



# *Rückblick*

- HTML
  - Auszeichnung, vorgegeben
- XML, XHTML, SGML
  - Auszeichnung, eigene
- RDF, OWL
  - Auszeichnung, inhaltliche Einordnung

# ***RDF-Model***

- ***RDF-Konzept*** (Tripel)
- ***RDF-Graph***
- ***RDF-Syntax***
- ***RDF-Schema***

# *RDF-Konzept*

- Resources
- Properties
- Values
- Subjekte
- Prädikate
- Objekte

Statements

Sätze



# ***Basistypen***

## ***Ressource:***

- komplexe, abstrakte oder konkrete Entität
- eindeutig durch URI charakterisiert (global)

## ***Literal:***

- Datentyp (definiert, undefiniert)

## ***Blank Node:***

- Anonyme Ressource (ohne Bezeichner, URI)
- nur innerhalb der Definition einer Ressource eindeutig

# Subjekte

- Beispiele:
  - Web-Seiten
  - Teile von Web-Seiten (HTML-/ XML-Element)
  - Sammlungen von Web-Seiten
- Typen:
  - Resource
  - Blank Node

# Prädikate

- Beispiele:
  - „Specific **aspect**,
  - **characteristic**,
  - **attribute**, or
  - **relation**“
- Typen:
  - Resource

# Objekte

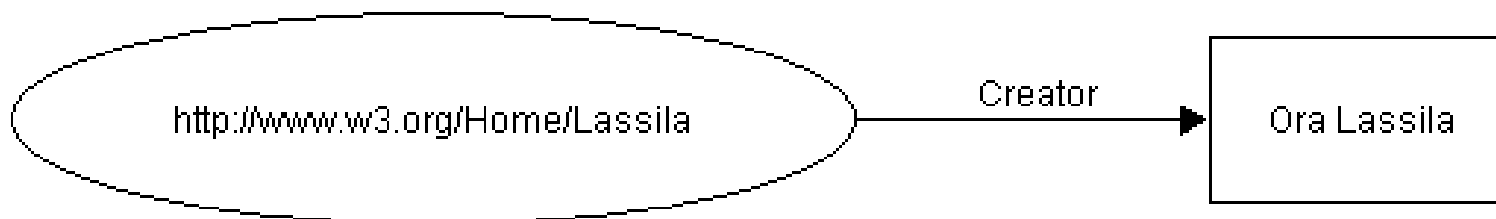
- Typen
  - Resources
  - Blank Nodes
  - Literals



# ***RDF-Syntax***

- Tripel
- RDF-Graph
- In XML eingebunden
- Notation 3 (N3), *Tim BernersLee*

# RDF-Graph -Beispiel



- **Subject:** `http://www.w3.org/Home/Lassila`
- **Predicate:** Creator
- **Object:** "Ora Lassila"

# RDF-Syntax (XML) -Beispiel

```
<rdf:RDF>
```

```
  <rdf:Description about="
    http://www.w3.org/Home/Lassila">
```

```
    <s:Creator>Ora Lassila</s:Creator>
```

```
  </rdf:Description>
```

