

RDF

CSC480: Semantic
Web Technologies

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Background

- Resource Description Framework
- Data model
- Provides semantics
- Define vocabulary for domain

RDF Components

- Syntax
 - Many
 - RDF/XML
 - Turtle
- Data model
 - RDF
- Semantics
 - RDFS

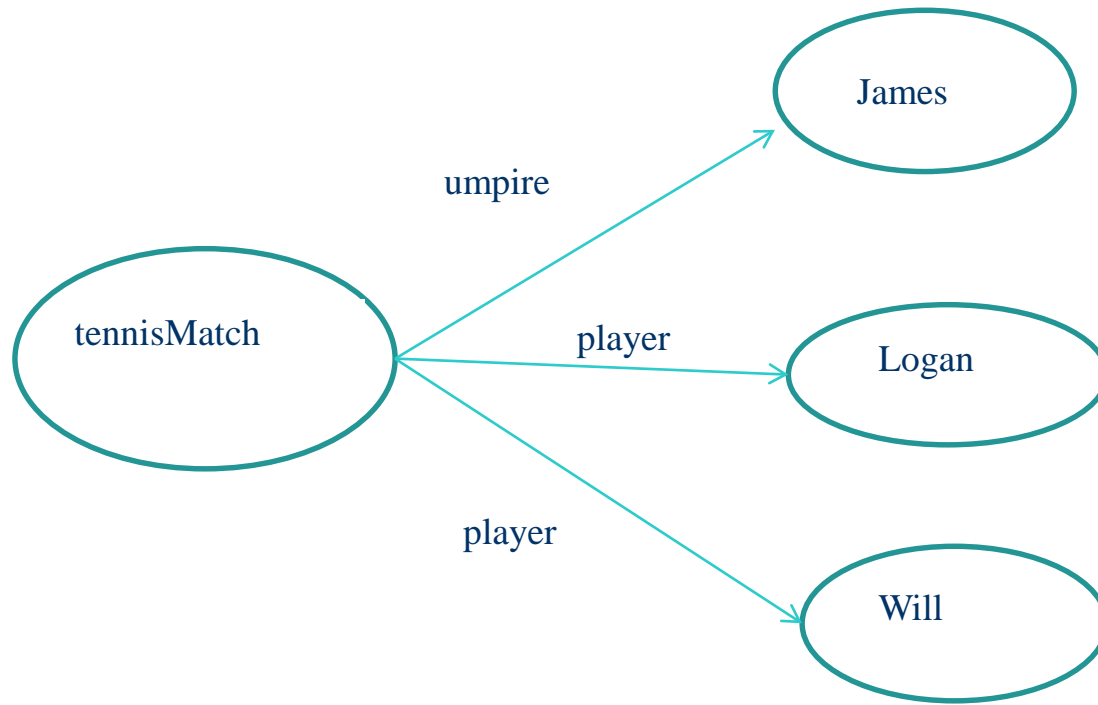
RDF Concepts

- Resource
- Property
- Statement
- Graph

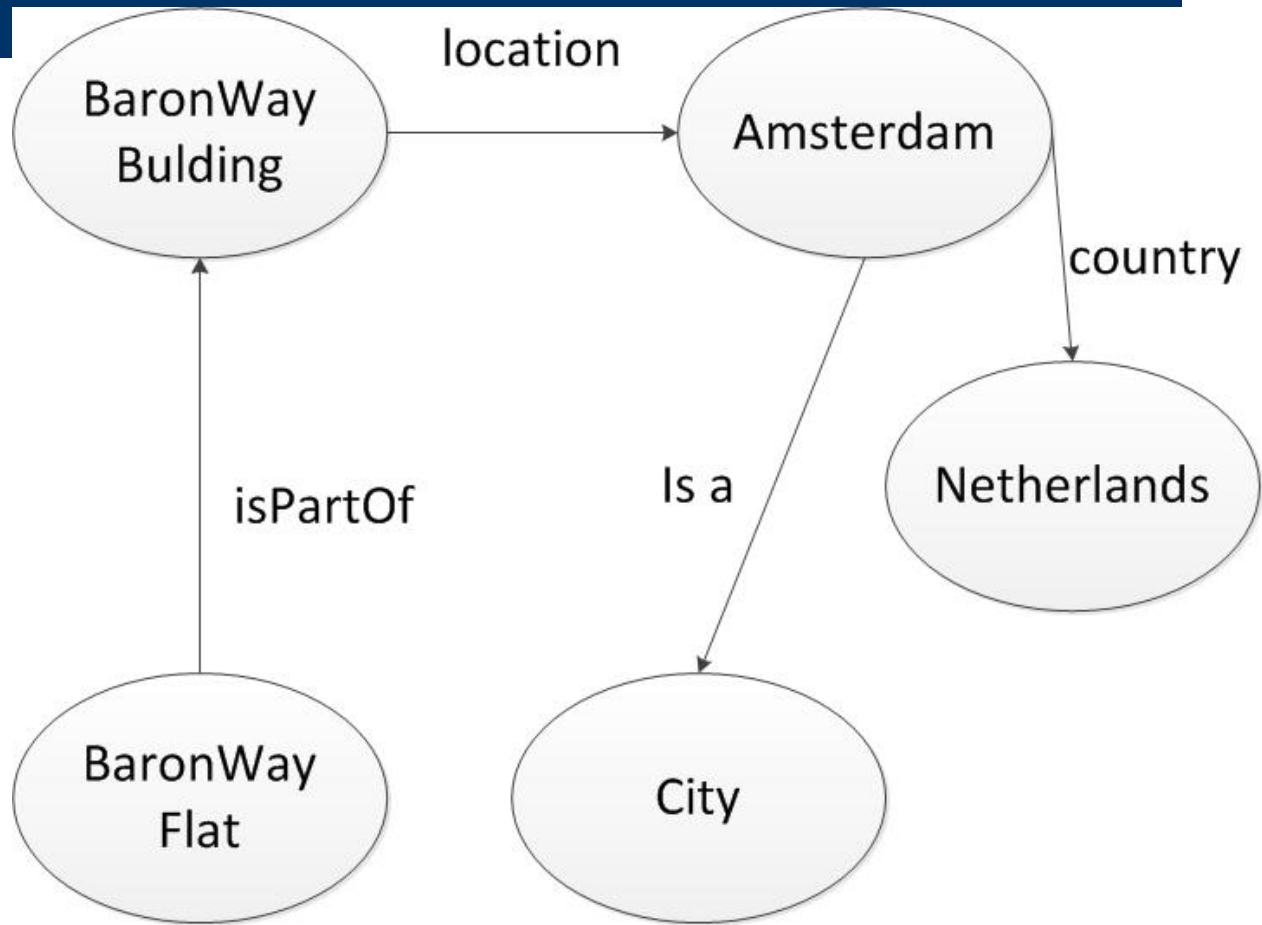
Triples

- Subject
- Predicate / Property
 - Binary only
- Object

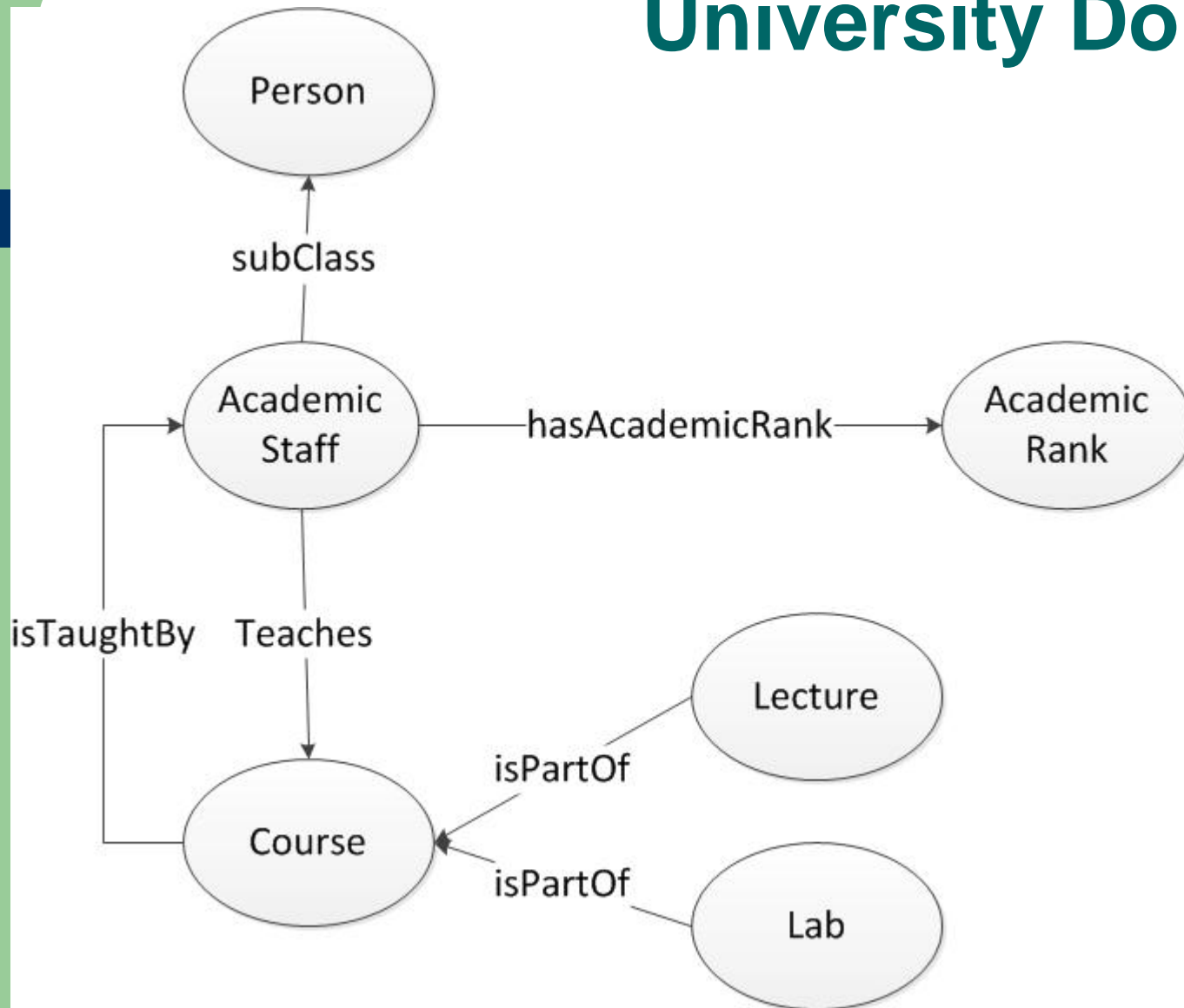
Predicates with more than Two Arguments



RDF Graph Example



University Domain



Linked Data Principles

- Use URIs as names for things
- Use HTTP URIs so that people can look up those names
- When someone looks up a URI, provide useful information, using standards (RDF)
