

Akademia Górniczo-Hutnicza  
im. Stanisława Staszica  
w Krakowie

2012-05-22

## **Sprawozdanie**

Podstawy Inżynierii Wiedzy: Semantic Web  
*Resource Description Framework (RDF) in use*

Tomasz Osiniak

# 1. Semantic vocabularies: Dublin Core

RDF/XML opisujący książki z użyciem słownika Dublin Core:

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<rdf:RDF
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  xmlns="http://student.agh.edu.pl/~osiniak/mylibrary#"
  xmlns:dc="http://purl.org/dc/elements/1.1/">

  <rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b1">
    <dc:title rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Stars</dc:title>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Herbert S. Zim</dc:creator>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Robert Horace Baker</dc:creator>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Mark R. Chartrand</dc:creator>
    <dc:publisher rdf:datatype="http://www.w3.org/2001/XMLSchema#string">St. Martin's Press</dc:publisher>
    <dc:date rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2001-04-14</dc:date>
    <pages datatype="http://www.w3.org/2001/XMLSchema#decimal">160</pages>
    <dc:description rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Enjoy the wonders of the
    heavens and understand more fully what you see. This Golden Guide shows you how with 150 full-color
    illustrations, including: Charts of the major constellations Tables to help locate the planets Up-to-date
    explanations of meteors, comets, eclipses, and other celestial objects Ideal for classroom use, to take along
    on vacations, and for use at home.</dc:description>
    <dc:language rdf:datatype="http://www.w3.org/2001/XMLSchema#string">en</dc:language>
    <dc:type rdf:datatype="http://www.w3.org/2001/XMLSchema#string">book</dc:type>
    <dc:subject rdf:datatype="http://www.w3.org/2001/XMLSchema#string">astronomy</dc:subject>
  </rdf:Description>

  <rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b2">
    <dc:title rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Understanding Variable Stars</dc:title>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">John R. Percy</dc:creator>
    <dc:publisher rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Cambridge University
    Press</dc:publisher>
    <dc:date rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2007-05-24</dc:date>
    <pages datatype="http://www.w3.org/2001/XMLSchema#decimal">350</pages>
    <dc:description rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Variable stars are those that
    change brightness. They come in many varieties, but each one provides important information about the star:
    its properties, its internal structure, and its evolution. This book provides a concise overview of variable
    stars, including a historical perspective, an introduction to stars in general, the techniques for
    discovering and studying variable stars, and a description of the main types of variable stars. Intended for
    anyone with some background knowledge of astronomy, it is especially suitable for undergraduate students and
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    <dc:language rdf:datatype="http://www.w3.org/2001/XMLSchema#string">en</dc:language>
    <dc:type rdf:datatype="http://www.w3.org/2001/XMLSchema#string">book</dc:type>
    <dc:subject rdf:datatype="http://www.w3.org/2001/XMLSchema#string">astronomy</dc:subject>
  </rdf:Description>

  <rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b3">
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    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Herbert S. Zim</dc:creator>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Ira N. Gabrielson</dc:creator>
    <dc:publisher rdf:datatype="http://www.w3.org/2001/XMLSchema#string">St. Martin's Press</dc:publisher>
    <dc:date rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2001-04-14</dc:date>
    <pages datatype="http://www.w3.org/2001/XMLSchema#decimal">160</pages>
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    identify-quickly and easily-the birds you are most likely to see. It tells you: What to look for Where and
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    the book contain a wealth of additional information about migration, eggs, nests, and food. This is the
    perfect bird book for beginners at any age.</dc:description>
    <dc:language rdf:datatype="http://www.w3.org/2001/XMLSchema#string">en</dc:language>
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  </rdf:Description>

  <rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b4">
    <dc:title rdf:datatype="http://www.w3.org/2001/XMLSchema#string">50 Weapons That Changed Warfare</dc:title>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">William Weir</dc:creator>
    <dc:publisher rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Career Press</dc:publisher>
    <dc:date rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2005-02-01</dc:date>
    <pages datatype="http://www.w3.org/2001/XMLSchema#decimal">261</pages>
    <dc:description rdf:datatype="http://www.w3.org/2001/XMLSchema#string">William Weir, author of New
    Page Book's 50 Battles That Changed the World, takes another look at the history of warfare, focusing on the
    hardware that served those famous battles, as well as others not as glorious. Included are: Individual
    weapons-from spears to the submarine gun. Crew-served weapons-from battering rams to "Big Bertha". Unmanned
    weapons-from punji stakes to "Bouncing Betty" landmines and trap guns. 50 Weapons That Changed Warfare even
    includes devices that, strictly speaking, are weapons carriers, such as tanks and bombers, but which have had
```

