

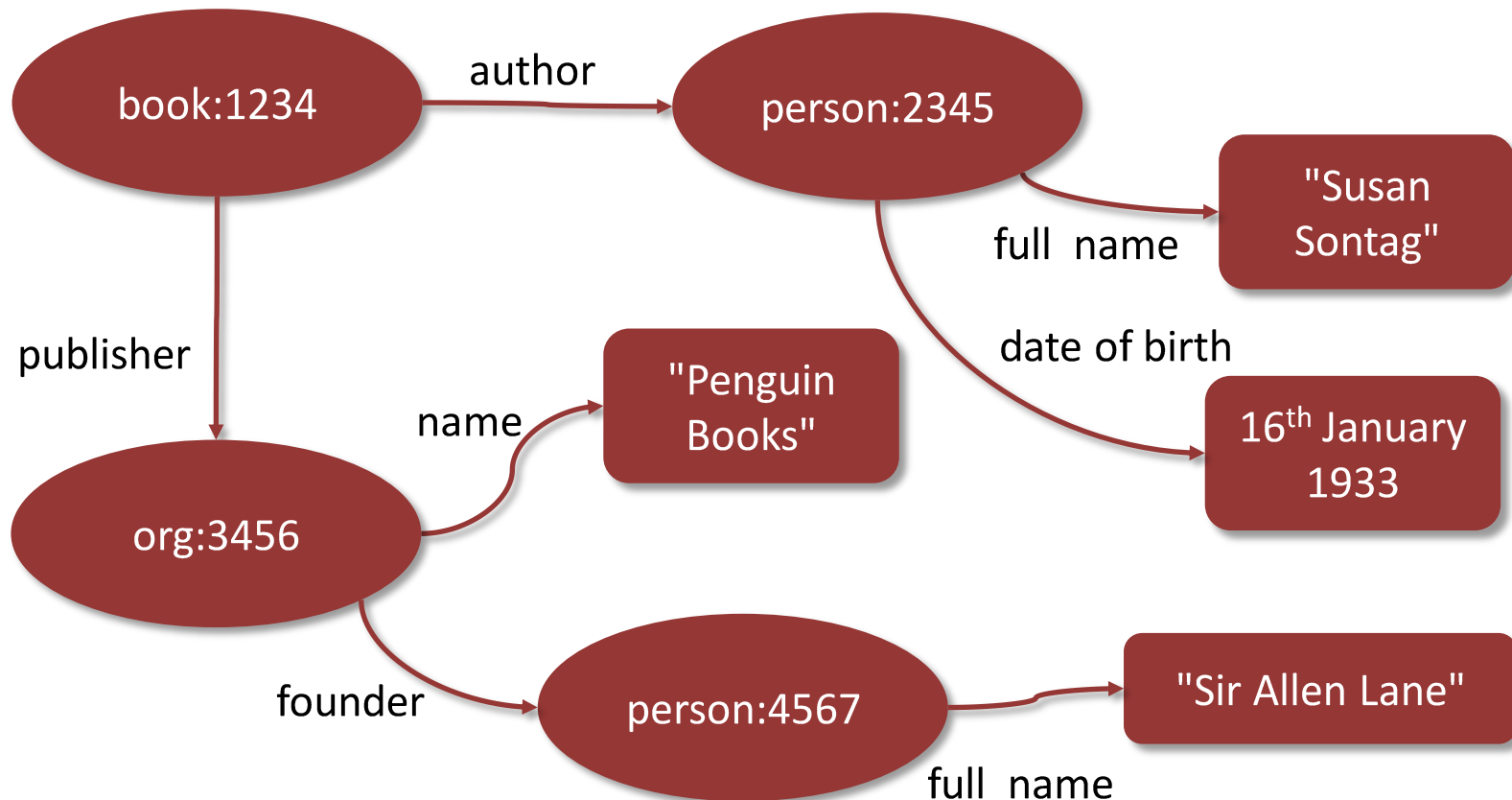
Introduction to linked data

Introducing Turtle



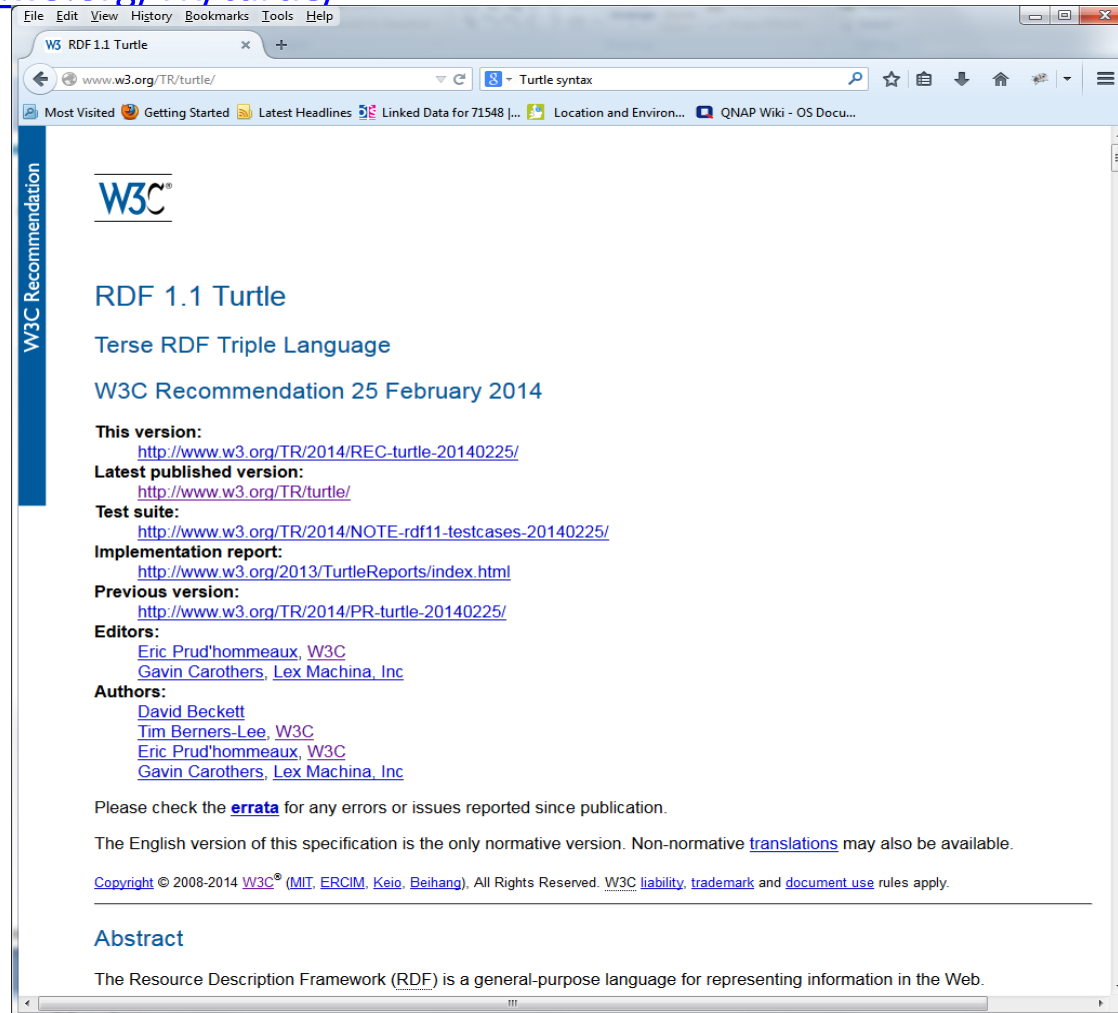
Useful for Diagrams...

... but not so useful for data exchange




Terse RDF Triple Language

<http://www.w3.org/TR/turtle/>



The screenshot shows a web browser window with the address bar set to www.w3.org/TR/turtle/. The page content includes the W3C logo, the title "RDF 1.1 Turtle", and the subtitle "Terse RDF Triple Language". It also displays the date "W3C Recommendation 25 February 2014" and a list of links for "This version", "Latest published version", "Test suite", "Implementation report", and "Previous version". The "Editors" and "Authors" sections list names and affiliations. A footer contains copyright information and a link to the abstract.

W3C Recommendation



RDF 1.1 Turtle

Terse RDF Triple Language

W3C Recommendation 25 February 2014

This version:
<http://www.w3.org/TR/2014/REC-turtle-20140225/>

Latest published version:
<http://www.w3.org/TR/turtle/>

Test suite:
<http://www.w3.org/TR/2014/NOTE-rdf11-testcases-20140225/>

Implementation report:
<http://www.w3.org/2013/TurtleReports/index.html>

Previous version:
<http://www.w3.org/TR/2014/PR-turtle-20140225/>

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Please check the [errata](#) for any errors or issues reported since publication.

The English version of this specification is the only normative version. Non-normative [translations](#) may also be available.

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Abstract

The Resource Description Framework (RDF) is a general-purpose language for representing information in the Web.