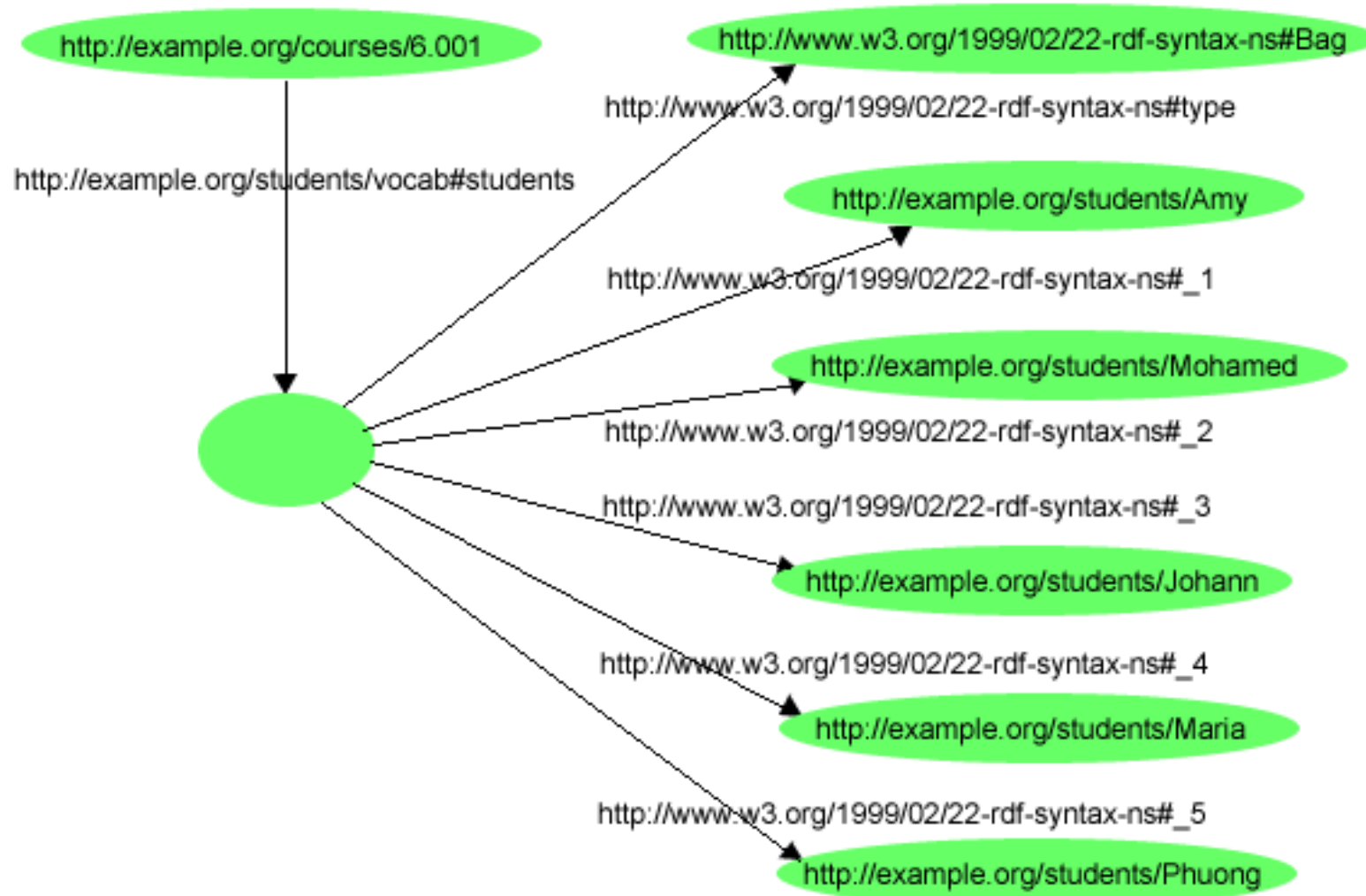
```
</rdf:RDF>
```

# *Container*

- Bag
- Seq (Sequence)
- Alt (Alternative)

# Bag

- a group of part numbers **in which the order of entry or processing of the part numbers does not matter.**



