SENG 42273
Semantic web and Ontological Engineering

Lecture 3

Resource Description Framework (RDF)

- RDF is the basic building block for supporting the Semantic Web.
- RDF is to the Semantic Web what HTML has been to the Web.
- The Resource Description Framework (RDF) is a language for representing resources in the World Wide Web.
- RDF is intended for situations in which this information needs to be processed by applications, rather than being only displayed to people.
- RDF is based on the idea of identifying things using Web identifiers (URIs).

Basic Elements of RDF

Resource : Any identifiable resource (digital, physical, or abstract) present on or connected to the WWW (Wikipedia)

Ex: http://www.yuchen.net/photography/SLR#Nikon-D70

Property : A resource that has a name and can be used as a property

Ex: http://www.yuchen.net/photography/SLR#weight

Statement : An RDF statement is used to describe properties of resources.

Ex: *http://www.yuchen.net/photography/SLR#Nikon-D70* has a *http://www.yuchen.net/photography/SLR#weight* whose value is 1.4 lb.

Basic Elements of RDF

Example

"John Smith created a particular Web page."

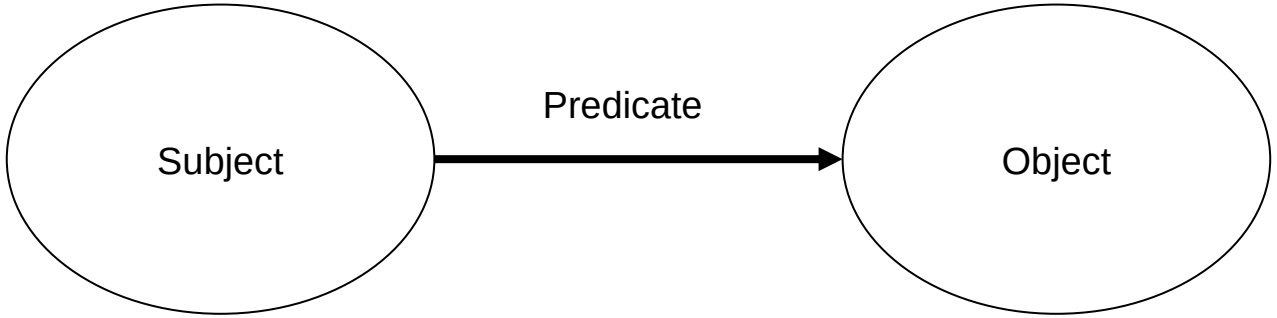
http://www.example.org/index.html has a **creator** whose value is **John Smith**

- the thing the statement describes (the web page`s URL)
- a specific property of the thing (e.g. creator)
- the concrete message the statement wants to give,
  in other words the value of the property (John Smith)

Basic Elements of RDF

RDF terminology

- the part that identifies the thing the statemant is about is called *subject*
- the part that identifies the property is called *predicate*
- the part that identifies the value of the property is called *object*



Basic Elements of RDF

http://www.example.org/index.html has a **creator** whose value is **John Smith**

- the *subject* is the URL „http://www.example.org/index.html“
- the *predicate* is the word „creator“
- the *object* is the name „John Smith“

Case study: consider the following description.

There is a person called LM who is a lecturer at SETU. He teaches SENG 42273 and SENG 34262 course modules to the undergraduates. Students can contact him via email address lm@kln.ac.lk. He holds a PhD and hence, he use Dr. as the title of his name.

Identify the Subject, Object, Predicate triples

- The subject
  - lecturer
- The objects
  - LM (name of the person)
  - lm@kln.ac.lk (email of the person)
  - Dr. (title of the person)
  - SETU (department)
- The predicates
  - "whose name is"
  - "whose email is"
  - "who works at"
  - "whose title is"

