



SPARQL By Example: The Cheat Sheet

Accompanies slides at:

<http://www.cambridgesemantics.com/semantic-university/sparql-by-example>

Comments & questions to:

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Conventions

Red text means:

“This is a core part of the SPARQL syntax or language.”

Blue text means:

“This is an example of query-specific text or values that might go into a SPARQL query.”

Nuts & Bolts

URIs

Write full URIs:

```
<http://this.is.a/full/URI/written#out>
```

Abbreviate URIs with prefixes:

```
PREFIX foo: <http://this.is.a/URI/prefix#>
```

```
... foo:bar ...
```

```
⇒ http://this.is.a/URI/prefix#bar
```

Shortcuts:

```
a ⇒ rdf:type
```

Literals

Plain literals:

```
"a plain literal"
```

Plain literal with language tag:

```
"bonjour"@fr
```

Typed literal:

```
"13"^^xsd:integer
```

Shortcuts:

```
true ⇒ "true"^^xsd:boolean
```

```
3 ⇒ "3"^^xsd:integer
```

```
4.2 ⇒ "4.2"^^xsd:decimal
```

Variables

Variables:

```
?var1, ?anotherVar, ?and_one_more
```

Comments

Comments:

```
# Comments start with a '#' and  
# continue to the end of the line
```

Triple

Patterns

```
ex:myWidget ex:partNumber "XY24Z1" .
```

Match an exact RDF triple:

```
?person foaf:name "Lee Feigenbaum" .
```

Match one variable:

```
conf:SemTech2009 ?property ?value .
```

Match multiple variables:

Common Prefixes

| prefix... | ...stands for |
|-----------|---|
| rdf: | http://xmlns.com/foaf/0.1/ |
| rdfs: | http://www.w3.org/2000/01/rdf-schema# |
| owl: | http://www.w3.org/2002/07/owl# |
| xsd: | http://www.w3.org/2001/XMLSchema# |
| dc: | http://purl.org/dc/elements/1.1/ |
| foaf: | http://xmlns.com/foaf/0.1/ |

More common prefixes at <http://prefix.cc>

Anatomy of a Query

Declare prefix shortcuts
(*optional*)

→ {
 PREFIX foo: <...>
 PREFIX bar: <...>
}

Define the dataset (*optional*)

...
SELECT ... ← Query result clause
 FROM <...>
 FROM NAMED <...>
 WHERE {
 ...
 } ← Query pattern

Query modifiers
(*optional*)

{
 GROUP BY ...
 HAVING ...
 ORDER BY ...
 LIMIT ...
 OFFSET ...
 VALUES ...
}

4 Types of SPARQL Queries

SELECT queries

Project out specific variables and expressions:

```
SELECT ?c ?cap (1000 * ?people AS ?pop)
```

Project out all variables:

```
SELECT *
```

Project out distinct combinations only:

```
SELECT DISTINCT ?country
```

Results in a table of values (in [XML](#) or [JSON](#)):

| ?c | ?cap | ?pop |
|-----------|-----------|------------|
| ex:France | ex:Paris | 63,500,000 |
| ex:Canada | ex:Ottawa | 32,900,000 |
| ex:Italy | ex:Rome | 58,900,000 |

CONSTRUCT queries

Construct RDF triples/graphs:

```
CONSTRUCT {  
  ?country a ex:HolidayDestination ;  
  ex:arrive_at ?capital ;  
  ex:population ?population .  
}
```

Results in RDF triples (in any RDF serialization):

```
ex:France a ex:HolidayDestination ;  
ex:arrive_at ex:Paris ;  
ex:population 635000000 .  
ex:Canada a ex:HolidayDestination ;  
ex:arrive_at ex:Ottawa ;  
ex:population 329000000 .
```

ASK queries

Ask whether or not there are any matches:

```
ASK
```

Result is either “true” or “false” (in [XML](#) or [JSON](#)):

```
true, false
```

DESCRIBE queries

Describe the resources matched by the given variables:

```
DESCRIBE ?country
```

Result is RDF triples (in any RDF serialization) :

```
ex:France a geo:Country ;  
ex:continent geo:Europe ;  
ex:flag <http://.../flag-france.png> ;  
...
```

Combining SPARQL Graph Patterns

Consider **A** and **B** as graph patterns.

A Basic Graph Pattern – one or more triple patterns

A . **B**

⇒ Conjunction. Join together the results of solving A and B by matching the values of any variables in common.

Optional Graph Patterns

A **OPTIONAL** { **B** }

⇒ Left join. Join together the results of solving A and B by matching the values of any variables in common, if possible. Keep all solutions from A whether or not there's a matching solution in B

Combining SPARQL Graph Patterns

Consider **A** and **B** as graph patterns.

