# SPARQL RDF Query Language Reference v1.8

Latest version: <http://www.dajobe.org/2005/04-sparql/>
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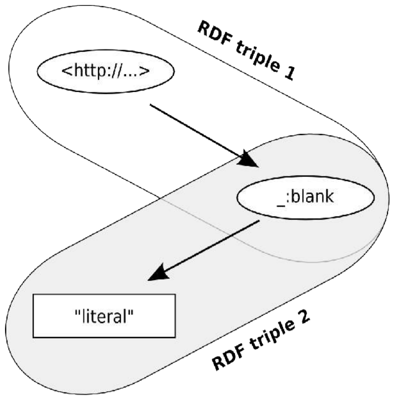
## *1. RDF Model and SPARQL RDF Terms Syntax*



**RDF Graph**: A set of RDF Triples

**RDF Triple**: A triple (3-tuple) of:

| | |
|---|---|
| Subject: | IRI or Blank Node |
| Predicate: | IRI |
| Object: | IRI or Blank Node or Literal |

**URI**: An absolute IRI which may include a # fragment.
`<http://www.w3.org/>`
`<http://example.org/#fragment>`

| | |
|---|---|
| `<abc.rdf>` | Relative IRI resolved against base IRI. |
| `<>` | Base IRI, usually the query document IRI |
| `ex:name` | IRI shorthand using XML-style prefix `ex` and local name. Declared with `PREFIX` (SPARQL) or `@prefix` (Turtle) |

**RDF Literal**: A Unicode string with an optional language tag.
`"hello"` `"bonjour"@fr`

**RDF Typed Literal**: A Unicode string and datatype IRI for encoding datatypes.
`"abc"^^<http://example.org/myDatatype>`
abbreviated with an XML QName style as:
`"10"^^xsd:integer`
Short forms for several common datatypes:

| | |
|---|---|
| `-10` | `"-10"^^xsd:integer` |
| `1.2345` | `"1.2345"^^xsd:decimal` |
| `true` | `"true"^^xsd:boolean` |

**Blank Node**: A node in a graph with a local name. The scope of the name is the RDF graph.
`_:node`

## *2. Common RDF Namespaces and Prefixes*

| Namespace | Common Prefix | Namespace URI |
|---|---|---|
| RDF | rdf: | http://www.w3.org/1999/02/22-rdf-syntax-ns# |
| Dublin Core | dc: | http://purl.org/dc/elements/1.1/ |
| FOAF | foaf: | http://xmlns.com/foaf/0.1/ |
| XML Schema Datatypes | xsd: | http://www.w3.org/2001/XMLSchema# |
| RDFS | rdfs: | http://www.w3.org/2000/01/rdf-schema# |
| OWL | owl: | http://www.w3.org/2002/07/owl# |

## *3. SPARQL Query Language Reference*

Based on SPARQL Query Language 23 November 2005
<http://www.w3.org/TR/2005/WD-rdf-sparql-query-20051123/>.

**RDF Term**: A part of an RDF Triple. An IRI, Blank Node or a Literal.
`<uri> _:b1 "Literal"@en "abc123"^^my:datatype`

**Query Variable:** Identifiers for binding to RDF Terms in matches.
`?a / $b` or in lists: `$name $title $place`

**Anonymous Query Variable:** Blank Nodes in a graph pattern act as variables that cannot be `SELECT`ed
`_:abc`

**Triple Pattern**: An RDF Triple with Query Variables or blank nodes allowed in each term:
```
<http://example.org/abc> ?x "Hello"
?subject ?predicate ?object
```
Turtle abbreviations can be used for Triple Patterns, see **Section 4**.

