Inference Rules

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Inference Rules

```
IF A THEN B

A => B
```

Inference Rules (1)

```
grandParent(?x, ?z) :-

    parent(?x, ?y) & parent(?y ?z)



parent(John, Mary)

parent(Mary, James)

=> grandParent(John, James)
```

Inference Rules (2)

```
?y ?q ?x :-

     ?p owl:inverseOf ?q &

     ?x ?p ?y
```

Inference Rules (3)

```
?x rdf:type ex:Adult :-

    ?x a ex:Person &

    ?x ex:age ?age &

    ?age >= 18
```

SPARQL Construct-Where Rules

```
PAT1 :- PAT2
```

```
construct { PAT1 }

where { PAT2 }
```

Construct-where Inference Rules

```
construct { ?x a ex:Adult }
where {
  ?x a ex:Person .
  ?x ex:age ?age .
  filter(?age >= 18)
}
```

Construct-where Inference Rules

1. Compute SPARQL query on *where* clause
2. For each query result:

   - instantiate *construct* template with result bindings

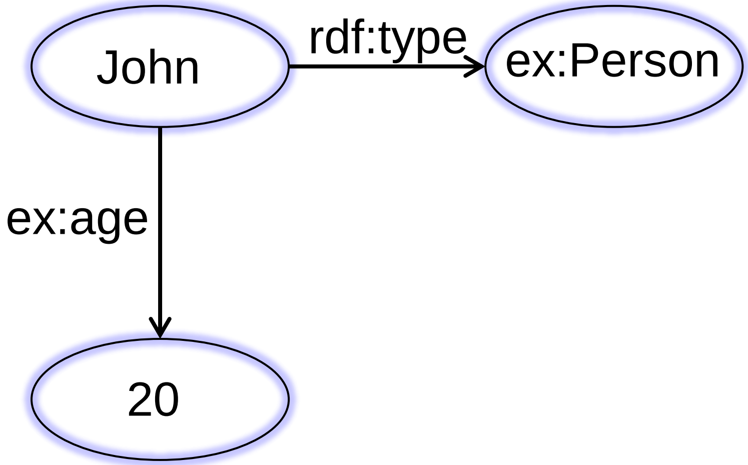
   - insert triples into graph

Construct-where Inference Rules

```
construct {
  ?x a ex:Adult
}
where {
   ?x a ex:Person .
   ?x ex:age ?age .
   filter(?age >= 18)
   }
```

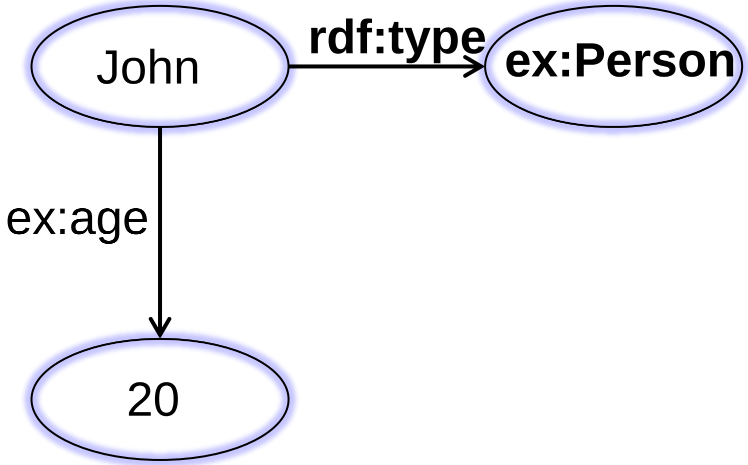
Construct-where Inference Rules

```
construct {
   ?x a ex:Adult
}
where {
    ?x a ex:Person .
    ?x ex:age ?age .
    filter(?age >= 18)
    }
```



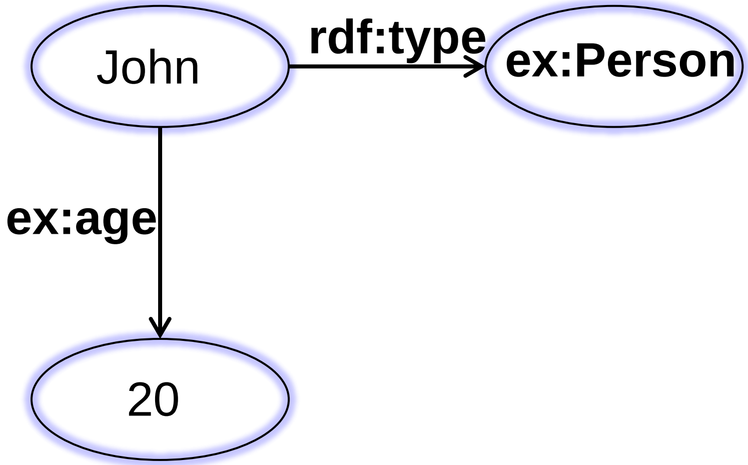
Construct-where Inference Rules

```
construct {
  ?x a ex:Adult
}
where {
   ?x a ex:Person .
   ?x ex:age ?age .
   filter(?age >= 18)
   }
```



