

# Introduction to Querying Linked Data

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Nebraska.Code() 2016  
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'I said, "**Could you put your documents on this web thing?**" And you did. Thanks! It's been a blast, hasn't it? ... Now, I want you to put your data on the web. Turns out that there is still huge unlocked potential. There is still a huge frustration that people have because **we haven't got data on the web as data.**'

Tim Berners-Lee, 2006 TED Talk



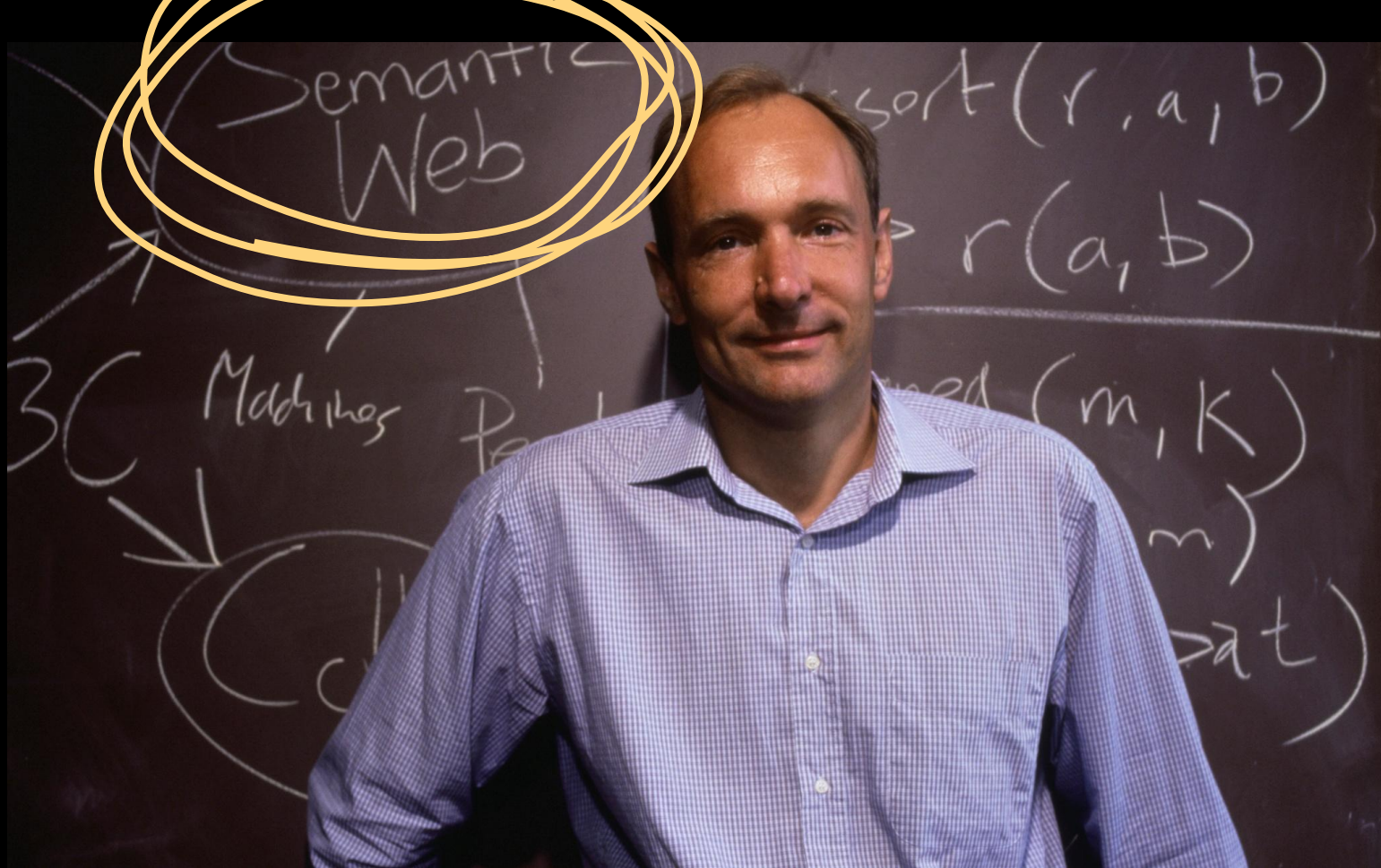
# What About...

Databases?

APIs?

XML Encoded Documents?





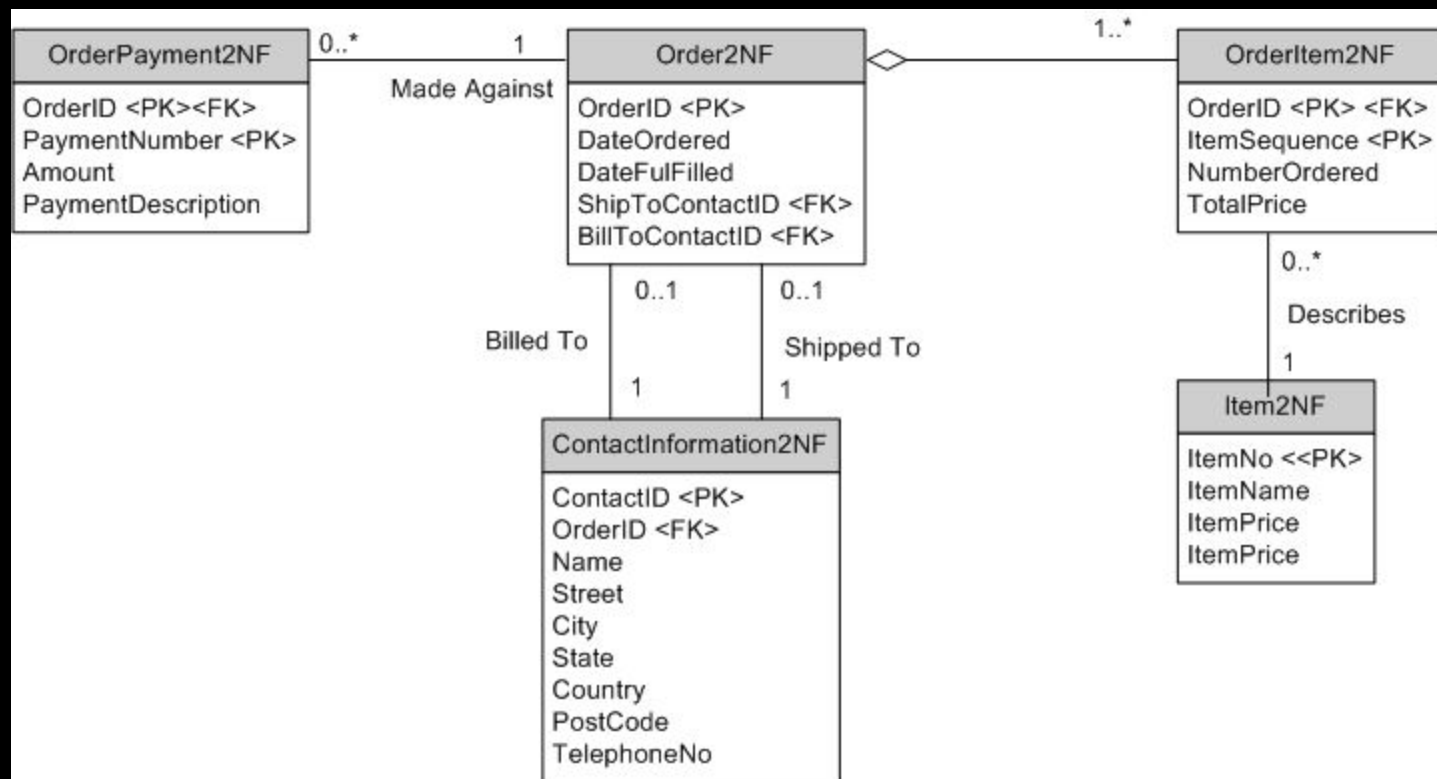
**“The Semantic Web isn’t just about putting data on the web. It is about making links...when you have some of it, you can find other, related, data.”**

- <https://www.w3.org/DesignIssues/LinkedData.html>



# Triples







Benjamin Sisko has rank Captain

Sisko serves on DS9

Sisko knows Jadzia Dax

Dax has rank Lt. Commander

Dax serves on DS9

Dax has position Chief Science Officer

Worf is the son of Mogh

Mogh is a Klingon warrior



"Dax" refers to  
the same entity  
each time

Dax has rank Lt. Commander

Dax serves on DS9

Dax has position Chief Science Officer

#1 refers to a  
**resource**

#1 has rank Lt. Commander

#1 serves on DS9

#1 has position Chief Science Officer

#1 is named "Jadzia Dax"

These could  
be resources

Her name is a  
**literal**

**RDF**

**Resource Description Framework**



**Subject**

**Predicate**

**Object**

**Sisko**

**rank**

**Captain**



**Resource**



**Subject**

**Predicate**

**Object**

starktrek.ufop/people  
#Sisko\_Benjamin

rank

starktrek.ufop/ranks  
#Captain

**Resource**

???

**Resource**



# Web Ontology Language

≈

OWL



Ontology is the philosophical study of the nature of being, becoming, existence, or reality -- wikipedia

<http://earlywashingtondc.org/rdf/oscys.objectproperties.owl#childOf>

```
▼<owl:ObjectProperty rdf:about="#childOf">
  <rdfs:domain rdf:resource="#Person"/>
  <rdfs:range rdf:resource="#Person"/>
  <owl:Inverseof rdf:resource="#parentOf"/>
  <rdfs:subPropertyOf rdf:resource="#familyRelationship"/>
</owl:ObjectProperty>
```



[xmlns.com/foaf/spec#term\\_workInfoHomepage](http://xmlns.com/foaf/spec#term_workInfoHomepage)

Property: foaf:workInfoHomepage

*work info homepage* - A work info homepage of some person; a page about their work for some organization.