Simple Statement



Prefixing:

Turtle

```
@prefix book: <http://example.org/book/> .
```

SPARQL

```
prefix book: <http://example.org/book/>
```

```
@prefix book: <http://example.org/book/> .
@prefix person: <http://example.org/person/> .
@prefix terms: <http://example.org/terms/> .

book:1234 terms:author person:2345 .
```

RDF Node Types

- URI Nodes

`book:1234`

- Blank Nodes

`_:bnodeId`

- Literal Nodes

- Plain/Untagged/Untyped

`"Susan Sontag"` or `"1234"`

- Language Tagged

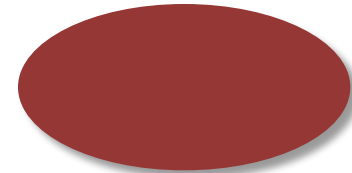
`"Susan Sontag"@en`

- Datatype (XML Schema Data Types)

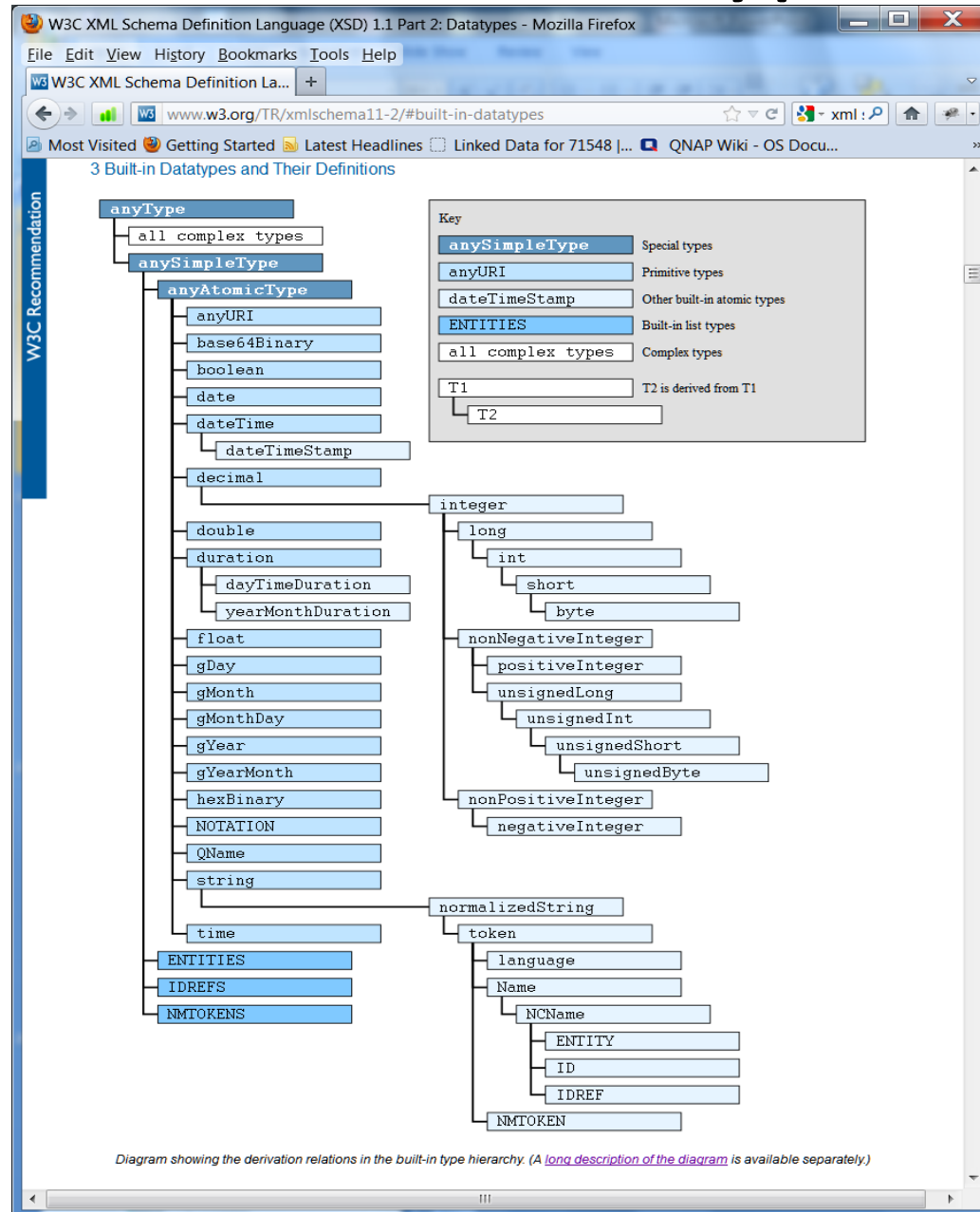
`20` or `"20"^^xsd:integer`

`20.0` or `"20.0"^^xsd:decimal`

`"2012-08-01"^^xsd:date`

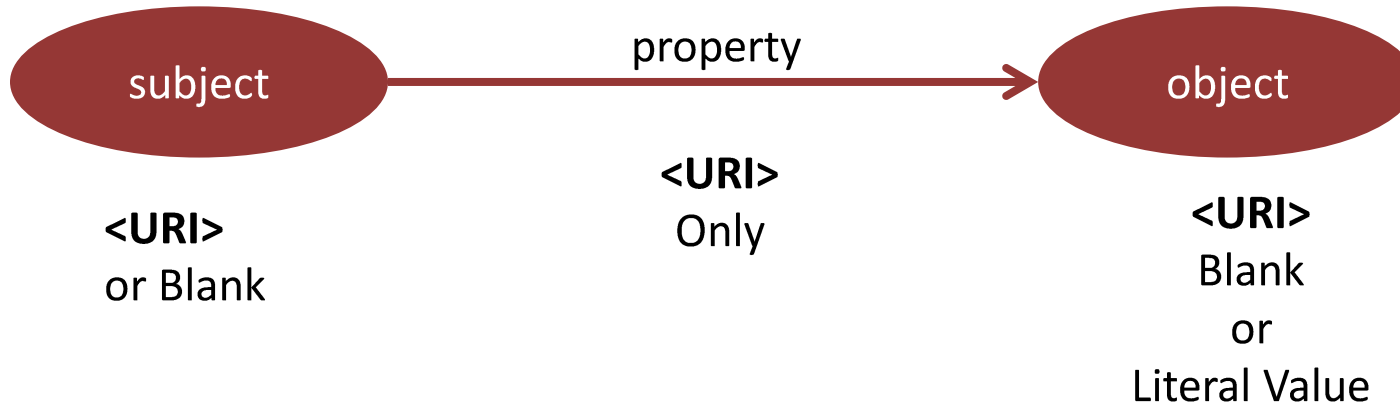


XML Schema Built-in Datatypes



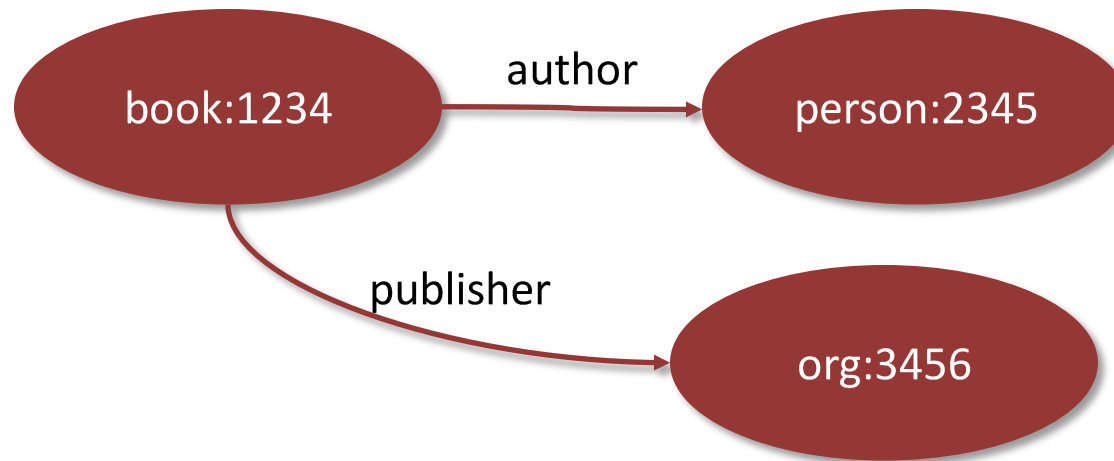
RDF: Statements

Three part sentence... hence 'triple'



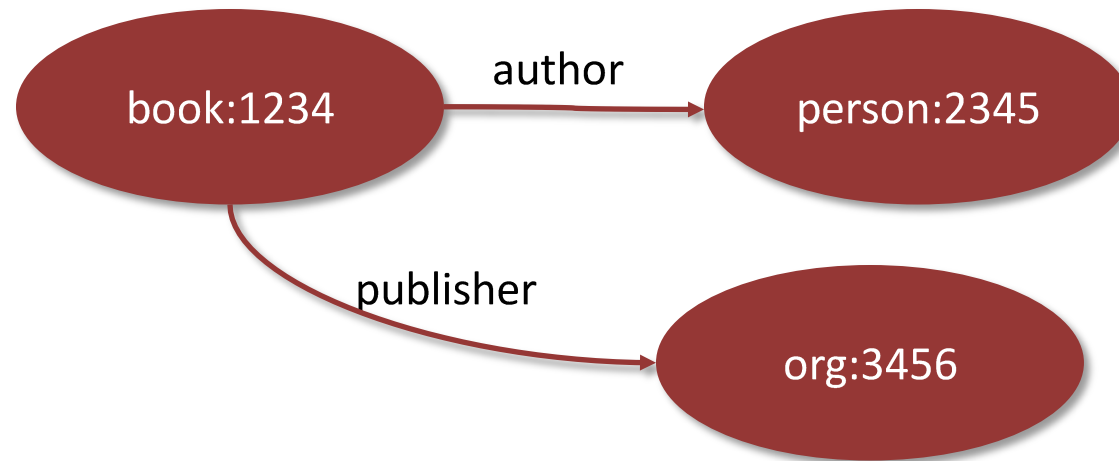
- URIs (web addresses) are the words used in RDF 'statements' (s p o)
- The Web acts as Dictionary to look up the definitions of 'words'.
- Word definitions are just more statements.
- Stable, persistent URI for terms and reference item .

