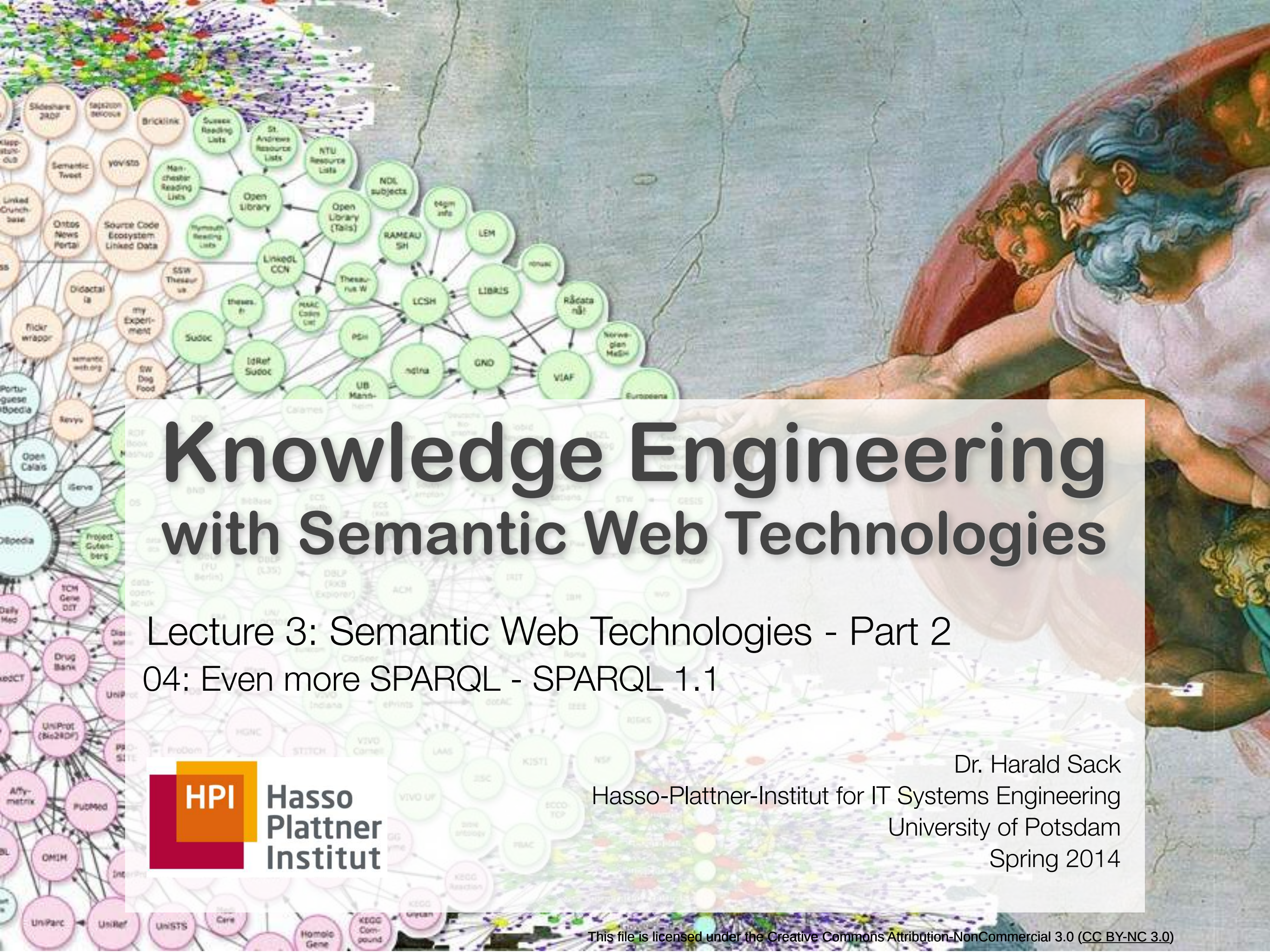


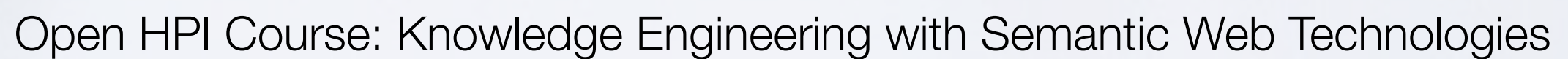


Knowledge Engineering with Semantic Web Technologies

Lecture 3: Semantic Web Technologies - Part 2
04: Even more SPARQL - SPARQL 1.1



Dr. Harald Sack
Hasso-Plattner-Institut for IT Systems Engineering
University of Potsdam
Spring 2014





04 Even More SPARQL – SPARQL 1.1

Open HPI Course: Knowledge Engineering with Semantic Web Technologies
Lecture 03: Semantic Web Technologies Pt.2

