



Knowledge Graphs

Lecture 2 – Basic Knowledge Graph Infrastructure

Excursion 1: Reification and RDF*

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- 2.1 How to Identify and Access Things
- 2.2 How to Represent Simple Facts with RDF
- 2.3 RDF Turtle Serialization
- 2.4 Vocabularies and Model Building with RDFS
- 2.5 RDF Complex Data Structures

Excursion 1: RDF Reification and RDF*

- 2.6 Logical Inference with RDF(S)

Excursion 2: RDFa – RDF and the Web



who might be a literary role model for Spock, the science officer of the USS Enterprise?



One literary role model for Spock, the science officer of the USS Enterprise, could be Sherlock Holmes. Both characters are known for their logical and analytical thinking, as well as their ability to remain calm and rational in difficult situations. Additionally, both characters have a strong sense of duty and a commitment to solving problems, whether they be scientific or criminal in nature.



<https://chat.openai.com/chat>



RDF Reification



- RDF also permits the interleaving of statements, i.e. to make statements about statements.
- Example:

ChatGPT states that Sherlock Holmes is a role model for Mr. Spock

■ **Part 1:** Sherlock Holmes is a role model for Mr. Spock
`:SherlockHolmes :roleModel :Spock .`

■ **Part 2:** stated by ChatGPT
`??? :statedBy :ChatGPT .`

RDF Reification



rdf:Statement

defines an RDF statement consisting of subject, predicate, object.

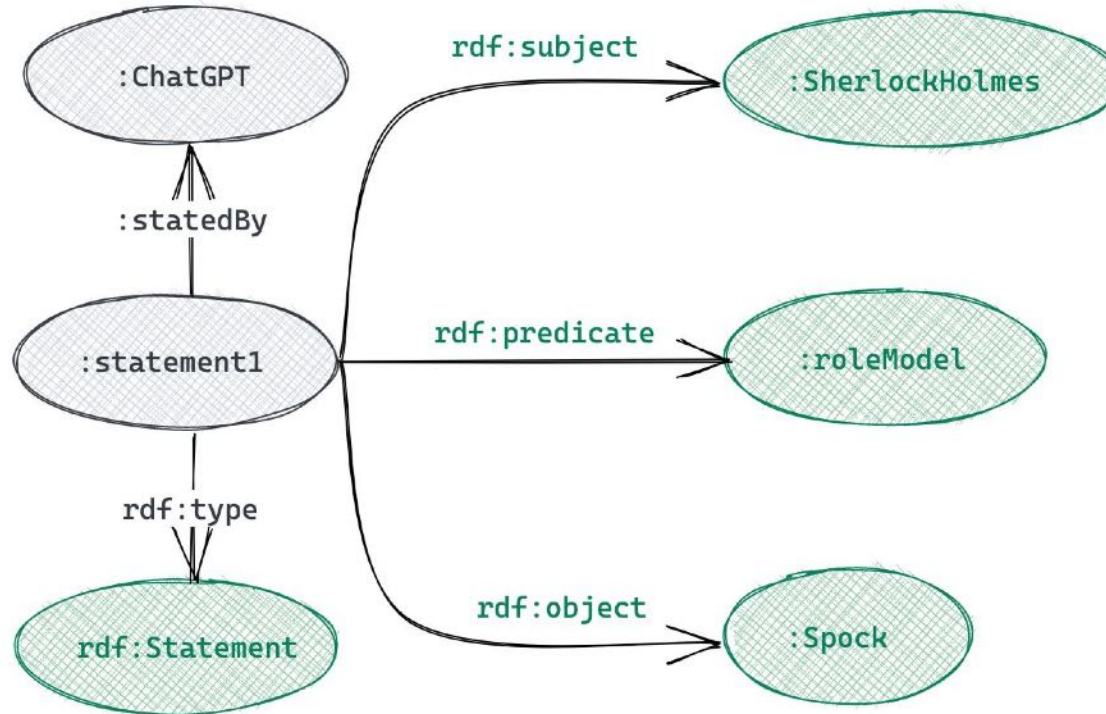
- `rdf:subject` - the described resource
- `rdf:predicate` - the original property
- `rdf:object` - the value of the property



RDF Reification



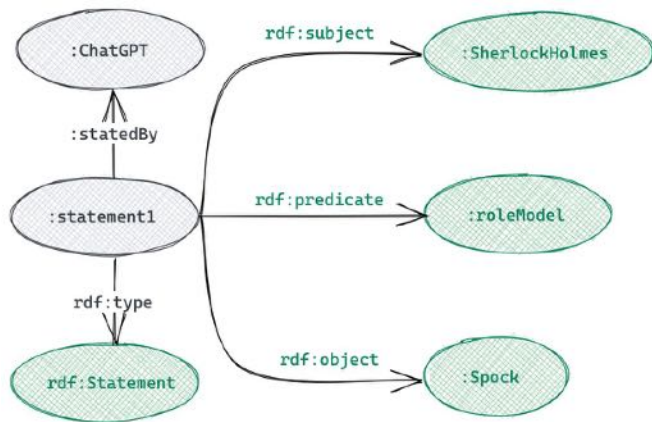
“ChatGPT states that Sherlock Holmes is a role model for Mr. Spock”.