More Statements



@prefix	book:	<http://example.org/book/>	.
@prefix	person:	<http://example.org/person/>	.
@prefix	terms:	<http://example.org/terms/>	.
book:1234	terms:author	person:2345	.
book:1234	terms:publisher	org:3456	.

More Statements



@prefix	book:	<http://example.org/book/>	.
@prefix	person:	<http://example.org/person/>	.
@prefix	terms:	<http://example.org/terms/>	.
book:1234	terms:author	person:2345	;
	terms:publisher	org:3456	.

Exercise: Draw in Bubble and Arc

```
@prefix ex:      <http://example.org/> .
@prefix foaf:   <http://xmlns.com/foaf/0.1/> .
@prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs:   <http://www.w3.org/2000/01/rdf-schema#> .

ex:stuart      rdf:type          foaf:Person ;
               ex:employedBy    ex:epimorphics ;
               foaf:knows        ex:tom ;
               foaf:name         "Stuart Williams" ;
               .

ex:tom         rdf:type          foaf:Person .

ex:epimorphics rdf:type          foaf:Organization .

foaf:Person    rdfs:subClassOf  foaf:Agent .

foaf:Organization rdfs:subClassOf foaf:Agent .
```

Turtle

```
@prefix ex: <http://example.org/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .

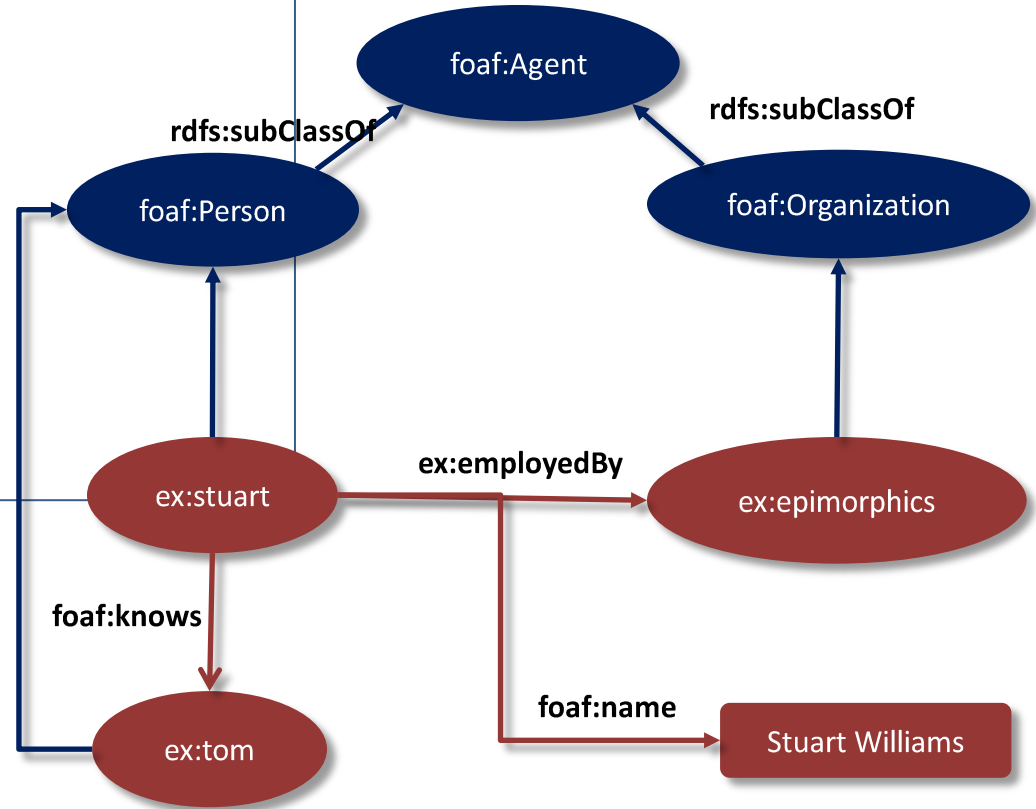
ex:stuart    rdf:type      foaf:Person ;
             ex:employedBy ex:epimorphics ;
             foaf:knows    ex:tom ;
             foaf:name     "Stuart Williams" ;
             .

ex:tom       rdf:type      foaf:Person .

ex:epimorphics rdf:type    foaf:Organization .

foaf:Person   rdfs:subClassOf foaf:Agent .

foaf:Organization rdfs:subClassOf foaf:Agent .
```



Turtle Syntax: Statement Separators

- ; Next statement has the same subject as its predecessor

```
ex:stuart      rdf:type      foaf:Person ;  
                foaf:name    "Stuart Williams" .
```

- ; Next statement has the same subject and property as its predecessor

```
ex:stuart      foaf:knows  ex:tom ,  
                ex:alex ,  
                ex:grant .
```