- SPARQL 1.1 Query:
 - Assignments (e.g. BIND, SELECT expressions)
 - Aggregate functions (e.g. COUNT, SUM, AVG)
 - Subqueries
 - Negation (EXISTS, NOT EXISTS, MINUS)
 - Property paths
- Basic query federation (SERVICE, BINDINGS)
- SPARQL 1.1 Update:
 - Graph update (INSERT DATA, DELETE DATA, INSERT, DELETE, DELETE WHERE, LOAD, CLEAR)
 - Graph management (CREATE, DROP, COPY, MOVE, ADD)
- SPARQL 1.1 Entailment for RDF, RDFS, OWL, RIF
- SPARQL 1.1 Service Descriptions

SPARQL 1.1 - Variable Assignments

- Example: Select all authors with their notable works and year of publication

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
PREFIX dbpprop: <http://dbpedia.org/property/>

SELECT ?author ?work ?date
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer .
    ?author dbpedia-owl:notableWork ?work .
    ?work dbpprop:releaseDate ?date
} ORDER BY ?date
LIMIT 100
```

author	work	date
http://dbpedia.org/resource/John_Crowley	http://dbpedia.org/resource/Little_Big	http://dbpedia.org/resource/1981_in_literature
http://dbpedia.org/resource/Will_Self	http://dbpedia.org/resource/Umbrella_(novel)	http://dbpedia.org/resource/United_Kingdom
http://dbpedia.org/resource/Will_Self	http://dbpedia.org/resource/Umbrella_(novel)	http://dbpedia.org/resource/United_States
http://dbpedia.org/resource/Daniel_Keyes	http://dbpedia.org/resource/Flowers_for_Algeron	"April 1959"@en
http://dbpedia.org/resource/Robert_M._Pirsig	http://dbpedia.org/resource/Zen_and_the_Art_of_Motorcycle_Maintenance	"April 1974"@en
http://dbpedia.org/resource/Charlotte_Perkins_Gilman	http://dbpedia.org/resource/Herland_(novel)	"April 1979"@en
http://dbpedia.org/resource/Lloyd_Alexander	http://dbpedia.org/resource/Westmark_(novel)	"April 1981"@en
http://dbpedia.org/resource/David_Eddings	http://dbpedia.org/resource/The_Belgariad	"April 1982"@en
http://dbpedia.org/resource/Cormac_McCarthy	http://dbpedia.org/resource/Blood_Meridian	"April 1985"@en
http://dbpedia.org/resource/Daniel_Pinkwater	http://dbpedia.org/resource/Borgel	"April 1990"@en
http://dbpedia.org/resource/Patrick_McCabe_(novelist)	http://dbpedia.org/resource/The_Butcher_Boy	"April 1992"@en
http://dbpedia.org/resource/Nancy_Farmer	http://dbpedia.org/resource/The_Ear,_the_Eye_and_the_Arm	"April 1994"@en
http://dbpedia.org/resource/Michael_Brodsky	http://dbpedia.org/resource/***(novel)	"April 1994"@en
http://dbpedia.org/resource/Margaret_Clark_(writer)	http://dbpedia.org/resource/Fat_Chance_(Margaret_Clark_novel)	"April 1996"@en
http://dbpedia.org/resource/Daniel_Handler	http://dbpedia.org/resource/The_Basic_Eight	"April 1998"@en
http://dbpedia.org/resource/Julian_Stockwin	http://dbpedia.org/resource/Kydd_(novel)	"April 2001"@en
http://dbpedia.org/resource/Dan_Brown	http://dbpedia.org/resource/The_Da_Vinci_Code	"April 2003"@en
http://dbpedia.org/resource/Brian_Keene	http://dbpedia.org/resource/The_Rising_(Keene_novel)	"April 2003"@en
http://dbpedia.org/resource/Frans_Sammut	http://dbpedia.org/resource/The_Da_Vinci_Code	"April 2003"@en
http://dbpedia.org/resource/G._B._Singh	http://dbpedia.org/resource/Gandhi_Behind_the_Mask_of_Divinity	"April 2004"@en
http://dbpedia.org/resource/Cecelia_Ahern	http://dbpedia.org/resource/PS,_I_Love_You_(novel)	"April 2004"@en
http://dbpedia.org/resource/David_Mitchell_(author)	http://dbpedia.org/resource/Black_Swan_Green	"April 2006"@en
http://dbpedia.org/resource/Timothy_Ferriss	http://dbpedia.org/resource/The_4-Hour_Workweek	"April 2007"@en
http://dbpedia.org/resource/Carole_Wilkinson	http://dbpedia.org/resource/Dragon_Moon	"April 2007"@en
http://dbpedia.org/resource/Marc_Ostrofsky	http://dbpedia.org/resource/Get_Rich_Click	"April 2011"@en
http://dbpedia.org/resource/Arthur_C._Clarke	http://dbpedia.org/resource/Rendezvous_with_Rama	"Aug 1973"@en
http://dbpedia.org/resource/Guy_Gavriel_Kay	http://dbpedia.org/resource/Tigana	"August 1990"@en
http://dbpedia.org/resource/David_Wellington_(author)	http://dbpedia.org/resource/Monster_Island_(novel)	"August 2004 April 2006"@en
http://dbpedia.org/resource/Premchand	http://dbpedia.org/resource/Bazaar-e-Husn	"Calcutta and Lahore"@en
http://dbpedia.org/resource/Henry_James	http://dbpedia.org/resource/The_Wings_of_the_Dove	"Constable: 30-Aug-1902Scribner's: 21-Aug-1902"@en
http://dbpedia.org/resource/Laurence_Sterne	http://dbpedia.org/resource/The_Life_and_Opinions_of_Tristram_Shandy,_Gentleman	"December 1759 – January 1767"@en
http://dbpedia.org/resource/Emily_Bront%C3%AB	http://dbpedia.org/resource/Wuthering_Heights	"December 1847"@en
http://dbpedia.org/resource/Henri_Barbusse	http://dbpedia.org/resource/Under_Fire_(novel)	"December 1916"@en
http://dbpedia.org/resource/David_Eddings	http://dbpedia.org/resource/The_Belgariad	"December 1984"@en
http://dbpedia.org/resource/Umera_Ahmad	http://dbpedia.org/resource/Pir-e-Kamil	"English: 2011"@en
http://dbpedia.org/resource/J._D._Salinger	http://dbpedia.org/resource/Franny_and_Zooey	"Fall 1961"@en
http://dbpedia.org/resource/Roald_Dahl	http://dbpedia.org/resource/The_Vicar_of_Nibbleswicke	"Feb 1991"@en
http://dbpedia.org/resource/James_Fenimore_Cooper	http://dbpedia.org/resource/The_Last_of_the_Mohicans	"February 1826"@en
http://dbpedia.org/resource/Joseph_Conrad	http://dbpedia.org/resource/Heart_of_Darkness	"February 1899"@en

SPARQL 1.1 - Variable Assignments

- Example: Select all authors with their notable works and year of publication

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
PREFIX dbpprop: <http://dbpedia.org/property/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?author ?work xsd:integer(?date) AS ?year
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer .
    ?author dbpedia-owl:notableWork ?work .
    ?work dbpprop:releaseDate ?date .
} ORDER BY ?year
LIMIT 100
```