- Include links to other URIs so that people can discover more things

Reification

- Process of reviewing relationship as an entity
- Add additional information
- Example
 - isMemberOf(P1, C1)
 - isMemberOf(P1, C2)
 - isMemberOf(P2, C1)
- Create new relationship: *Membership*
 - Instance for each *isMemberOf* relationship

Miscellaneous

- Named graph
 - Identifier for set of statements (portion of graph)
 - Reference identifier in triples
- Blank nodes
 - Resource with no known URI
 - *_:id*

RDF Syntax: Example

- Friend of a Friend (FOAF)
- Toby Segaran (<http://kiwitobes.com/toby.rdf#ts>)
knows
Colin Evans (<http://semprog.com/people/colin>)

RDF/XML

- Encode RDF with XML
- Original syntax
- Some elements
 - rdf:RDF
 - rdf:Description
 - rdf:about
 - rdf:ID
 - rdf:resource

Example

```
<foaf:Person rdf:about="http://kiwitobes.com/toby.rdf#ts">
  <foaf:name>Toby Segaran</foaf:name>
  <foaf:knows>
    <foaf:Person
      rdf:about="http://semprog.com/people/colin">
        <foaf:name>Colin Evans</foaf:name>
      </foaf:Person>
    </foaf:knows>
  </foaf:Person>
```

Example 2

- BaronWayExample.xml

RDFa

- Used to describe web page content - XHTML
- Embed RDF in HTML attributes

Example

```
<div xmlns:foaf="http://smlns.com/foaf/0.1/"
      about="http://kiwitobes.com/toby.rdf#ts" typeof="foaf:Person">
  Name: <span property="foaf:name">Toby Segaran</span><br/>
  Friends:<br/>
  <ul rel="foaf:knows">
    <li about="http://semprog.com/people/colin"
          typeof="foaf:Person" property="foaf:name">
      Colin Evans</li>
  </ul>
</div>
```

