



Programming for Semantic Web

Petr Křemen



Outline

- Semantic Web Application Architecture
- JSON-LD
- Example of a Semantic Web Application pipeline

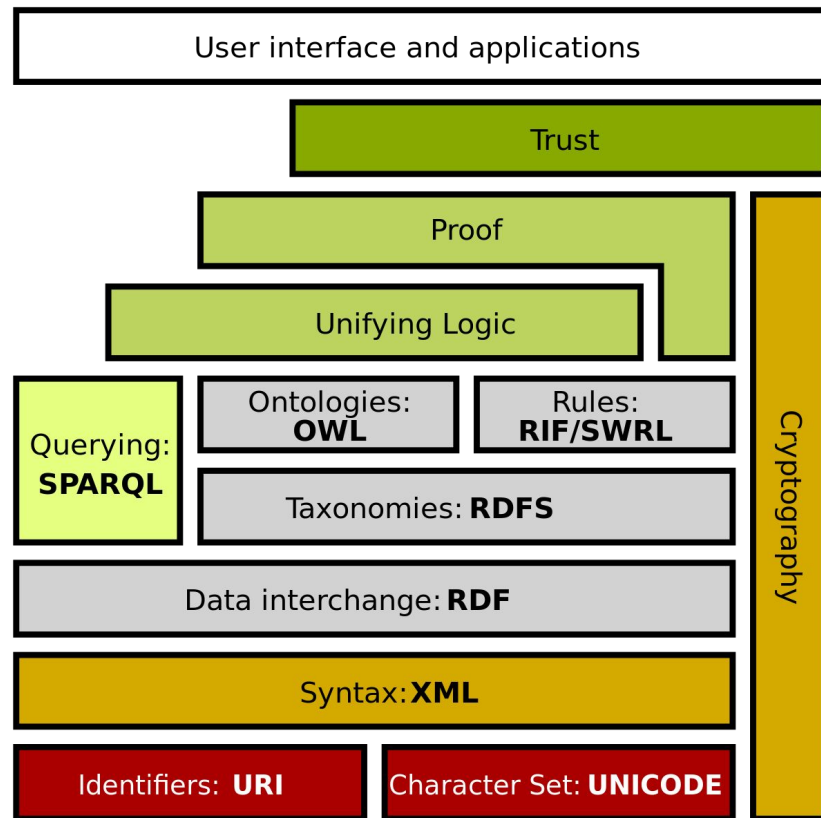


Semantic Web Architectures



Semantic Web Stack

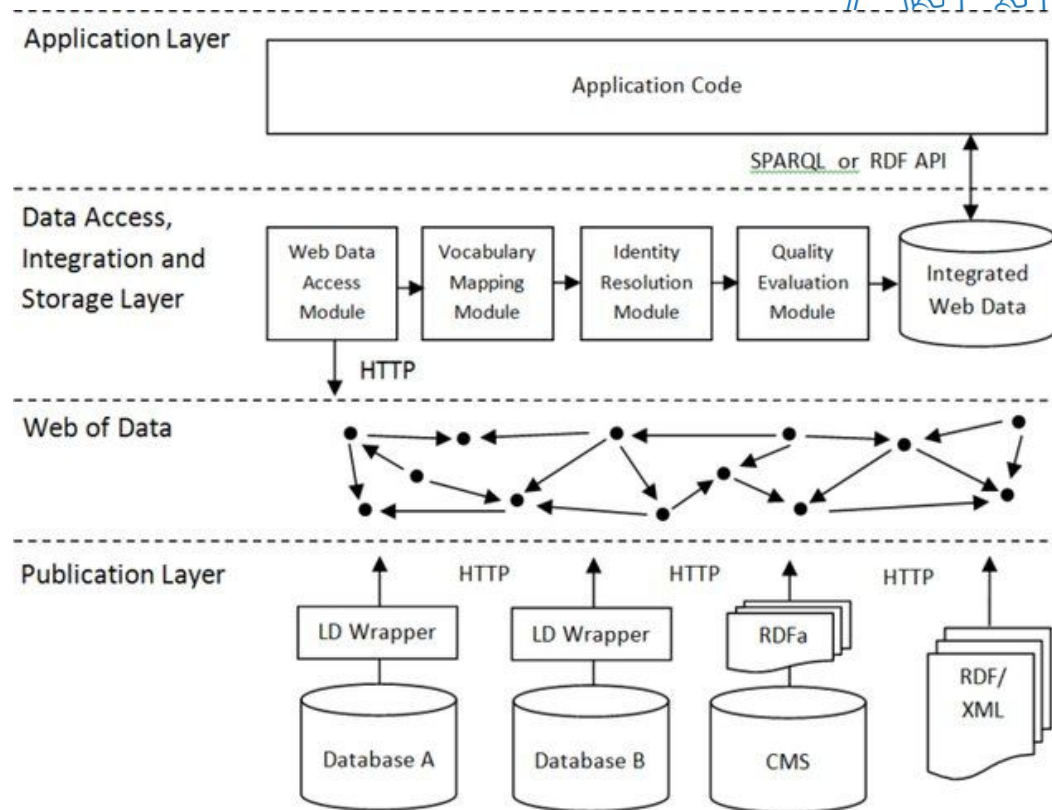
(to remind)



From https://en.wikipedia.org/wiki/Semantic_Web_Stack



Typical semweb application architecture



From: Necula, Sabina-Cristiana. (2015). A Semantic Web Solution for E-Government Educational Services. Informatica Economica. 19. 43-54. 10.12948/issn14531305/19.4.2015.04.