- Next statement starts with an explicit subject

```
ex:tom          rdf:type      foaf:Person .  
ex:epimorphics rdf:type      foaf:Organization .
```

Turtle Syntax:

URI, Prefixes, and Prefixed Names

- `<{uri}>`
eg. `<http://example.org/station/oxford-circus>`
- **Beware...** in turtle this is a **literal** string **NOT** a **URI node**.
" `http://example.org/station/oxford-circus` "
- **@prefix** `{prefix}: {namespace} .`
eg. `@prefix station: <http://example.org/station/> .`
- `{prefix}:{localName}`
eg: `station:oxford-circus` NB. No angle brackets, no string quotes.
- `station:oxford-circus` and `<http://example.org/station/oxford-circus>` are interchangeable (given an appropriate prefix declaration).

Exercise: Draw a Bubble and Arc for Northwick Park

http://training.epimorphics.com/transport/london-underground/station/northwick_park? view=outgoing

Transport

Linked Data API

Northwick Park
http://training.epimorphics.com/transport/london-underground/station/northwick_park

outgoing connection	
Connection from Northwick Park Metropolitan Line	
on line	Metropolitan Line
to stop	Harrow-on-the-Hill
Connection from Northwick Park Metropolitan Line	
on line	Metropolitan Line
to stop	Preston Road

Viewer

This is the SPARQL query that was generated to pull together the data about the selected item. You can modify it here and re-run the query by clicking on the 'View SPARQL' link for more options at the endpoint's page.

```

@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix metro: <http://training.epimorphics.com/transport/def/metro/> .
@prefix lu-line: <http://training.epimorphics.com/transport/london-underground/line/> .
@prefix api: <http://purl.org/linked-data/api/vocab#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix lu-station: <http://training.epimorphics.com/transport/london-underground/station/> .

lu-station:preston_road
  rdfs:label "Preston Road" .

<http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/preston_road>
  rdfs:label "Connection from Northwick Park to Preston Road along the Metropolitan Line" ;
  metro:onLine lu-line:metropolitan_line ;
  metro:toStop lu-station:preston_road .

lu-line:metropolitan_line
  rdfs:label "Metropolitan Line" .

lu-station:northwick_park
  rdfs:label "Northwick Park" ;
  metro:outgoingConnection <http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/preston_road> , <http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/harrow_on_the_hill> .

<http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/harrow_on_the_hill>
  rdfs:label "Connection from Northwick Park to Harrow-on-the-Hill along the Metropolitan Line" ;
  metro:onLine lu-line:metropolitan_line ;
  metro:toStop lu-station:harrow_on_the_hill .

lu-station:harrow_on_the_hill
  rdfs:label "Harrow-on-the-Hill" .

<http://training.epimorphics.com/transport/london-underground/station/northwick_park.ttl?_view=outgoing>
  a api:Page ;
  api:definition <http://training.epimorphics.com/transport/meta/london-underground/station/_key.ttl?_view=outgoing> ;
  api:extendedMetadataVersion <http://training.epimorphics.com/transport/london-underground/station/northwick_park.ttl?_view=outgoing&metadata=all> ;
  foaf:primaryTopic lu-station:northwick_park .
  
```

```
northwick_park.ttl
1 @prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
2 @prefix foaf: <http://xmlns.com/foaf/0.1/> .
3 @prefix metro: <http://training.epimorphics.com/transport/def/metro/> .
4 @prefix lu-line: <http://training.epimorphics.com/transport/london-underground/line/> .
5 @prefix api: <http://purl.org/linked-data/api/vocab#> .
6 @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
7 @prefix lu-station: <http://training.epimorphics.com/transport/london-underground/station/> .
8
9 lu-station:preston_road
10     rdfs:label "Preston Road" .
11
12 <http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/preston_road>
13     rdfs:label "Connection from Northwick Park to Preston Road along the Metropolitan Line" ;
14     metro:onLine lu-line:metropolitan_line ;
15     metro:toStop lu-station:preston_road .
16
17 lu-line:metropolitan_line
18     rdfs:label "Metropolitan Line" .
19
20 lu-station:northwick_park
21     rdfs:label "Northwick Park" ;
22     metro:outgoingConnection
23     <http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/preston_road> ,
24     <http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/harrow_on_the_hill> .
25
26 <http://training.epimorphics.com/transport/london-underground/connection/metropolitan_line/northwick_park/harrow_on_the_hill>
27     rdfs:label "Connection from Northwick Park to Harrow-on-the-Hill along the Metropolitan Line" ;
28     metro:onLine lu-line:metropolitan_line ;
29     metro:toStop lu-station:harrow_on_the_hill .
30
31 lu-station:harrow_on_the_hill
32     rdfs:label "Harrow-on-the-Hill" .
33
34 <http://training.epimorphics.com/transport/london-underground/station/northwick_park.ttl?_view=outgoing>
35     a api:Page ;
36     api:definition <http://training.epimorphics.com/transport/meta/london-underground/station/_key.ttl?_view=outgoing> ;
37     api:extendedMetadataVersion
38     <http://training.epimorphics.com/transport/london-underground/station/northwick_park.ttl?_view=outgoing&_metadata=all> ;
39     foaf:primaryTopic lu-station:northwick_park .
```