```

enormous effects on the conduct of war. This book describes the effects of these weapons and how and why they
changed warfare-from the bloody carnage produced by hand weapons throughout history to the never used but
universally feared fusion bomb, whose sole purpose is to destroy millions of people while leaving buildings
intact. Each weapon is not only described, but also illustrated to give a clearer picture of its usage and
effects.</dc:description>
  <dc:language rdf:datatype="http://www.w3.org/2001/XMLSchema#string">en</dc:language>
  <dc:type rdf:datatype="http://www.w3.org/2001/XMLSchema#string">book</dc:type>
  <dc:subject rdf:datatype="http://www.w3.org/2001/XMLSchema#string">military history</dc:subject>
</rdf:Description>

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      <rdf:li rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#book-b3"/>
      <rdf:li rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#book-b4"/>
    </rdf:Bag>
  </MyFavouriteBooks>
</rdf:Description>
</rdf:RDF>

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## 2. RDFSchema

RDF/XML opisujący książki z użyciem prostej taksonomii:

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  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns="http://student.agh.edu.pl/~osiniak/mylibrary#"
  xmlns:dc="http://purl.org/dc/elements/1.1/">

  <rdfs:Class rdf:ID="MultimediaItem" />
  <rdfs:Class rdf:ID="Book">
    <rdfs:subClassOf rdf:resource="#MultimediaItem" />
    <rdfs:label>Books class</rdfs:label>
    <rdfs:comment>Class of all the books in my library.</rdfs:comment>
  </rdfs:Class>
  <rdfs:Class rdf:ID="MusicCD">
    <rdfs:subClassOf rdf:resource="#MultimediaItem" />
    <rdfs:label>Music Compact Discs class</rdfs:label>
    <rdfs:comment>Class of all the CDs in my library.</rdfs:comment>
  </rdfs:Class>
  <rdfs:Class rdf:ID="DVD">
    <rdfs:subClassOf rdf:resource="#MultimediaItem" />
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    <rdfs:comment>Class of all the DVDs in my library.</rdfs:comment>
  </rdfs:Class>

  <rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b1">
    <dc:title rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Stars</title>
    <dc:creator rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Herbert S. Zim</dc:creator>
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    <rdf:type rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#Book"/>
  </rdf:Description>

  <rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b2">
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    <dc:type rdf:datatype="http://www.w3.org/2001/XMLSchema#string">book</dc:type>
    <dc:subject rdf:datatype="http://www.w3.org/2001/XMLSchema#string">birdwatching</dc:subject>
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</rdf:Description>

<rdf:Description rdf:about="http://student.agh.edu.pl/~osiniak/mylibrary#book-b4">
    <dc:title rdf:datatype="http://www.w3.org/2001/XMLSchema#string">50 Weapons That Changed Warfare</title>
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    <dc:publisher rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Career Press</dc:publisher>
    <dc:date rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2005-02-01</dc:date>
    <pages datatype="http://www.w3.org/2001/XMLSchema#decimal">261</pages>
    <dc:description rdf:datatype="http://www.w3.org/2001/XMLSchema#string">William Weir, author of New
Page Book's 50 Battles That Changed the World, takes another look at the history of warfare, focusing on the
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weapons-from spears to the submachine gun. Crew-served weapons-from battering rams to "Big Bertha". Unmanned
weapons-from punji stakes to "Bouncing Betty" landmines and trap guns. 50 Weapons That Changed Warfare even
includes devices that, strictly speaking, are weapons carriers, such as tanks and bombers, but which have had
enormous effects on the conduct of war. This book describes the effects of these weapons and how and why they
changed warfare-from the bloody carnage produced by hand weapons throughout history to the never used but
universally feared fusion bomb, whose sole purpose is to destroy millions of people while leaving buildings
intact. Each weapon is not only described, but also illustrated to give a clearer picture of its usage and
effects.</dc:description>
    <dc:language rdf:datatype="http://www.w3.org/2001/XMLSchema#string">en</dc:language>
    <dc:type rdf:datatype="http://www.w3.org/2001/XMLSchema#string">book</dc:type>
    <dc:subject rdf:datatype="http://www.w3.org/2001/XMLSchema#string">military history</dc:subject>
    <rdf:type rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#Book"/>
</rdf:Description>

