# Case Study

- Post on Piazza case study folder on your team's choice for your paper/project soon.
  - You need my approval before actually working on it.
  - Please attach files in your post using menu item (Insert->Insert file) if you have any, so both your team and I can see them.
  - If multiple teams picked the same paper/project, the one posted it earliest will get it.
- One bonus point for system demonstration
  - To encourage working with real systems/tools, I'm happy to offer one bonus point for each team who can demonstrate the system associated with the paper/project during their presentation.
  - But I would recommend you only work on system demonstration after other parts of the case study are done because it might be very time consuming to get a system/tool working.
- Fill out this spreadsheet on your case study presentation time slot
  - 15 minutes for each presentation + 2-3 minutes for Q&A.

# Reminder of Midterm 2 Next Week

- Midterm covers chapters 8-13. 30 questions and 0.5 for each question. Total mark: 15
  - We will still have multi-choice questions (pick one from multiple circles), multi-answer questions (pick two or more from multiple squares) and short answer questions
- The exam will be available 4:30-5:45 PM ET Thursday, November 19th on Blackboard
  - No class after exam
- Send me on Piazza via **private posts** on at most five recommended questions by the end of Wednesday, November 18th
- Using the lockdown browser, blackboard will record your picture, your photo ID and your activity during exam
- If you have difficulty to access the exam at blackboard, you can contact me via slack or email
- During exam, it is difficult to discuss questions with me. Just answer the question based on your understanding. If you have questions, you can contact me after exam
- Because we are having midterm next week, the deadline for this chapter's exercise is Wednesday after midterm 2
  - Working on exercise should still help your exam preparation

# IS 651: Distributed Systems
# Chapter 12: Semantic Web

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**Fall 2020**

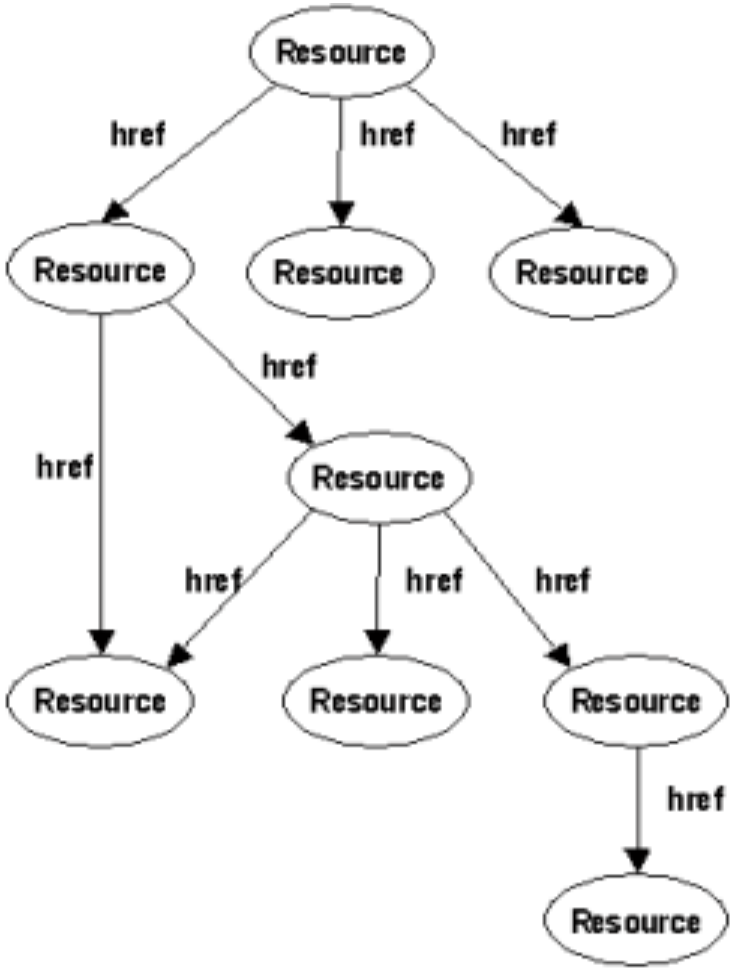
# Learning Outcomes

- After learning this chapter, you should be able to
  - Understand the basics of Semantic Web and its techniques
  - Be able to do simple SPARQL SELECT queries