RDF Triple

TABLE 3.1
An RDF Triple Expressed in a Table Format

Subject	Predicate	Object
mySLR:Nikon-D70	mySLR:weight	1.4 lb

RDF Graph Model

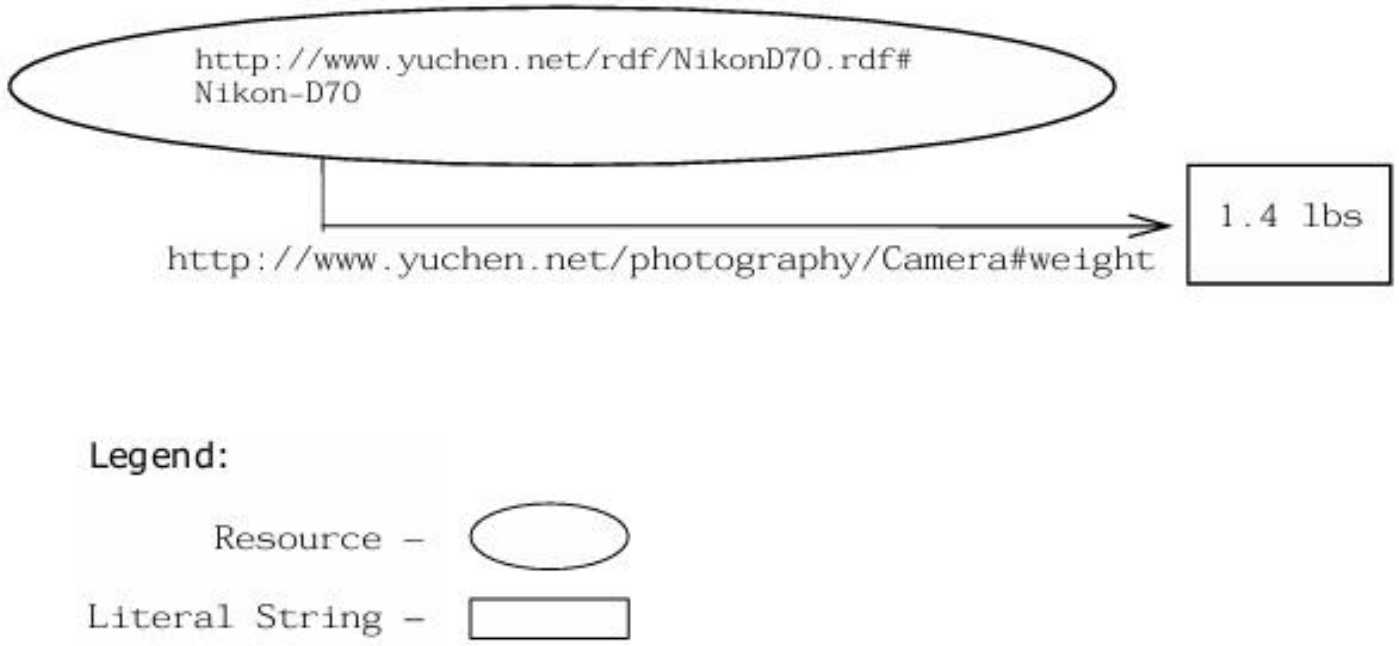


FIGURE 3.2 RDF graph model.

Convert the information into RDF triples using standard terminology, syntax, and vocabularies

- Subject:
  - http://www.setu.kln.ac.lk/academics#lecturer

- Predicates:
  - http://www.w3.org/2000/10/swap/pim/contact#fullName
  - http://www.w3.org/2000/10/swap/pim/contact#mailbox
  - http://www.w3.org/2000/10/swap/pim/contact#personalTitle
  - http://www.w3.org/1999/02/22-rdf-syntax-ns#type
  - http://www.w3.org/2000/10/swap/pim/contact#ContactLocation

- Objects:
  - LM (name of the person)
  - lm@kln.ac.lk (email of the person)
  - Dr. (title of the person)
  - Person (type of LM)
  - SETU (contact location)

Describe LM using a RDF graph

Basic Elements of RDF

To make these statements *machine-proccessable* two things are needed:

- a system of *machine-processable* identifiers (for subjects, predicates and objects) without any possibilty of confusion between similar looking identifiers

Uniform Resource Identifiers (URI) allow to identify and uniquely name things - even if they have no network-accessible location.

- a *machine-processable* language for representing these statements and exchanging them between machines

RDF defines a XML markup language, named RDF/XML, which allows to represent RDF statements.

Rule of thumb:

Knowledge (or information) is expressed as a statement in the form of subject, predicate, and object, and this order should never be changed.