Either-or Graph Patterns

{ A } UNION { B }

⇒ Disjunction. Include both the results of solving A and the results of solving B.

“Subtracted” Graph Patterns (SPARQL 1.1)

A MINUS { B }

⇒ Negation. Solve A. Solve B. Include only those results from solving A that are *not compatible* with any of the results from B.

SPARQL Subqueries (*SPARQL 1.1*)

Consider **A** and **B** as graph patterns.

```
A .  
{  
  SELECT ...  
  WHERE {  
    B  
  }  
}  
C .
```

⇒ Join the results of the subquery with the results of solving A and C.

SPARQL Filters

- SPARQL **FILTER**s eliminate solutions that do not cause an expression to evaluate to true.
- Place **FILTER**s in a query inline within a basic graph pattern


A . **B** . **FILTER** (...expr...)

| Category | Functions / Operators | Examples |
|-------------------------------------|--|--|
| Logical & Comparisons | !, &&, , =, !=, <, <=, >, >=, IN, NOT IN | <code>?hasPermit ?age < 25</code> |
| Conditionals <i>(SPARQL 1.1)</i> | EXISTS, NOT EXISTS, IF, COALESCE | <code>NOT EXISTS { ?p foaf:mbox ?email }</code> |
| Math | +, -, *, /, abs, round, ceil, floor, RAND | <code>?decimal * 10 > ?minPercent</code> |
| Strings <i>(SPARQL 1.1)</i> | STRLEN, SUBSTR, UCASE, LCASE, STRSTARTS, CONCAT, STRENDS, CONTAINS, STRBEFORE, STRAFTER | <code>STRLEN(?description) < 255</code> |
| Date/time <i>(SPARQL 1.1)</i> | now, year, month, day, hours, minutes, seconds, timezone, tz | <code>month(now()) < 4</code> |
| SPARQL tests | isURI, isBlank, isLiteral, isNumeric, bound | <code>isURI(?person) !bound(?person)</code> |
| Constructors <i>(SPARQL 1.1)</i> | URI, BNODE, STRDT, STRLANG, UUID, STRUUID | <code>STRLANG(?text, "en") = "hello"@en</code> |
| Accessors | str, lang, datatype | <code>lang(?title) = "en"</code> |
| Hashing <i>(1.1)</i> | MD5, SHA1, SHA256, SHA512 | <code>BIND(SHA256(?email) AS ?hash)</code> |
| Miscellaneous | sameTerm, langMatches, regex, REPLACE | <code>regex(?ssn, "\\d{3}-\\d{2}-\\d{4}")</code> |


Aggregates (SPARQL 1.1)

1. Partition results into groups based on the expression(s) in the **GROUP BY** clause
2. Evaluate projections and aggregate functions in **SELECT** clause to get one result per group
3. Filter aggregated results via the **HAVING** clause

| ?key | ?val | ?other1 |
|------|------|---------|
| 1 | 4 | ... |
| 1 | 4 | ... |
| 2 | 5 | ... |
| 2 | 4 | ... |
| 2 | 10 | ... |
| 2 | 2 | ... |
| 2 | 1 | ... |
| 3 | 3 | ... |



| ?key | ?sum_of_val |
|------|-------------|
| 1 | 8 |
| 2 | 22 |
| 3 | 3 |



| ?key | ?sum_of_val |
|------|-------------|
| 1 | 8 |
| 3 | 3 |

SPARQL 1.1 includes: **COUNT**, **SUM**, **AVG**, **MIN**, **MAX**, **SAMPLE**, **GROUP_CONCAT**

Property Paths (*SPARQL 1.1*)

- Property paths allow triple patterns to match arbitrary-length paths through a graph
- Predicates are combined with regular-expression-like operators:

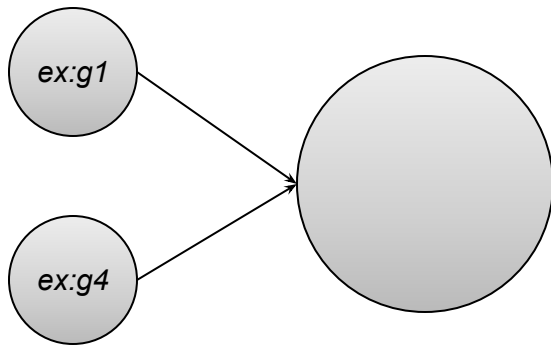
| Construct | Meaning |
|--------------------------|---|
| <code>path1/path2</code> | Forwards path (<code>path1</code> followed by <code>path2</code>) |
| <code>^path1</code> | Backwards path (object to subject) |
| <code>path1 path2</code> | Either <code>path1</code> or <code>path2</code> |
| <code>path1*</code> | <code>path1</code> , repeated zero or more times |
| <code>path1+</code> | <code>path1</code> , repeated one or more times |
| <code>path1?</code> | <code>path1</code> , optionally |
| <code>!uri</code> | Any predicate except <code>uri</code> |
| <code>!^uri</code> | Any backwards (object to subject) predicate except <code>uri</code> |

RDF Datasets

A SPARQL query accesses a *default graph* (normally) and zero or more *named graphs* (when inside a **GRAPH** clause).