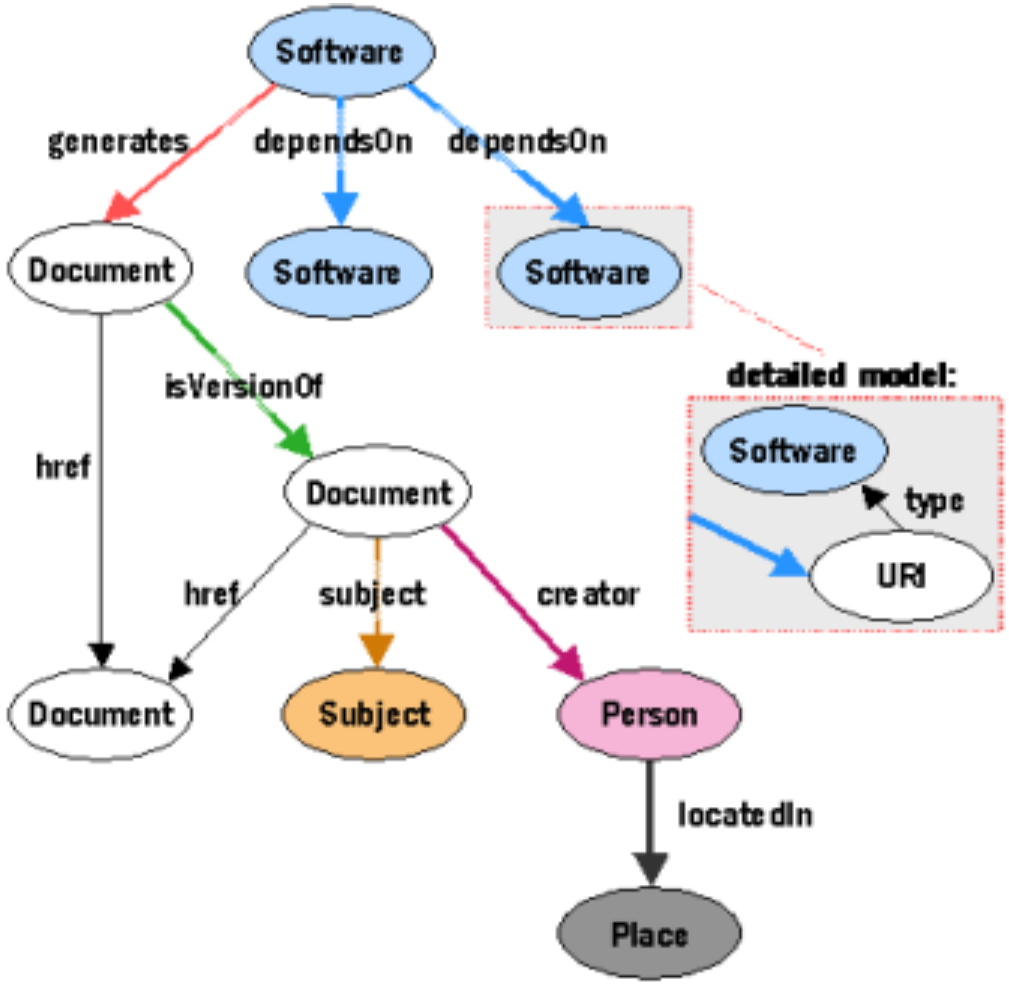
# The Semantic Web

- Syntax VS Semantics
- Web 3.0: Make the web easier to be understood by computers
  - Web 2.0: user generated web contents, usability, and interoperability. Examples are blog, wiki, social network sites and mashup.
- Techniques/standards for Semantic Web
  - Resource description framework (RDF) - describing data with a global naming scheme (URIs)
  - RDF Schema (RDFS) - A standard way of describing the properties of that data
  - Web Ontology Language (OWL) - A standard way of describing relationships between data items.
  - RDF Stores and SPARQL - A standard way of storing and querying graphs.

# From Current Web to Semantic Web




a) Current Web




b) Semantic Web

# Resource Description Framework (RDF)

- RDF is a graph model built by triples: <resource/subject, property/predicate, value/object>
- RDF describes data with a global naming scheme (URIs)
- RDF is independent of any serialization
- Common RDF serialization notion/language are N3 and XML
- Commonly used RDF vocabularies include Dublin Core, FOAF
  - You can define your own vocabularies
- W3C's RDF Validation Service for validation and graph representation
  - One graph representation example

# N3 and XML Serialization for RDF

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema> .

