



Discovering Open Data

David Tarrant
@davetaz



Formats, Structures and Files

Data formats are complex and have
~~suffered~~ benefited from years of
development in many different domains.

One domain is bringing them all together...



Types of Data



Reference data

“things”

People Facilities Places
Books Buildings

Transaction data

“stats involving things”

Expenditure
Weather Consumption
Observation

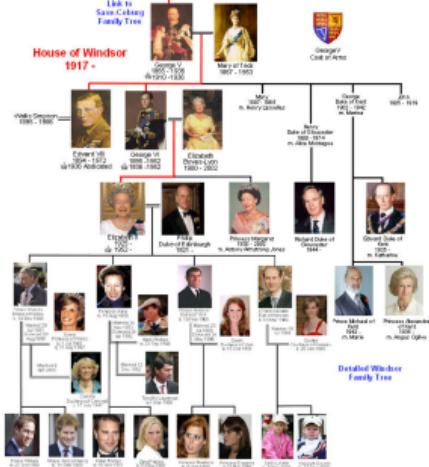


Data Representations

Tabular

| Region | Production | | | Y (b) |
|--------------------|------------|--------------------------|-----------------------|----------------------------|
| Country | Level 2 | Production (thousand MT) | Change from last year | Change from 5 year average |
| Brazil | | 57289 | -4.05% | +2.00% |
| Mato Grosso | | 18,008 | 0.90% | 6.17% |
| Parana | | 9,571 | -19.55% | -9.09% |
| Rio Grande do Sul | | 7,844 | 0.86% | 9.36% |
| Goes | | 6,820 | 4.23% | 5.27% |
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| Piaui | | 856 | 4.49% | 23.75% |
| Para | | 194 | -3.13% | 1.02% |
| Distrito Federal | | 155 | 1.37% | -1.11% |
| Roraima | | 22 | -54.10% | -41.70% |

Hierarchical



Network/Graph



Square peg
round hole



5 Data Formats



Human
Consumption



Machine
Consumption

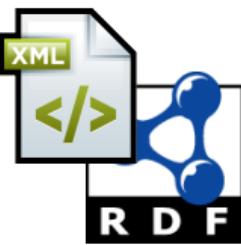
(3) Data Structures



Tabular Data



Hierarchical / Tree Data



Data Exchange Formats
(Graph/Network)

Characteristics



Tabular Data

| Product | Category | Region | Time | Actual | Target |
|-----------|-----------|---------------|-------|--------------|--------------|
| Incubator | Biohazard | Europe | Q1-Q3 | \$12,000,000 | \$11,700,000 |
| Incubator | Biohazard | Europe | Q1-Q3 | \$11,500,000 | \$11,200,000 |
| Incubator | Biohazard | North America | Q1-Q3 | \$11,200,000 | \$10,900,000 |
| Incubator | Biohazard | North America | Q1-Q3 | \$10,900,000 | \$10,600,000 |
| Incubator | Biohazard | South America | Q1-Q3 | \$10,600,000 | \$10,300,000 |
| Incubator | Biohazard | South America | Q1-Q3 | \$10,300,000 | \$10,000,000 |
| Incubator | Biohazard | Asia | Q1-Q3 | \$10,000,000 | \$9,700,000 |
| Incubator | Biohazard | Asia | Q1-Q3 | \$9,700,000 | \$9,400,000 |
| Incubator | Biohazard | Africa | Q1-Q3 | \$9,400,000 | \$9,100,000 |
| Incubator | Biohazard | Africa | Q1-Q3 | \$9,100,000 | \$8,800,000 |
| Incubator | Biohazard | Oceania | Q1-Q3 | \$8,800,000 | \$8,500,000 |
| Incubator | Biohazard | Oceania | Q1-Q3 | \$8,500,000 | \$8,200,000 |
| Incubator | Biohazard | Middle East | Q1-Q3 | \$8,200,000 | \$7,900,000 |
| Incubator | Biohazard | Middle East | Q1-Q3 | \$7,900,000 | \$7,600,000 |
| Incubator | Biohazard | Latin America | Q1-Q3 | \$7,600,000 | \$7,300,000 |
| Incubator | Biohazard | Latin America | Q1-Q3 | \$7,300,000 | \$7,000,000 |
| Incubator | Biohazard | Europe | Q4-Q1 | \$12,000,000 | \$11,700,000 |
| Incubator | Biohazard | Europe | Q4-Q1 | \$11,500,000 | \$11,200,000 |
| Incubator | Biohazard | North America | Q4-Q1 | \$11,200,000 | \$10,900,000 |
| Incubator | Biohazard | North America | Q4-Q1 | \$10,900,000 | \$10,600,000 |
| Incubator | Biohazard | South America | Q4-Q1 | \$10,600,000 | \$10,300,000 |
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| Incubator | Biohazard | Africa | Q4-Q1 | \$9,400,000 | \$9,100,000 |
| Incubator | Biohazard | Africa | Q4-Q1 | \$9,100,000 | \$8,800,000 |
| Incubator | Biohazard | Oceania | Q4-Q1 | \$8,800,000 | \$8,500,000 |
| Incubator | Biohazard | Oceania | Q4-Q1 | \$8,500,000 | \$8,200,000 |
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Record based