- We, humans use natural language to communicate
  - Subject-Verb-Object
- Machines communicate using RDF language
  - Subject-Predicate-Object
- Understanding RDF vocabulary
  - Namespaces
    - prefix rdf:, namespace URI: http://www.w3.org/1999/02/22-rdf-syntax-ns#
    - prefix rdfs:, namespace URI: http://www.w3.org/2000/01/rdf-schema#
    - prefix dc:, namespace URI: http://purl.org/dc/elements/1.1/
    - prefix owl:, namespace URI: http://www.w3.org/2002/07/owl#

Standard namespaces

rdf: Indicates identifiers used in RDF. The set of identifiers defined in the standard is quite small and is used to define types and properties in RDF. The global URI for the *rdf* namespace is *http://www.w3.org/1999/02/22-rdf-syntax-ns#*.

rdfs: Indicates identifiers used for the RDF Schema language, RDFS. The scope and semantics of the symbols in this namespace are the topics of future chapters. The global URI for the *rdfs* namespace is *http://www.w3.org/2000/01/rdf-schema#*.

owl: Indicates identifiers used for the Web Ontology Language, OWL. The scope and semantics of the symbols in this namespace are the topics of future chapters. The global URI for the *owl* namespace is *http://www.w3.org/2002/07/owl#*.

RDF Syntax

- There are different RDF syntaxes:
  - **RDF/XML** : RDF/XML is an encoding of RDF in the XML language. This allows RDF to be used with existing XML processing tools.
  - **Turtle** : Terse RDF Triple Language (Turtle) is a text-based syntax for RDF. The file extension used for Turtle text files is ".ttl“

RDF/XML

```
1: <?xml version="1.0"?>
2: <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
            xmlns="http://www.yuchen.net/photography/Camera#">
3:   <SLR rdf:ID="Nikon-D70">
4:      <weight>1.4 lbs</weight>
5:   </SLR>
6: </rdf:RDF>
```

RDF/XML

RDF Document Using `rdf:about`

```
1: <?xml version="1.0"?>
2: <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
            xmlns="http://www.yuchen.net/photography/Camera#">
3:   <SLR rdf:about="http://www.yuchen.net/rdf/NikonD70.rdf#Nikon-
      D70">
4:     <weight>1.4 lbs</weight>
5:   </SLR>
6: </rdf:RDF>
```