Semantic Web Tools and Applications

- For Software Engineers
 - RDF Triple Stores - see lecture 14
 - [Virtuoso](#), [Fuseki](#), [GraphDb](#), [BlazeGraph](#)
 - RDF/OWL APIs - see lecture 14
 - Java - [Jena](#), [RDF4J](#), [OWLAPI](#), [SHACL API by Top Quadrant](#)
 - Python - [rdflib](#)
 - JavaScript - [jsonld](#)
- For Data Engineers
 - Linked Data Tools and Visualizations
 - [YasGUI](#)
 - [WebVOWL](#)
 - Reasoners
 - Pellet ([OpenLet](#)), [Hermit](#), [ELK](#), ([Fact++](#))



JSON-LD



JSON

JavaScript Object Notation

```
{
  "data": [
    {
      "created_time": "2017-12-08T01:08:57+0000",
      "message": "Love this puzzle. One of my favorite puzzles",
      "id": "post-id"
    },
    {
      "created_time": "2017-12-07T20:06:14+0000",
      "message": "You need to add grape as a flavor.",
      "id": "post-id"
    }
  ]
}
```

From <https://developers.facebook.com/docs/graph-api/using-graph-api/>



JSON-LD

JSON linked data

```
{
  "@context": "https://mywebwithcont.ext/context.jsonld"
  "data": [
    {
      "created_time": "2017-12-08T01:08:57+0000",
      "message": "Love this puzzle. One of my favorite puzzles",
      "id": "1"
    },
    {
      "created_time": "2017-12-07T20:06:14+0000",
      "message": "You need to add grape as a flavor.",
      "id": "2"
    }
  ]
}
```



JSON-LD context

<https://mywebwithcont.ext/context.jsonld>

```
{
  "@context": {
    "sioc": "http://rdfs.org/sioc/ns#",
    "dcterms": "http://purl.org/dc/terms/",
    "data": "@graph",
    "id": "@id",
    "message": {
      "@id": "sioc:content",
      "@language": "en",
      "@type": "xsd:string"
    },
    "created_time": {
      "@id": "dcterms:created",
      "@type": "xsd:dateTimeStamp"
    }
  }
}
```



JSON-LD resources

- <https://json-ld.org/playground/>
 - Link to the [previous example](#)
- <https://w3c.github.io/json-ld-syntax>
- libraries
 - JavaScript - <https://www.npmjs.com/package/jsonld>
 - Java - <https://github.com/kbss-cvut/jb4jsonld>
 - Python - <https://github.com/digitalbazaar/pyld>

JSON-LD is becoming #1 RDF representation and is actively developed (currently version 1.1. draft)



Application Use-Case



Conceptual Modeling for eGovernment

- how to tackle ambiguous terms in documents?
- how to connect (open) datasets to legislation?
- how to connect (open) datasets together?



Keyword ambiguity

Building is a construction

- both above and below ground
- spatially compact
- with walls and roof
- with heating