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    <MyFavouriteBooks>
        <rdf:Bag>
            <rdf:li rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#book-b1"/>
            <rdf:li rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#book-b3"/>
            <rdf:li rdf:resource="http://student.agh.edu.pl/~osiniak/mylibrary#book-b4"/>
        </rdf:Bag>
    </MyFavouriteBooks>
</rdf:Description>
</rdf:RDF>

```

### 3. SPARQL - demo

*What semantic vocabularies are used in the queries? What are they for?*

FOAF – opis osób, relacji między ludźmi, obiektami

DC, DCT – opis zasobów (wideo, zdjęcia, strony internetowe itd.)

SIOC (Semantically-Interlinked Online Communities Project) – opis społeczności prowadzących dyskusje (blogi, fora, listy dyskusyjne) oraz ich powiązań

OWL – język ontologii

RSS – metadane często zmieniających się treści stron WWW

REV – opis recenzji, ocen

PRJ – opis projektów, niezależny od dziedziny

TAG – opis tagów i zależności między nimi

*What do SELECT queries do?*

Zwracają dane zawężone według wskazanych kryteriów w postaci relacji.

*What do CONSTRUCT queries do?*

Zwracają dane zawężone według wskazanych kryteriów w postaci grafu RDF.

### 4. SPARQL queries - basics

*Friends who have name and e-mail defined*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT DISTINCT ?name ?email
WHERE {
  ?x rdf:type foaf:Person.
  ?x foaf:name ?name.
  ?x foaf:mbox ?email.
}
```

*Friends who have name and e-mail defined and optional homepage*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT DISTINCT ?name ?email ?homepage
WHERE {
  ?x rdf:type foaf:Person.
  ?x foaf:name ?name.
  ?x foaf:mbox ?email.
  OPTIONAL {?x foaf:homepage ?homepage}
}
```

*Friends who have name and e-mail defined and optional homepage, sorted by name descending*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT DISTINCT ?name ?email ?homepage
WHERE {
  ?x rdf:type foaf:Person.
  ?x foaf:name ?name.
  ?x foaf:mbox ?email.
  OPTIONAL {?x foaf:homepage ?homepage}
}
ORDER BY DESC(?name)
```

## 5. SPARQL queries – options

*People whose name starts with 'K'*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT DISTINCT ?name
WHERE {
  ?x rdf:type foaf:Person.
  ?x foaf:name ?name.
  FILTER regex(str(?name), "^K")
}
```

*People who are older than 18 years old*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT DISTINCT ?name ?age
WHERE {
  ?x rdf:type foaf:Person.
  ?x foaf:name ?name.
  ?x foaf:age ?age.
  FILTER (?age > '18')
}
```

*People whose name starts with 'K' or are older than 18 years old, make search caseinsensitive*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
SELECT ?name ?age
WHERE
{
  ?x rdf:type foaf:Person;
  foaf:name ?name;
  foaf:age ?age.
  FILTER (regex(?name, '^k', 'i') && xsd:decimal(?age) > 18)
}
```

*People having e-mails on student.agh.edu.pl server*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name, ?email
WHERE {
  ?x rdf:type foaf:Person;
  foaf:name ?name;
  foaf:mbox ?email.
  FILTER regex(?email, ".*student.agh.edu.pl$")
}
```

*Name of people, who have homepage or e-mail on student.agh.edu.pl server*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT DISTINCT ?name ?email ?homepage
WHERE {
  ?x rdf:type foaf:Person.
  ?x foaf:name ?name.
  {?x foaf:mbox ?email.
    FILTER regex(?email, ".*student.agh.edu.pl$")
  }
UNION
  {?x foaf:homepage ?homepage
    FILTER regex(?homepage, "^http://student.agh.edu.pl/~.*")}
}
```

## 6. Open Data Sets

*What are the main limitations of using (querying for information) the RDF datasets such as DBPedia or MusicBrainz?*

Długi czas wykonywania złożonych zapytań, niespójne ontologie.