RDF/XML

RDF Document Using `rdf:type`

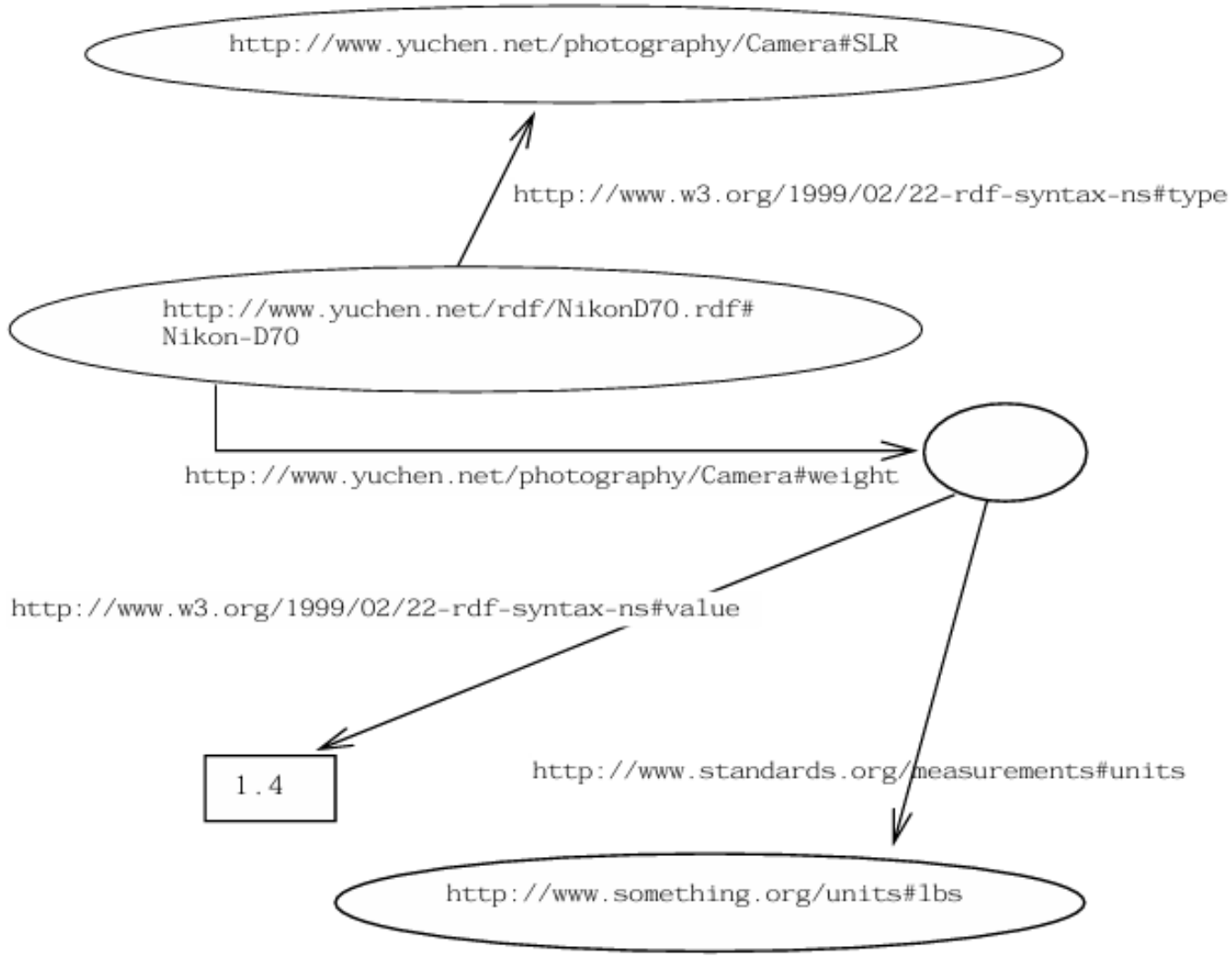
```
1: <?xml version="1.0"?>
2: <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
          xmlns="http://www.yuchen.net/photography/Camera#">
3:    <rdf:Description rdf:about="http://www.yuchen.net/rdf/
            NikonD70.rdf#Nikon-D70">
4:       <rdf:type rdf:resource="http://www.yuchen.net/
               photography/Camera#SLR"/>
5:      <weight>1.4 lbs</weight>
6:   </rdf:Description>
7: </rdf:RDF>
```

RDF/XML

RDF Document Using `rdf:value`

```
1: <?xml version="1.0"?>
2: <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
3:          xmlns:uom="http://www.standards.org/measurements#"
4:          xmlns="http://www.yuchen.net/photography/Camera#">
5:   <rdf:Description rdf:about="http://www.yuchen.net/rdf/
          NikonD70.rdf#Nikon-D70">
6:      <rdf:type rdf:resource="http://www.yuchen.net/photography/
            Camera#SLR"/>
7:      <weight>
8:        <rdf:Description>
9:          <rdf:value>1.4</rdf:value>
10:           <uom:units rdf:resource="http://www.something.org/
                  units#lbs"/>
11:       </rdf:Description>
12:     </weight>
13:   </rdf:Description>
14: </rdf:RDF>
```

RDF/XML


http://www.yuchen.net/photography/Camera#SLR
http://www.w3.org/1999/02/22-rdf-syntax-ns#type
http://www.yuchen.net/rdf/NikonD70.rdf#
Nikon-D70
http://www.yuchen.net/photography/Camera#weight
http://www.w3.org/1999/02/22-rdf-syntax-ns#value
1.4
http://www.standards.org/measurements#units
http://www.something.org/units#lbs

RDF/XML

RDF Document Using `rdf:parseType`

```
1: <?xml version="1.0"?>
2: <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
3:          xmlns:uom="http://www.standards.org/measurements#"
4:          xmlns="http://www.yuchen.net/photography/Camera#">
5:    <rdf:Description rdf:about="http://www.yuchen.net/rdf/
          NikonD70.rdf#Nikon-D70">
6:      <rdf:type rdf:resource="http://www.yuchen.net/photography/
          Camera#SLR"/>
7:        <weight rdf:parseType="Resource">
8:          <rdf:value>1.4</rdf:value>
9:          <uom:units rdf:resource="http://www.something.org/
              units#lbs"/>
10:       </weight>
11:   </rdf:Description>
12: </rdf:RDF>
```