Turtle

- Terse RDF Triple Language
- Text-based
- Example
 - “Baron Way Building is located in Amsterdam”
 - <http://www.semanticwebprimer.org/ontology/apartments.ttl#BaronWayBuilding>
<<http://dbpedia.org/ontology/location>>
<<http://dbpedia.org/resource/Amsterdam>>

Turtle (2)

- Literal values
 - Quoted with data type appended
 - Default is string
 - “12”^^<http://www.w3.org/2001/XMLSchema#integer>
- Data type shortcuts
 - Integer: no quotes
 - Decimal: no quotes with period

Turtle Syntax Shortcuts

- Namespaces
 - @prefix
 - Qualified name
 - apt:BaronWayApartment apt:isPartOf
apt:BaronWayBuilding
- Multiple statements, same subject
- Multiple statements, same subject and predicate

Example

```
<http://kiwitobes.com/toby.rdfs#ts>
```

```
  a :Person ;
```

```
  :name "Toby Segaran" ;
```

```
  :knows <http://semprog.com/people/colin> .
```

N3

- Notation3
- Shorthand notation
- Not XML-compliant

Example

```
@prefix foaf: <http://xmlns.com/foaf/0.1/>.
```

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

```
@prefix tobex: <http://kiwitobes.com/tobyd.rdf#>.
```

```
@prefix semperp: <http://semprog.com/people/>.
```

```
tobex:ts a foaf:Person;  
        foaf:name "Toby Segaran";  
        foaf:knows semperp:colin .
```

```
semperp:colin a foaf:Person;  
              foaf:name "Colin Evans".
```

N-Triples

- Subset of N3
- Simple, verbose
- No prefixes

Example

```
<http://kiwitobes.com/toby.rdf#ts>
```

```
  <http://xmlns.com/foaf/0.1/name> "Toby Segaran".
```

```
<http://kiwitobes.com/toby.rdf#ts>
```

```
  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
```

```
  <http://xmlns.com/foaf/0.1/Person>.
```

```
< http://kiwitobes.com/toby.rdf#ts>
```

```
  <http://xmlns.com/foaf/0.1/knows>
```

```
  <http://semprog.com/people/colin>.
```

Example (2)

<http://semprog.com/people/colin>

 <http://xmlns.com/foaf/0.1/name> “Colin Evans”.

<http://semprog.com/people/colin>

 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>

 <http://xmlns.com/foaf/0.1/Person>.

