command-line tools and a Java API
- We'll look at how to
  - Load the peeps example files
  - Browse the results
  - Query the graph via the Web console

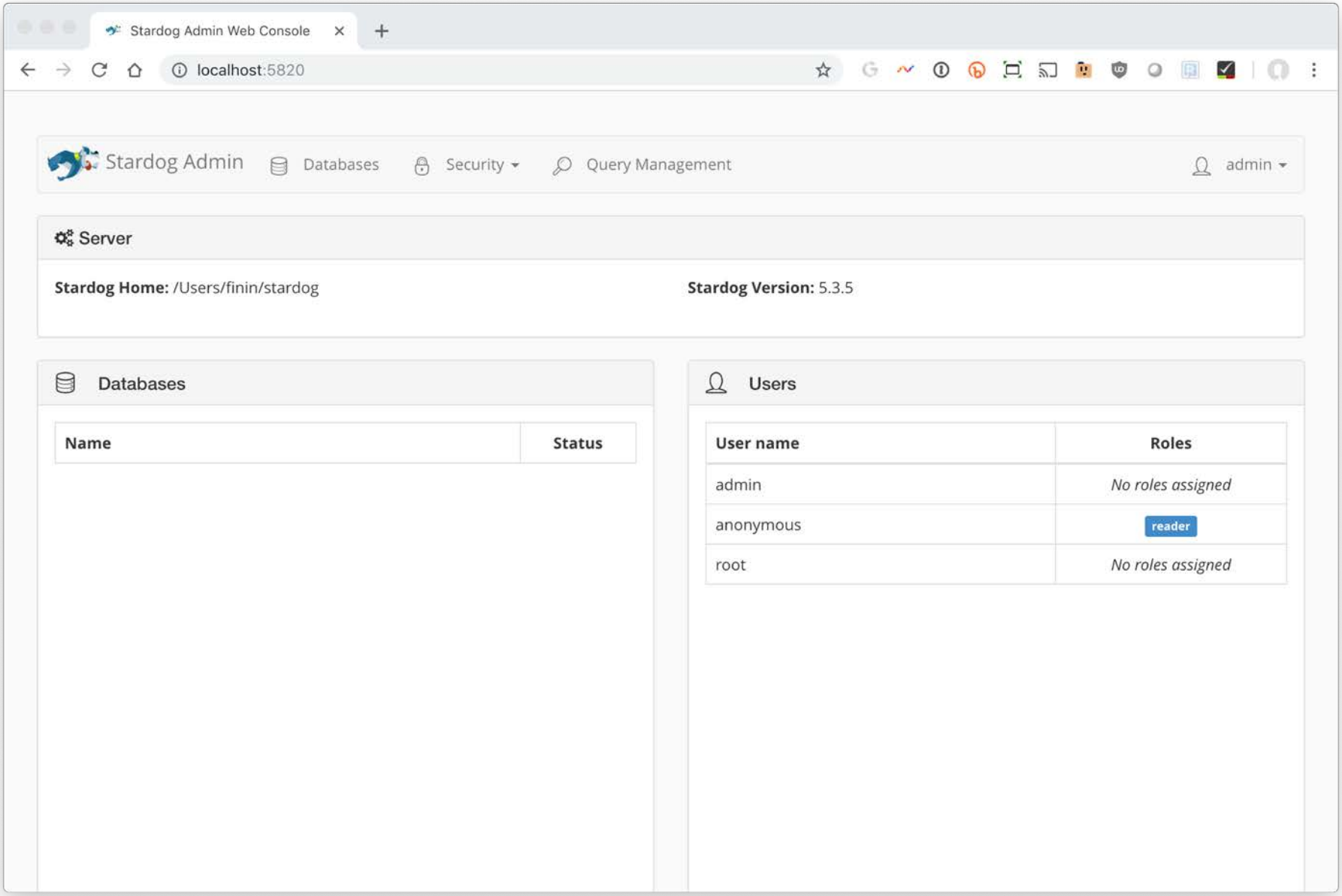
Start Stardog

- This command will start Stardog listening to its default port (5820) and disable security