# Bag (2)

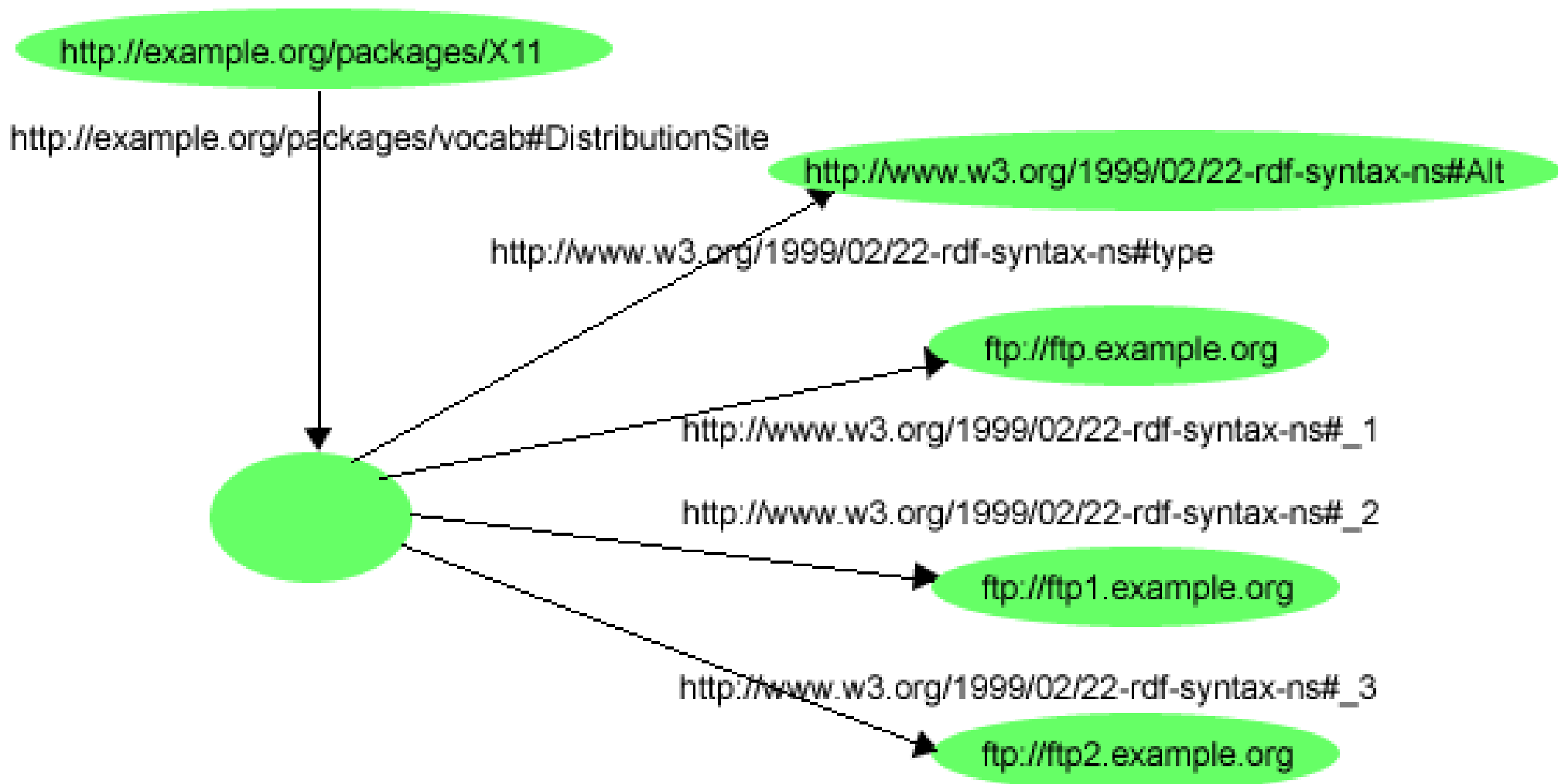
- `<?xml version="1.0"?>`
- `<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:s="http://example.org/students/vocab#">`
- `<rdf:Description rdf:about="http://example.org/courses/6.001">`
- `<s:students>`
- `<rdf:Bag>`
- `<rdf:li rdf:resource="http://example.org/students/Amy"/>`
- `<rdf:li rdf:resource="http://example.org/students/Mohamed"/>`
- `<rdf:li rdf:resource="http://example.org/students/Johann"/>`
- `<rdf:li rdf:resource="http://example.org/students/Maria"/>`
- `<rdf:li rdf:resource="http://example.org/students/Phuong"/>`
- `</rdf:Bag>`
- `</s:students>`
- `</rdf:Description>`
- `</rdf:RDF>`

# Seq (Sequence)

- **a group** of resources or literals, possibly including duplicate members, **where the order of the members is significant**

# Alt (Alternative)

- a **group of** resources or *literals* that are **alternatives** (typically for a single value of a property)