Best suited to statistical and flat data

Easy to process

Good Example

| Road | Cars | Lorrys | Coaches/Buses | Bikes | Total |
|--------------|----------------|---------------|---------------|-----------|----------------|
| M1 | 13,000 | 500 | 250 | 2 | 13,752 |
| M6 | 17,500 | 2000 | 1000 | 0 | 20,500 |
| M20 | 14,000 | 4000 | 1200 | 13 | 19,213 |
| M25 | 100,000 | 8000 | 9000 | 9 | 117,009 |
| Total | 144,500 | 14,500 | 11,450 | 24 | 170,474 |

Less Good Example

| Event Name | Location | Speaker | Date | Time | Tickets Sold |
|-----------------------------|-----------------------------|-----------------|-------------|-------------|---------------------|
| Russian Delegation Training | The Open Data Institute | David Tarrant | 6/9/2013 | All Day | 58/50 |
| Data as the Divine | Open 1 | Kathryn Corrick | 23/7/2013 | 13:00 | 23/50 |
| Open Data Intro | R304, Kings College, London | Jeni Tennison | 19/7/2013 | 13:00 | 58/100 |
| Open Data in Practice | The ODI | David Tarrant | 7/6/2013 | 09:00 | 14/16 |
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Incorrect / Redundant Data

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Incorrect / Redundant Data



Data we can reference
by identifier

Referencing by identifier

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| Data as the Divine | 1 | 2 | 23/7/2013 | 13:00 | 23/50 |
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|-------------|-------------------------|------------|-----------------|
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| 2 | Kings College, London | 2 | Kathryn Corrick |
| | | 3 | Jeni Tennison |



Data...bases



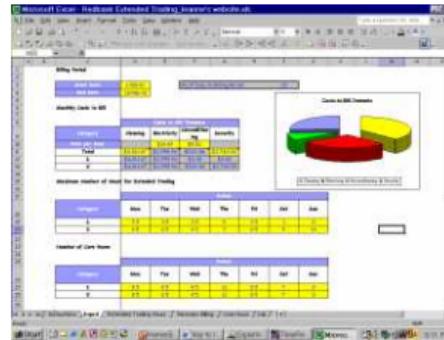
Added ability to perform powerful queries on tabular data.

Added **relationships** and
a data model.

Spreadsheets and Databases

It is possible to reference by identifier in a spreadsheet?