  stardog-admin server start --disable-security

- Enter the URL http://localhost:5820 to access the Web console

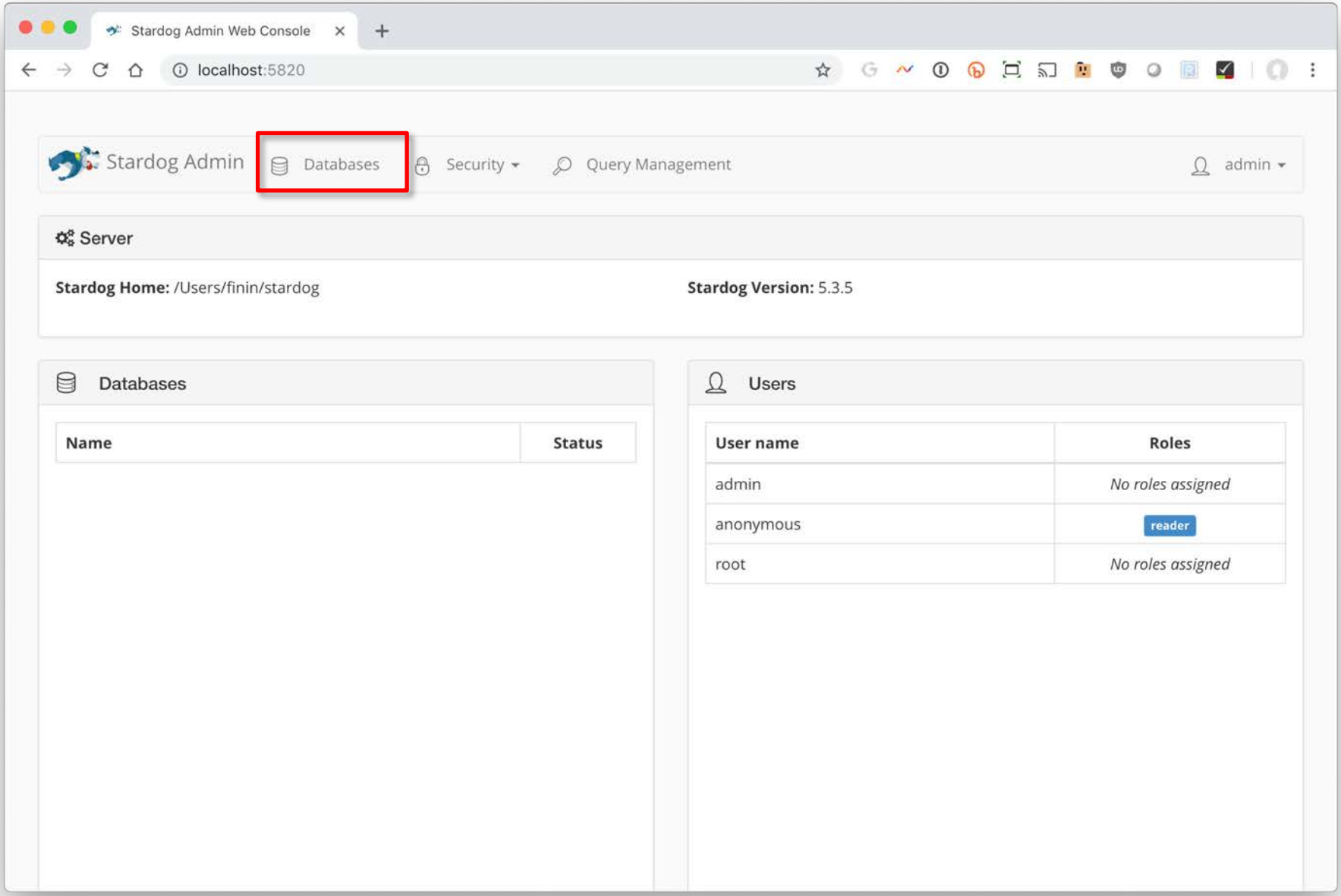
  Use admin for bothe the user and password


Stardog Admin Web Console
localhost:5820
Stardog Admin
Databases
Security
Query Management
admin
Server
Stardog Home: /Users/finin/stardog
Stardog Version: 5.3.5
Databases
Name
Status
Users
User name
Roles
admin
No roles assigned
anonymous
reader
root
No roles assigned

