Resource Description Framework (RDF)

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1. Introduction

- **RDF** means Resource Description Framework
- Markup language to describe internet resources
- Creates logical statements about objects (resources/literals)
- Fundamental core technology of the **semantic web**
- Structures metadata for machine-readable interactions

2. History

- Predecessor was Meta Content Framework (MCF) in XML developed in 1995
- RDF developed by W3C to structure web metadata, during the browser wars
- First RDF draft in August 1997 with an official release in 1999
- Two major updates throughout the years, most recent update in 2014

3. RDF Basics

3.1 Triple Structure

- RDF data uses **triples**: subject, predicate and object
- Totallity of triples forms a graph, called **RDF model**
- Subject and predicate are resources; Object can be resource or literal

Figure 1: Visual representation of a triples

3. RDF Basics

3.2 Ressources and Literals

- **Resources:** Identified by URIs; represent entities like people or relationships
- **Literals:** Specific values (e.g., strings, numbers) providing data, no references

```
Subject:    Lennard              | Subject:   Lennard
Predicate:  hasFriend            | Predicate: hasAge
Object:     Niclas  (Resource)   | Object:    22  (Literal)
```

3. RDF Basics

3.3 URIs

- RDF resources must have a URI, a unique character string identifier
- URIs resemble URLs; URLs are specific URIs for web pages
- IRIs: Newer, broader URIs supporting more Unicode characters

```
# URI for a person resource, such as Lennard
http://example.com/people/lennard

# URI for a book resource
http://example.com/books/978-3-16-148410-0
```
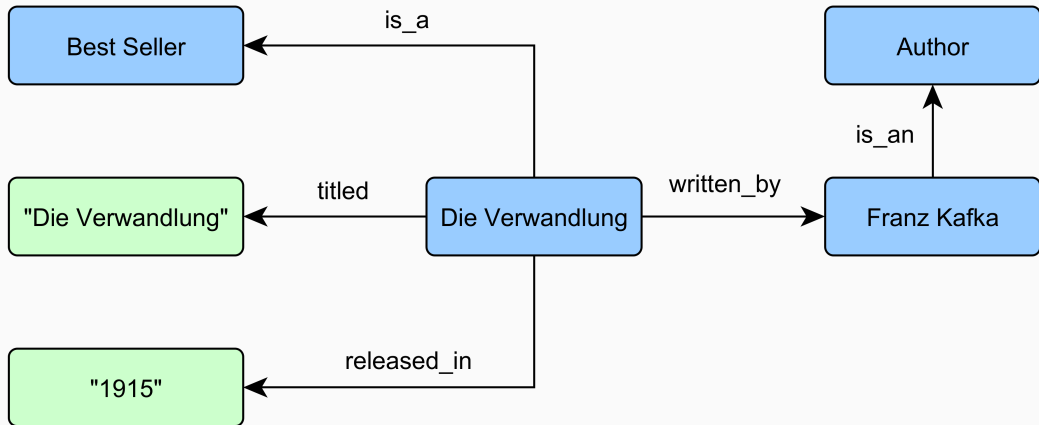
3.4 Example

Figure 2: RDF-Model of the book "Die Verwandlung"

4. RDF Syntaxes

4.1 RDF/XML

- First W3C standard RDF format; less common due to complex syntax

```xml
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:dc="http://purl.org/dc/elements/1.1/">
    <rdf:Description rdf:about="http://ex.org/Die_Verwandlung">
        <dc:title>Die Verwandlung</dc:title>
        <dc:creator>Franz Kafka</dc:creator>
        <dc:date>1915</dc:date>
    </rdf:Description>
</rdf:RDF>
```

Figure 3: Example of RDF/XML

4.2 Turtle

- User-friendly, readable format; uses prefixes for URIs and allows comments
- Ideal to use for hand-editing RDF due to its high human-readability

```
@prefix dc: <http://purl.org/dc/elements/1.1/> .
<http://example.org/books/Die_Verwandlung>
     dc:title "Die Verwandlung" ;
     dc:creator "Franz Kafka" ;
     dc:date "1915" .
```

Figure 4: Example of Turtle

4. RDF Syntaxes

4.3 Other Formats

- **JSON-LD:** JSON format for linked data, easy integration with web apps
- **N-Triples:** Line-based text format for representing RDF triples
- **RDFa:** Embeds RDF in HTML/XML for enriched semantic content

5. RDF in Practice

Linked Open Data (LOD)

- LOD is openly available data on the web, identified and linked by URIs
- It utilizes RDF to create semantic connections between data points

DBpedia

- Transforms Wikipedia articles for the semantic web
- Data follows the RDF standard for structured information

Wikidata

- Free knowledge base for structured data in RDF format
- Supports data linking and integration with other LOD sources

6. Related topics

RDF Schema (RDFS)

- Extends RDF with classes and properties to structure data
- Defines classes (rdfs:Class) and hierarchies (rdfs:subClassOf)

SPARQL

- Query language for retrieving/manipulating RDF data
- Enables pattern-based data access across diverse sources

```
SELECT ?email WHERE {
  <http://ex.org/LennardFe> <http://ex.org/hasEmail> ?email.
}
```

7. Conclusion

- **Foundational Framework:** Essential for linking data on the web
- **Synergism:** Enables seamless data exchange across systems
- **Machine-Readable:** Standardizes data semantics for machines
- **Rich Ecosystem:** Supports various applications in data management

8. References

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