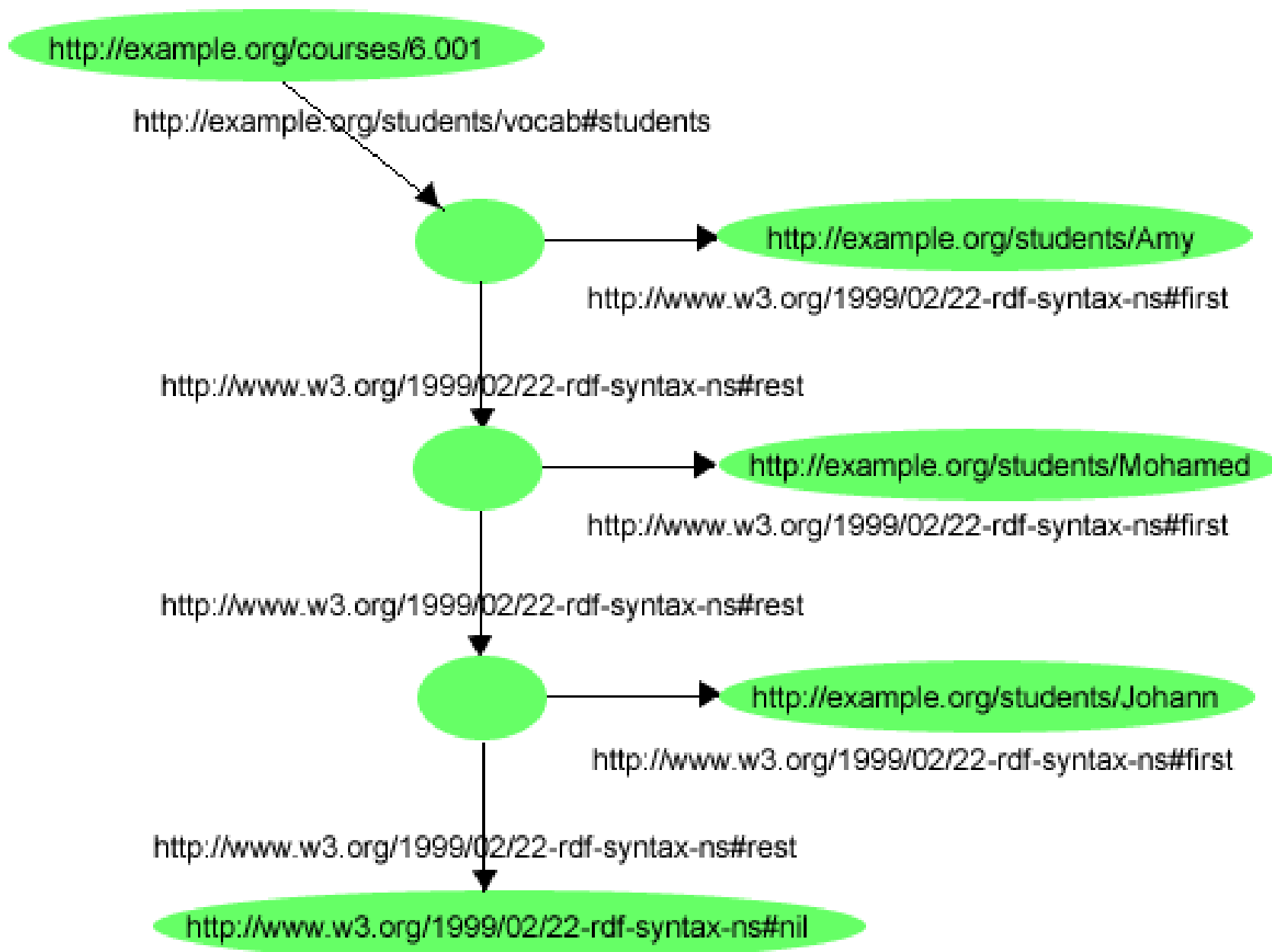
# Alt (2)

- `<?xml version="1.0"?>`
- `<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:s="http://example.org/packages/vocab#">`
- 
- `<rdf:Description rdf:about="http://example.org/packages/X11">`
- `<s:DistributionSite>`
- `<rdf:Alt>`
- `<rdf:li rdf:resource="ftp://ftp.example.org"/>`
- `<rdf:li rdf:resource="ftp://ftp1.example.org"/>`
- `<rdf:li rdf:resource="ftp://ftp2.example.org"/>`
- `</rdf:Alt>`
- `</s:DistributionSite>`
- `</rdf:Description>`
- `</rdf:RDF>`

# *RDF Collections*

- An RDF collection is a group of things **represented as a *list structure*** in the RDF graph.
- This list structure is constructed using a predefined collection vocabulary consisting of
  - the predefined type ***rdf:List***,
  - the predefined properties ***rdf:first***
  - and ***rdf:rest***, and
  - the predefined resource ***rdf:nil***.