**Graph Pattern**: A block that matches part of the queried RDF graph.

**Basic Graph Pattern**: A set of Triple Patterns binding RDF Terms in the graph to variables. Written as a `{..}` block with '`.`' separating the triple patterns:
```
{ <http://example.org/abc> ?y "Hello" .
 ?subject $predicate "Literal" }
```

**Group Graph Pattern:** A graph pattern containing multiple graph patterns which must all match
```
{ { ?person rdf:type  foaf:Person }
  { ?person foaf:name "Dave" } }
```

**Optional Graph Pattern**: A graph pattern which may fail to match and provide bindings but not cause the entire query to fail. Written with `OPTIONAL` before a graph pattern.
```
OPTIONAL { ?person foaf:nick ?nick }
```

**Union Graph Pattern**: A pair of graph patterns any of which may match and bind the same variables. Written with the `UNION` keyword between two graph patterns.
```
{ ?node ex:name ?name } UNION
{ ?node vcard:FN ?name }
```

**Graph Graph Pattern:** A keyword for specifying a graph name to use or to return a graph name as a binding. Written with the `GRAPH` keyword before a graph pattern.
```
GRAPH <http://example.org/myfoaf>
  { ?person foaf:name ?name }
GRAPH ?graph { ?person foaf:name ?name }
```

**Value Constraints:** A boolean expression in a graph pattern over query variables that constrains matched graph patterns.
```
{ ?item ex:size $size .  FILTER ($size < 10 ) }
```

## *4. SPARQL Query Language Structure*

| | |
|---|---|
| **Prologue** (optional) | `BASE <`*iri*`>`<br>`PREFIX` *prefix*`: <`*iri*`>` (repeatable) |
| **Query Result forms** (required, pick 1) | `SELECT (DISTINCT)` sequence of ?*variable*<br>`SELECT (DISTINCT)*`<br>`DESCRIBE` sequence of ?*variable* or <*iri*><br>`DESCRIBE *`<br>`CONSTRUCT {` *graph pattern* `}`<br>`ASK` |
| **Query Dataset Sources** (optional) | Add triples to the background graph (repeatable):<br>`FROM <`*iri*`>`<br>Add a named graph (repeatable):<br>`FROM NAMED <`*iri*`>` |
| **Graph Pattern (**optional, required for `ASK`) | `WHERE {` *graph pattern* [ `FILTER` *expression* ]} |
| **Query Results Ordering** (optional) | `ORDER BY ...` |
| **Query Results Selection** (optional) | `LIMIT` *n*, `OFFSET` *m* |

## *5. SPARQL Query Result Forms*

**Variable Bindings:** A sequence of (set of variable bindings) for each query pattern match.

```
SELECT *
WHERE { $a rdf:type $b }
```

to ask for bindings for all variables mentioned in the query and

```
SELECT $a ?b
WHERE { $a rdf:type ?b }
```

to list them explicitly

**RDF Graph:**

**Describe Resources:** An RDF graph describing resources either given by URI

```
DESCRIBE <http://example.org/thing>
```

or by binding variables using the same syntax as `SELECT`.

```
DESCRIBE ?person
WHERE  { ?person foaf:name "Dave" }
```

**Build an RDF graph** An RDF graph made by substituting variables into a triple template.

```
CONSTRUCT { ?a foaf:knows ?b }
WHERE { ?a ex:KnowsQuiteWell ?b }
```

**Boolean:** True if the query pattern could be answered.

```
ASK
WHERE { ?a rdf:type foaf:Person }
```

## *6. Query Results Ordering and Modifying*

The optional modifications on query results are performed in the following order:

1. `DISTINCT` to ensure solutions in the sequence are unique
1. `ORDER BY` ordering solutions sequences by variable, expression or extension function call:
   `ORDER BY DESC(?date) ?title ASC(?familyName) my:fn(?a)`
   in descending order by *date*, by ascending *title* order, by *familyName* ascending, by extension function
2. `LIMIT` *n* to restrict the number of solutions to *n*
3. `OFFSET` *m* to start the results in the solution from item *m*

