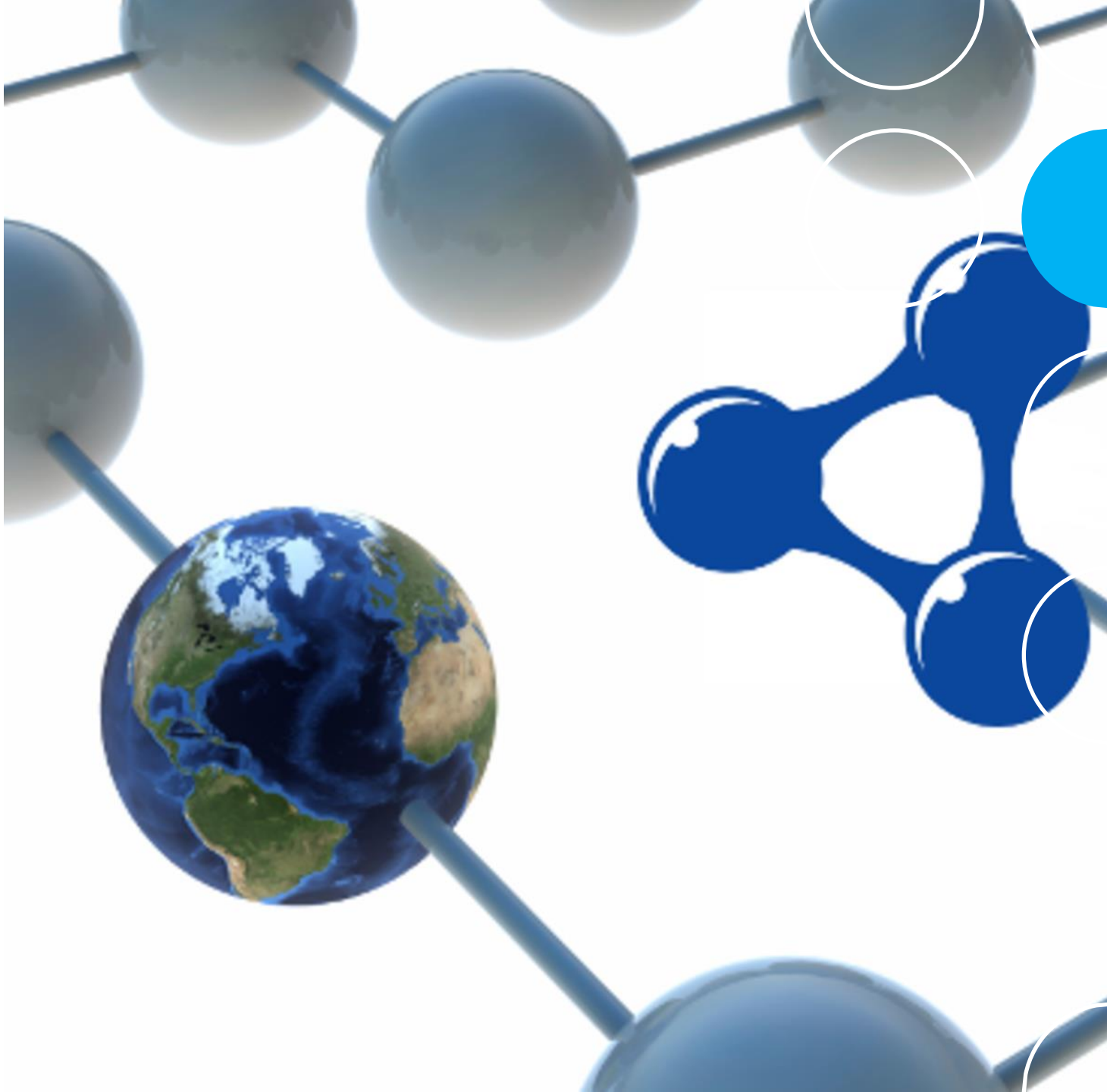
Semantic Web and Linked Data

Liliana Ferreira

2022/23



Class 5: Learning Objectives

- Review RDF principles;
- RDF Schema.

- Exercises
- Practical Work

- Introduction to SPARQL?

REMEMBER!