**Status:** testing

**Domain:** having this property implies being a [Person](#)

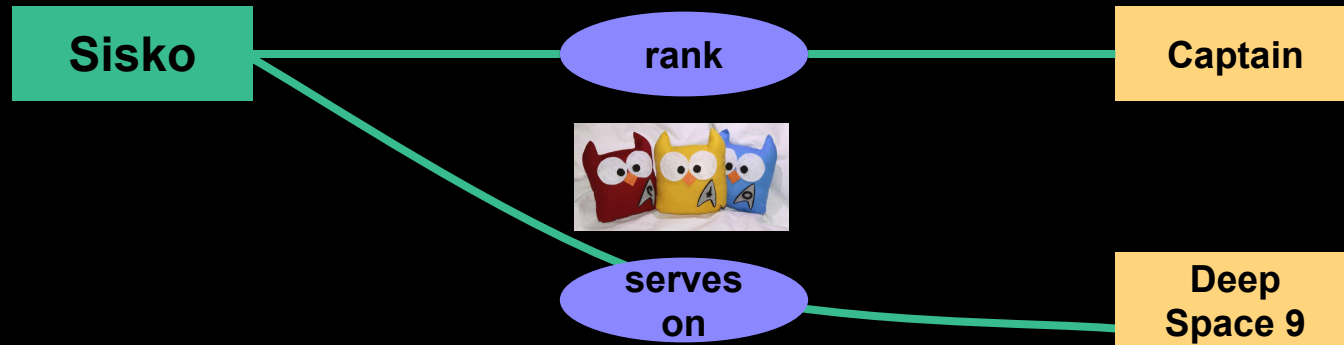
**Range:** every value of this property is a [Document](#)

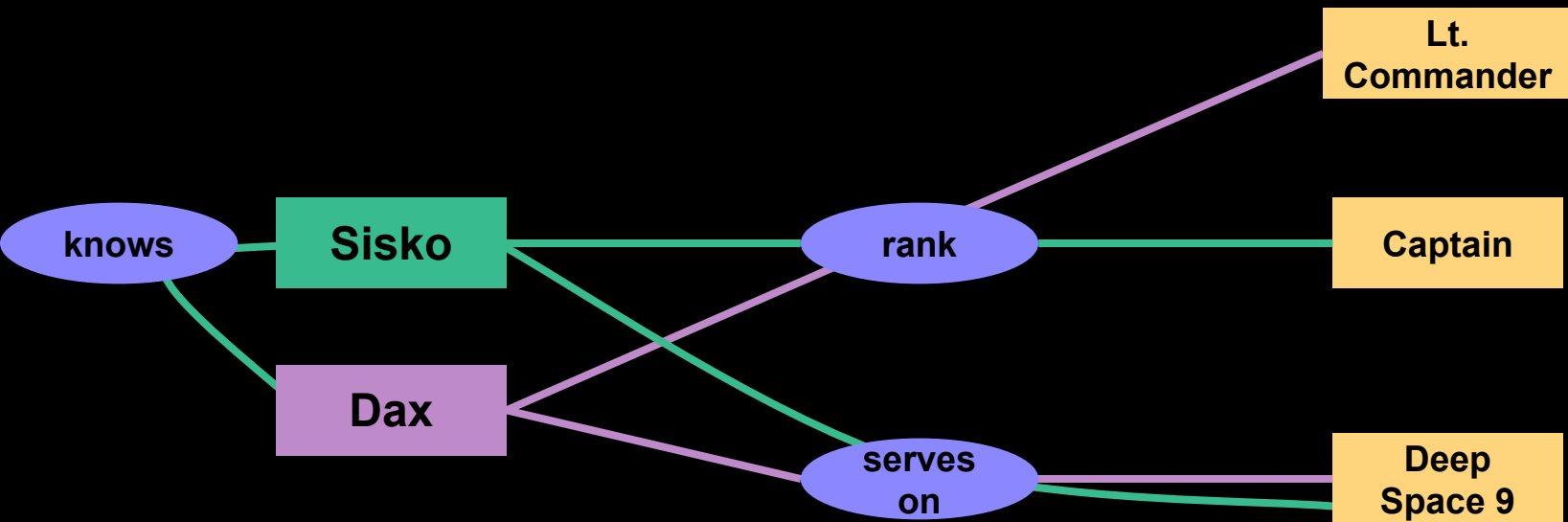
The [workInfoHomepage](#) of a [Person](#) is a [Document](#) that describes their work. It is generally (but not necessarily) a different document from their [homepage](#), and from any [workplaceHomepage](#)(s) they may have.

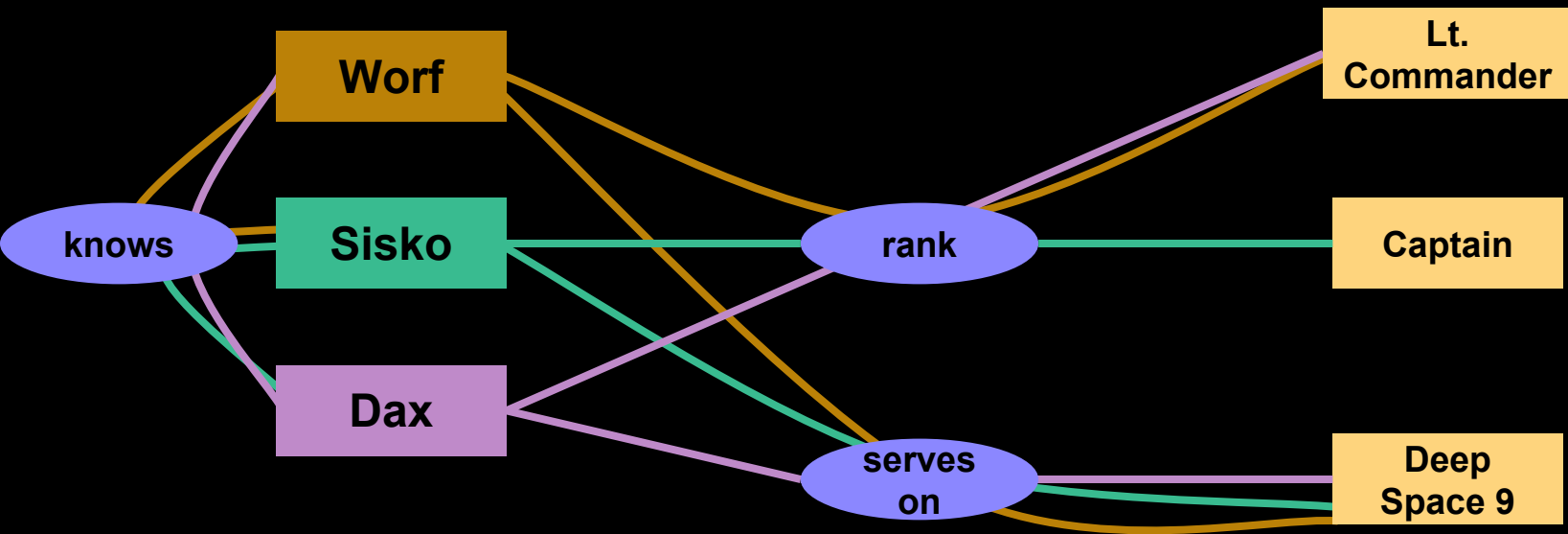
The purpose of this property is to distinguish those pages you often see, which describe someone's professional role within an organisation or project. These aren't really homepages, although they share some characteristics.