*new variable
assignment*

- SPARQL 1.1 allows the creation of new values in a query

author	work	year
http://dbpedia.org/resource/A. J. Quinnell	http://dbpedia.org/resource/The Mahdi	
http://dbpedia.org/resource/A. J. Quinnell	http://dbpedia.org/resource/Man on Fire (novel)	
http://dbpedia.org/resource/Augusten Burroughs	http://dbpedia.org/resource/Running with Scissors (memoir)	
http://dbpedia.org/resource/B. Traven	http://dbpedia.org/resource/The Treasure of the Sierra Madre	1927
http://dbpedia.org/resource/B. Traven	http://dbpedia.org/resource/The Death Ship	1926
http://dbpedia.org/resource/Brian O'Nolan	http://dbpedia.org/resource/The Dalkey Archive	1964
http://dbpedia.org/resource/Brian O'Nolan	http://dbpedia.org/resource/The Third Policeman	1967
http://dbpedia.org/resource/Brian O'Nolan	http://dbpedia.org/resource/At Swim-Two-Birds	1939
http://dbpedia.org/resource/Carole Wilkinson	http://dbpedia.org/resource/Dragonkeeper	2003
http://dbpedia.org/resource/DBC Pierre	http://dbpedia.org/resource/Vernon God Little	20
http://dbpedia.org/resource/Dale Carnegie	http://dbpedia.org/resource/How to Win Friends and Influence People	
http://dbpedia.org/resource/Erica Jong	http://dbpedia.org/resource/Fear of Flying (novel)	1973
http://dbpedia.org/resource/Hubert Selby, Jr.	http://dbpedia.org/resource/Last Exit to Brooklyn	1964
http://dbpedia.org/resource/Hunter S. Thompson	http://dbpedia.org/resource/The Rum Diary (novel)	1998
http://dbpedia.org/resource/Hunter S. Thompson	http://dbpedia.org/resource/Fear and Loathing on the Campaign Trail '72	1973
http://dbpedia.org/resource/James Frey	http://dbpedia.org/resource/A Million Little Pieces	
http://dbpedia.org/resource/Jeanette Winterson	http://dbpedia.org/resource/Oranges Are Not the Only Fruit	21
http://dbpedia.org/resource/John Banville	http://dbpedia.org/resource/The Sea (novel)	
http://dbpedia.org/resource/John McGahern	http://dbpedia.org/resource/Amongst Women	1990
http://dbpedia.org/resource/John McGahern	http://dbpedia.org/resource/The Barracks	1963
http://dbpedia.org/resource/Ken Kesey	http://dbpedia.org/resource/Sometimes a Great Notion	
http://dbpedia.org/resource/Kevin Brooks (writer)	http://dbpedia.org/resource/Martyn Pig	1
http://dbpedia.org/resource/Maeve Binchy	http://dbpedia.org/resource/Tara Road	28
http://dbpedia.org/resource/Magnus Mills	http://dbpedia.org/resource/The Restraint of Beasts	7
http://dbpedia.org/resource/Michael Lewis	http://dbpedia.org/resource/Liar's Poker	
http://dbpedia.org/resource/Nancy Mitford	http://dbpedia.org/resource/The Pursuit of Love	1945
http://dbpedia.org/resource/Rebecca Wells	http://dbpedia.org/resource/Little Altars Everywhere	
http://dbpedia.org/resource/Robert Holdstock	http://dbpedia.org/resource/Mythago Wood	1984
http://dbpedia.org/resource/Robert M. Pirsig	http://dbpedia.org/resource/Lila: An Inquiry into Morals	1991
http://dbpedia.org/resource/Robert M. Pirsig	http://dbpedia.org/resource/Zen and the Art of Motorcycle Maintenance	

