ICCL Summer School Dresden 2013
Semantic Web – Ontology Languages and Their Use

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Gartner: Big Data Will Generate 6 Million U.S. Jobs by 2015

Susan Hall | CHARTING YOUR IT CAREER 23 OCT, 2012

Gartner predicts that 4.4 million IT jobs will be created to support Big Data by 2015, with 1.9 million of them to be in the United States.

In addition, every Big Data-related role in the United States will create employment for three people outside of IT, pushing the total to 6 million U.S. Jobs, Peter Sondergaard, senior vice president at Gartner and global head of research, told those attending the Gartner Symposium ITxpo. He said:

But there is a challenge. There is not enough talent in the industry. Our public and private education systems are failing us. Therefore, only one-third of the IT jobs will be filled. Data experts will be a scarce, valuable commodity,” he said. “IT leaders will need immediate focus on how their organization develops and attracts the skills required. These jobs will be needed to grow your business. These jobs are the future of the new information economy.

Though I don’t follow Sondergaard’s math, we know there’s a shortage of analytics talent for Big Data and for engineering talent as well.
Big Data is characterized not only by the enormous volume or the velocity of its generation but also by the heterogeneity, diversity and complexity of the data.

Suzi Iacono, source: http://community.topcoder.com/coeci/nitrdf

- **volume**: the sheer size of the data
- **velocity**: new data is added at breathtaking speed
- **variety**: different formats and different perspectives

Sometimes mentioned:
- **value**: how useful is the data?
- **veracity**: how good/reliable is the data?

however, these can also be subsumed under “variety”.
### Linked Data: Volume

**Number of Datasets**

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**Number of triples (Sept 2011)**

- 31,634,213,770 with 503,998,829 out-links

From [http://www4.wiwiss.fu-berlin.de/lodcloud/state/](http://www4.wiwiss.fu-berlin.de/lodcloud/state/)
Linked Data 2011

Jens Lehmann (Linked Data Lifecycle)
Peter Haase (Linked Data Applications)
Information as RDF triples / graph

LOTR hasAuthor Tolkien.
Hobbit hasAuthor Tolkien.
LOTR hasCharacter Bilbo.
Hobbit hasCharacter Bilbo.

LOTR

Tolkien

Hobbit

Bilbo

Sebastian Rudolph (RDF)
### DBpedia: LOTR page

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- [www.glyphweb.com/arda/](http://www.glyphweb.com/arda/)  
- [www.tolkienlibrary.com/](http://www.tolkienlibrary.com/)  
- [www.tolkien.co.uk/](http://www.tolkien.co.uk/)  
- [www.houghtonmifflinbooks.com/features/lordoftheringstrilogy/](http://www.houghtonmifflinbooks.com/features/lordoftheringstrilogy/) |
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- dbpedia:The_Fellowship_of_the_Ring  
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| dbprop:expiry             | 20 (xsd:integer)                                                     |
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- dbpedia:High_fantasy |
| dbprop:hasPhotoCollection | ![Image](http://www4.wiwiss.fu-berlin.de/flickrwrapper/photos/The_Lord_of_the_Rings)  
Tolkien's own cover designs for the three volumes |
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- category:Fantasy_books_by_series  
- category:1950s_fantasy_novels  
- category:Sequel_novels  
- category:Lord_of_the_Rings  
- category:English_novels |
Geoindexed Linked Data – courtesy of Krzysztof Janowicz
http://stko.geog.ucsb.edu/location_linked_data
Data Velocity

- Weather sensors
- Tweets
- Satellite images
- ...
Linked Data: Variety

Copernicus lunar crater located on earth – courtesy of Krzysztof Janowicz http://stko.geog.ucsb.edu/location_linked_data (missing reference coordinate system)

Copernicus is a lunar impact crater named after the astronomer Nicolaus Copernicus, located in eastern Oceanus Procellarum. It is estimated to be about 800 million years old, and typifies craters that formed during the Copernican period in that it has a prominent ray system.

Characteristics

Copernicus is visible using binoculars, and is located slightly northwest of the center of the Moon's Earth-facing hemisphere. South of the crater is the Mare Insularum, and to the south-southwest is the crater Reinhold. North of Copernicus are the Montes Carpatus, which lie at the south edge of Mare Imbrium. West of Copernicus is a group of dispersed lunar hills. Due to its relative youth, the crater has remained in a relatively pristine shape since it formed.

The circular rim has a discernible hexagonal form, with a terraced inner wall and a 30 km wide, sloping rampart that descends nearly a kilometer to the surrounding mare. There are three distinct terraces visible, and arc-shaped landslides due to slumping of the inner wall as the crater debris subsided.

Most likely due to its recent formation, the crater floor has not been flooded.
“Nancy Pelosi voted in favor of the Health Care Bill.”
Linked Data: Variety and Veracity

Geoindexed Linked Data – courtesy of Krzysztof Janowicz
http://stko.geog.ucsb.edu/location_linked_data
### Linked Data: Variety and Veracity

Courtesy of Krzysztof Janowicz

http://stko.geog.ucsb.edu/location_linked_data

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#### SPARQL Query

Results for your query (6) - Edit query

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Linked Data: Variety and Veracity

Courtesy of Krzysztof Janowicz
http://stko.geog.ucsb.edu/location_linked_data

Map of the Gulf of Guinea, showing the chain of islands formed by the Cameroon line of volcanoes.
Variety can be handled with existing methods if volume and velocity are small.

Big Data research is primarily about methods for handling variety if volume and velocity are so high that existing methods fail.
Basic Idea of the Semantic Web

- **Person 1** exchanges symbols with **Person 2**. The symbol is "beetle".
- **Agent 1** and **Agent 2** exchange symbols.
- **Ontology** description involves agreement on concepts.
- Specific Domain, e.g., Animals.
Ontology Example

subClass

instantiation

x:Professor

x:Employee

rdfs:Class

x:Rudi

x:Daniel

x:PhD-Student

x:Student

x:Tutor

rdfs:domain

rdfs:range

x:email

rdf:Literal

x:advises

rdfs:range

x:responsible_for

rdfs:subPropertyOf

x:rdfs:domain

x:email

rdf:Literal

x:responsible_for

rdfs:subPropertyOf

Declaration of properties

Declaration of classes

rules

responsible_for(y,x) ∧ Professor(y)

→ Employee(x)

Sebastian Rudolph (RDF)
Franz Baader (Description Logics)
Pascal Hitzler (Ontologies and Rules)
Markus Krötzsch (Lightweight Ontology Languages)
Matthias Knorr (Unifying Semantic Web Logic)
Thomas Eiter (Querying Ontologies)
Basic Idea of the Semantic Web

Ontology represents general domain knowledge

- e.g. every publication has an author

DL Rules
Krötzsch, Rudolph, Hitzler
ECAI 2008

Data e.g. on Websites
Basic Idea of the Semantic Web

e.g. every publication has an author
Basic Idea of the Semantic Web

Ontology represents general domain knowledge
  e.g. every publication has an author

Data e.g. on Websites

DL Rules
Krötzsch, Rudolph, Hitzler
ECAI 2008
Basic Idea of the Semantic Web

[Diagram showing interconnected concepts related to the Semantic Web, including ontologies and data relations.]
Basic Idea of the Semantic Web
Applications

Uwe Aßmann (Model Checking Applications)
Peter Haase (Linked Data Applications at fluidOps)
Krzysztof Janowicz (Geoscience Applications)
## Programme

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General References