<http://www.pr-owl.org/resources/StarTrek/StarTrek.owl>







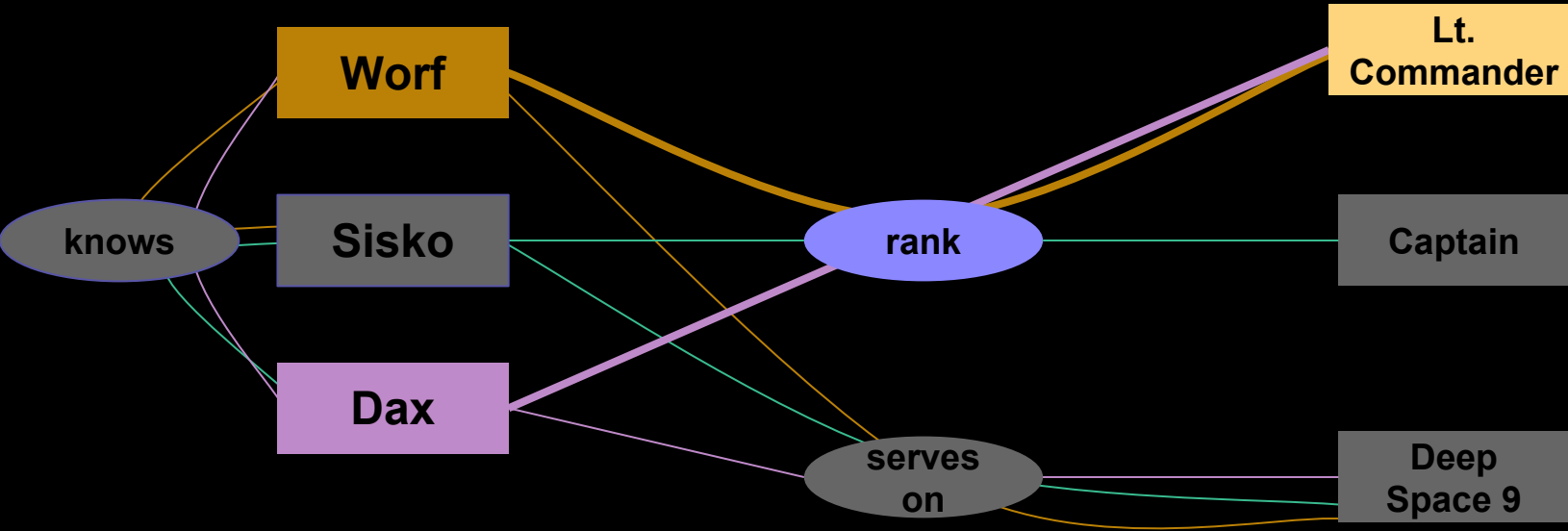


# Who has

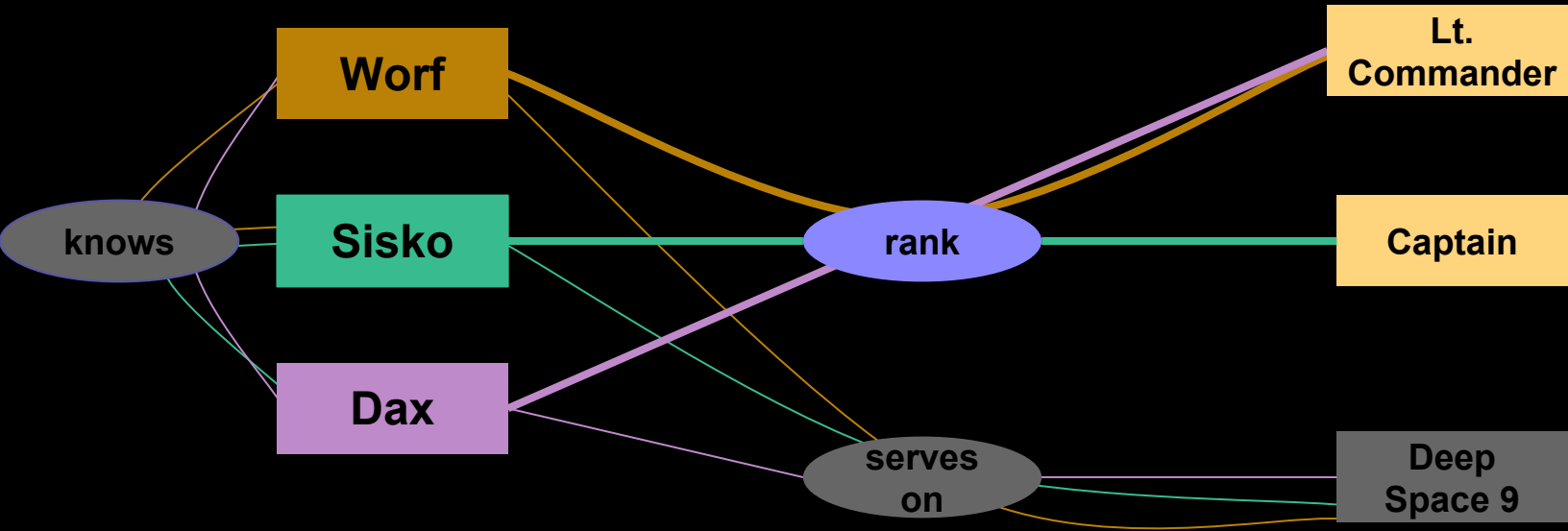
rank

Lt.  
Commander

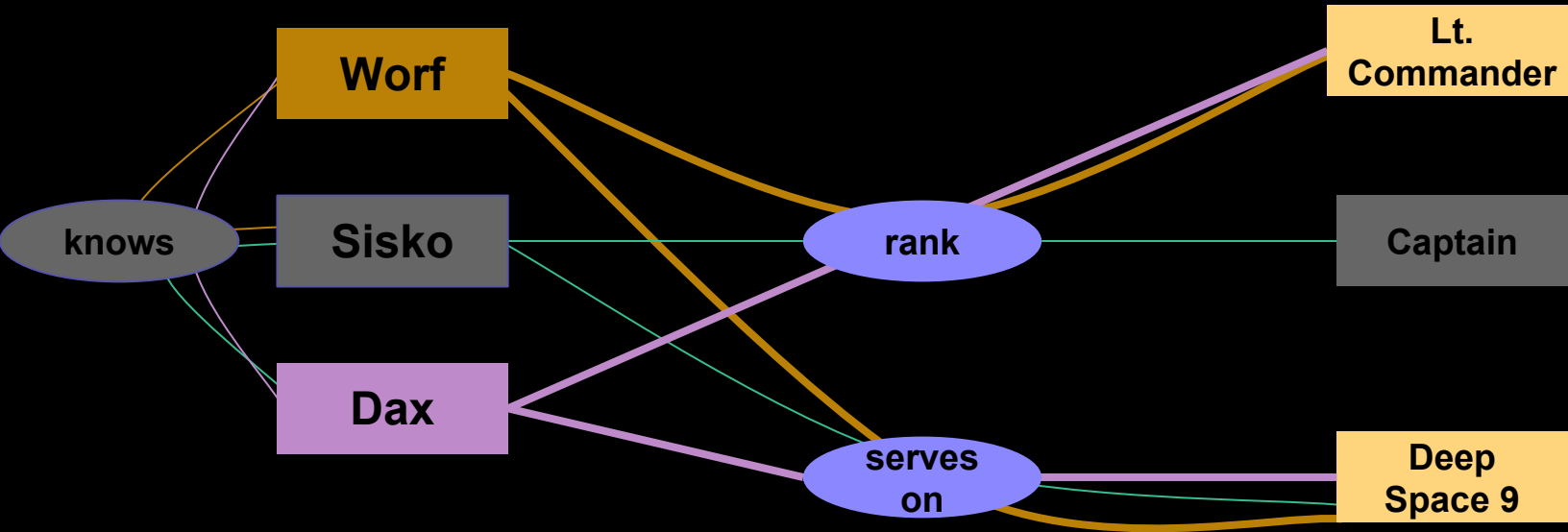
?



# Who has **rank** anything?



Who has **rank** **Lt. Commander** ?  
Those people **serve on** what vessel / station?





**Turtle**

**N-Triples**

**N-Quads**

**JSON-LD**

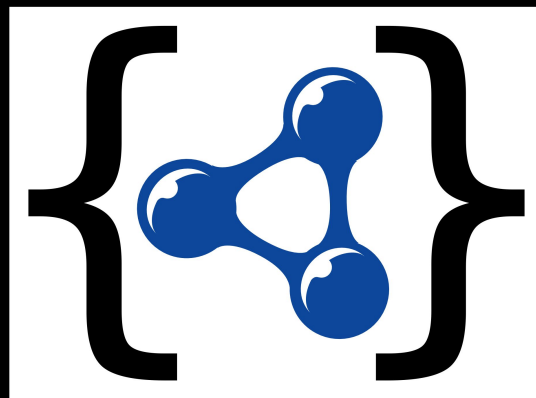
**Notation3**

**RDF/XML**

**RDFa**

**microdata**

**Microformats (older)**



**JSON-LD**

# Marking Up Sites With Linked Data





<div>

# <h1>Human Dental Office</h1>

<p>

Dr. Samantha Web welcomes you to the  
Human Dental Office, where we are totally normal humans.

</p>

<ul>

<li>Weekdays: 7am - 4pm</li>

<li>Saturday: 11am - 3pm</li>

</ul>

<p>402-431-2817</p>

</div>



**Company name**

```
<div>  
  <h1>Human Dental Office</h1>  
  <p>  
    Dr. Samantha Web welcomes you to the  
    Human Dental Office, where we are totally normal humans.  
  </p>  
  <ul>  
    <li>Weekdays: 7am - 4pm</li>  
    <li>Saturday: 11am - 3pm</li>  
  </ul>  
  <p>402-431-2817</p>  
</div>
```

**Probably a normal human**

**Something of a red flag**

**Hours of Operation**

**Phone #**

The diagram illustrates a web page snippet for 'Human Dental Office'. Annotations point to various parts of the code and text: 'Company name' points to the h1 tag; 'Probably a normal human' points to the main text paragraph; 'Something of a red flag' points to the phrase 'totally normal humans'; 'Hours of Operation' points to the list of hours; and 'Phone #' points to the phone number. A decorative bar at the bottom is divided into four colored segments: blue, purple, yellow, and red.

```
<div>
```

```
<h1>Human Dental Office</h1>
```

```
<p>
```

```
  Dr. Samantha Web welcomes you to the  
  Human Dental Office, where we are totally normal humans.
```

```
</p>
```

```
<ul>
```

```
  <li>Weekdays: 7am - 4pm</li>
```

```
  <li>Saturday: 11am - 3pm</li>
```

```
</ul>
```

```
<p>402-431-2817</p>
```