SPARQL 1.1 - Variable Assignments

- Example: Select all authors with their notable works and year of publication

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
PREFIX dbpprop: <http://dbpedia.org/property/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?author ?work (REPLACE(str(?date), "[^0-9]", "")) AS ?year
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer .
    ?author dbpedia-owl:notableWork ?work .
    ?work dbpprop:releaseDate ?date
    FILTER REGEX (?date, "[0-9]{4}") .
ORDER BY ?year
LIMIT 100
```

new variable assignment

- SPARQL 1.1 allows the creation of new values in a query

author	work	year
http://dbpedia.org/resource/A. J. Quinnell	http://dbpedia.org/resource/The Mahdi	1982
http://dbpedia.org/resource/A. J. Quinnell	http://dbpedia.org/resource/Man on Fire (novel)	1980
http://dbpedia.org/resource/Dale Carnegie	http://dbpedia.org/resource/How to Win Friends and Influence People	1936
http://dbpedia.org/resource/Rebecca Wells	http://dbpedia.org/resource/Little Altars Everywhere	1998
http://dbpedia.org/resource/Robert M. Pirsig	http://dbpedia.org/resource/Zen and the Art of Motorcycle Maintenance	1974
http://dbpedia.org/resource/William P. Young	http://dbpedia.org/resource/The Shack	2007
http://dbpedia.org/resource/Beatrix Potter	http://dbpedia.org/resource/The Tale of Peter Rabbit	1902
http://dbpedia.org/resource/Dan Brown	http://dbpedia.org/resource/Angels & Demons	2000
http://dbpedia.org/resource/Daniel Handler	http://dbpedia.org/resource/Watch Your Mouth	2000
http://dbpedia.org/resource/Daniel Keyes	http://dbpedia.org/resource/Flowers for Algeron	1959
http://dbpedia.org/resource/Daniel Keyes	http://dbpedia.org/resource/Flowers for Algeron	1966
http://dbpedia.org/resource/David Eddings	http://dbpedia.org/resource/The Belgariad	1984
http://dbpedia.org/resource/David Eddings	http://dbpedia.org/resource/The Belgariad	1982
http://dbpedia.org/resource/David Eddings	http://dbpedia.org/resource/The Belgariad	1984
http://dbpedia.org/resource/David Eddings	http://dbpedia.org/resource/The Belgariad	1983
http://dbpedia.org/resource/David Eddings	http://dbpedia.org/resource/The Belgariad	1982
http://dbpedia.org/resource/Larry Niven	http://dbpedia.org/resource/Ringworld	1970
http://dbpedia.org/resource/Laurence Sterne	http://dbpedia.org/resource/The Life and Opinions of Tristram Shandy, Gentleman	17591767
http://dbpedia.org/resource/Timothy Ferriss	http://dbpedia.org/resource/The 4-Hour Workweek	2007
http://dbpedia.org/resource/Tucker Max	http://dbpedia.org/resource/I Hope They Serve Beer in Hell	2006
http://dbpedia.org/resource/Dean Koontz	http://dbpedia.org/resource/Phantoms (novel)	1983
http://dbpedia.org/resource/Maxwell Gray	http://dbpedia.org/resource/The Silence of Dean Maitland	1886
http://dbpedia.org/resource/Robert Chambers (publisher born 1802)	http://dbpedia.org/resource/Vestiges of the Natural History of Creation	1844
http://dbpedia.org/resource/Surender Mohan Pathak	http://dbpedia.org/resource/Daylight Robbery (novel)	2010
http://dbpedia.org/resource/Joanna Russ	http://dbpedia.org/resource/The Female Man	1975
http://dbpedia.org/resource/Ethel Lilian Voynich	http://dbpedia.org/resource/The Gadfly	1897
http://dbpedia.org/resource/J. D. Salinger	http://dbpedia.org/resource/Franny and Zooey	1961
http://dbpedia.org/resource/Rudyard Kipling	http://dbpedia.org/resource/Kim (novel)	1901
http://dbpedia.org/resource/Samuel Beckett	http://dbpedia.org/resource/Molloy (novel)	19511955
http://dbpedia.org/resource/Stephen King	http://dbpedia.org/resource/The Stand	1990
http://dbpedia.org/resource/Stephen King	http://dbpedia.org/resource/The Stand	1978
http://dbpedia.org/resource/V. S. Naipaul	http://dbpedia.org/resource/A Bend in the River	1979
http://dbpedia.org/resource/Yann Martel	http://dbpedia.org/resource/Life of Pi	2001

SPARQL 1.1 - Aggregate Functions

- Example: How many authors are there in DBpedia?

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>

SELECT (COUNT(?author)) AS ?num
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer .
}
```

aggregate function

- SPARQL 1.1 allows the use of aggregate functions in queries

SPARQL 1.1 - Aggregate Functions

- Example: How many **distinct** authors are there in DBpedia who have entries for notable works?