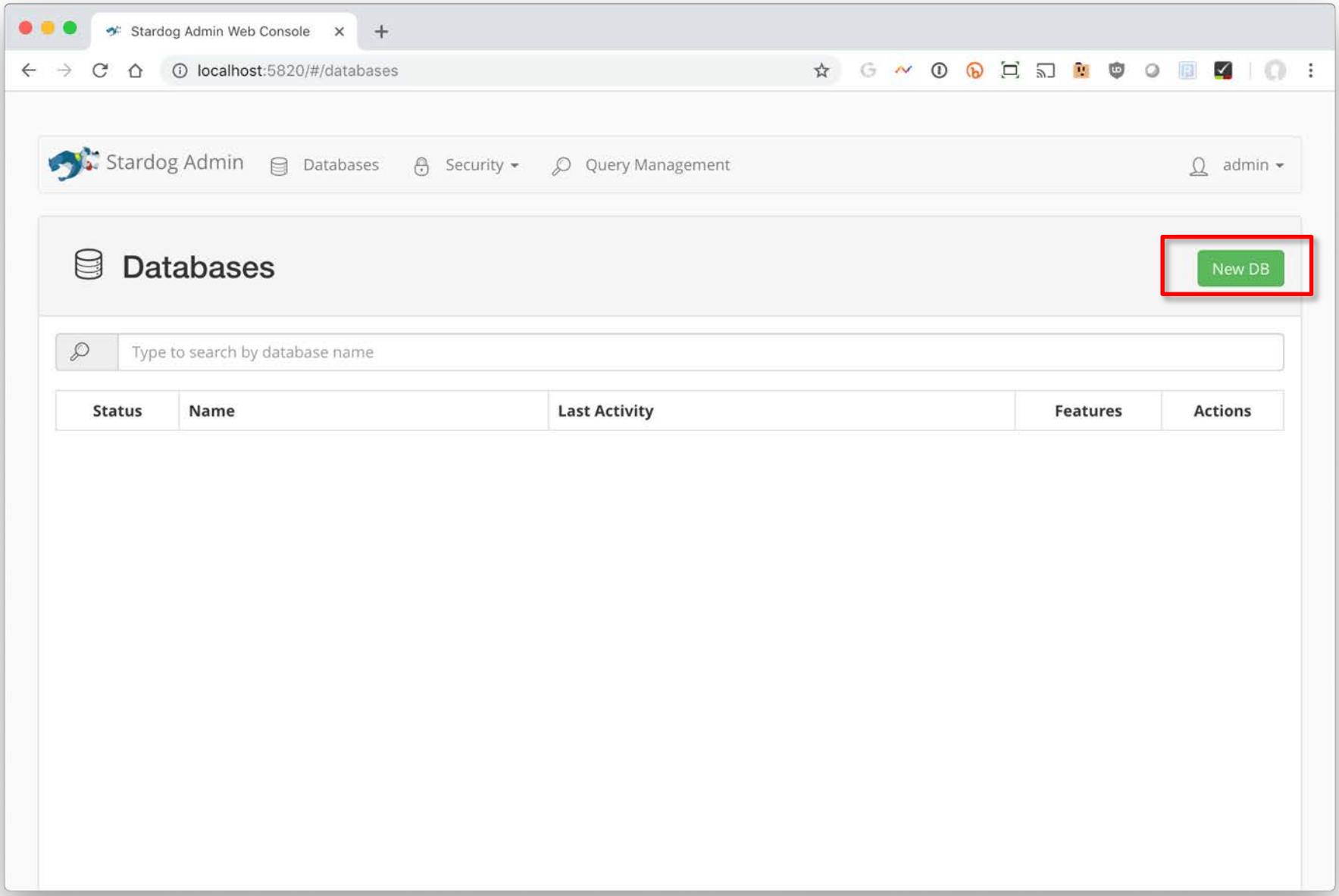
Stardog script

- load_peeps.sh is a bash script for loading the peeps data and ontology
- Use variations for other systems or shells
- Once loaded go to http://localhost:5820/ to use Stardog's web interface