## *7. Values – datatypes, expressions and operators*

Supported datatypes: RDF Terms, `xsd:boolean, xsd:string, xsd:double, xsd:float, xsd:decimal, xsd:integer` and `xsd:dateTime`

| | | |
|---|---|---|
| **Logical operators**: | Logical: | *A* \|\| *B*, *A* `&&` *B*, `!`A, (*A*) |
| | Comparison (*A op B*): | =, !=, <, >, <=, >= |
| **Arithmetic operators:** | Unary: | +*A*, -*A* |
| | Binary (*A op B*): | +, -, *, / |
| **RDF operators:** | Boolean: | `BOUND`(*A*), `isIRI`(*A*) / `isURI`(*A*), `isBlank`(*A*), `isLiteral`(*A*) |
| | String: | `STR`(A), `LANG`(*A*), `DATATYPE`(*A*) |
| **String Match operator:** | | `REGEX(` *string expression*, *pattern expression* [,*flags expression*] `)` *pattern* syntax is from XQuery 1.0 / XPath 2.0, XML Schema, similar to Perl. *flags* are s, m, i, x |
| **Extension Functions and Explicit Type Casting:** | | *QName* `(` *expression*, *expression*, ... `)` |
| **Automatic Type Promotion:** | from `xsd:decimal` | to `xsd:float` |
| | from `xsd:float` | to `xsd:double` |

## *8. Turtle RDF Syntax Reference (Turtle 2006-01-2121 <http://www.dajobe.org/2004/01/turtle/>)*

Turtle (Terse RDF Triple Language) describes triples in an RDF graph and allows abbreviations. Triple Patterns in SPARQL can use the same abbreviations.

**RDF Terms:**

| | | |
|---|---|---|
| IRI | < *IRI* > | (<> is the base IRI, often the document IRI) |
| Literal: | `"`*string*`"` or `"`*string*`"`@*language* or ^^< *datatype IRI* > | |
| Blank Node: | `_:` *name* or `[]` for an anonymous blank node | |

**`@prefix` operator:** IRIs can be written as XML-style QNames by defining a prefix / IRI binding:

```
@prefix dc: <http://purl.org/dc/elements/1.1/> .
```

**Triples:** 3 RDF terms with whitespace separating them as necessary, and '`.`' between triples:

```
<> dc:title "SPARQL Reference" .
<> dc:date "2006-02-06"^^xsd:dateTime .
```

**, operator:** Triples with the same subject and predicate may be abbreviated with '`,`':

```
<http://example.org/book> dc:title "My Book", "Mein Buch"@de .
```

**; operator**: Triples with the same subject may be abbreviated with '`;`':

```
<http://work.example.org/> dc:title "My Workplace";
                                dc:publisher "My Employer" .
```

**[ ... ] operator**: A sequence of (predicate object) pairs may be put inside `[` ... `]` and a blank node subject will be assigned to them:

```
<> dc:creator [ foaf:name "Dave"; foaf:homePage <http:...> ] .
```

**[] operator**: A blank node:

```
[] a ex:Book [ dc:title "Thing"; dc:description "On shelf" ] .
```

**a predicate**: The common `rdf:type` QName may be abbreviated by the keyword `a` as a predicate:

```
<> a Foaf:Document .
```

**Decimal integers:** Positive or negative decimal integers can be written as (type `xsd:integer`)

```
<> ex:sizeInBytes 12345 .
```

**Decimal numbers:** Positive or negative decimal numbers can be written as (type `xsd:decimal`)

```
<> ex:shoeSize 8.5 .
```

**( ... ) collections:** RDF collections can be written inside `(` ... `)` as space-separated lists of contents:

```
<> ex:contents ( ex:apple ex:banana ex:pear ) .
```

## *9. Example SPARQL Query*

```
BASE <http://example.org/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
# This is a relative IRI to BASE above
PREFIX ex: <properties/1.0#>

SELECT DISTINCT $person ?name $age
FROM <http://rdf.example.org/personA.rdf>
FROM <http://rdf.example.org/personB.rdf>
WHERE {  $person a foaf:Person ;
                  foaf:name ?name.
           OPTIONAL { $person ex:age $age } .
           FILTER (!REGEX(?name, "Bob"))
         }
ORDER BY ASC(?name) LIMIT 10 OFFSET 20
```