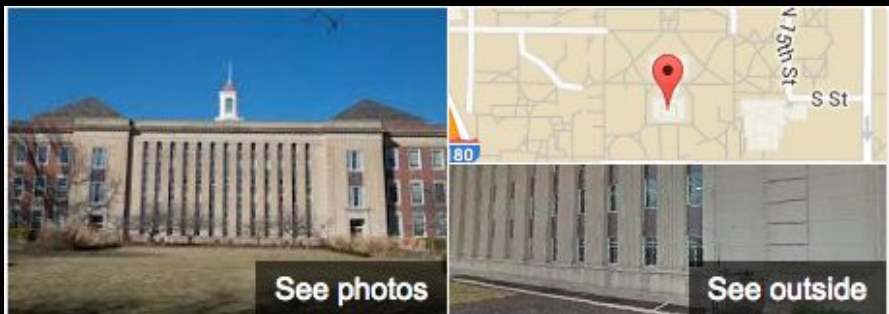
```
</div>
```

Header tag

Bunch o' text in  
a paragraph

List with some text

It's a paragraph filled with characters resembling  
a phone number



See photos

See outside

## Love Library ★

Library

Website

Directions

**Located in:** [University of Nebraska-Lincoln](#)

**Address:** Love Library North and Link, 318 R St, Lincoln, NE 68508

**Phone:** (402) 472-9568

**Hours:**

<b>Thursday</b>	<b>7:30AM–11PM</b>	■
Friday	7:30AM–8PM	
Saturday	9AM–5PM	
Sunday	12–11PM	
Monday	7:30AM–11PM	
Tuesday	7:30AM–11PM	
Wednesday	7:30AM–11PM	■

## Love Library

### Regular Hours

#### LOVE SOUTH MAIN ENTRANCE

Monday-Thursday: 7:30 am - 1 am


Friday: 7:30 am - 8 pm

Saturday: 9 am - 5 pm (Open Football Saturdays)

Sunday: 12 noon - 1 am

```
▼ <h3>
  "Regular Hours"
  <span class="wdn-subhead">Love South Main Entrance</span>
</h3>
▼ <p>
  "Monday-Thursday: 7:30 am - 1 am"
  <br>
  "
  Friday: 7:30 am - 8 pm"
  <br>
  "
  Saturday: 9 am - 5 pm (Open Football Saturdays)"
  <br>
  "
  Sunday: 12 noon - 1 am"
</p>
```

```
<div vocab="http://schema.org/" typeof="LocalBusiness">
  <h1 property="name">Human Dental Office</h1>
  <p>
    Dr. Samantha Web welcomes you to the
    <span property="name">Human Dental Office</span>, where we are totally
normal humans.
  </p>
  <ul>
    <li property="openingHours" content="Mo-Fr 7:00-16:00">Weekdays: 7am -
4pm</li>
    <li property="openingHours" content="Sa 11:00-15:00">Saturday: 11am - 3pm</li>
  </ul>
  <p property="telephone">402-431-2817</p>
</div>
```



@prefix rdfs: <http://www.w3.org/ns/rdfs#> .

@prefix schema: <http://schema.org/> .

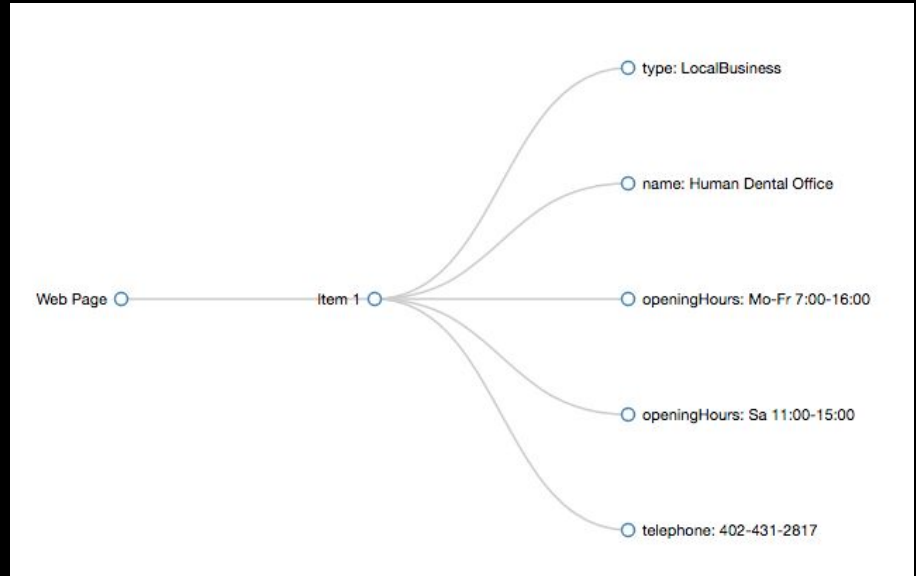
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

<https://rdfs.info/play/>


rdfs:usesVocabulary schema: .

\_:1

rdfs:type schema:LocalBusiness;  
schema:name "Human Dental Office";  
schema:openingHours "Mo-Fr 7:00-16:00";  
schema:openingHours "Sa 11:00-15:00";  
schema:telephone "402-431-2817" .



```
<div vocab="http://schema.org/" typeof="LocalBusiness">
  <h1 property="name">Human Dental Office</h1>
  <p>
    <span vocab="http://xmlns.com/foaf/0.1/" typeof="Person">
      <span property="name">Dr. Samantha Web</span></span> welcomes you to the
      <span property="name">Human Dental Office</span>, where we are totally
normal humans.
    </p>
    <ul>
      <li property="openingHours" content="Mo-Fr 7:00-16:00">Weekdays: 7am -
4pm</li>
      <li property="openingHours" content="Sa 11:00-15:00">Saturday: 11am - 3pm</li>
    </ul>
    <p property="telephone">402-431-2817</p>
</div>
```



@prefix rdfs: <http://www.w3.org/ns/rdf#> .  
@prefix schema: <http://schema.org/> .  
@prefix foaf: <http://xmlns.com/foaf/0.1/> .  
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

<https://rdfa.info/play/>

rdfs:usesVocabulary schema;;

rdfs:usesVocabulary foaf: .

\_:1

rdfs:type schema:LocalBusiness;

schema:name "Human Dental Office";

schema:openingHours "Mo-Fr 7:00-16:00";

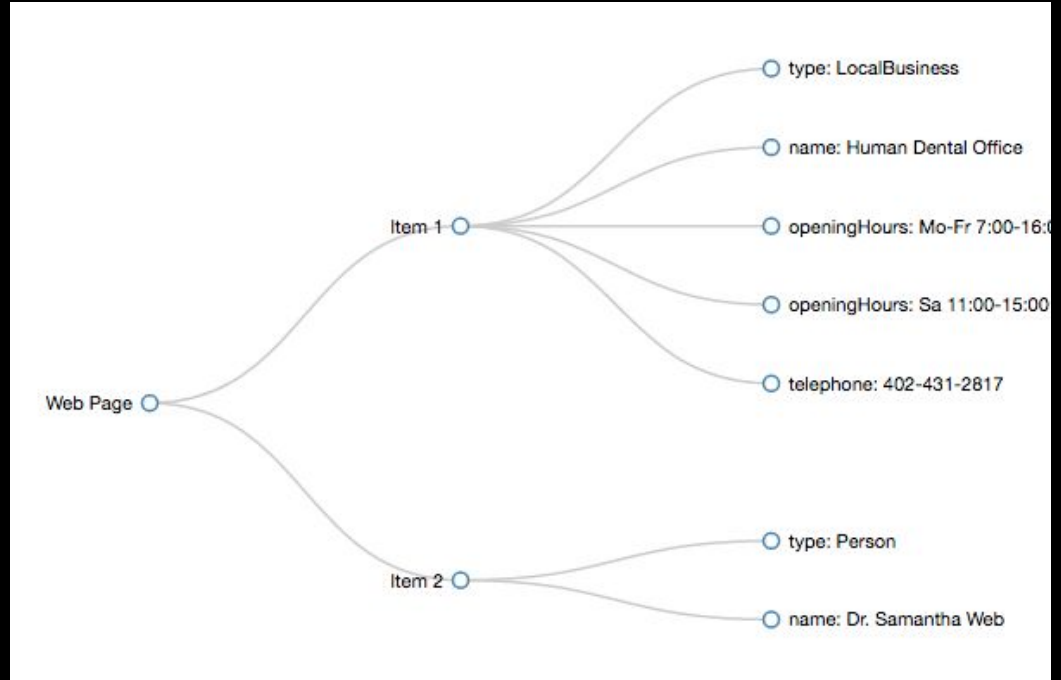
schema:openingHours "Sa 11:00-15:00";

schema:telephone "402-431-2817" .

\_:2


rdfs:type foaf:Person;

foaf:name "Dr. Samantha Web" .





```
<div prefix="schema: http://schema.org/ foaf: http://xmlns.com/foaf/0.1/"
typeof="schema:LocalBusiness foaf:Person">
  <h1 property="schema:name">Human Dental Office</h1>
  <p>
    <span property="foaf:name">Dr. Samantha Web</span> welcomes you to the
    <span property="schema:name">Human Dental Office</span>, where we are
    totally normal humans.
  </p>
  <ul>
    <li property="schema:openingHours" content="Mo-Fr 7:00-16:00">Weekdays: 7am
    - 4pm</li>
    <li property="schema:openingHours" content="Sa 11:00-15:00">Saturday: 11am -
    3pm</li>
  </ul>
  <p property="schema:telephone">402-431-2817</p>
</div>
```



## LocalBusiness

Thing > Organization > LocalBusiness

Thing > Place > LocalBusiness

A particular physical business or branch of an organization. Examples of LocalBusiness include a restaurant, a particular branch of a restaurant chain, a branch of a bank, a medical practice, a club, a bowling alley, etc.