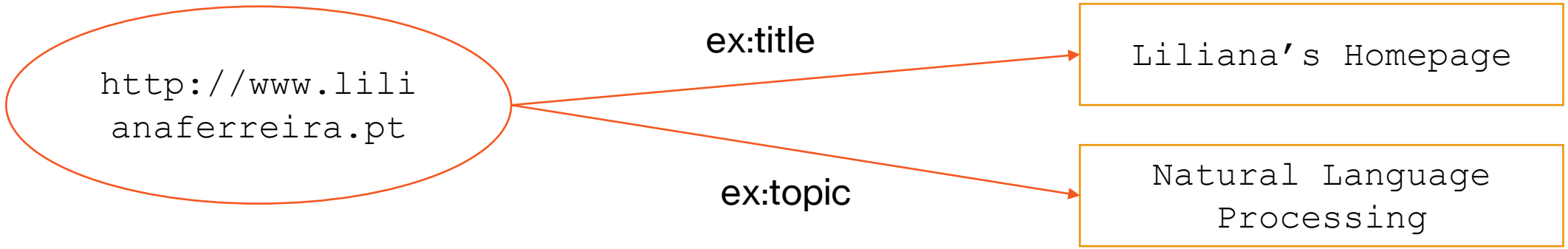
- RDF is not an ontology language but a data model (!!!)
    - RDF is a W3C Recommendation
    - RDF is designed to be read by computers
    - RDF is for describing resources on the Web
    - RDF uses URIs to identify and reference resources on the Web
- RDF/XML is just one way of serializing RDF. Other serializations format include TURTLE and N3.
- NQuads and Trig even support (named) graphs.

Example

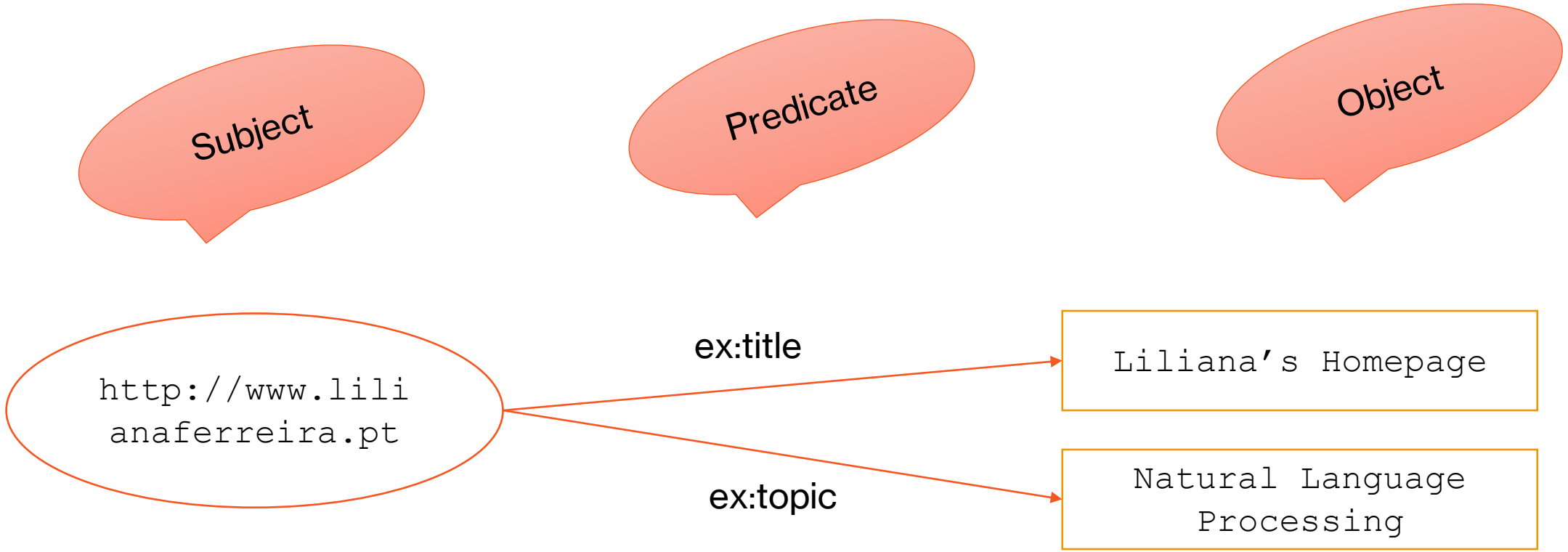
```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:ex="http://www.example.org/ont#">

         <rdf:Description rdf:about="http://www.lilianaferreira.pt">
            <ex:title>Liliana's Homepage</ex:title>
            <ex:topic>Natural Language Processing</ex:topic>
         </rdf:Description>

</rdf:RDF>
```