*Act 406/2000
Coll., on Energy
Management*

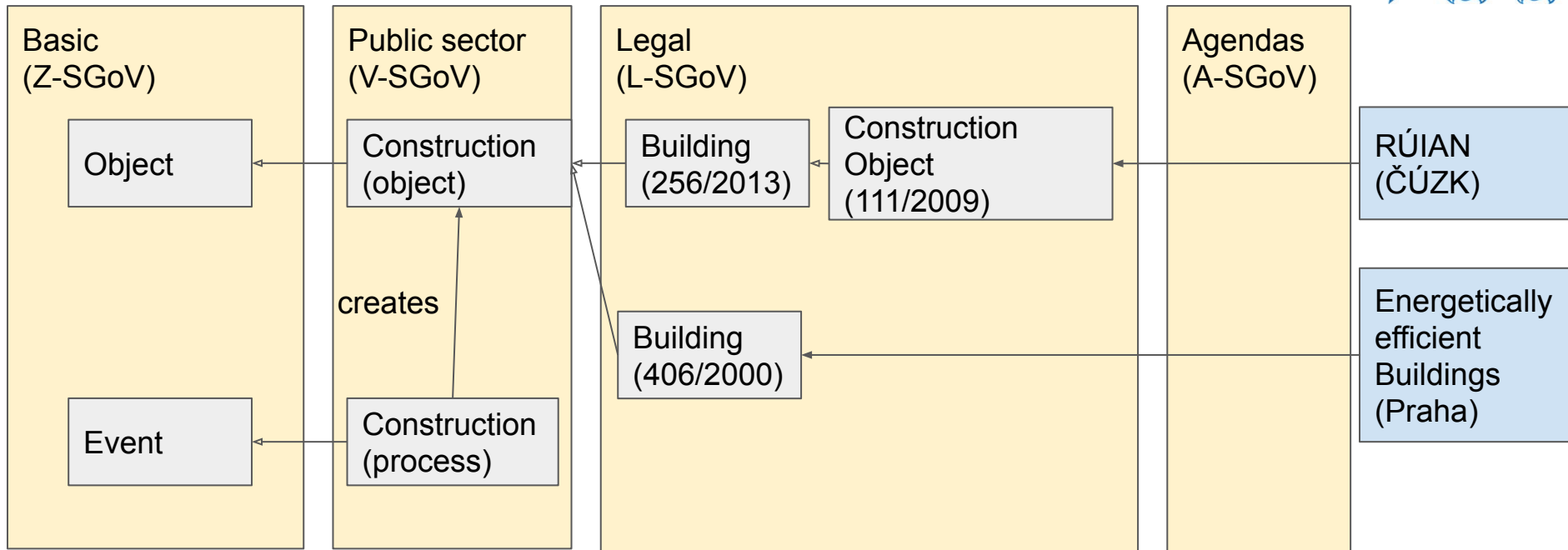
Building is a construction

- above ground
- with solid foundations
- spatially compact
- with walls and roof

*Act 256/2013 Coll,
Cadastral Law*

Bus stops ?

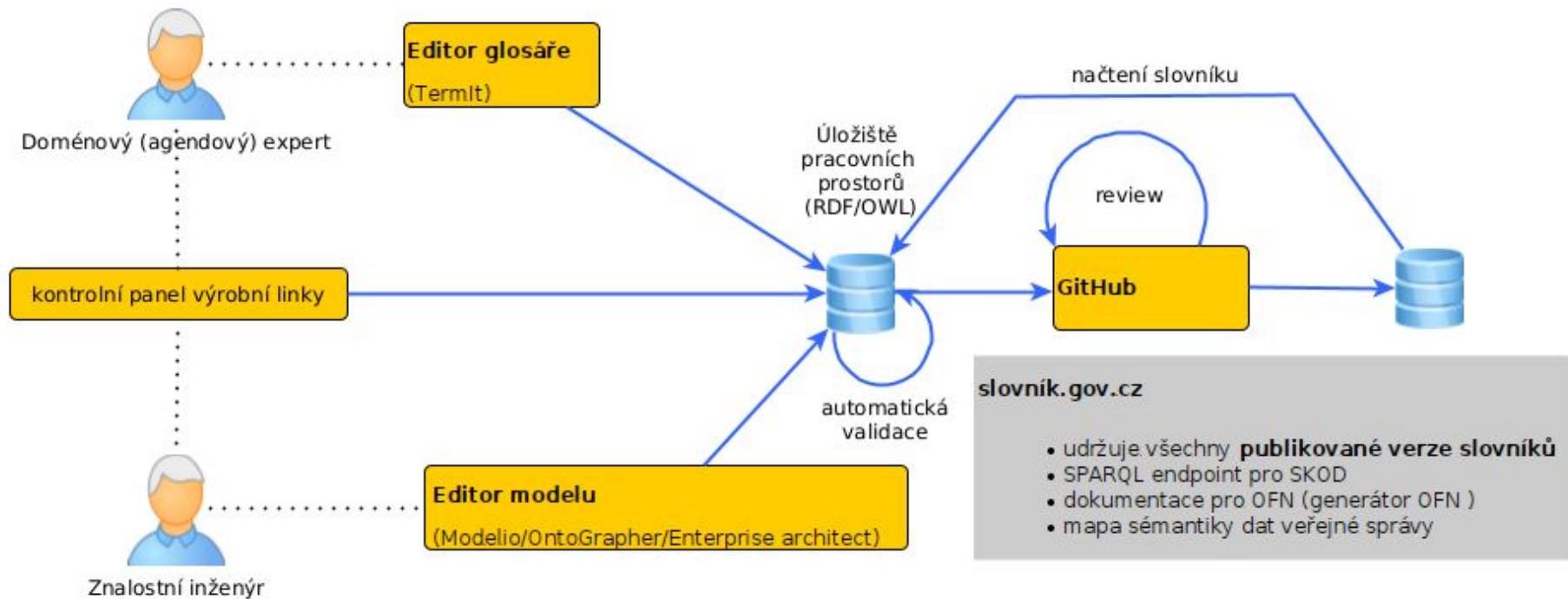
Semantic government vocabulary (SSP)



Basic info - <https://slovník.gov.cz>

Linked Data API + SPARQL Endpoint - <https://slovník.gov.cz/sparql>

Assembly line of Conceptual Models





Termit

- tool for management of interlinked vocabularies/thesauri
- SKOS-compliant, UFO-based
- back-end inference
 - inverse links
 - vocabulary dependencies

Text
Annotation
Service