Usage: Between 500,000 and 1,000,000 domains

## Dentist

Thing > Organization > LocalBusiness > ProfessionalService > Dentist

Thing > Organization > LocalBusiness > MedicalBusiness > Dentist

Thing > Organization > MedicalOrganization > Dentist

Thing > Place > LocalBusiness > ProfessionalService > Dentist

Thing > Place > LocalBusiness > MedicalBusiness > Dentist

A dentist.

Usage: Between 1000 and 10,000 domains

`<div vocab="https://health-lifesci.schema.org/" typeof="Dentist">`

```
<script type="application/ld+json">
{
  "@graph": [
    {
      "@id": "_:a",
      "@type": "https://health-lifesci.schema.org/Dentist",
      "https://health-lifesci.schema.org/name": "Human Dental Office",
      "https://health-lifesci.schema.org/openingHours": [
        "Sa 11:00-15:00",
        "Mo-Fr 7:00-16:00"
      ],
      "https://health-lifesci.schema.org/telephone": "402-431-2817"
    },
    {
      "@id": "_:b",
      "@type": "http://xmlns.com/foaf/0.1/Person",
      "http://xmlns.com/foaf/0.1/name": "Dr. Samantha Web"
    }
  ]
}
</script>
```

http://www.unl.edu/

**FETCH & VALIDATE**

CANCEL

Shortlink

Results - [Filter by use case](#)

```
4.1.css?v=2016-05-09" />
76 <script src="sharedcode/js/picturefill.min.js" async></script>
77 <meta name="google-site-verification"
    content="IBnMrc35WF2Fjglqjd_q3QmhmY9qnHUu4gKLS0111Fw" />
78 <script type="application/ld+json">
79 {
80   "@context" : "http://schema.org",
81   "@type" : "CollegeOrUniversity",
82   "name" : "University of Nebraska–Lincoln",
83   "url" : "http://www.unl.edu",
84   "sameAs" : [
85     "http://www.facebook.com/UNLincoln",
86     "https://twitter.com/UNLincoln",
87     "https://www.instagram.com/unlincoln/",
88     "https://www.linkedin.com/edu/school?id=18836",
89     "https://plus.google.com/+UNLincoln",
90     "https://www.pinterest.com/unlincoln/",
91     "https://en.wikipedia.org/wiki/University_of_Nebraska%E2%80%93Lincoln"
92   ]
93 }
94 </script><!-- InstanceEndEditable -->
```

CollegeOrUniversity (1)

All good ✓

#### CollegeOrUniversity

name:	University of Nebraska–Lincoln
url:	http://www.unl.edu
sameAs:	http://www.facebook.com/UNLincoln
sameAs:	https://twitter.com/UNLincoln
sameAs:	https://www.instagram.com/unlincoln/
sameAs:	https://www.linkedin.com/edu/school?id=18836
sameAs:	https://plus.google.com/+UNLincoln
sameAs:	https://www.pinterest.com/unlincoln/
sameAs:	https://en.wikipedia.org/wiki/University_of_Nebraska%E2%80%93Lincoln

Custom Search Result Filters

http://allrecipes.com/recipe/236991/chef-johns-rhut

FETCH & VALIDATE

CANCEL

Shortlink

```
1633 </div>
1634         <div itemprop="reviewRating" itemscope
1635         itemType="http://schema.org/Rating">
1636             <meta itemprop="ratingValue" content="5">
1637             </div>
1638             <div class="review-date">6/10/2014</div>
1639             <meta itemprop="dateCreated" content="2014-06-10">
1640         </div>
1641     </article>
1642     <p itemprop="reviewBody">
1643     Love this! Easy to make! I put a few more strawberries and less
1644     rhubarb than it called for. </p>
1645     <div class="review-detail">
1646         <a class="review-detail__link"
1647         href="reviews/4734788/" ng-
1648         click="$event.preventDefault();reviewModalDialog(0, sortBy)">
1649             <span class="icon--expand-icon"></span>
1650             <span>Read more</span>
1651         </a>
1652     </div>
```

Results - Filter by use case ▾

ingredients:	1 tablespoon lemon juice
ingredients:	1 teaspoon lemon zest
ingredients:	Topping:
ingredients:	1/2 cup brown sugar
ingredients:	1/2 cup whole wheat flour
ingredients:	1/2 cup rolled oats
ingredients:	1/4 teaspoon salt
ingredients:	1 pinch ground cinnamon
ingredients:	4 tablespoons cold butter, cut into cubes
prepTime:	PT15M
cookTime:	PT35M
totalTime:	PT50M
recipeInstructions:	Preheat oven to 375 degrees F (190 degrees C). Grease a 2-quart baking dish. Combine rhubarb, strawberries, white sugar, lemon juice, and lemon zest together in a bowl. Stir brown sugar, whole wheat flour, oats, salt, and cinnamon together in a bowl. Cut cold butter into oat mixture with a pastry blender until the mixture resembles coarse crumbs and butter pieces are pea-sized. Pour rhubarb mixture into prepared baking dish. Spread oatmeal mixture evenly over the top. Bake in the preheated oven until golden and bubbling.

**JSON-LD**

<http://json-ld.org/>

**Schema.org**

<http://schema.org/>

**RDFa**

<https://rdfa.info/>

**Google Structured  
Data Markup Helper**

<https://www.google.com/webmasters/markup-helper/>



"Bing! That's data. Data, data, data."  
- Tim Berners-Lee

**Google: Knowledge Graph**

**Bing: Marking Up Your Site**

**Facebook: Open Graph Protocol**



'Google has done a tremendous service in exposing some Linked Data to the end user. **They could do a much greater service if they exposed it as a SPARQL endpoint.** Somehow I don't expect it to show up in the Google API anytime soon.

I've expressed concern over the privatization of the semantic web before. I don't think this is quite the same thing. Maybe this is more of a "don't show us how the sausage is made" dynamic. It's hard to blame Google for letting people assume the Knowledge Graph is more of their magic. **But if IT leaders and practitioners continue to think they can't do this stuff because they aren't Google, opportunities are going to be missed.** In fact, they already are. I find it ironic that one of the objections raised to the Semantic Web is that it all sounds too much like science fiction. In his blog post Singhal hails the Knowledge Graph as Google's first baby step towards the Star Trek computer. If we don't start to step up, when that computer eventually materializes it will be ad-driven. We need to get more comfortable with semantic technologies and bringing them into the enterprise. **The more Linked Open Data available, the more powerful the graph becomes for all of us.** It's time to get more involved or as Jean-Luc Picard might say, "Engage!" '

- Darin Stewart, 2012 "Google's Knowledge Graph: Yeah, that's the Semantic Web (sort of)"





# Let's Think Big!

...wikipedia is pretty big...



**Search Engines**

**BBC Things**

**Dbpedia**

**OpenStreetMap**



# NATURE PREHISTORIC LIFE

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[Life](#) > [Animals](#) > [Prehistoric](#) > [Reptiles](#) > [Ichthyosaurs](#)

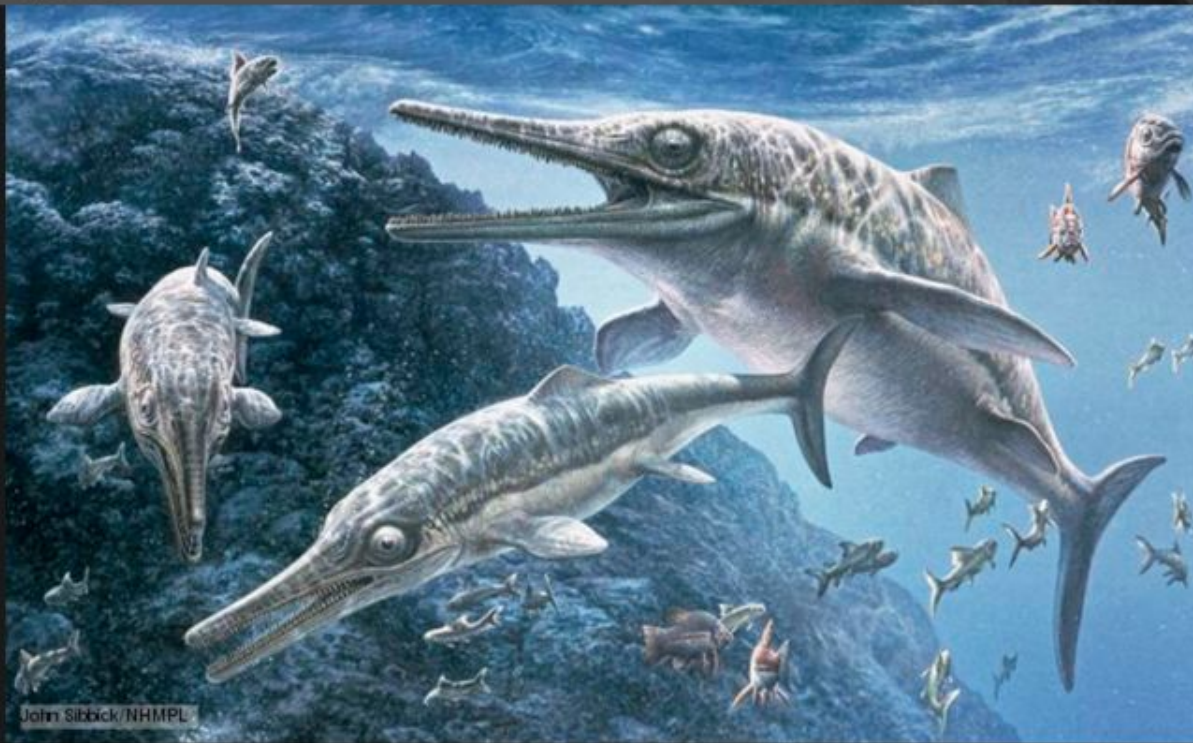
## Ichthyosaurs

Ichthyosaurs were predatory marine reptiles that swam the world's oceans while dinosaurs walked the land. They appeared in the Triassic period, dying out around 25 million years before the extinction event that wiped out the dinosaurs. Ichthyosaurs (literally 'fish-lizards') evolved from an as yet unidentified land reptile that moved back into the water. These huge animals rapidly diversified from being lizards with fins to developing a much more streamlined, fish-like form built for speed. One species has been calculated to have a cruising speed of 36 km/h. These enormous predators remained at the top of the food chain until they were replaced by the plesiosaurs.