# RDF Collections (2)



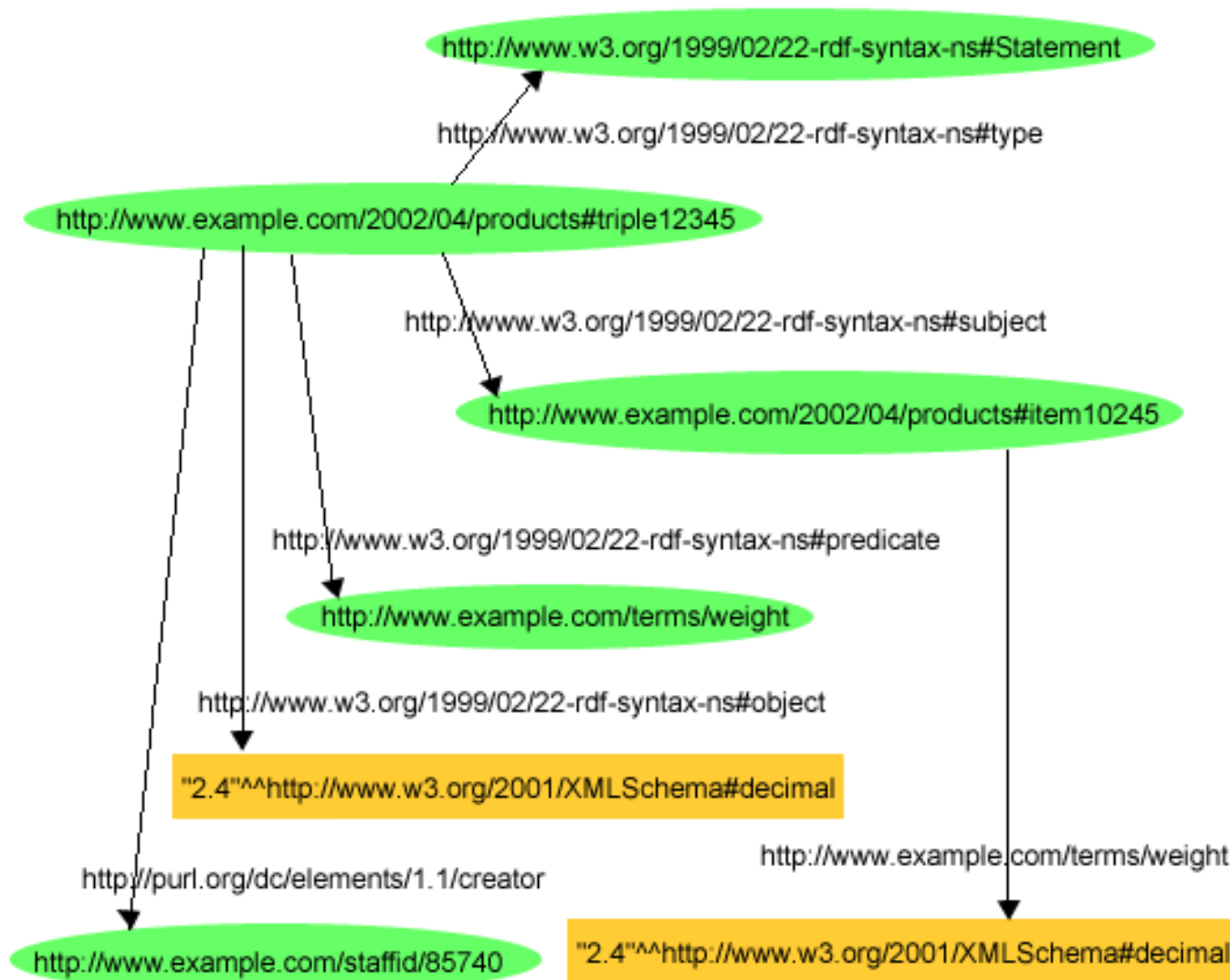
# RDF Collections (3)