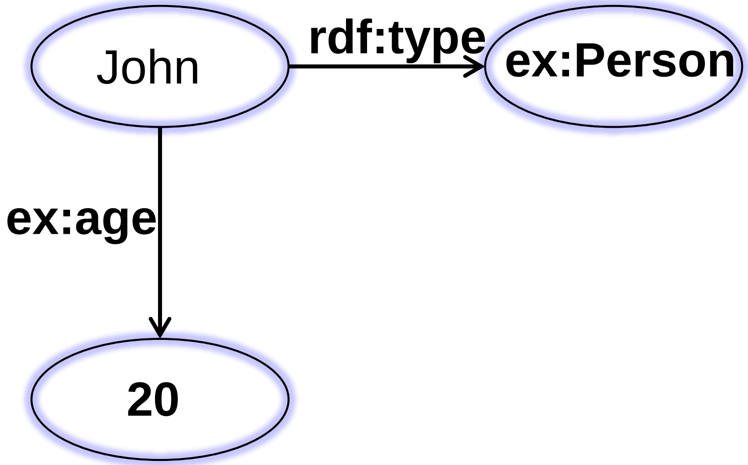
Construct-where Inference Rules

```
construct {
  ?x a ex:Adult
}
where {
   ?x a ex:Person .
   ?x ex:age ?age .
   filter(?age >= 18)
   }
```



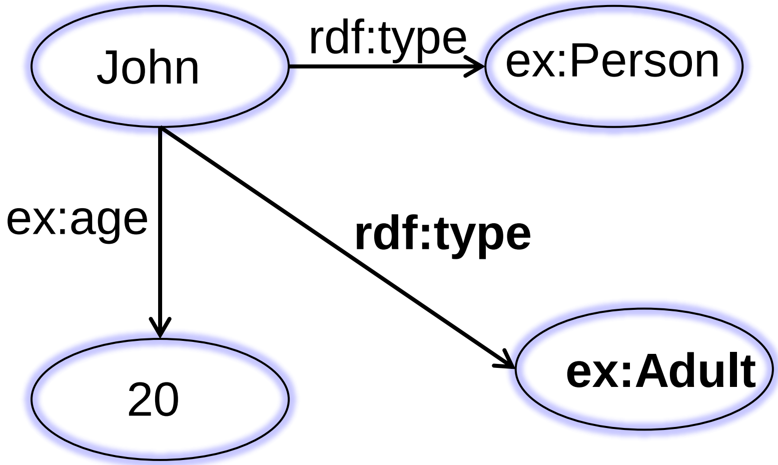
Construct-where Inference Rules

```
construct {
  ?x a ex:Adult
}
where {
   ?x a ex:Person .
   ?x ex:age ?age .
   filter(?age >= 18)
   }
```



Construct-where Inference Rules

```
construct {
  **?x a ex:Adult**
}
where {
   ?x a ex:Person .
   ?x ex:age ?age .
   filter(?age >= 18)
   }
```



Construct-where Inference Rules

Entailments are processed until **saturation**

- Loop on all Rules
- Untill nothing new is deduced

Construct-where Inference Rules

Inferences stored in named graph kg:rule

Retrieve inferences:

```
select *
from kg:rule
where {
  ?x ?p ?y
}
```

Example: Symmetry

```
construct {
   ?y ?p ?x
}
where {
   ?p a owl:SymmetricProperty
   ?x ?p ?y
}
```

Example: Transitivity

```
construct {
  ?x ?p ?z
}
where {
  ?p rdf:type owl:TransitiveProperty
  ?x ?p ?y
  ?y ?p ?z
}
```

Exercise

Rules for rdfs:domain, rdfs:subPropertyOf

Example: domain

```
construct {

   ?x rdf:type ?d

}

where {

   ?p rdfs:domain ?d

   ?x ?p ?y

}
```

Example: subPropertyOf

```
construct {
   ?x ?q ?y
}
where {
   ?p rdfs:subPropertyOf ?q
   ?x ?p ?y
}
```

RDF/XML Rule Syntax

```
<rule>
<body>

prefix h: <http://www.inria.fr/2007/09/11/humans.rdfs#>
construct {
   ?f h:hasSpouse ?x
}
where {
   ?x h:hasSpouse ?f
}

</body>
</rule>
```

RDF/XML Rule Syntax

```
<rule>
<body>

prefix h: <http://www.inria.fr/2007/09/11/humans.rdfs#>
construct {
   ?f h:hasSpouse ?x
}
where {
   ?x h:hasSpouse ?f
}

</body>
</rule>
```

RDF/XML Rule Syntax

```
<rule>
<body>
<![CDATA[
prefix h: <http://www.inria.fr/2007/09/11/humans.rdfs#>
construct {
  ?f h:hasSpouse ?x
}
where {
  ?x h:hasSpouse ?f
}
]]>
</body>
</rule>
```

RDF/XML Rule Syntax

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE rdf:RDF [
<!ENTITY rdf   "http://www.w3.org/1999/02/22-rdf-syntax-ns#">
<!ENTITY rdfs  "http://www.w3.org/2000/01/rdf-schema#">
<!ENTITY rul   "http://ns.inria.fr/edelweiss/2011/rule#">
]>

<rdf:RDF xmlns:rdfs="&rdfs;" xmlns:rdf="&rdf;"  xmlns = '&rul;' >

<rule>
   <body>
       construct {} where {}
   </body>
</rule>

</rdf:RDF>
```