RDF Reification



“ChatGPT states that Sherlock Holmes is a role model for Mr. Spock”.

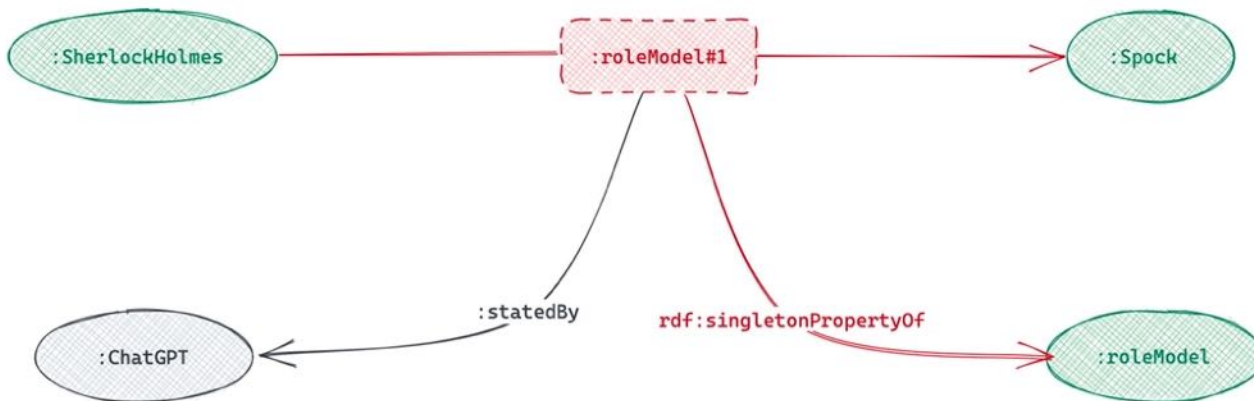


```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix : <http://example.org/KG2023#> .
```

```
:statement1 a rdf:Statement ;
    rdf:subject    :SherlockHolmes ;
    rdf:predicate  :roleModel ;
    rdf:object     :Spock .
:statement1 :statedBy :ChatGPT .
```

Alternative Representations – Singleton Properties

“ChatGPT states that Sherlock Holmes is a role model for Mr. Spock”.

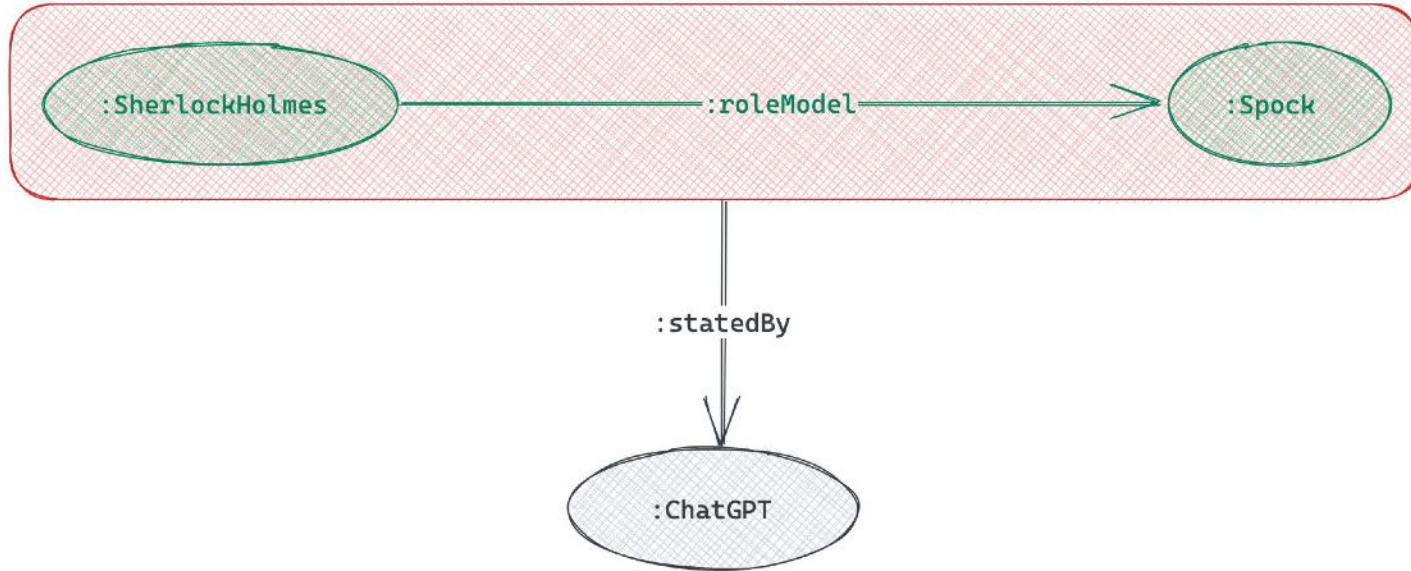


```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix : <http://example.org/KG2023#> .

:SherlockHolmes :roleModel#1 :Spock .
:roleModel#1    rdf:singletonPropertyOf :roleModel ;
                :statedBy      :ChatGPT .
```