Scientific name: Ichthyosauria

Rank: **Order**

Common names: fish lizard

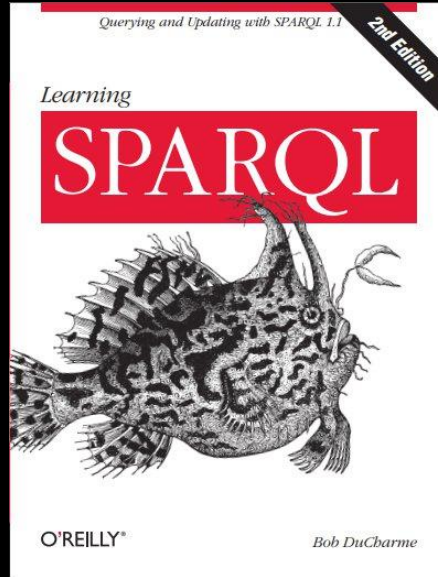





**BBC 2012 Olympics**



# Querying Large Datasets




```
SELECT *  
FROM <graph_uri>  
WHERE {  
  
}  
LIMIT 100
```



?s ?p ?o




```
SELECT *  
FROM <graph_uri>  
WHERE {  
    ?s ?p ?o  
}  
LIMIT 100
```





```
SELECT *  
FROM <graph_uri>  
WHERE {  
    <resource> ?p ?o  
}  
LIMIT 100
```



## Default Data Set Name (Graph IRI)

<http://dbpedia.org>

## Query Text

```
SELECT *  
WHERE {  
  <http://dbpedia.org/resource/George\_Washington> ?p ?o  
}  
LIMIT 200
```

<http://dbpedia.org/sparql>

<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<a href="http://dbpedia.org/class/yago/Officeholder110371450">http://dbpedia.org/class/yago/Officeholder110371450</a>
<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<a href="http://dbpedia.org/class/yago/Owner110389398">http://dbpedia.org/class/yago/Owner110389398</a>
<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<a href="http://dbpedia.org/class/yago/PhysicalEntity100001930">http://dbpedia.org/class/yago/PhysicalEntity100001930</a>
<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<a href="http://dbpedia.org/class/yago/UnitedStatesArmyGenerals">http://dbpedia.org/class/yago/UnitedStatesArmyGenerals</a>
<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<a href="http://dbpedia.org/class/yago/WashingtonCollegePeople">http://dbpedia.org/class/yago/WashingtonCollegePeople</a>
<a href="http://dbpedia.org/ontology/deathPlace">http://dbpedia.org/ontology/deathPlace</a>	<a href="http://dbpedia.org/resource/Virginia">http://dbpedia.org/resource/Virginia</a>
<a href="http://dbpedia.org/ontology/deathPlace">http://dbpedia.org/ontology/deathPlace</a>	<a href="http://dbpedia.org/resource/United_States">http://dbpedia.org/resource/United_States</a>
<a href="http://dbpedia.org/ontology/deathPlace">http://dbpedia.org/ontology/deathPlace</a>	<a href="http://dbpedia.org/resource/Mount_Vernon">http://dbpedia.org/resource/Mount_Vernon</a>
<a href="http://dbpedia.org/property/deathPlace">http://dbpedia.org/property/deathPlace</a>	<a href="http://dbpedia.org/resource/Virginia">http://dbpedia.org/resource/Virginia</a>
<a href="http://dbpedia.org/property/deathPlace">http://dbpedia.org/property/deathPlace</a>	<a href="http://dbpedia.org/resource/United_States">http://dbpedia.org/resource/United_States</a>
<a href="http://dbpedia.org/property/deathPlace">http://dbpedia.org/property/deathPlace</a>	<a href="http://dbpedia.org/resource/Mount_Vernon">http://dbpedia.org/resource/Mount_Vernon</a>
<a href="http://dbpedia.org/ontology/deathDate">http://dbpedia.org/ontology/deathDate</a>	1799-12-14
<a href="http://dbpedia.org/ontology/birthPlace">http://dbpedia.org/ontology/birthPlace</a>	<a href="http://dbpedia.org/resource/British_America">http://dbpedia.org/resource/British_America</a>
<a href="http://dbpedia.org/ontology/birthPlace">http://dbpedia.org/ontology/birthPlace</a>	<a href="http://dbpedia.org/resource/Westmoreland_County,_Virginia">http://dbpedia.org/resource/Westmoreland_County,_Virginia</a>
<a href="http://dbpedia.org/ontology/birthPlace">http://dbpedia.org/ontology/birthPlace</a>	<a href="http://dbpedia.org/resource/Colony_of_Virginia">http://dbpedia.org/resource/Colony_of_Virginia</a>
<a href="http://dbpedia.org/property/birthPlace">http://dbpedia.org/property/birthPlace</a>	<a href="http://dbpedia.org/resource/British_America">http://dbpedia.org/resource/British_America</a>
<a href="http://dbpedia.org/property/birthPlace">http://dbpedia.org/property/birthPlace</a>	<a href="http://dbpedia.org/resource/Westmoreland_County,_Virginia">http://dbpedia.org/resource/Westmoreland_County,_Virginia</a>
<a href="http://dbpedia.org/property/birthPlace">http://dbpedia.org/property/birthPlace</a>	<a href="http://dbpedia.org/resource/Colony_of_Virginia">http://dbpedia.org/resource/Colony_of_Virginia</a>
<a href="http://dbpedia.org/ontology/birthDate">http://dbpedia.org/ontology/birthDate</a>	1732-02-22
<a href="http://purl.org/dc/terms/subject">http://purl.org/dc/terms/subject</a>	<a href="http://dbpedia.org/resource/Category:1732_births">http://dbpedia.org/resource/Category:1732_births</a>
<a href="http://purl.org/dc/terms/subject">http://purl.org/dc/terms/subject</a>	<a href="http://dbpedia.org/resource/Category:1799_deaths">http://dbpedia.org/resource/Category:1799_deaths</a>
<a href="http://purl.org/dc/terms/subject">http://purl.org/dc/terms/subject</a>	<a href="http://dbpedia.org/resource/Category:18th-century_American_Episcopalians">http://dbpedia.org/resource/Category:18th-century_American_Episcopalians</a>
<a href="http://purl.org/dc/terms/subject">http://purl.org/dc/terms/subject</a>	<a href="http://dbpedia.org/resource/Category:18th-century_American_politicians">http://dbpedia.org/resource/Category:18th-century_American_politicians</a>
<a href="http://purl.org/dc/terms/subject">http://purl.org/dc/terms/subject</a>	<a href="http://dbpedia.org/resource/Category:American_cartographers">http://dbpedia.org/resource/Category:American_cartographers</a>
<a href="http://purl.org/dc/terms/subject">http://purl.org/dc/terms/subject</a>	<a href="http://dbpedia.org/resource/Category:American_deists">http://dbpedia.org/resource/Category:American_deists</a>

## Virtuoso SPARQL Query Editor


Default Data Set Name (Graph IRI)

Query Text

```
SELECT *  
WHERE {  
  ?presidents a <http://dbpedia.org/class/yago/PresidentsOfTheUnitedStates>  
}  
LIMIT 200
```

presidents
<a href="http://dbpedia.org/resource/Zachary_Taylor">http://dbpedia.org/resource/Zachary_Taylor</a>
<a href="http://dbpedia.org/resource/Benjamin_Harrison">http://dbpedia.org/resource/Benjamin_Harrison</a>
<a href="http://dbpedia.org/resource/Chester_A._Arthur">http://dbpedia.org/resource/Chester_A._Arthur</a>
<a href="http://dbpedia.org/resource/Harry_S._Truman">http://dbpedia.org/resource/Harry_S._Truman</a>
<a href="http://dbpedia.org/resource/James_Buchanan">http://dbpedia.org/resource/James_Buchanan</a>
<a href="http://dbpedia.org/resource/John_Adams">http://dbpedia.org/resource/John_Adams</a>
<a href="http://dbpedia.org/resource/Millard_Fillmore">http://dbpedia.org/resource/Millard_Fillmore</a>
<a href="http://dbpedia.org/resource/Presidential_Issue">http://dbpedia.org/resource/Presidential_Issue</a>
<a href="http://dbpedia.org/resource/Franklin_Pierce">http://dbpedia.org/resource/Franklin_Pierce</a>
<a href="http://dbpedia.org/resource/John_Tyler">http://dbpedia.org/resource/John_Tyler</a>
<a href="http://dbpedia.org/resource/Gerald_Ford">http://dbpedia.org/resource/Gerald_Ford</a>
<a href="http://dbpedia.org/resource/Abraham_Lincoln">http://dbpedia.org/resource/Abraham_Lincoln</a>
<a href="http://dbpedia.org/resource/Andrew_Jackson">http://dbpedia.org/resource/Andrew_Jackson</a>
<a href="http://dbpedia.org/resource/Andrew_Johnson">http://dbpedia.org/resource/Andrew_Johnson</a>
<a href="http://dbpedia.org/resource/Bill_Clinton">http://dbpedia.org/resource/Bill_Clinton</a>
<a href="http://dbpedia.org/resource/Calvin_Coolidge">http://dbpedia.org/resource/Calvin_Coolidge</a>
<a href="http://dbpedia.org/resource/Dwight_D._Eisenhower">http://dbpedia.org/resource/Dwight_D._Eisenhower</a>
<a href="http://dbpedia.org/resource/Franklin_D._Roosevelt">http://dbpedia.org/resource/Franklin_D._Roosevelt</a>
<a href="http://dbpedia.org/resource/George_H._W._Bush">http://dbpedia.org/resource/George_H._W._Bush</a>
<a href="http://dbpedia.org/resource/George_Washington">http://dbpedia.org/resource/George_Washington</a>

```
SELECT *  
WHERE {  
  ?thing1 ?p ?thing2 .  
  ?thing2 ?p2 ?thing3  
}
```