<http:/userpages.umbc.edu/~jianwu/foaf.rdf>
foaf:name
"Jianwu Wang"^^xsd:string .
```

```
<rdf:RDF
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:foaf="http://xmlns.com/foaf/0.1/">
   <rdf:Description
      rdf:about="http://userpages.umbc.edu/~jianwu/foaf.rdf">
     <foaf:name>Jianwu Wang</foaf:name>
    </rdf:Description>
</rdf:RDF>
```

# RDFSchema

- RDF Schema is an extension of the basic RDF vocabulary
- It provides a standard way of describing the properties of that data
- It adds the concept of class (sub-class), and associated properties (sub-property) to RDF triples

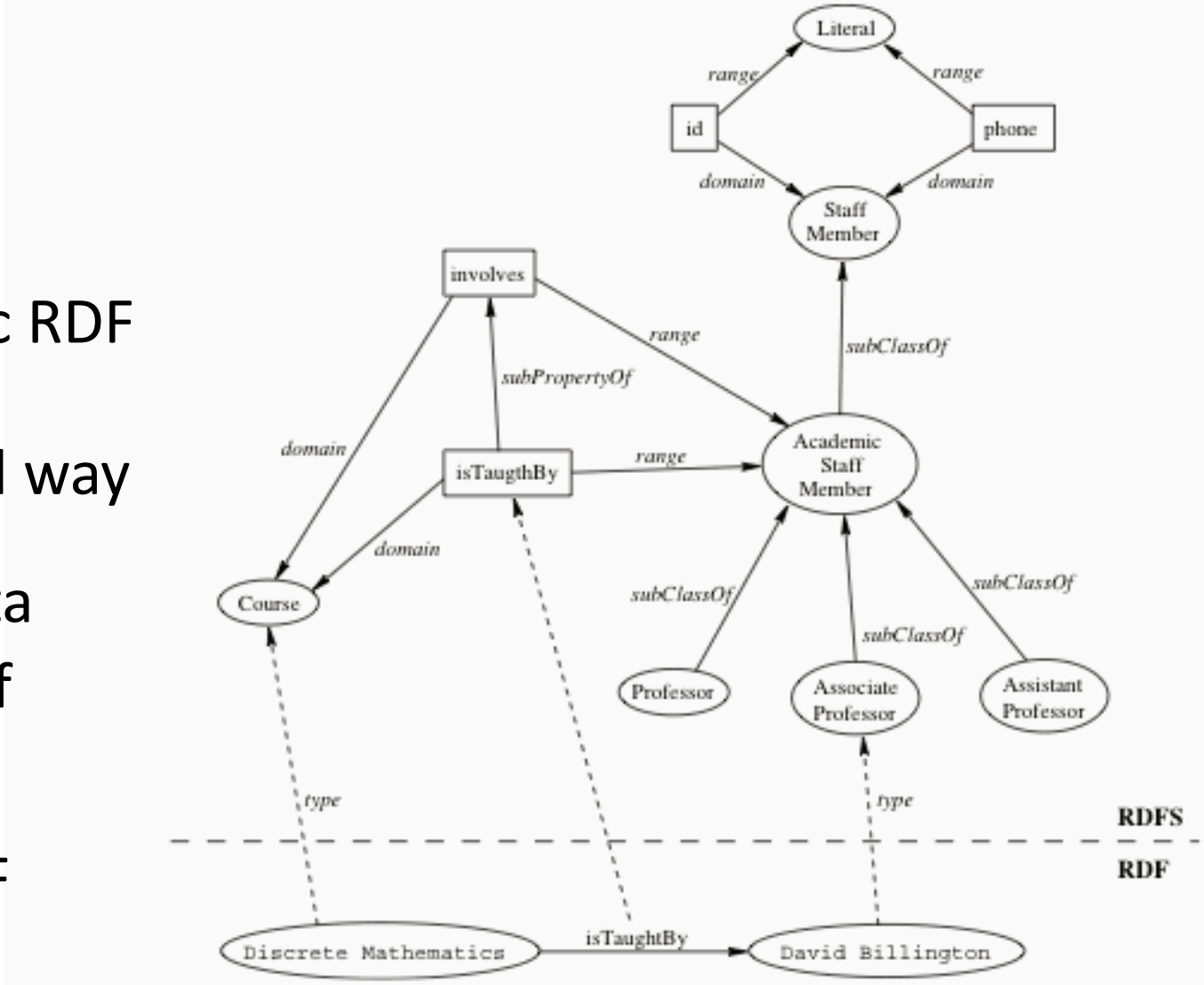



**Figure 3.6** RDF and RDFS layers

# RDFSchema (2)

- The RDF Schema class and property system is similar to the type systems of object-oriented programming languages such as the Java language.
- A difference is RDF Schema defines a property separately/independently by its range class and domain class
- A specific resource is a type of a class
  - UMBC is a type of university class
- You can find RDFSchema example in N3 at book chapter