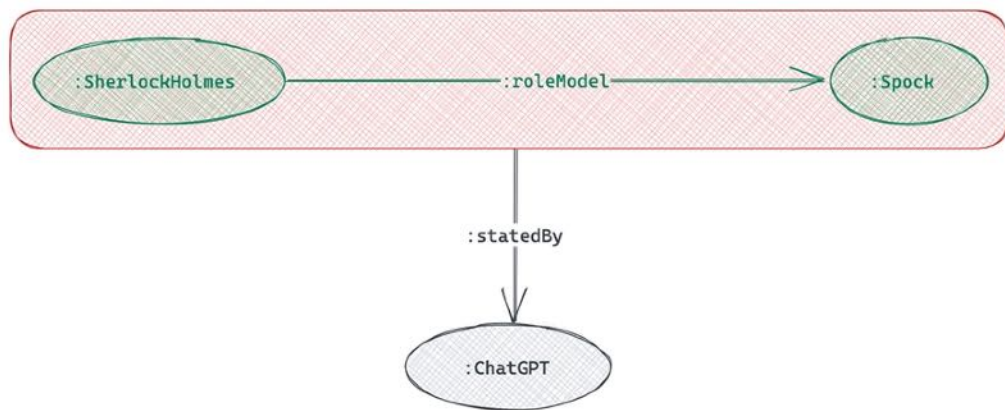

Alternative Representations – RDF*

- **RDF*** allows to consider RDF graphs either as subjects or objects of RDF triples.
- **RDF*** syntax allows to recursively embed graphs into graphs.
- *“ChatGPT states that Sherlock Holmes is a role model for Mr. Spock”.*



Alternative Representations – RDF*

“ChatGPT states that Sherlock Holmes is a role model for Mr. Spock”.



```
@prefix : <http://example.org/KG2023#> .
```

```
<< :SherlockHolmes :roleModel :Spock >> :statedBy :ChatGPT .
```

RDF Reification



- What is the use of reification?
 - Modeling **data provenance**
 - Formalizing statements about **reliability** and **trust**
 - Define **metadata** about statements
- **But you should be careful...**
 - **Relations** and **classes** can be transformed into **instances** potentially resulting in **type conflicts**
 - Risk to define **infinite recursions** and **cycles**

A composite image featuring Spock from Star Trek. He is seated at a wooden desk, wearing his characteristic blue and black uniform. He is looking directly at the viewer with a serious expression. On the desk in front of him are several sheets of paper, a quill pen, and two glass flasks. Behind him is a large, arched window that looks out onto a space station or ship's interior, with a starship visible in the distance. The text "Logical Inference with RDF(S)" is overlaid in a large, yellow, sans-serif font across the middle of the image.

Logical Inference with RDF(S)

Next Lecture...

Bibliographic References:

- Guus Schreiber, Yves Raimond (2014), [RDF 1.1 Primer](#), W3C Working Group Note 24 June 2014
- Joem Madertma (2019), [What's the best RDF serialization format?](#), ontola.io
- Eric Prud'hommeaux, Gavin Carothers (Eds.) (2014), [RDF 1.1 Turtle - Terse RDF Triple Language](#), W3C Recommendation 25 February 2014

Picture References:

- [1] “In this image in the style of Dürer's Renaissance woodcuts, Mr. Spock, science officer of the USS Enterprise, is depicted in deep space fully covered with interlinked the RDF source code fragments.”, created via ArtBot, ProtoGen Diffusion, 2023, [CC-BY-4.0], <https://tinybots.net/artbot>
- [2] “In this Sherlock Holmes inspired book illustration, Spock, the science officer of the USS Enterprise is depicted together with Sherlock Holmes, the great Victorian detective. Both are sitting in arm chairs and have a glass of wine together. Holmes is smoking his pipe. Spock is absorbed in thoughts over his 3D chessboard.”, created via ArtBot, MidjourneyDiffusion, 2023, [CC-BY-4.0], <https://tinybots.net/artbot>
- [3] “Mr. Spock, science officer of the USS Enterprise in a room with the walls covered with interlinked RDF source code fragments in the style of a High Renaissance painting.”, created via ArtBot, ProtoGen Diffusion, 2023, [CC-BY-4.0], <https://tinybots.net/artbot>