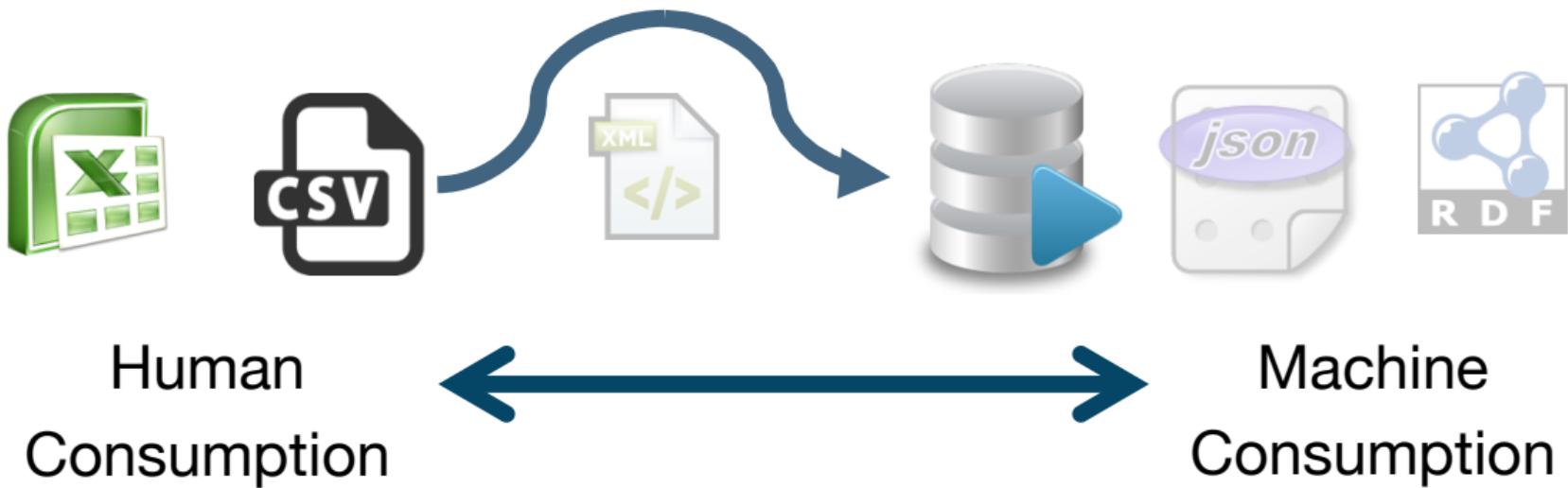
Is your spreadsheet then a database not a spreadsheet?



Spreadsheet: A computer program used chiefly for accounting, in which figures are arranged in the rows and columns of a grid.
Database: Two or more tables whose data are organized in a way that the data are related and/or linked to one another.