Example


Subject
Predicate
Object
http://www.lili
anaferreira.pt
ex:title
ex:topic
Liliana's Homepage
Natural Language
Processing

Example

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
       xmlns:ex="http://www.example.org/ont#">

       <rdf:Description rdf:about="http://www.lilianaferreira.pt">
          <ex:title>Liliana's Homepage</ex:title>
          <ex:topic>Natural Language Processing</ex:topic>
       </rdf:Description>

</rdf:RDF>
```

RDF/XML

```
@prefix ex: <http://www.example.org/ont#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .


<http://www.lilianaferreira.pt> ex:title "Liliana's Homepage" .
<http://www. lilianaferreira.pt > ex:topic "Natural Language Processing" .
```

TURTLE

Example

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
       xmlns:ex="http://www.example.org/ont#">

       <rdf:Description rdf:about="http://www.lilianaferreira.pt">
          <ex:title>Liliana's Homepage</ex:title>
          <ex:topic>Natural Language Processing</ex:topic>
       </rdf:Description>

</rdf:RDF>
```

RDF/XML

```
@prefix ex: <http://www.example.org/ont#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .


<http://www.lilianaferreira.pt> ex:title "Liliana's Homepage" ;
ex:topic "Natural Language Processing" .
```

TURTLE

Suitable Text Editors

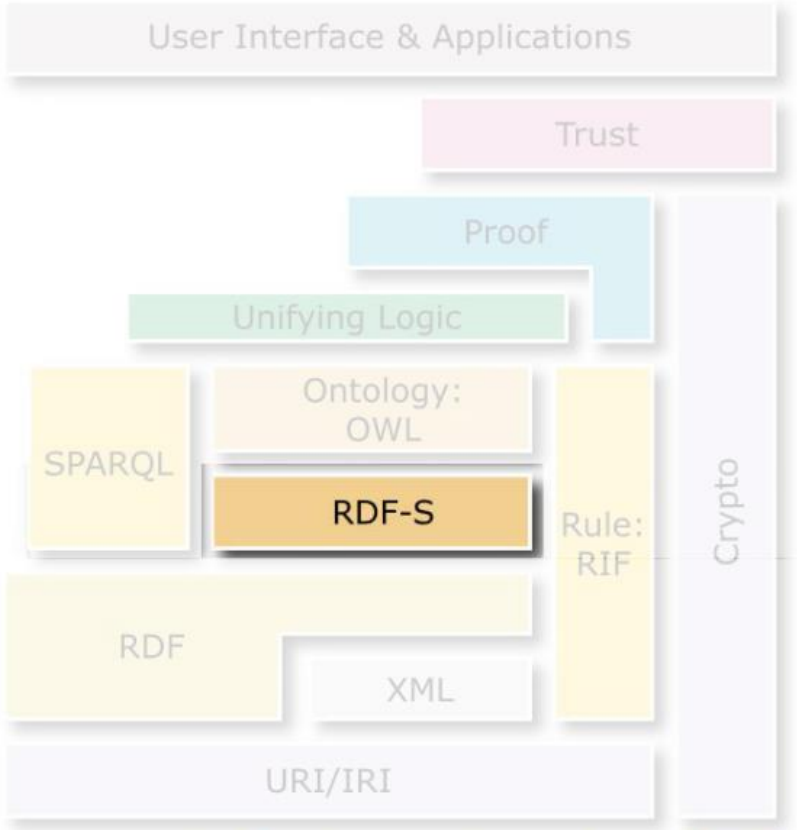
- Remember, **RDF is a data model.**
- Ontologies require ontology languages (such as the Web Ontology Language described later on) for which adequate tools exist.
- For RDF, however, most adequate tooling performs syntactic checks rather than semantic checks.

Suitable Text Editors

- Two fairly known editors with support for RDF (via plugins) are
  - Visual Studio Code and
  - Atom.
- The former might be more lightweight, easier to install, and proposes the installation of plugins upon or saving files of a particular type.

RDF Schema

- To represent light-weight ontologies in RDF;
- RDFS provides standard vocabulary to declare *in* RDF vocabularies to be used in RDF descriptions;
- RDFS reuses the vocabulary of RDF and introduces additional constructs;
- An RDF vocabulary is a set of property declarations and class declarations.