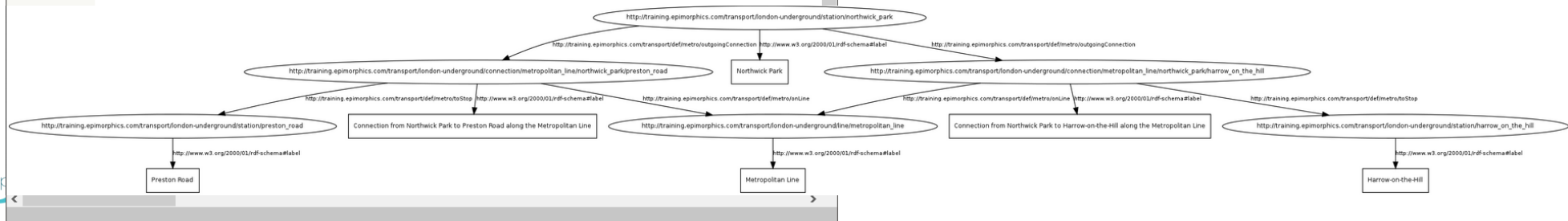
Check you answer using Qclassroom

The screenshot shows the Qclassroom web interface. The browser address bar displays 'training.epimorphics.com/qclassroom'. The page has tabs for 'RDF data editor', 'SPARQL query editor', and 'Prefixes editor'. Under 'EXAMPLE DATASETS', 'SPARQL tutorial' and 'London underground' are visible. The SPARQL query editor contains the following code:

```
1 @prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
2 @prefix foaf: <http://xmlns.com/foaf/0.1/> .
3 @prefix metro: <http://training.epimorphics.com/transport/def/metro/> .
4 @prefix lu-line: <http://training.epimorphics.com/transport/london-underground/line/> .
5 @prefix api: <http://purl.org/linked-data/api/vocab#> .
6 @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
7 @prefix lu-station: <http://training.epimorphics.com/transport/london-underground/station/> .
8
9 lu-station:preston_road
10   rdfs:label "Preston Road" .
11
12 <http://training.epimorphics.com/transport/london-underground/connection/metro:metropolitan_line
13   rdfs:label "Connection from Northwick Park to Preston Road along the Metropolitan Line" ;
14   metro:onLine lu-line:metropolitan_line ;
15   metro:toStop lu-station:preston_road .
16
17 lu-line:metropolitan_line
18   rdfs:label "Metropolitan Line" .
19
20 lu-station:northwick_park
21   rdfs:label "Northwick Park" ;
22   metro:outgoingConnection <http://training.epimorphics.com/transport/london-underground/connection/metro:metropolitan_line
23   > .
24 <http://training.epimorphics.com/transport/london-underground/connection/metro:metropolitan_line
25   rdfs:label "Connection from Northwick Park to Harrow-on-the-Hill along the Metropolitan Line" ;
26   metro:onLine lu-line:metropolitan_line ;
27   metro:toStop lu-station:harrow_on_the_hill .
28
```

Below the editor are buttons for 'clear', 'add known prefixes', 'load', and 'generate diagram'. A status message says 'Store contains 16 triples'.

1. RDF Data Editor
2. Copy/Paste
3.  load
4.  generate diagram



'a' little word...

- `rdf:type` can be written a

`ex:stuart` a `foaf:Person` .

`ex:epimorphics` a `foaf:Organization` .

`u-station:northwick_park`
 a `metro:UndergroundStation` .