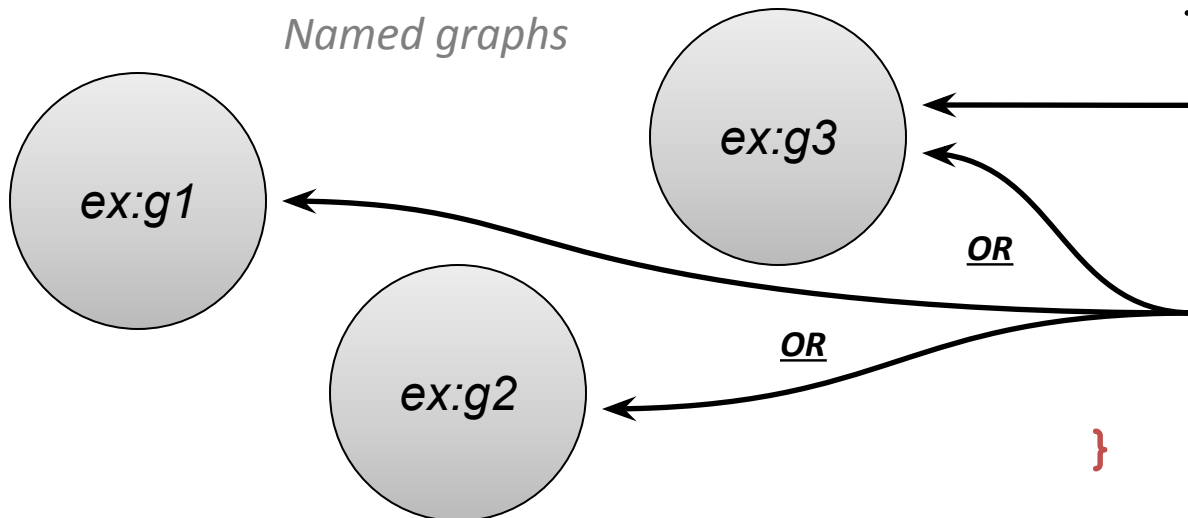
Default graph

(the merge of zero or more graphs)



```
PREFIX ex: <...>  
SELECT ...  
FROM ex:g1  
FROM ex:g4  
FROM NAMED ex:g1  
FROM NAMED ex:g2  
FROM NAMED ex:g3  
WHERE {  
... A ...
```

Named graphs



```
GRAPH ex:g3 {  
... B ...  
}  
GRAPH ?graph {  
... C ...  
}
```

SPARQL Over HTTP (the SPARQL Protocol)

`http://host.domain.com/sparql/endpoint?<parameters>`

where <parameters> can include:

`query=<encoded query string>`

e.g. `SELECT+*%0DWHERE+{...`

`default-graph-uri=<encoded graph URI>`

e.g. `http%3A%2F%2Fexample.com%2Ffoo...`

n.b. zero or more occurrences of `default-graph-uri`

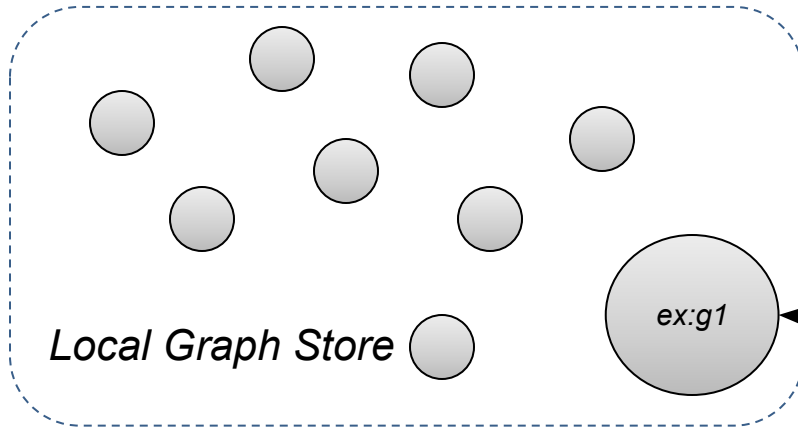
`named-graph-uri=<encoded graph URI>`

e.g. `http%3A%2F%2Fexample.com%2Fbar...`

n.b. zero or more occurrences of `named-graph-uri`

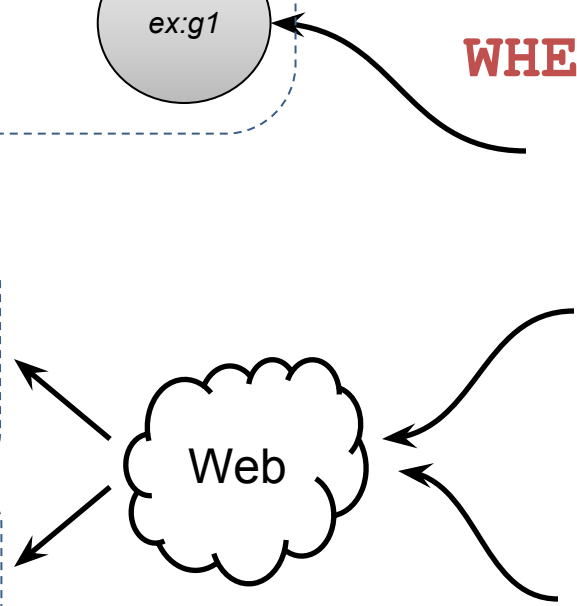
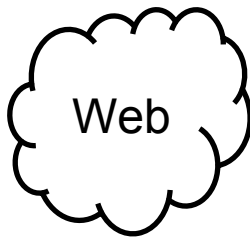
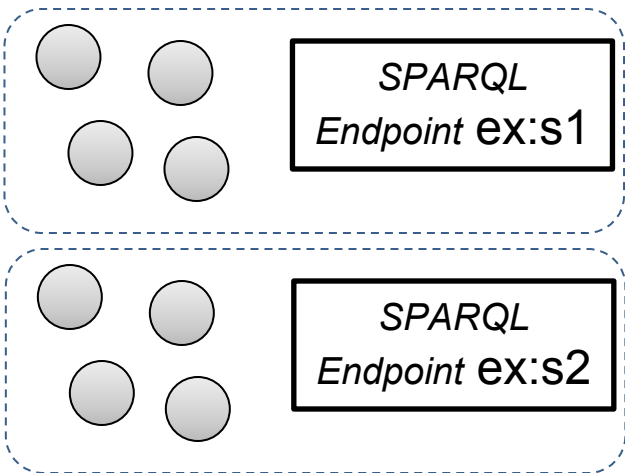
HTTP GET or POST. Graphs given in the protocol override graphs given in the query.

Federated Query (SPARQL 1.1)



```
PREFIX ex: <...>  
SELECT ...  
FROM ex:g1  
WHERE {  
  ... A ...
```

```
SERVICE ex:s1 {  
  ... B ...  
}  
SERVICE ex:s2 {  
  ... C ...  
}  
}
```



SPARQL 1.1 Update

SPARQL Update Language Statements

```
INSERT DATA { triples }
```

```
DELETE DATA {triples}
```

```
[ DELETE { template } ] [ INSERT { template } ] WHERE { pattern }
```

```
LOAD <uri> [ INTO GRAPH <uri> ]
```

```
CLEAR GRAPH <uri>
```

```
CREATE GRAPH <uri>
```

```
DROP GRAPH <uri>
```

[...] denotes optional parts of SPARQL 1.1 Update syntax

Some Public SPARQL Endpoints

| Name | URL | What's there? |
|----------------|---|---|
| SPARQLer | http://sparql.org/sparql.html | General-purpose query endpoint for Web-accessible data |
| DBPedia | http://dbpedia.org/sparql | Extensive RDF data from Wikipedia |
| DBLP | http://www4.wiwiss.fu-berlin.de/dblp/snorql/ | Bibliographic data from computer science journals and conferences |
| LinkedMDB | http://data.linkedmdb.org/sparql | Films, actors, directors, writers, producers, etc. |
| World Factbook | http://www4.wiwiss.fu-berlin.de/factbook/snorql/ | Country statistics from the CIA World Factbook |
| bio2rdf | http://bio2rdf.org/sparql | Bioinformatics data from around 40 public databases |

SPARQL Resources

- SPARQL Specifications Overview
 - <http://www.w3.org/TR/sparql11-overview/>
- SPARQL implementations
 - <http://esw.w3.org/topic/SparqlImplementations>
- SPARQL endpoints
 - <http://esw.w3.org/topic/SparqlEndpoints>
- SPARQL Frequently Asked Questions
 - <http://www.thefigtrees.net/lee/sw/sparql-faq>
- Common SPARQL extensions
 - <http://esw.w3.org/topic/SPARQL/Extensions>