Without the Web

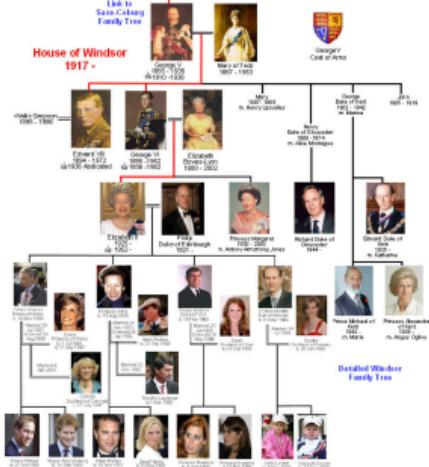


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Hierarchical



Network/Graph



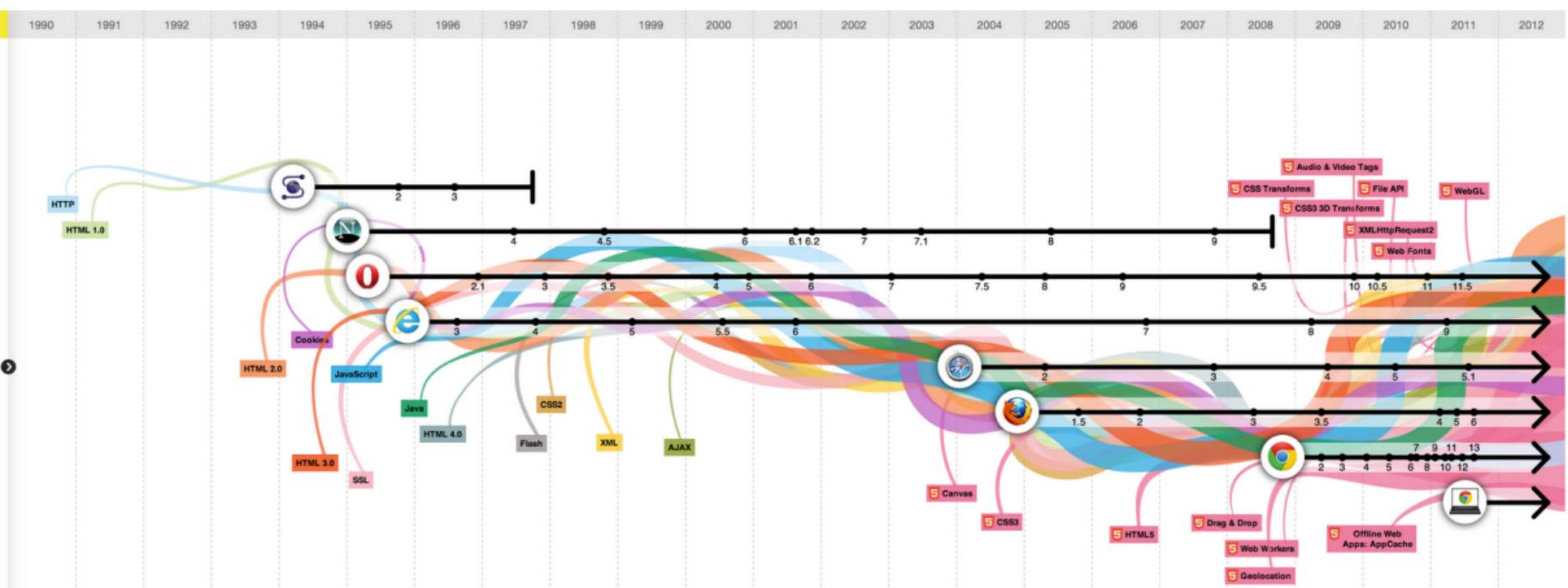
Discovering Data Exercise (Part 1)