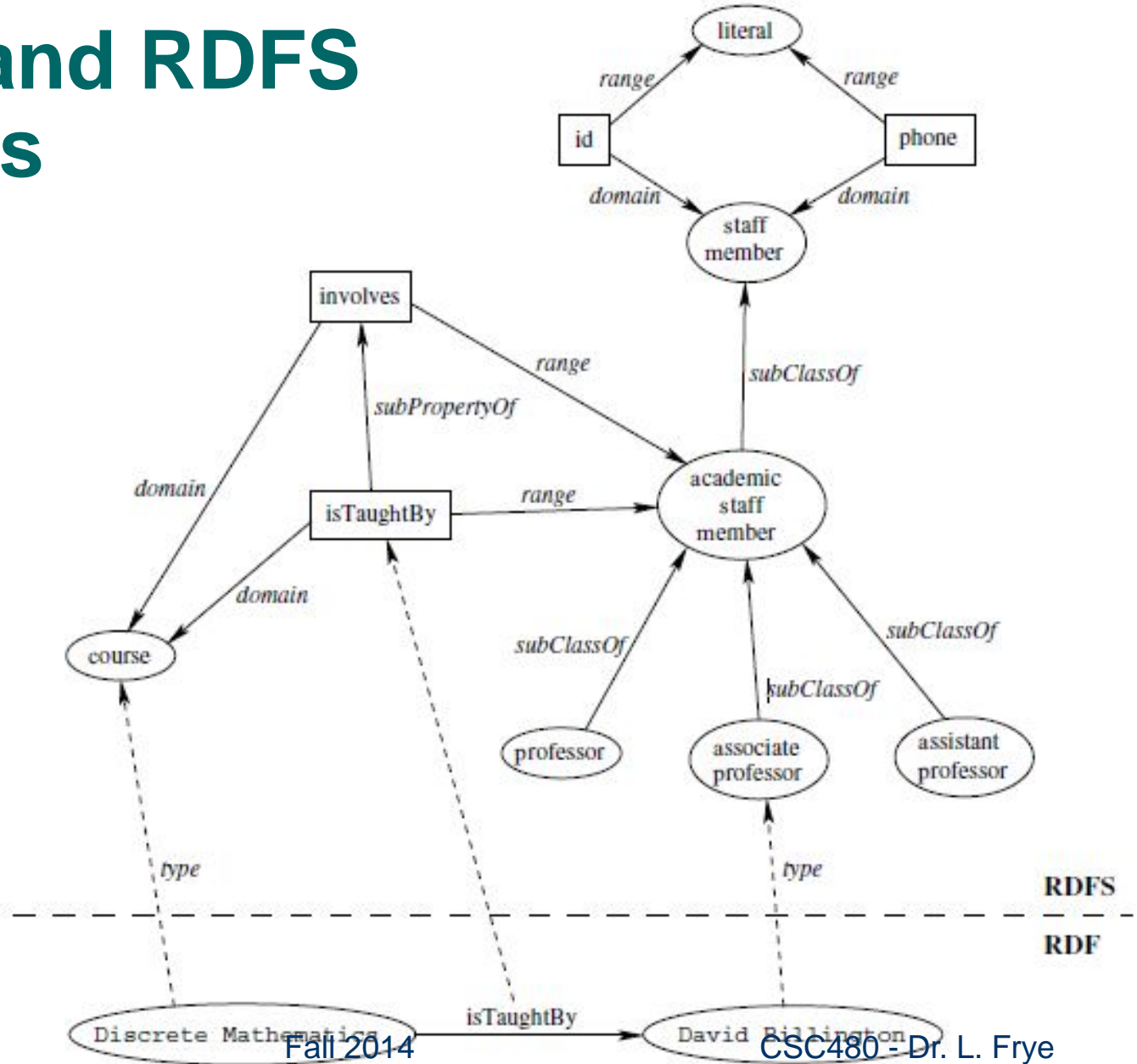
RDF Schema (RDFS)

- Describe RDF vocabularies
- Describe classes and properties
- Provides semantics

RDFS Basics

- **Classes**
 - subclass
 - superclass
- **Instances**
- **rdf:type**
- **Restrictions**
 - domain
 - range
- **Properties**
 - hierarchical

RDF and RDFS Layers



RDFS Namespaces

- <http://www.w3.org/2000/01/rdf-schema#>
- <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

Core Classes

- `rdfs:Resource` – class of all resources
- `rdfs:Class` – class of all classes
- `rdfs:Literal` – class of all literals
- `rdf:Property` – class of all properties
- `rdf:Statement` – class of all reified statements

Core Properties

- `rdf:type` –instance of
- `rdfs:subClassOf`
- `rdfs:subPropertyOf`
- `rdfs:domain`
- `rdfs:range`
- `rdfs:subject`
- `rdfs:predicate`
- `rdfs:object`

Miscellaneous Properties

- `rdfs:value`
- `rdfs:comment`
- `rdfs:label`
- `rdfs:seeAlso`
- `rdfs:isDefinedBy`

FOL to Represent RDF and RDFS

- Triple – a predicate with three arguments
 - Resource, R
 - Property, P
 - Value, V
 - PropVal(P, R, V)

Some FOL for RDF/RDFS

- $\text{PropVal}(\text{type}, R, T) \rightarrow \text{Type}(R, T)$
- Resource is most general class, so
 - $\text{Type}(\text{?p}, \text{Property}) \rightarrow \text{Type}(\text{?p}, \text{Resource})$
 - $\text{Type}(\text{?c}, \text{Class}) \rightarrow \text{Type}(\text{?c}, \text{Resource})$
- $\text{PropVal}(\text{type}, \text{type}, \text{Property}) \rightarrow \text{Type}(\text{type}, \text{Property})$
- What do these state?
 - $\text{Type}(\text{?s}, \text{Statement}) \rightarrow \text{Type}(\text{?s}, \text{Resource})$
 - $\text{Type}(\text{Statement}, \text{Class})$

RDF Examples

- Article.xml
- relationships.xml