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
```

```
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
```

```
SELECT (COUNT(DISTINCT ?author)) AS ?num
```

```
FROM <http://dbpedia.org/>
```

```
WHERE {
```

```
    ?author rdf:type dbpedia-owl:Writer .
```

```
    ?author dbpedia-owl:notableWork ?work .
```

```
}
```

*aggregate
function*

- SPARQL 1.1 allows the use of aggregate functions in queries

SPARQL 1.1 - Aggregate Functions

- Example: Which author wrote how many notable works?

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
```

```
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
```

```
SELECT ?author (COUNT(?work)) AS ?num_works
```

```
FROM <http://dbpedia.org/>
```

```
WHERE {
```

```
    ?author rdf:type dbpedia-owl:Writer .
```

```
    ?author dbpedia-owl:notableWork ?work .
```

```
} GROUP BY ?author
```

```
ORDER BY DESC (?num_works)
```

*aggregate
function*

author	num_works
http://dbpedia.org/resource/Vince Powell	20
http://dbpedia.org/resource/Roald Dahl	18
http://dbpedia.org/resource/Joseph Conrad	15
http://dbpedia.org/resource/Rexhep Qosja	13
http://dbpedia.org/resource/Edward Stratemeyer	12
http://dbpedia.org/resource/Julian Stockwin	12
http://dbpedia.org/resource/Judd Apatow	11
http://dbpedia.org/resource/Chris Meledandri	11
http://dbpedia.org/resource/Brian Cooke	11
http://dbpedia.org/resource/David Mamet	11
http://dbpedia.org/resource/Laurence Marks (British writer)	9
http://dbpedia.org/resource/Dino Stamatopoulos	9
http://dbpedia.org/resource/William Trevor	9
http://dbpedia.org/resource/Ismail Kadare	9
http://dbpedia.org/resource/Cicero	9
http://dbpedia.org/resource/Samuel Beckett	9
http://dbpedia.org/resource/Maurice Gran	9
http://dbpedia.org/resource/Writings of Marcus Tullius Cicero	9
http://dbpedia.org/resource/Jim Allen (playwright)	9
http://dbpedia.org/resource/Johnnie Mortimer	9
http://dbpedia.org/resource/David Weir (writer)	9
http://dbpedia.org/resource/Eric Chappell	9

SPARQL 1.1 - Aggregate Functions

- Example: Which author wrote 3 notable works (according to DBpedia)?

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
```

```
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
```

```
SELECT ?author (COUNT(?work)) AS ?num_works
```

```
FROM <http://dbpedia.org/>
```

```
WHERE {
```

```
    ?author rdf:type dbpedia-owl:Writer .
```

```
    ?author dbpedia-owl:notableWork ?work .
```

```
} GROUP BY ?author
```

```
HAVING COUNT(?work) = 3
```

```
ORDER BY DESC (?num_works)
```

*aggregate
function*

author	num_works
http://dbpedia.org/resource/Fidel Villarroel	3
http://dbpedia.org/resource/Frances Hardinge	3
http://dbpedia.org/resource/John Gardner (American writer)	3
http://dbpedia.org/resource/John Orloff	3
http://dbpedia.org/resource/Malcolm Lowry	3
http://dbpedia.org/resource/Monica Edwards	3
http://dbpedia.org/resource/Peter Bowker	3
http://dbpedia.org/resource/Richard Russo	3
http://dbpedia.org/resource/Sajjad Zaheer	3
http://dbpedia.org/resource/Alois Jir%C3%A1sek	3
http://dbpedia.org/resource/Andrew Marshall (writer)	3
http://dbpedia.org/resource/David Dobkin (director)	3
http://dbpedia.org/resource/Virginia Spencer Carr	3
http://dbpedia.org/resource/Ernesto Sabato	3
http://dbpedia.org/resource/Khaled Mattawa	3
http://dbpedia.org/resource/R. A. Chandrasena	3
http://dbpedia.org/resource/Patrick McCabe (novelist)	3
http://dbpedia.org/resource/Chris Valentino	3
http://dbpedia.org/resource/Carole Wilkinson	3
http://dbpedia.org/resource/Christopher Nolan (author)	3
http://dbpedia.org/resource/David Brin	3
http://dbpedia.org/resource/David Levithan	3

SPARQL 1.1 - Aggregate Functions

- SPARQL 1.1 provides more aggregate functions
 - SUM
 - AVG
 - MIN
 - MAX
 - SAMPLE -- „pick“ one non-deterministically
 - GROUP_CONCAT -- concatenate values with a designated string separator

SPARQL 1.1 - Aggregate Functions

- Example: Compare an arbitrary title and non-english titles of notable Works by authors

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>

SELECT (SAMPLE(?title) AS ?name)
        (GROUP_CONCAT(?alt_titles; SEPARATOR=", ") AS ?alt_names)
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer .
    ?author dbpedia-owl:notableWork ?work .
    ?work rdfs:label ?title .
    ?work rdfs:label ?alt_titles
    FILTER (LANG(?alt_titles)!="en") .
GROUP BY ?author
```