- `<?xml version="1.0"?>`
- `<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:s="http://example.org/students/vocab#">`
- 
- `<rdf:Description rdf:about="http://example.org/courses/6.001">`
- `<s:students rdf:parseType="Collection">`
- `<rdf:Description rdf:about="http://example.org/students/Amy"/>`
- `<rdf:Description rdf:about="http://example.org/students/Mohamed"/>`
- `<rdf:Description rdf:about="http://example.org/students/Johann"/>`
- `</s:students>`
- `</rdf:Description>`
- `</rdf:RDF>`

# RDF Collections (4)

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:s="http://example.org/students/vocab#">
  <rdf:Description rdf:about="http://example.org/courses/6.001">
    <s:students rdf:nodeID="sch1"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="sch1">
    <rdf:first rdf:resource="http://example.org/students/Amy"/>
    <rdf:rest rdf:nodeID="sch2"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="sch2">
    <rdf:first rdf:resource="http://example.org/students/Mohamed"/>
    <rdf:rest rdf:nodeID="sch3"/>
  </rdf:Description>
  <rdf:Description rdf:nodeID="sch3">
    <rdf:first rdf:resource="http://example.org/students/Johann"/>
    <rdf:rest rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#nil"/>
  </rdf:Description>
</rdf:RDF>
```

# Reification

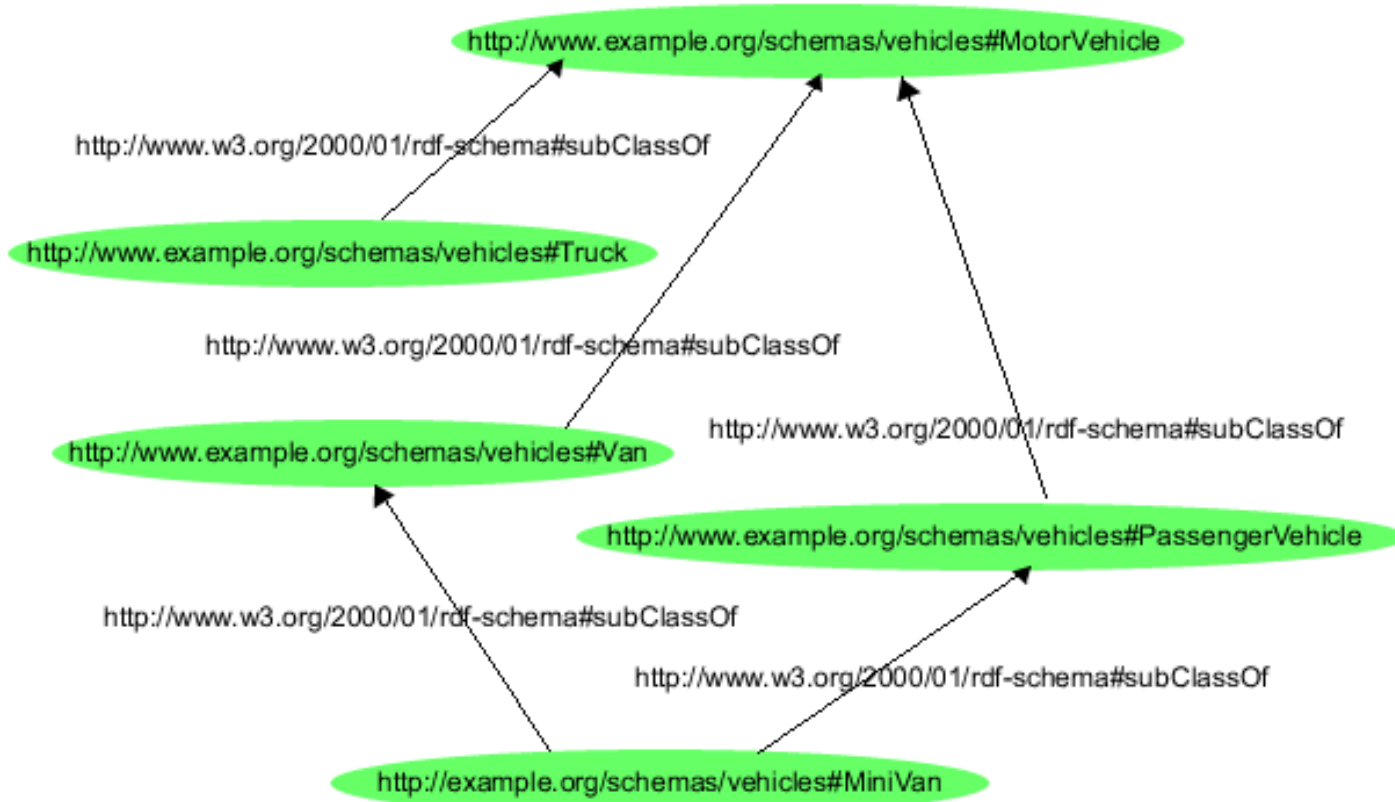


exproducts:triple12345	rdf:type	rdf:Statement .
exproducts:triple12345	rdf:subject	exproducts:item10245 .
exproducts:triple12345	rdf:predicate	exterms:weight .
exproducts:triple12345	rdf:object	"2.4"^^xsd:decimal .
exproducts:triple12345	dc:creator	exstaff:85740 .

# ***RDFS (RDF Schema)***

- Types
- Classes
  - Subclasses
- Properties
  - Subproperties

# Classes - Beispiel



ex:MotorVehicle  
 ex:PassengerVehicle  
 ex:Van  
 ex:Truck  
 ex:MiniVan

rdf:type  
 rdf:type  
 rdf:type  
 rdf:type  
 rdf:type

rdfs:Class .  
 rdfs:Class .  
 rdfs:Class .  
 rdfs:Class .  
 rdfs:Class .

ex:PassengerVehicle  
 ex:Van  
 ex:Truck

rdfs:subClassOf  
 rdfs:subClassOf  
 rdfs:subClassOf

ex:MotorVehicle .  
 ex:MotorVehicle .  
 ex:MotorVehicle .

ex:MiniVan  
 ex:MiniVan

rdfs:subClassOf  
 rdfs:subClassOf

ex:Van .  
 ex:PassengerVehicle .