?person

rank

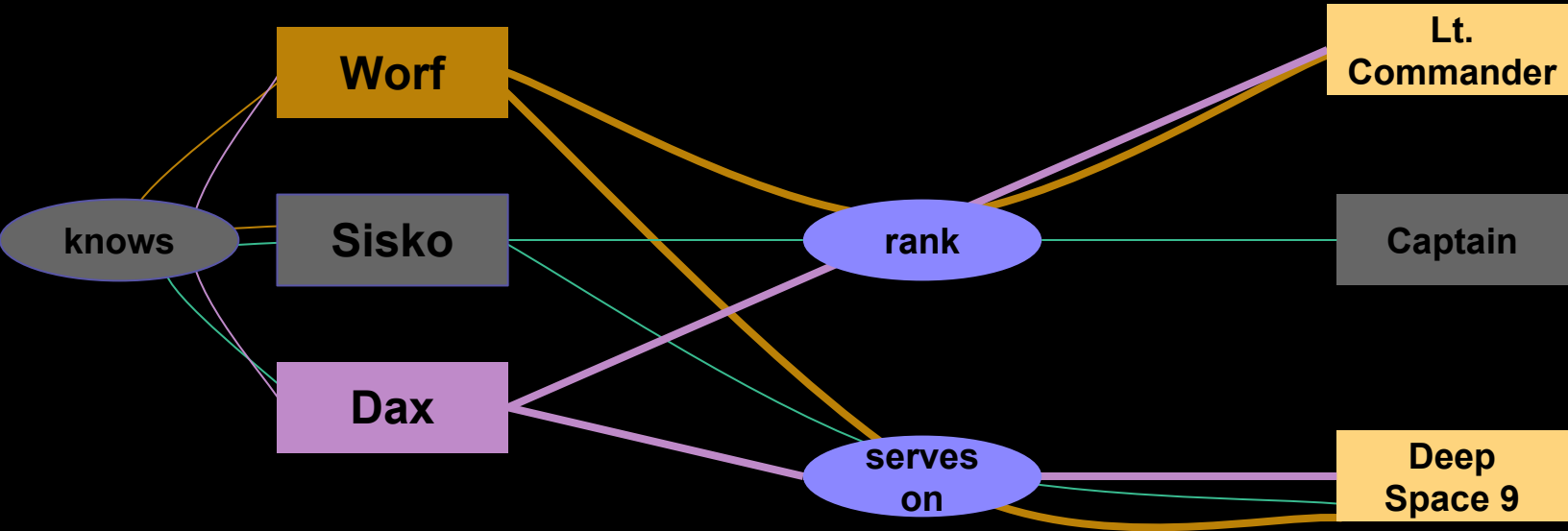
Lt.  
Commander

.

?person

serve  
on

?vessel



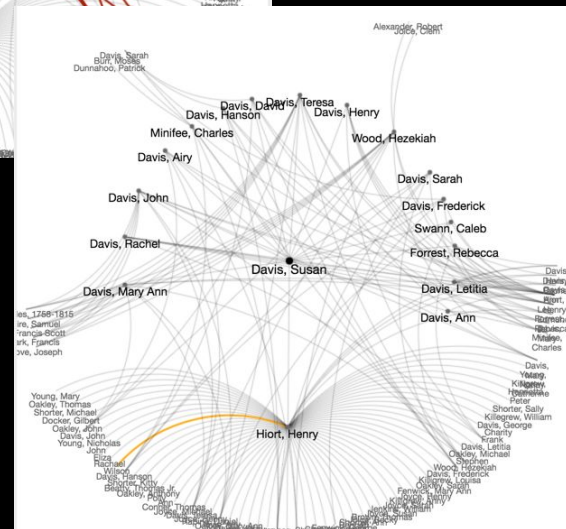
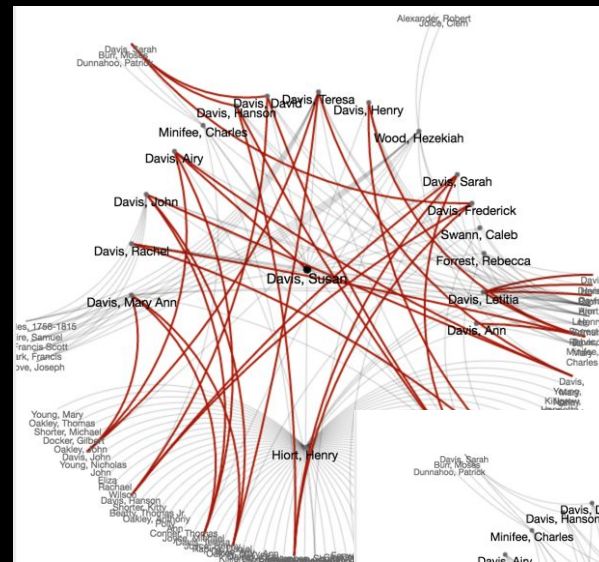
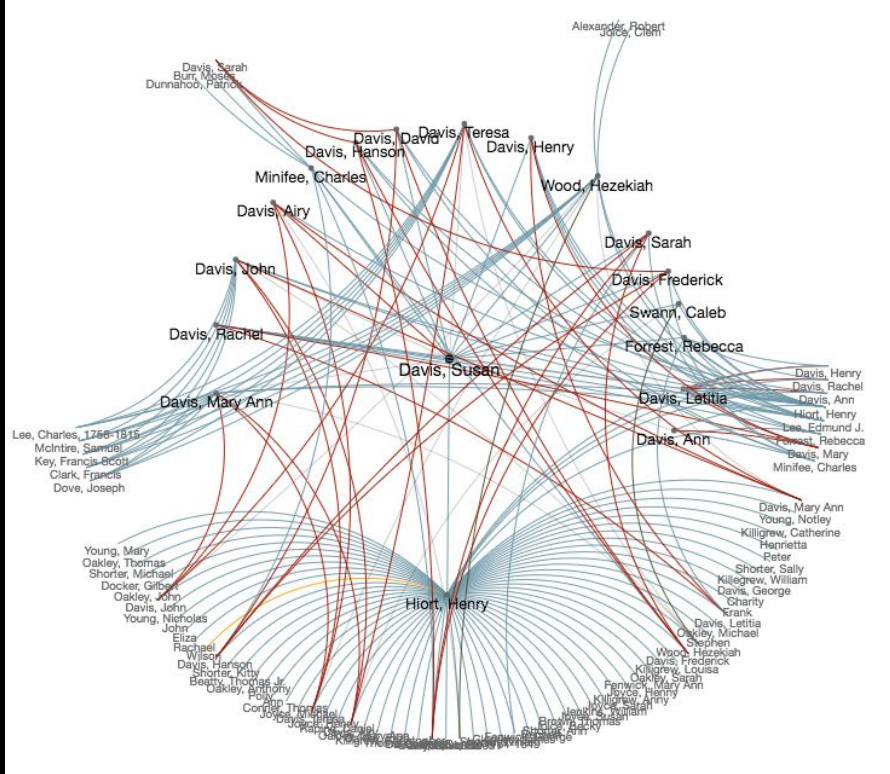


# 0 SAY CAN YOU SEE

EARLY WASHINGTON, D.C., LAW & FAMILY



```
osrdf:per.000160 a "person";
  oscys:clientOf osrdf:per.000011;
  oscys:fullName "Davis, Susan";
  oscys:fullname "Davis, Susan";
  oscys:judgedBy osrdf:per.000004;
  oscys:parentOf osrdf:per.001601,
    osrdf:per.001602,
    osrdf:per.001603,
    osrdf:per.001608;
  oscys:petitionerAgainst osrdf:per.000168;
  oscys:sex "female";
  oscys:siblingOf osrdf:per.000150,
    osrdf:per.000161;
  oscys:witnessAgainst osrdf:per.000153,
    osrdf:per.000166,
    osrdf:per.001604;
  oscys:witnessFor osrdf:per.000150,
    osrdf:per.000151,
    osrdf:per.000152,
    osrdf:per.000161,
    osrdf:per.000162,
    osrdf:per.000163,
    osrdf:per.000164,
```



# Search By Relationship Type

Find people related by a specific type of connection in the OSCYS data.