*aggregate
function*

[illegible]

SPARQL 1.1 - Subqueries

- Example: Select all authors, who they are influenced by and all the influencers notable works

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
```

```
SELECT ?author ?influencer ?work
FROM <http://dbpedia.org/>
```

```
WHERE {
```

```
{ SELECT ?author ?influencer
  FROM <http://dbpedia.org/>
```

```
  WHERE {
```

```
    ?author rdf:type dbpedia-owl:Writer .
```

```
    ?author dbpedia-owl:influencedBy ?influencer .
```

```
  } LIMIT 10
```

```
}
```

```
?influencer dbpedia-owl:notableWork ?work .
```

```
}
```

subquery

- Subqueries are a way to embed SPARQL queries within other queries
- result is achieved by first evaluating the inner query

SPARQL 1.1 - Negation

- Example: Select all authors, who don't have a notable work entry in DBpedia

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>

SELECT ?author
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer
    FILTER NOT EXISTS {?author dbpedia-owl:notableWork ?work .}
}
```

*filter query
result for
existence*

- Filtering of query solutions is done within a **FILTER** expression using **NOT EXISTS** and **EXISTS**.

SPARQL 1.1 - Negation

- Example: Select all authors, who don't have a notable work entry in DBpedia

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>

SELECT ?author
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer
    FILTER NOT EXISTS {?author dbpedia-owl:notableWork ?work .}
}
```

*filter query
result for
existence*

- Filtering of query solutions is done within a **FILTER** expression using **NOT EXISTS** and **EXISTS**.

SPARQL 1.1 - Negation

- Example: Select all authors, who don't have a notable work entry in DBpedia

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>

SELECT ?author
FROM <http://dbpedia.org/>
WHERE {
    ?author rdf:type dbpedia-owl:Writer
    MINUS {?author dbpedia-owl:notableWork ?work .}
}
```

*remove from
query result*

- Filtering of query solutions by removing possible solutions with MINUS.

- A **property path** is a possible route through an RDF graph between two graph nodes.

- trivial case: property path of length 1, i.e. a triple pattern
- **alternatives**: match one or both possibilities

```
{ :book1 dc:title|rdfs:label ?displayString }
```

- **sequence**: property path of length >1

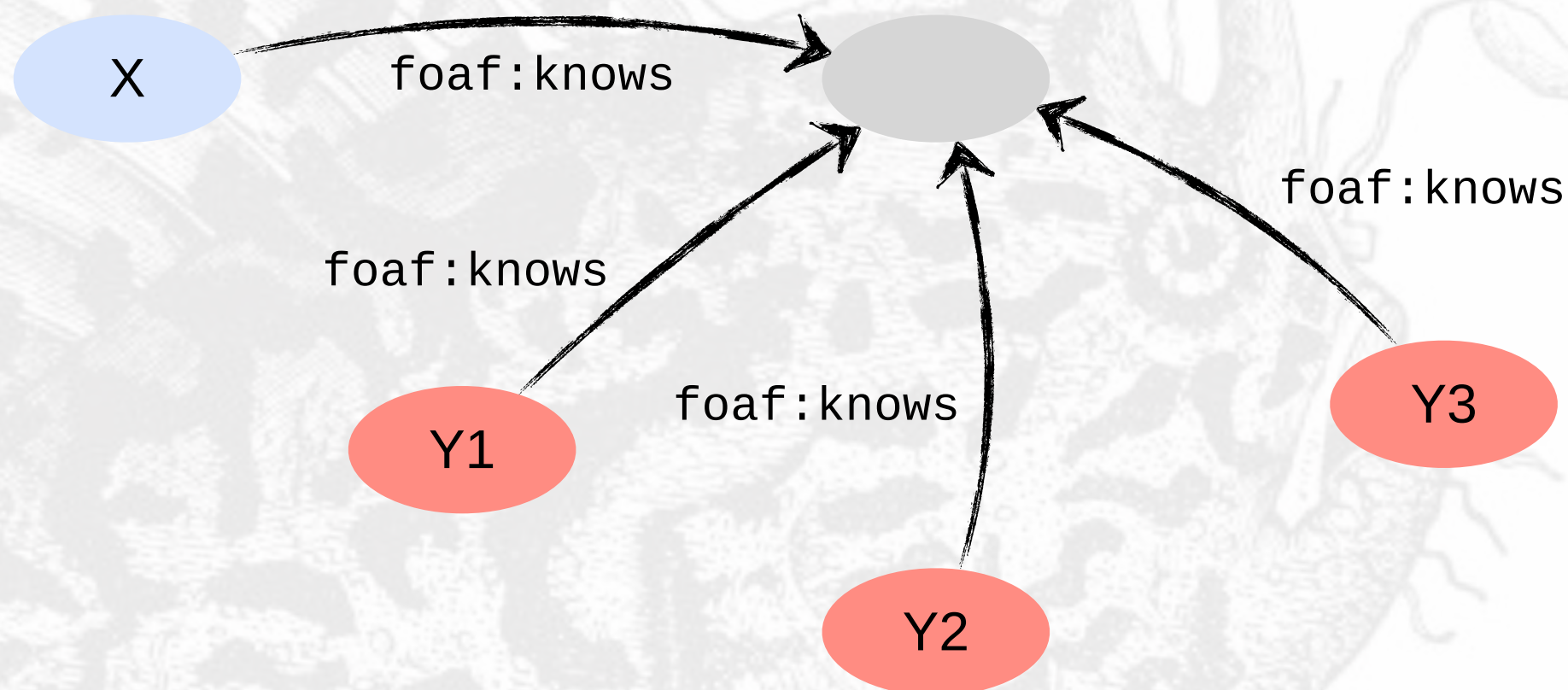
```
{ ?x foaf:mbox <mailto:alice@example> .  
  ?x foaf:knows/foaf:knows/foaf:name ?name . }
```