# RDF-Syntax in XML

- [1] **RDF** ::= ['<rdf:RDF>'] description\* ['</rdf:RDF>']
- [2] **description** ::= '<rdf:Description' idAboutAttr? '>'  
 propertyElt\* '</rdf:Description>'
- [3] **idAboutAttr** ::= idAttr | aboutAttr
- [4] **aboutAttr** ::= 'about=' URI-reference '''
- [5] **idAttr** ::= 'ID=' IDsymbol '''
- [6] **propertyElt** ::= '< propName '>' value '</ propName '>'  
 | '< propName resourceAttr '/>'
- [7] **propName** ::= QName
- [8] **value** ::= description | string
- [9] **resourceAttr** ::= 'resource=' URI-reference '''
- [10] **Qname** ::= [ NSprefix ':' ] name
- [11] **URI-reference** ::= string, interpreted per [URI]
- [12] **IDsymbol** ::= (any legal XML name symbol)
- [13] **name** ::= (any legal XML name symbol)
- [14] **NSprefix** ::= (any legal XML namespace prefix)
- [15] **string** ::= (any XML text, with "<", ">", and "&"  
 escaped)

# *Notation 3 (N3) -Ziele*

- to optimize expression of ***data and logic in the same language***,
- to allow RDF to be expressed,
- to allow ***rules to be integrated*** smoothly with RDF,
- to allow ***quoting*** so that ***statements about statements*** can be made, and
- to be as ***readable, natural, and symmetrical*** as possible.

# Notation 3 (N3) -Features

- **URI abbreviation using prefixes** which are bound to a namespace (using @prefix) a bit like in XML,
- Repetition of **another object** for the **same subject** and predicate using a comma ","
- Repetition of **another predicate** for the **same subject** using a semicolon ";"
- **Bnode syntax** with a certain properties just put the properties between [ and ]
- **Formulae** allowing N3 graphs to be quoted within N3 graphs using { and }
- **Variables** and **quantification** to allow rules, etc to be expressed
- A simple and **consistent grammar**.

# *RDF Query*

- W3C:
  - SPARQL Query Language

# Quellen

- Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer", MIT Press , 2004 , Kapitel 3
- <http://www.w3.org/TR/rdf-primer/>
- <http://www.w3.org/TR/2003/WD-rdf-primer-20031010/>
- <http://www.w3.org/TR/1999/REC-rdf-syntax-19990222/>
- <http://www.w3.org/DesignIssues/Notation3.html>
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