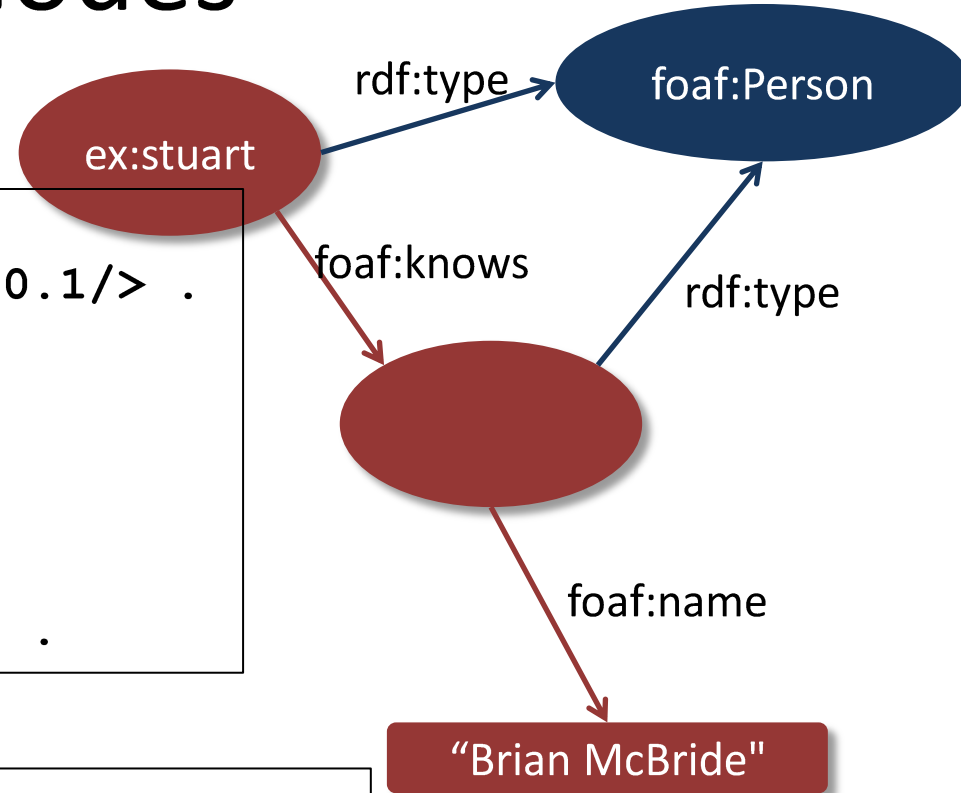
Turtle Syntax: Blank Nodes

Approach #1: bnodeIds: `_{bnodeId}`

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

ex:stuart    a          foaf:Person ;
              foaf:knows _:b1 .

_:b1         a          foaf:Person ;
              foaf:name  "Brian McBride" .
```



Approach #2: in-line bnodes: `[...]`

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

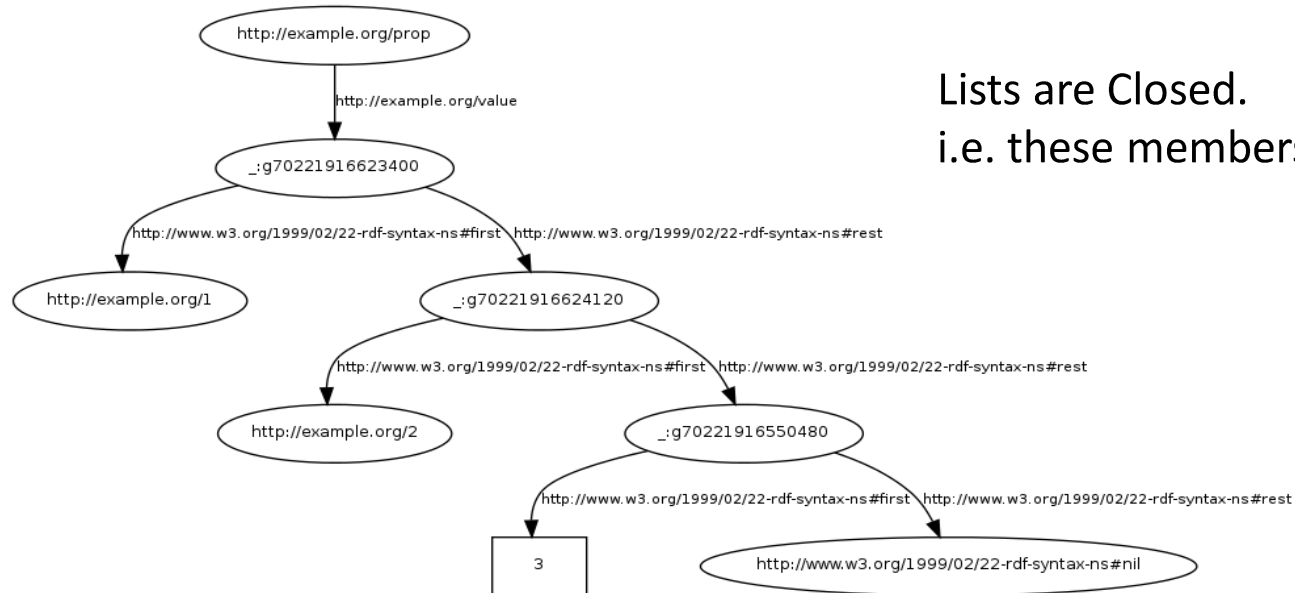
ex:stuart    a          foaf:Person ;
              foaf:knows [
                            a          foaf:Person ;
                            foaf:name  "Brian McBride"
                          ] .
```

NB. NO full-stop

Turtle Syntax: Lists

```
@base      <http://example.org/> .  
@prefix ex: <http://example.org/> .  
  
ex:prop ex:value ( <1> <2> 3 ) .
```

<http://training.epimorphics.com/qclassroom>



Questions?



www.epimorphics.com