RDF/XML

The Pattern of an RDF Document

```
1:  <rdf:Description rdf:resources="#resource-0">
2:    <someNameSpace:propertyName-0>
3:       <rdf:Description rdf:resource="#resource-1">
4:          <someNameSpace:propertyName-1>
5:             <rdf:Description rdf:resource="#resource-2">
6:                <someNameSpace:propertyName-2>
7:                   ...
8:                </someNameSpace:propertyName-2>
9:             </rdf:Description>
10:         </someNameSpace:propertyName-1>
11:      </rdf:Description>
12:   </someNameSpace:propertyName-0>
13: </rdf:Description>
```

Activity

- Find RDF triples and draw the graph data model (source: https://www.w3schools.com/xml/xml_rdf.asp)

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Empire Burlesque">
  <cd:artist>Bob Dylan</cd:artist>
  <cd:country>USA</cd:country>
  <cd:company>Columbia</cd:company>
  <cd:price>10.90</cd:price>
  <cd:year>1985</cd:year>
</rdf:Description>

</rdf:RDF>
```

RDF/XML

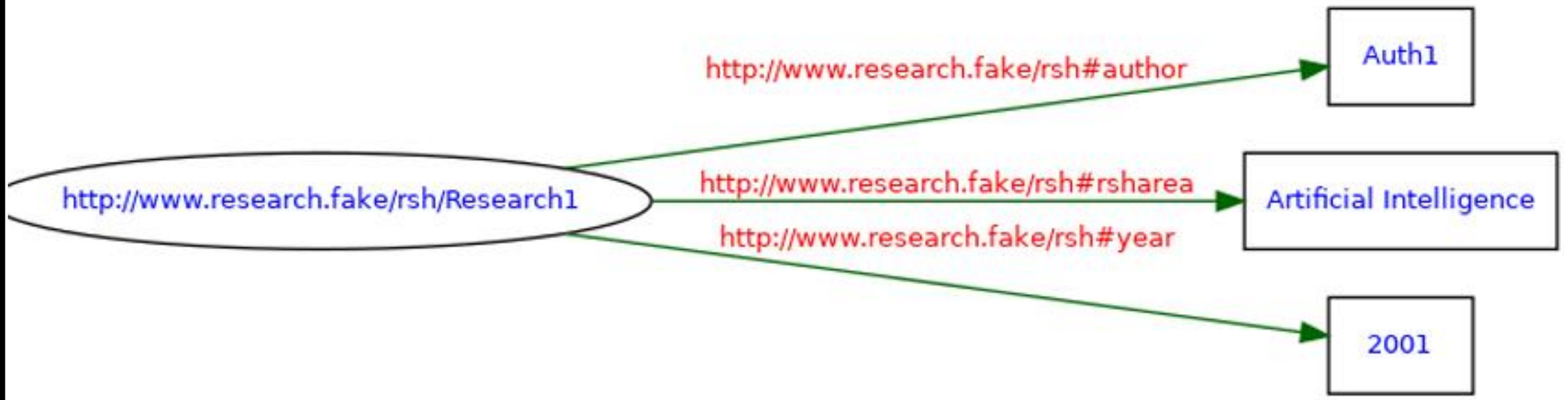
Convert below data into RDF triples and validate them using https://www.w3.org/RDF/Validator/

Paper title	Authors	Research area	Publication year
Research1	Auth1	AI	2001
Research2	Auth2	ML	2002
Research3	Auth3	WEB	2004

Construct RDF graph models. How do you merge them?

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-
ns#"
xmlns:rsh="http://www.research.fake/rsh#">
<rdf:Description
rdf:about="http://www.research.fake/rsh/Research1">
<rsh:author>Auth1</rsh:author>
<rsh:rsharea>Artificial Intelligence</rsh:rsharea>
<rsh:year>2001</rsh:year>
</rdf:Description>
</rdf:RDF>
```

raph of the data model



Q & A