# Quick Question

- Extend the RDFShema example to add student concept and instances

# OWL (Web Ontology Language)

- OWL is a language for defining and instantiating Web ontologies
- Ontology is a term borrowed from philosophy that refers to the science of describing the kinds of entities in the world and how they are related
- An OWL ontology may include descriptions of classes, properties and their instances
- Given such an ontology, the OWL formal semantics specifies how to derive its logical consequences, i.e. facts not literally present in the ontology, but **entailed** by the semantics

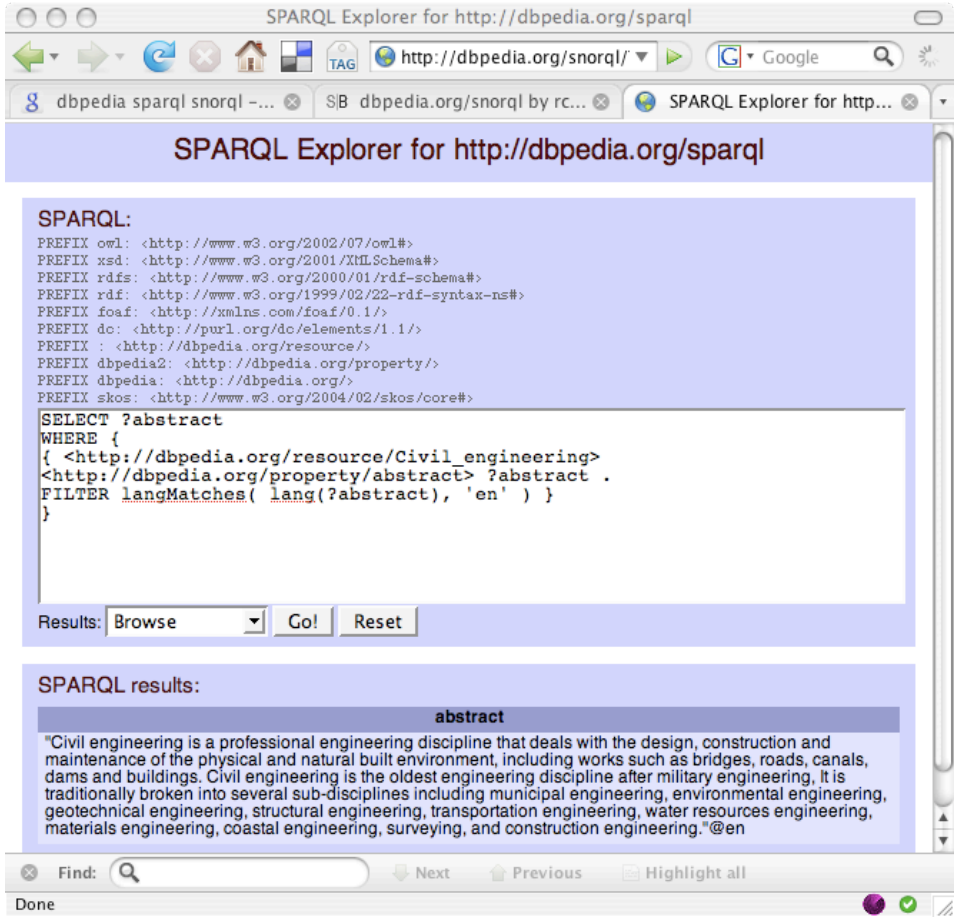
# SPARQL

- SPARQL is a query language for RDF
  - Recursive acronym: SPARQL Protocol and RDF Query Language
- Four types of SPARQL queries
  - *SELECT*
  - *CONSTRUCT*
  - *ASK*
  - *DESCRIBE*
- You can specify one or more SPARQL endpoints in SPARQL query
  - Endpoint list: https://www.w3.org/wiki/SparqlEndpoints

# SPARQL Demo

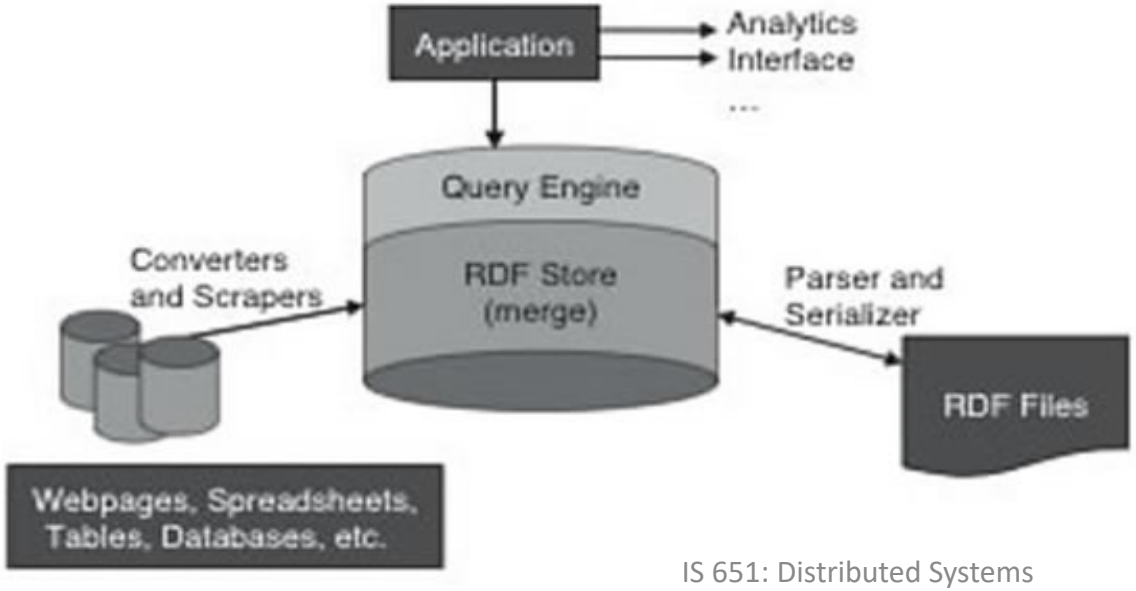
- SPARQL Explorer
- An SELECT query example

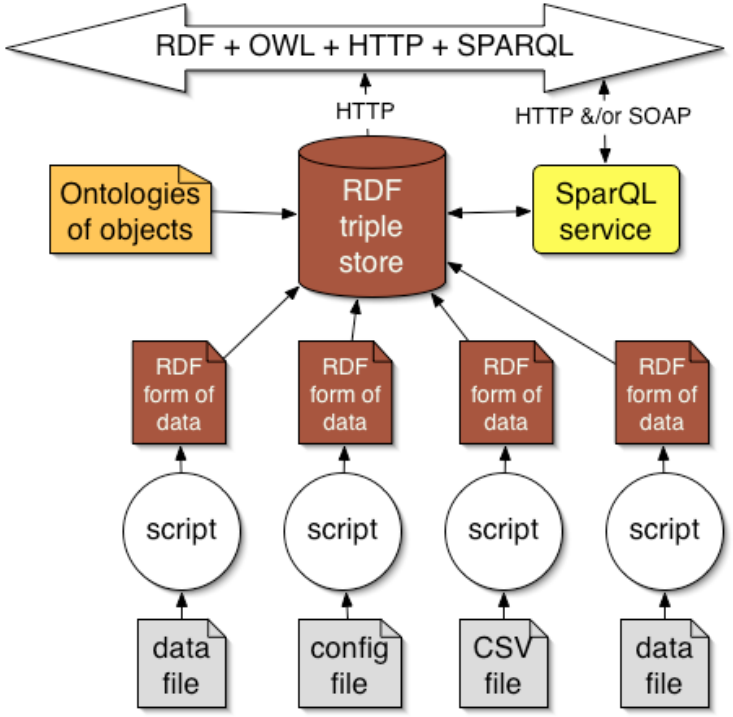
```
PREFIX dbo:  <http://dbpedia.org/property/>
SELECT ?name ?birth
{
?person dbo:birthPlace :Berlin .
?person dbo:birthDate ?birth .
?person foaf:name ?name .
?person dbo:deathDate ?death .
FILTER (?birth < "1900-01-01"^^xsd:date) . }  ORDER BY ?name
#People who were born in Berlin before 1900
```



# RDF (Triple) Stores

- An RDF triple store is a purpose-built **graph** database for the storage and retrieval of RDF metadata
- RDF Store Software:
  Jena, RDF4J/Sesame, Neo4j, etc.




create RDF files from other formats

# Linked Data

- A method of publishing and interlinking structured data so it can become more useful through semantic queries
- It builds upon HTTP, RDF and URIs
- This enables data from different sources to be connected and queried
- Famous linked data sets
  - DBpedia for extracted data from Wikipedia
  - FOAF for persons, their properties and relationships

# Semantic Web Criticism

- Web is too vast and vague
  - But what about specific areas?
- Too computer-friendly


"Now! ... *That* should clear up a few things around here!"