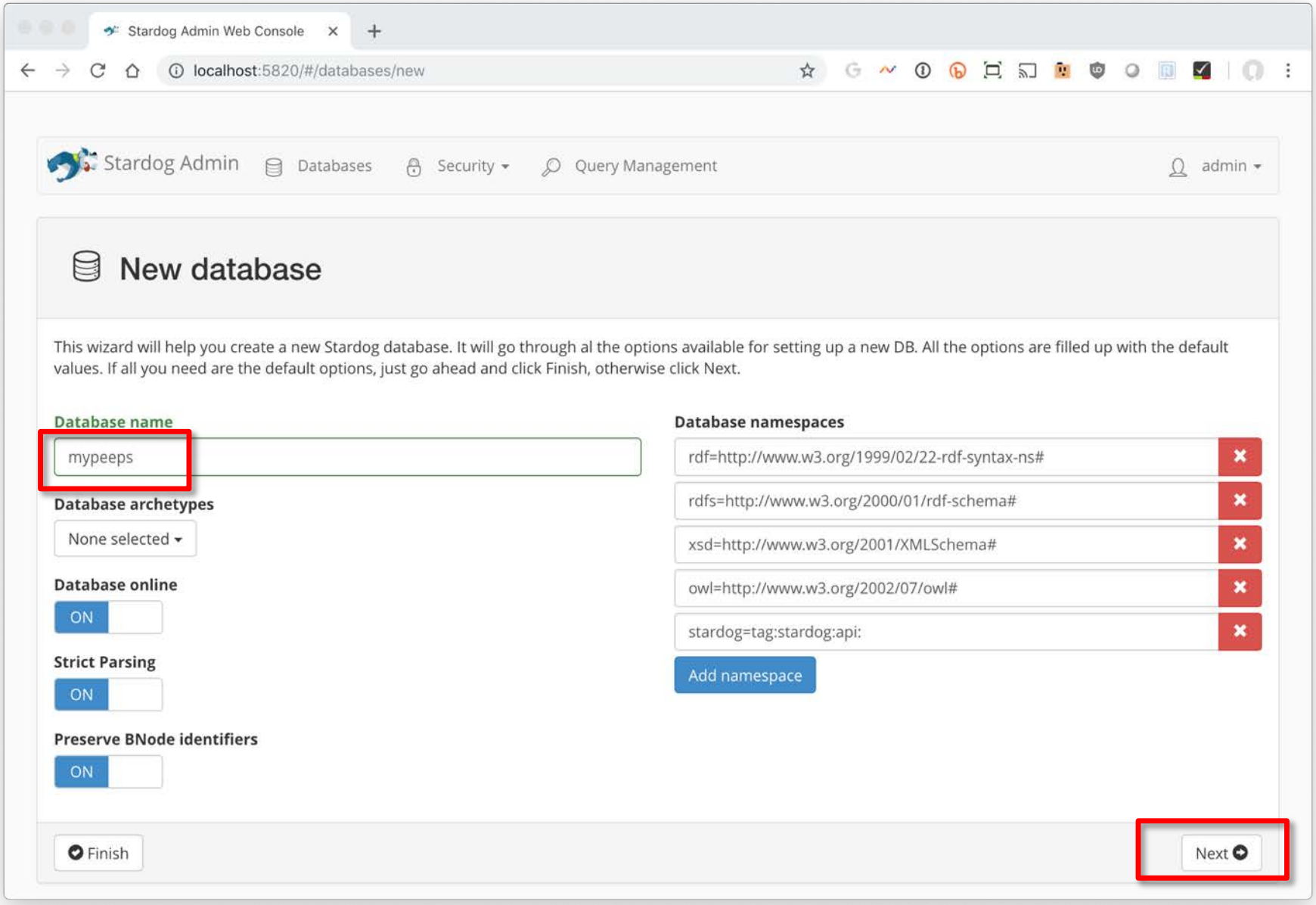
Stardog's web interface

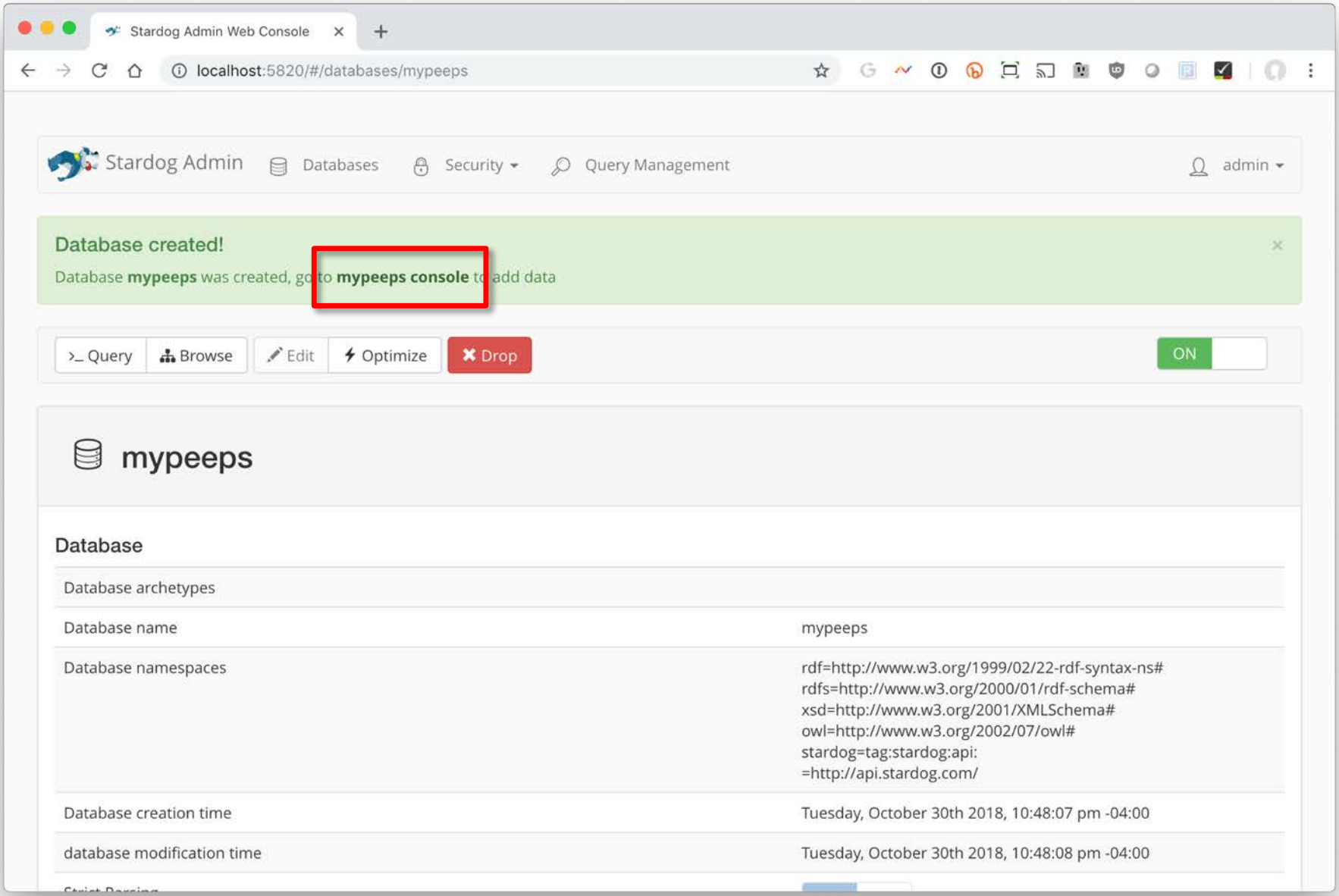


Create a database

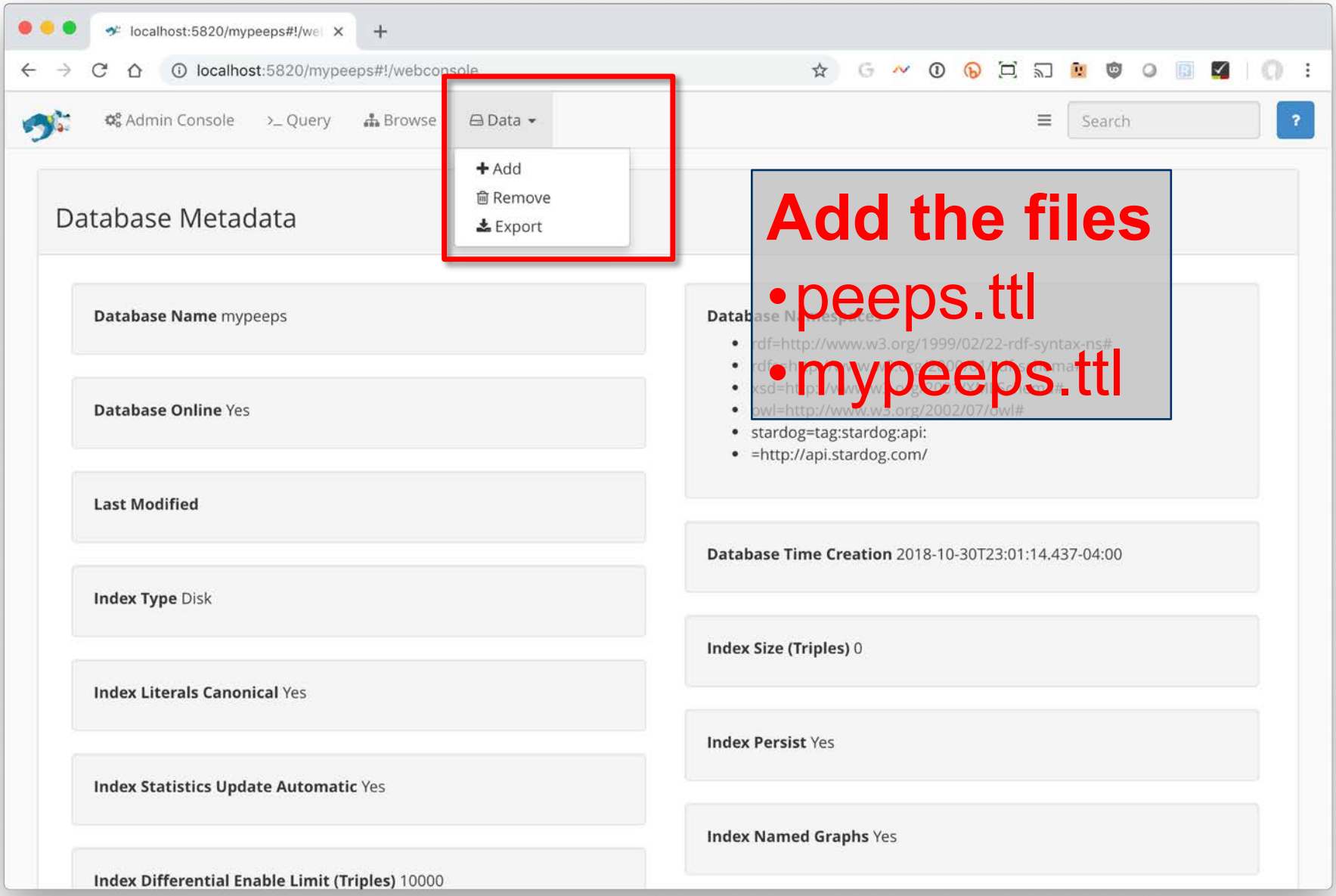


Name it mypeeps and accept the defaults

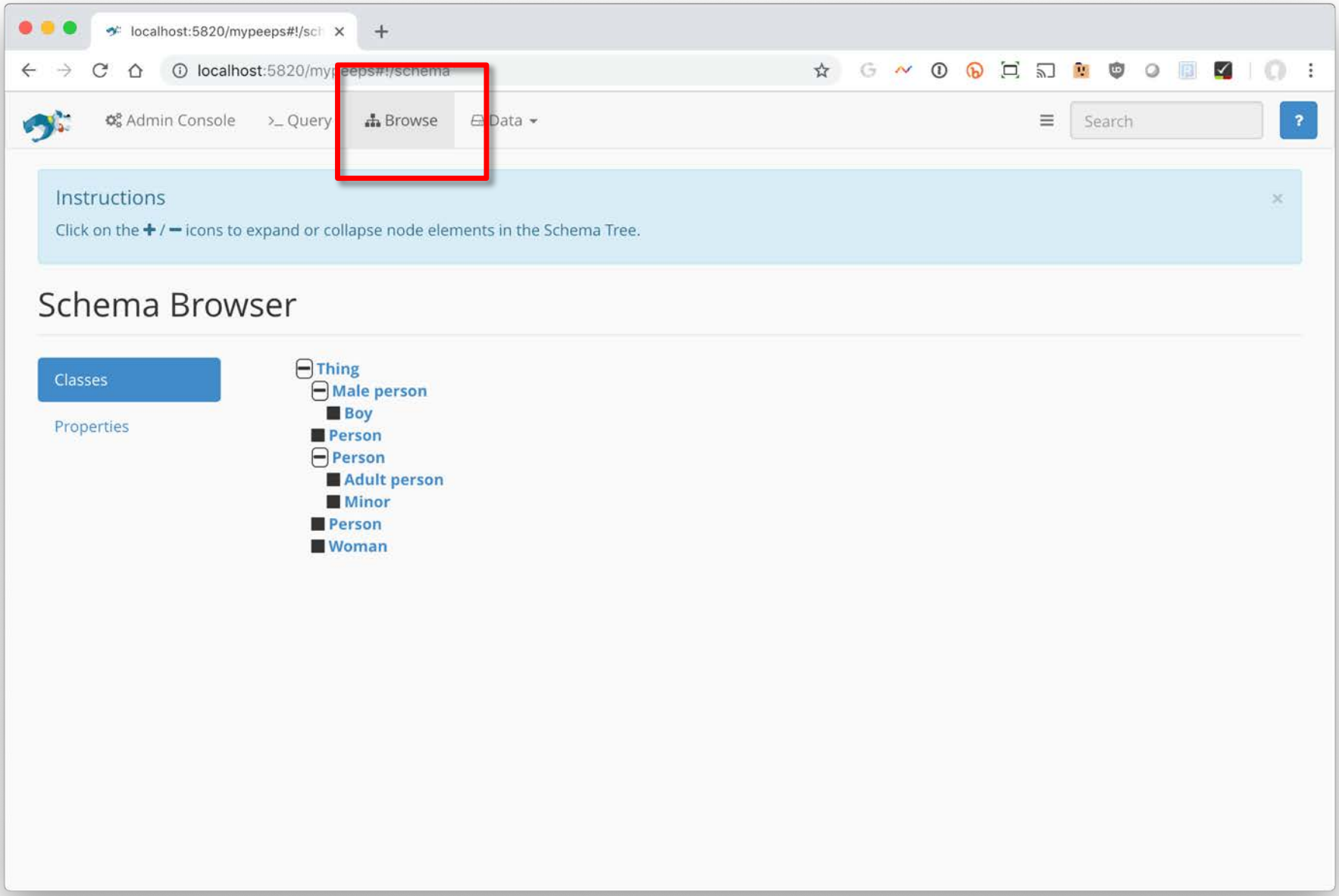



Stardog Admin Web Console
localhost:5820/#/databases/mypeeps
Stardog Admin
Databases
Security
Query Management
admin
Database created!
Database mypeeps was created, go to mypeeps console to add data
Query
Browse
Edit
Optimize
Drop
ON
mypeeps
Database
Database archetypes
Database name
mypeeps
Database namespaces
rdf=http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs=http://www.w3.org/2000/01/rdf-schema#
xsd=http://www.w3.org/2001/XMLSchema#
owl=http://www.w3.org/2002/07/owl#
stardog=tag:stardog:api:
=http://api.stardog.com/
Database creation time
Tuesday, October 30th 2018, 10:48:07 pm -04:00
database modification time
Tuesday, October 30th 2018, 10:48:08 pm -04:00