The Web



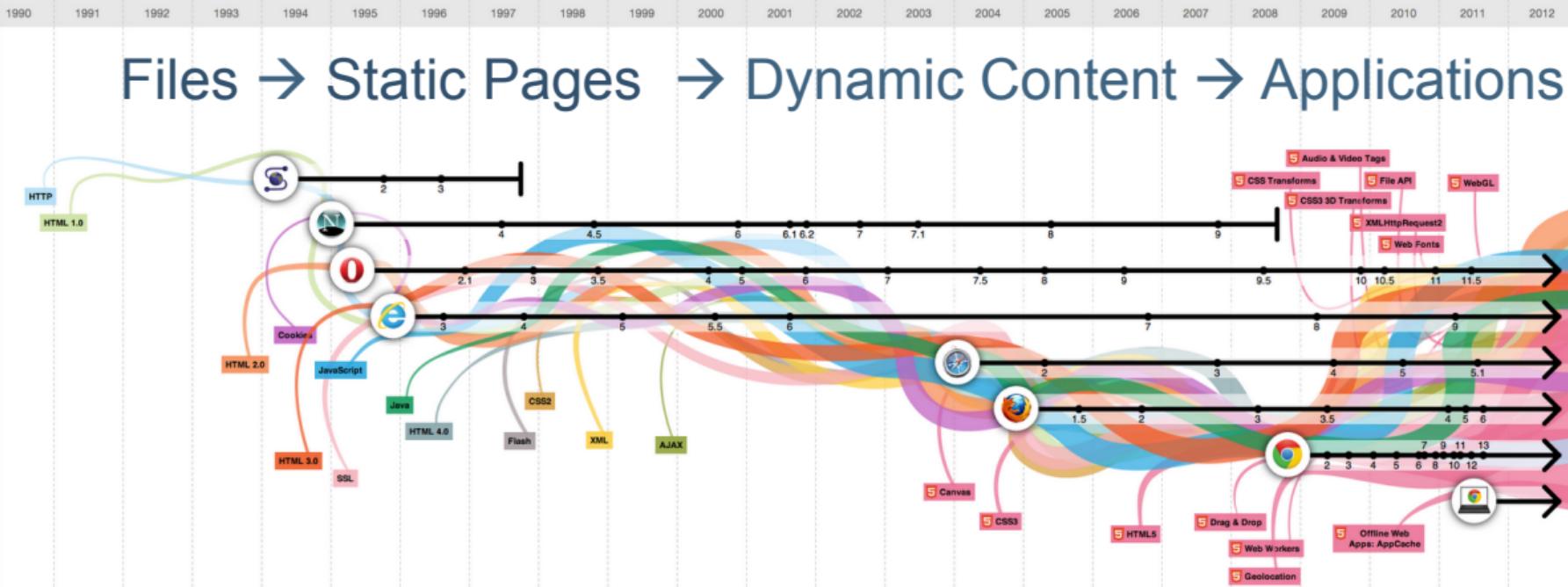
Evolution of the Web



<http://www.evolutionoftheweb.com/>



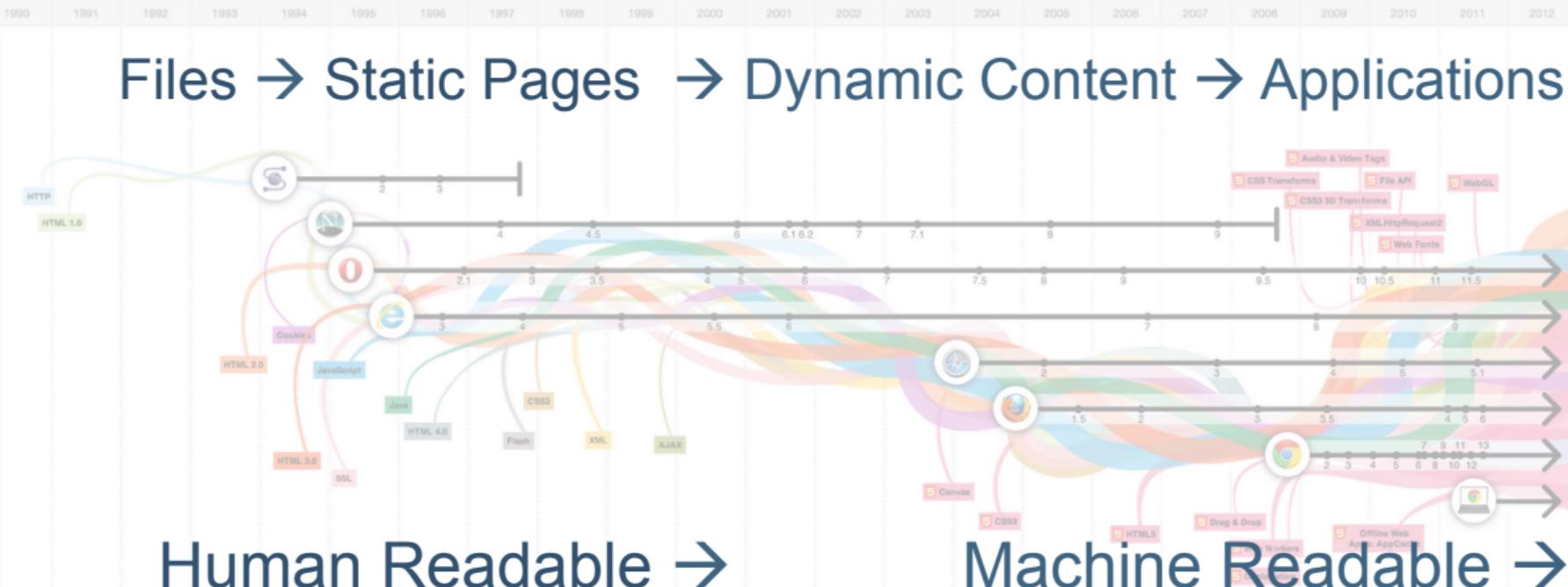
Evolution of the Web



<http://www.evolutionoftheweb.com/>



Evolution of the Web



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Human

Readable

Web

World Wide Web

The WorldWideWeb (W3) is a wide-area [hypermedia](#) information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an [executive summary](#) of the project, [Mailing lists](#) , [Policy](#) , November's [W3 news](#) , [Frequently Asked Questions](#) .

What's out there?

Pointers to the world's online information, [subjects](#) , [W3 servers](#), etc.