- **inverse property paths**: reversing the direction of the triple

```
{ ?x foaf:mbox <mailto:alice@example> }  
=  
{ <mailto:alice@example> ^foaf:mbox ?x }
```

- **inverse path sequences** paths

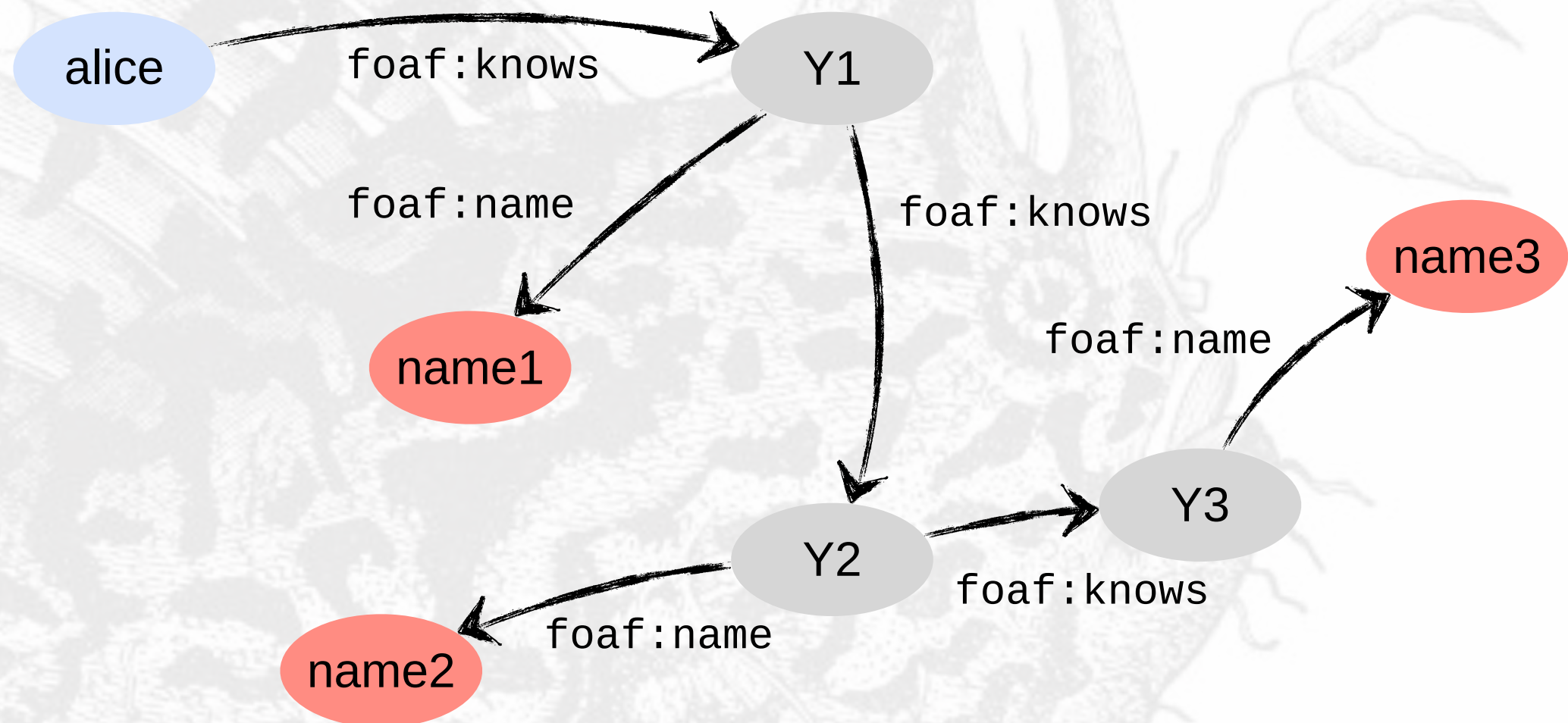
```
{ ?x foaf:knows/^foaf:knows ?y .  
  FILTER(?x != ?y) }
```