Enslaved By



Go!

Individual	enslaved by
<a href="#">Lyles, Sylvester</a>	<a href="#">Hyatt, Christopher C.</a>
<a href="#">James</a>	<a href="#">Thompson, Elizabeth</a>
<a href="#">Gordon, Ann</a>	<a href="#">Harrison, Mildred</a>
<a href="#">Compton, Henry</a>	<a href="#">Dorsey, William</a>
<a href="#">Lewis, Jane</a>	<a href="#">Conrad, Nelson</a>
<a href="#">Johnson, Ellen</a>	<a href="#">Tyler, Trueman</a>
<a href="#">Morris, Peter</a>	<a href="#">Davis, Jonathan</a>

## Direct Relationships

Starting Person	Relationship	Final Person
<a href="#">Key, Francis Scott</a>	attorney with	<a href="#">Caldwell, Elias Boudinot</a>
<a href="#">Key, Francis Scott</a>	attorney against	<a href="#">Caldwell, Elias Boudinot</a>

## Relationships Two Apart

Starting Person	Relationship	Person	Relationship	Final Person
<a href="#">Key, Francis Scott</a>	attorney for	<a href="#">Lingan, Janet</a>	client of	<a href="#">Caldwell, Elias Boudinot</a>
<a href="#">Key, Francis Scott</a>	attorney against	<a href="#">Bennett</a>	oppositions attorney	<a href="#">Caldwell, Elias Boudinot</a>
<a href="#">Key, Francis Scott</a>	opposing attorneys	<a href="#">Taney, Augustus</a>	opposing attorneys	<a href="#">Caldwell, Elias Boudinot</a>
<a href="#">Key, Francis Scott</a>	opposing attorneys	<a href="#">Law, John</a>	attorney with	<a href="#">Caldwell, Elias Boudinot</a>
<a href="#">Key, Francis Scott</a>	attorney with	<a href="#">Taney, Augustus</a>	opposing attorneys	<a href="#">Caldwell, Elias Boudinot</a>
<a href="#">Key, Francis Scott</a>	deposed	<a href="#">Middleton, Walter H.</a>	deponent of	<a href="#">Caldwell, Elias Boudinot</a>

<http://cdrh.github.io/>



I get how to write queries,  
but **WHERE** do I write queries?



# Available Online Processors

<http://www.sparql.org/sparql.html>

<http://dbpedia.org/sparql>

# Setting Up Your Own Processor

[Jena Fuseki](#)

[Virtuoso](#)

[w3 List of Implementations](#)

# Command Line Utilities

[Jena ARQ](#)



	<b>npm</b>	<b>rubygems</b>	<b>php packagist</b>	<b>rdocumentation</b>	<b>pypi</b>
<b>rdf</b>	<b>211</b>	<b>105</b>	<b>45</b>	<b>14</b>	<b>485</b>
<b>json-ld</b>	<b>94</b>	<b>2</b>	<b>20</b>	<b>1</b>	<b>n/a*</b>
<b>sparql</b>	<b>70</b>	<b>11</b>	<b>18</b>	<b>20</b>	<b>81</b>
<b>microdata</b>	<b>33</b>	<b>9</b>	<b>16</b>	<b>48</b>	<b>29</b>

\* Too fuzzy to return reasonable results



# 7,444 datasets found

Demographic Statistics By Zip Code  706 recent views

*City of New York* — Demographic statistics broken down by zip code

[CSV](#) [RDF](#) [JSON](#) [XML](#)

Crimes - 2001 to present  620 recent views

*City of Chicago* — This dataset reflects reported incidents of crime (with the exception of juveniles whose offense dates are 2003 or earlier) where data exists for each victim) that occurred in the City of Chicago from 2001 to the present.

[CSV](#) [RDF](#) [JSON](#) [XML](#)

U.S. Chronic Disease Indicators (CDI)  427 recent views

*U.S. Department of Health & Human Services* — CDC's Division of Population Health has developed a cutting set of 124 indicators that were developed by consensus and that allows for comparison across states and large...

[CSV](#) [RDF](#) [JSON](#) [xsl](#)

data.gov

**Search Engine Optimization**  
**Website Creation**  
**Data Discovery**  
**Interconnectivity**  
**Collaboration**



**"OK, so it's called linked data.  
I want you to make it.  
I want you to demand it.  
And I think it's an idea worth spreading."**

- Tim Berners-Lee



# Resources - Tim Berners-Lee & RDF

- [Berners-Lee, 1998: Semantic Web Roadmap](#)
- [Berners-Lee, 1998: Web Architecture from 50,000 Feet](#)
- [Berners-Lee, Hendler, Lassila, 2001: The Semantic Web \(Scientific American\)](#)
- [Berners-Lee, 2006: Linked Data](#)
- [Berners-Lee, 2009: The Next Web \(TED Talk\)](#)
- [W3C Resource Description Framework \(RDF\)](#)
- [Dussault, 2015, "Figuring out RDF and SPARQL: Part I Triples"](#)

# Resources - RDFa, JSON-LD, Schema.org

- <https://rdfa.info/> - intro specs, resources, playground, plugins, libraries
- <http://json-ld.org/> - specs, playground, resources
- [Sporny, 2008, RDFa Basics](#) - video
  
- <http://schema.org/>
- [Google Developer Schema Guides](#)
- [Google Structured Data Testing Tool](#)
- [Google Structured Data](#)
- [Bing Linked Data Markup Overview](#)

# Resources - Ontologies / OWL

- <https://prefix.cc/> - namespace lookup
- <https://www.w3.org/TR/owl-features/> - w3 documentation
- <http://xmlns.com/foaf/spec/> - friend of a friend ontology
- [Ontologies Website Introduction](#) - BBC Ontologies
- [Schema.org](#) - collection of schemas
- [Early Washington DC Ontology](#) (in progress)

# Resources - Semantic Search Tools

- [The Knowledge Graph](#)
- <http://ogp.me/> - Open Graph Protocol (Facebook)
- [Stewart, 2012: "Google's Knowledge Graph: Yeah, That's the Semantic Web, Sort Of"](#)
- <http://swoogle.umbc.edu/> - swoogle

# Resources - BBC Semantic Web

- [W3C, "Case Study: Use of Semantic Web Technologies on the BBC Web Sites"](#)
- [Bartlett, 2013, "Linked Data: Connecting Together the BBC's Online Content"](#)
- [Linked Data and the Semantic Web](#)
- [Murphy, 2014, "Opening Up the BBC's Linked Data with /things"](#)
- [Linked Data](#) - BBC landing page for semantic web rationale and technology
- [Ontologies Website Introduction](#)



# Resources - SPARQL

- [Hausenblas, 2009, "The Web, One Huge Database"](#) - video introduction
- [StackOverflow - Blank Nodes](#) - This is the most helpful answer ever
- [W3C SPARQL Specifications](#)
- [Dussault, 2015, "Figuring out RDF and SPARQL: Part II Getting Set Up"](#)
- [Dussault, 2015, "Figuring out RDF and SPARQL: Part III Some Queries"](#)

# Resources - Datasets

- [Project Gutenberg](#) - downloadable RDF file
- [datahub](#) - Open Knowledge Foundation sponsored dataset search
- [British National Bibliography](#)
- [BBC Things](#) - no SPARQL endpoint
- [data.gov](#) - dataset finding aid
- [LinkedGeoData](#) - OpenStreetMap data
- [OpenStreetMap Semantic Network](#)
- [dbpedia sparql editor](#)
- [dbpedia data downloads](#)
- [YAGO](#)
- [Early Washington DC Relationships TTL \(in progress\)](#)

# Image Citations

- <https://static.guim.co.uk/sys-images/Guardian/Pix/pictures/2015/5/29/1432905359571/dffff0c3-c2de-4a28-9e42-6c113b9ed1d9-2060x1236.jpeg>
- <http://www.diranieh.com/Database/Figures/Schema2NF.gif>
- [http://www.ctvnews.ca/polopoly\\_fs/1.2024833.1460442480!/httpImage/image.jpg\\_gen/derivatives/landscape\\_620/image.jpg](http://www.ctvnews.ca/polopoly_fs/1.2024833.1460442480!/httpImage/image.jpg_gen/derivatives/landscape_620/image.jpg)
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- [https://upload.wikimedia.org/wikipedia/commons/thumb/b/b0/Openstreetmap\\_logo.svg/2000px-Openstreetmap\\_logo.svg.png](https://upload.wikimedia.org/wikipedia/commons/thumb/b/b0/Openstreetmap_logo.svg/2000px-Openstreetmap_logo.svg.png)
- <http://www.learningsparql.com/img/cover.jpg>
- [https://c1.staticflickr.com/7/6005/5927758528\\_a2060423e7\\_b.jpg](https://c1.staticflickr.com/7/6005/5927758528_a2060423e7_b.jpg)
- <https://s-media-cache-ak0.pinimg.com/736x/b0/6f/d0/b06fd0c88c0a04391923558dafa0ba0d.jpg>
- <http://petattack.com/wp-content/uploads/2014/07/cute-owl-wallpaper-15774-16256-hd-wallpapers.jpg>
- [https://upload.wikimedia.org/wikipedia/en/thumb/d/de/2012\\_Summer\\_Olympics\\_logo.svg/922px-2012\\_Summer\\_Olympics\\_logo.svg.png](https://upload.wikimedia.org/wikipedia/en/thumb/d/de/2012_Summer_Olympics_logo.svg/922px-2012_Summer_Olympics_logo.svg.png)