Semantic Web Stack of standards W3C®

RDF Schema

- RDF(S) is a W3C Recommendation
- RDF(S) is an extension of RDF
- RDF(S) provides a framework to describe vocabularies
- RDF(S) describe resources with classes, properties and values

Associating a Namespace to a Vocabulary

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-
ns#>
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
@base <http://fe.up.pt/2021/students.rdfs>
(...)
```

RDF(S) Classes

rdfs:Resource	RDF(S) top element, all other classes are derived from this
rdfs:Class	The Class class
rdf:Property	Base class for properties
rdfs:Literal	The base class for literal values. Allows literal values such as strings and integers
rdfs:Datatype	The base class of data types

RDF(S) Properties

rdfs:subClassOf	Indicates the subject is a subclass of the object in a statement.
rdfs:subPropertyOf	The subject is a sub-property of the property.
rdfs:comment **rdfs:label**	Simple properties that take string literals as values. Labels refer to *human-readable* versions of a resource's *name* and a comment provides a human-readable *description* of a resource.
rdfs:domain	Used to state that any resource that has a given property is an instance of one or more classes.
rdfs:range	Used to state that the values of a property are instances of one or more classes.
rdfs:isDefinedBy	Points to the human readable definition of a class, usually a URL.

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Declaring Classes of Resources

- Naming classes;
- Organizing them into hierarchies.

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
@base <http://fe.up.pt/2021/students.rdfs>
<Woman> a rdfs:Class ;
        rdfs:subClassOf <Person>, <Female> .
```

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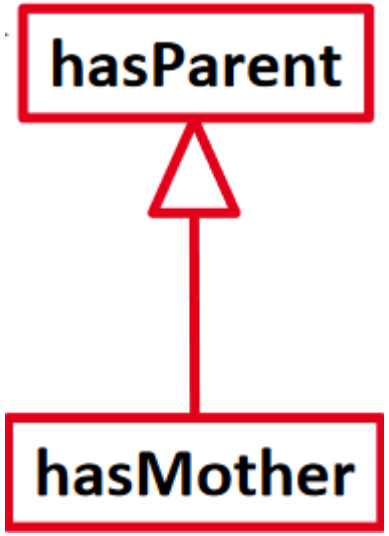
Declaring Types of Properties

- Naming types of properties
- Organizing them into hierarchies

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
@base <http://fe.up.pt/2021/students.rdfs>
<hasMother> a rdf:Property ;
rdfs:subPropertyOf <hasParent> .
```



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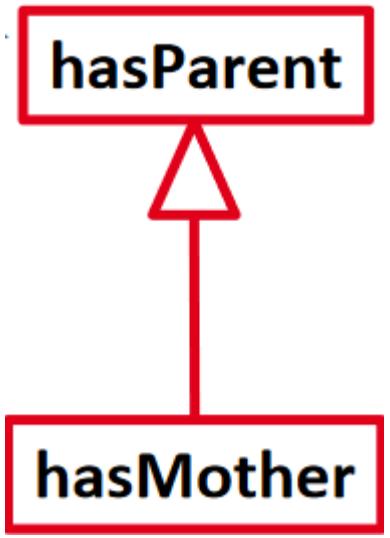
Declaring Property Signatures

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
@base <http://fe.up.pt/2021/students.rdfs>
<hasMother> a rdf:Property ;
      rdfs:subPropertyOf <hasParent> ;
      rdfs:domain <Person> ;
      rdfs:range <Woman> .
```



Documenting Class and Property Declarations

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
@base <http://fe.up.pt/2021/students.rdfs>
```

```
<Woman> a rdfs:Class ;
rdfs:label "woman"@en ;
rdfs:comment "an adult female person"@en .


<hasMother> a rdf:Property ;
rdfs:label "has for mother"@en ;
rdfs:comment "to have a woman for mother"@en .
```

Referencing and Using Schemas

in the description of a resource

```
@prefix h: <http://fe.up.pt/2021/students.rdfs#>
@base < http://fe.up.pt/2021/students.rdfs-instances>
<Alice> a h:Woman; h:hasMother <Laura> .
```

Further reading RDFS

- RDF Schema 1.1
- RDF Schema on Wikipedia
- To choose/find a schema, use the Linked Open Vocabularies (LOV) service
- To find a schema with a prefix frequently used for it, use the prefix.cc service