26

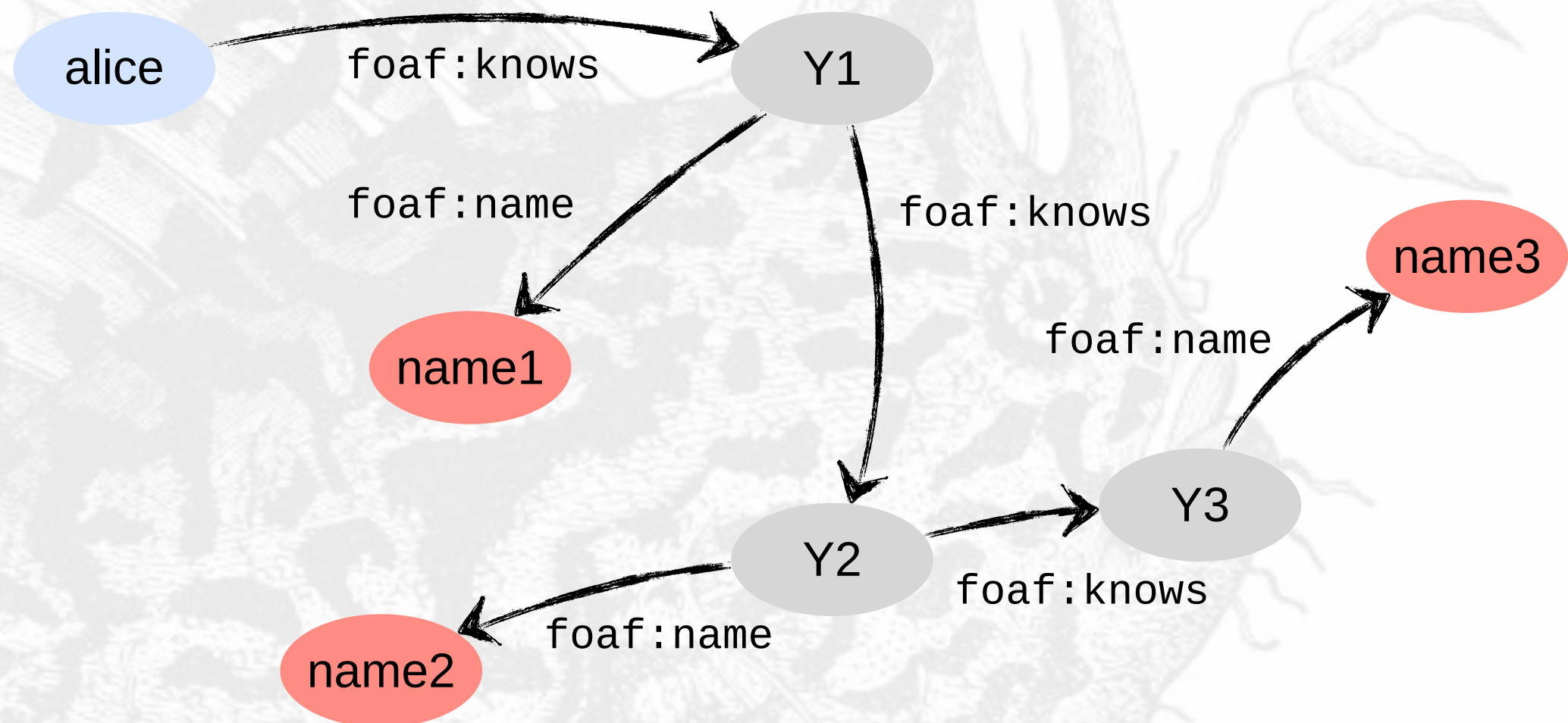
- **arbitrary length match**

```
{ ?x foaf:mbox <mailto:alice@example> .  
  ?x foaf:knows+/foaf:name ?name . }
```



- arbitrary length match

```
{ ?x foaf:mbox <mailto:alice@example> .  
  ?x foaf:knows+/foaf:name ?name . }
```



- **inverse path sequences** paths

```
{ ?x foaf:knows/^foaf:knows ?y .  
  FILTER(?x != ?y) }
```

- **arbitrary length match**

```
{ ?x foaf:mbox <mailto:alice@example> .  
  ?x foaf:knows+/foaf:name ?name . }
```

- **negated property paths**

```
{ ?x !(rdf:type|^rdf:type) ?y }
```

SPARQL 1.1 - Property Paths

- Example: Who are the authors who were influenced by the influencers of George Orwell?

```
PREFIX : <http://dbpedia.org/resource/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>

SELECT ?influencedByInfluencers
FROM <http://dbpedia.org/>
WHERE {
    :George_Orwell
    dbpedia-owl:influencedBy/^dbpedia-owl:influencedBy
    ?influencedByInfluencers .
}
```

*path
expression*

How to store RDF Data?

05 How to store RDF(S) Data? – SPARQL 1.1 (5)

Open HPI Course: Knowledge Engineering with Semantic Web Technologies
Lecture 03: Semantic Web Technologies Pt.2