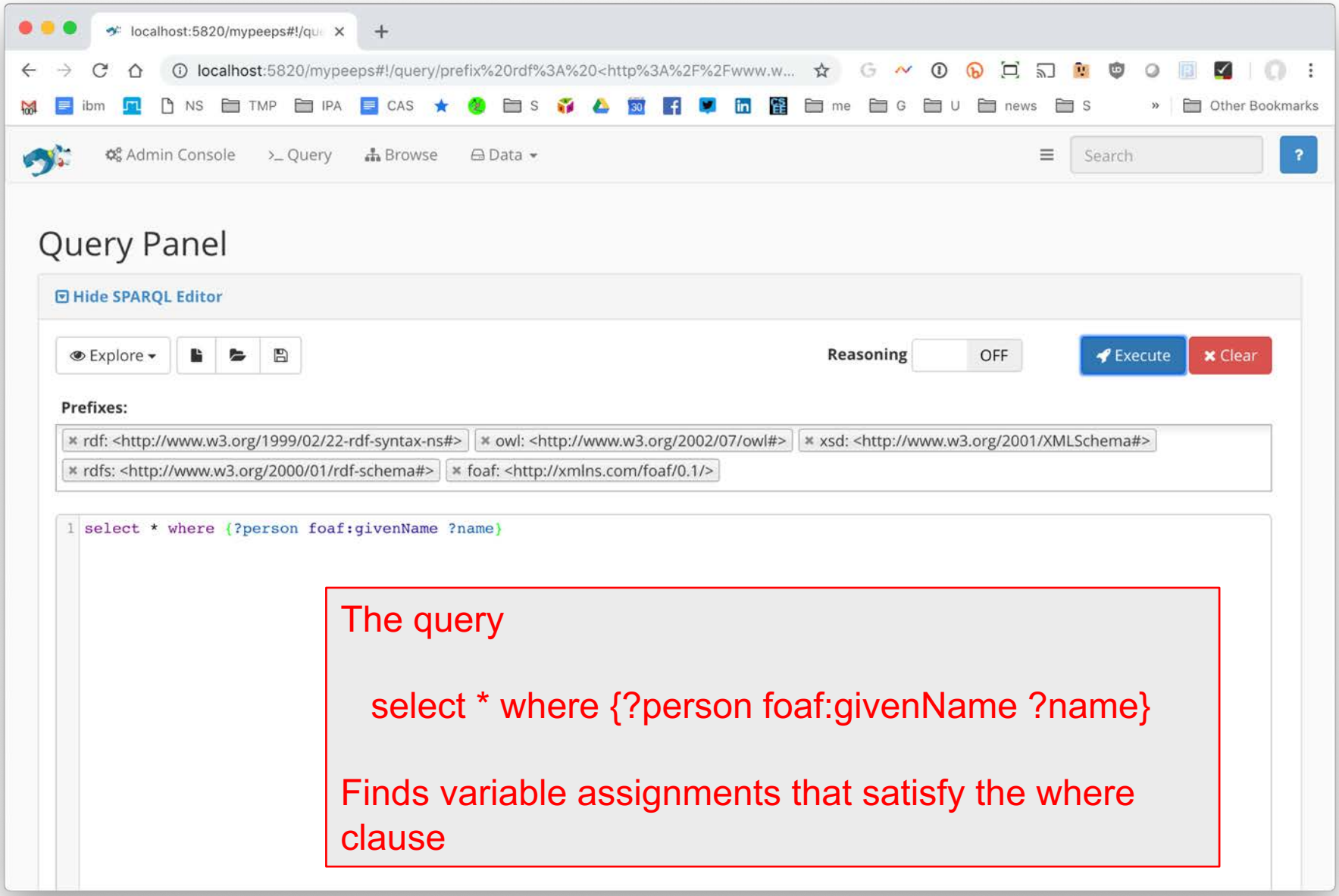
Click on *data* and select *+Add*



Go to Browse to explore the graph



Go to Query to enter a SPARQL query

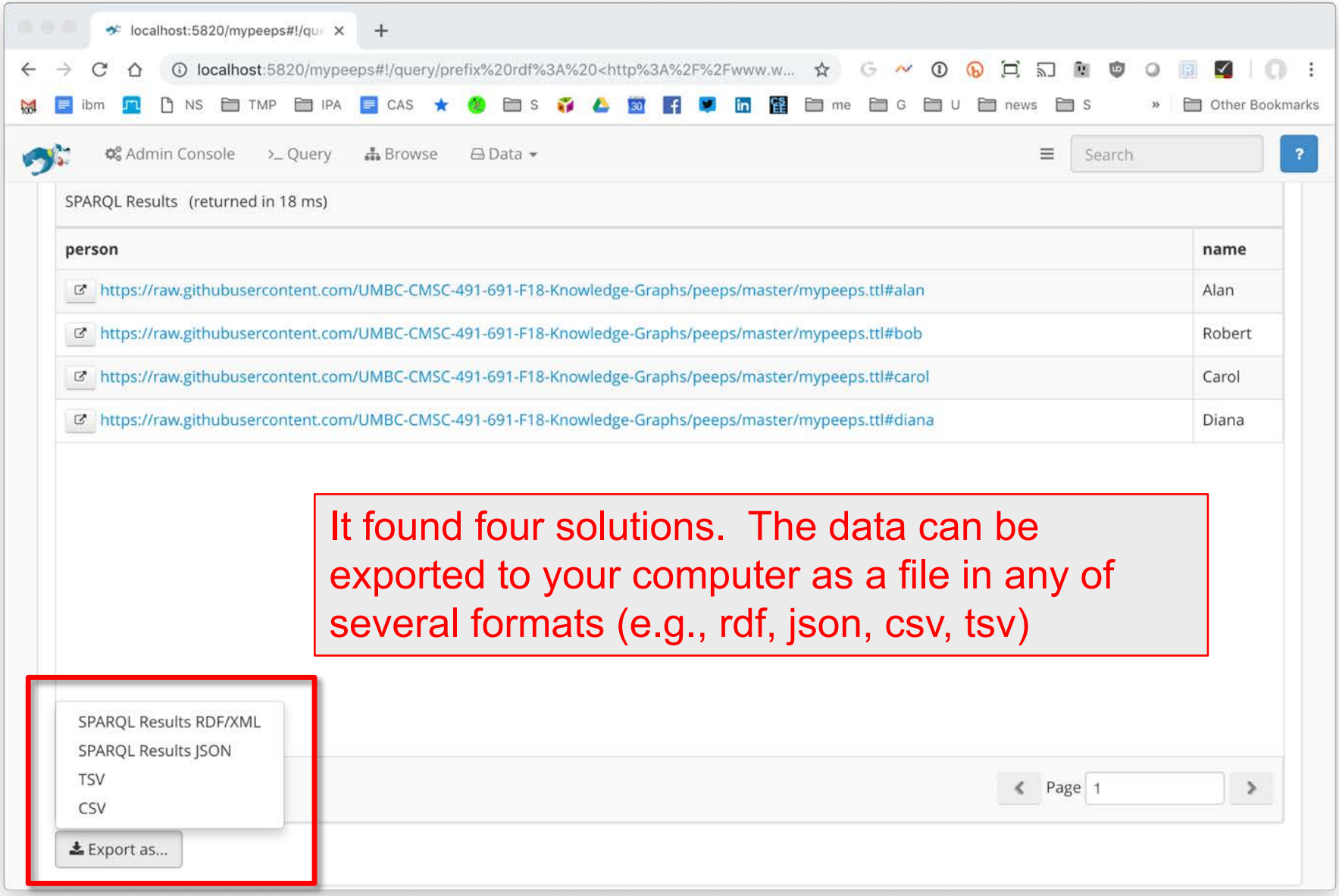


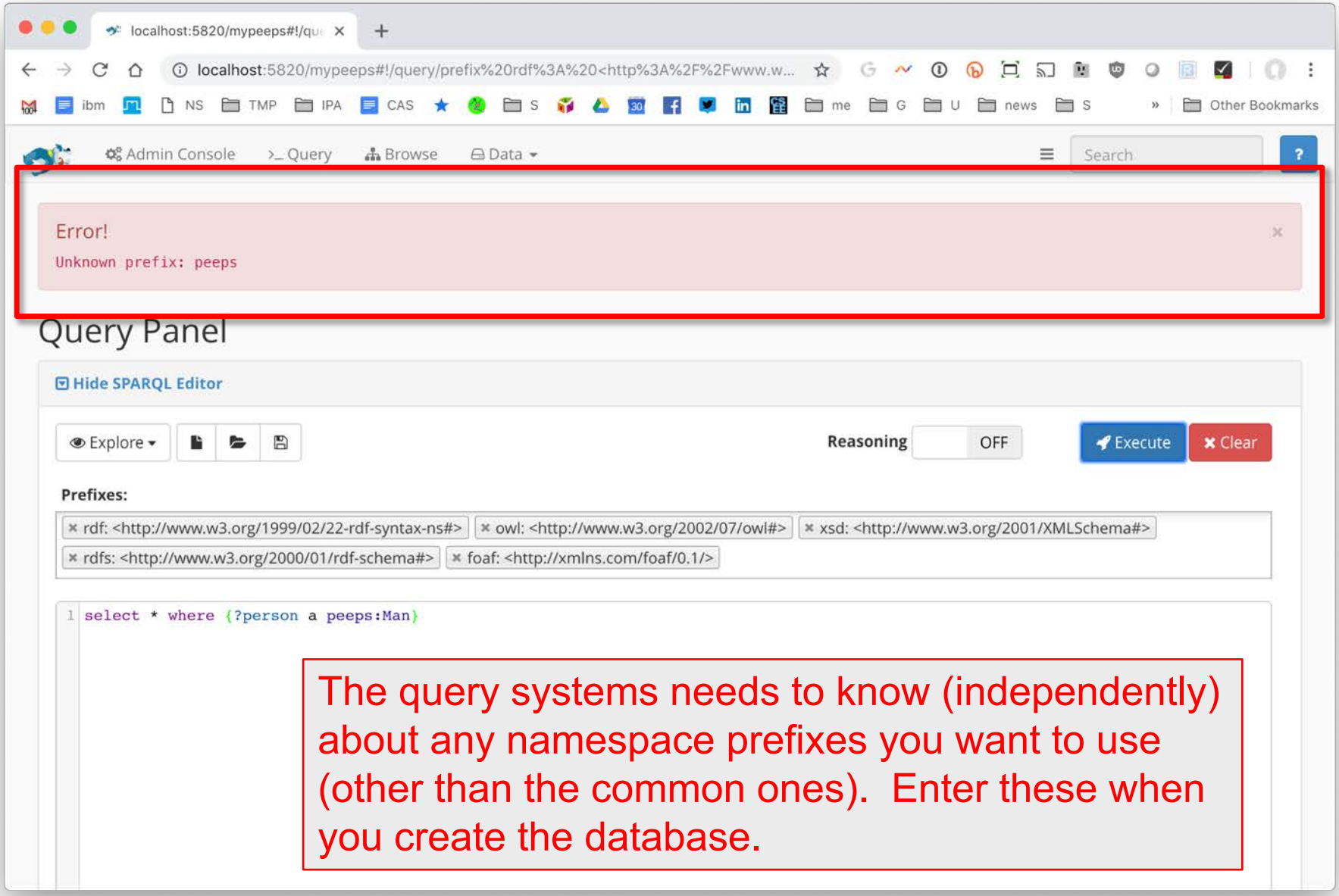
The query

select * where {?person foaf:givenName ?name}

Finds variable assignments that satisfy the where clause

Go to Query to enter a SPARQL query




localhost:5820/mypeeps#!/query/prefix%20rdf%3A%20<http%3A%2F%2Fwww.w...
Admin Console
Query
Browse
Data
Search
Error!
Unknown prefix: peeps
Query Panel
Hide SPARQL Editor
Explore
Reasoning
OFF
Execute
Clear
Prefixes:
rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
owl: <http://www.w3.org/2002/07/owl#>
xsd: <http://www.w3.org/2001/XMLSchema#>
rdfs: <http://www.w3.org/2000/01/rdf-schema#>
foaf: <http://xmlns.com/foaf/0.1/>
1 select * where {?person a peeps:Man}
The query systems needs to know (independently) about any namespace prefixes you want to use (other than the common ones). Enter these when you create the database.

Command line commands

Running a simple bash script will create or refresh the peeps knowledge graph example

```
#!/bin/bash
# loads peeps.ttl, mypeeps.ttl and associated namespaces into a Stardog database.

PORT="5820"
SERVER="http://localhost:$PORT"
DBNAME="mypeeps"
DBURL="$SERVER/$DBNAME"

# stop server in case one is already running
stardog-admin --server $SERVER server stop

# start server
stardog-admin server start --port $PORT --disable-security

# drop database $DBNAME in case it exists already
stardog-admin --server $SERVER db drop -n $DBNAME

# create database $DBNAME with reasoning and search enabled
stardog-admin --server $SERVER db create -o reasoning.sameas=FULL -o search.enabled=true -n $DBNAME

# load ontology and data
stardog data add $DBURL peeps.ttl mypeeps.ttl

# add namespace prefixes for the query system to use
stardog namespace import --verbose $DBURL prefixes.ttl
```

Query from Python

- Stardog serves as a endpoint for SPARQL queries
- Use this URL to send queries to the mypeeps database

  http://localhost:5820/mypeeps/query/
- There are packages that help do this in many languages, including Python
- See query.py in the peeps repository