Help

on the browser you are using

Software Products

A list of W3 project components and their current state. (e.g. [Line Mode](#) ,[X11 Viola](#) , [NeXTStep](#) , [Servers](#) , [Tools](#) , [Mail robot](#) , [Library](#))

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How can I help ?

If you would like to support the web..

Getting code

Getting the code by [anonymous FTP](#) , etc.



Question

What is significant about the first web page?



Markup

Links & Tags

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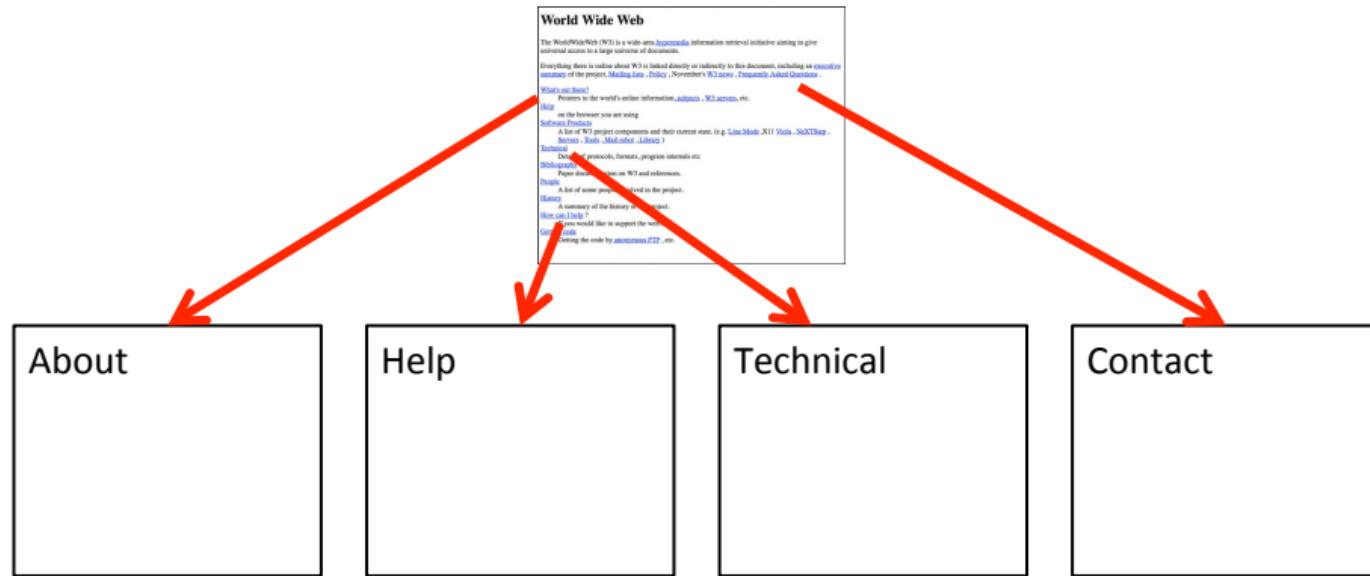
[Getting code](#)

Getting the code by [anonymous FTP](#) , etc.

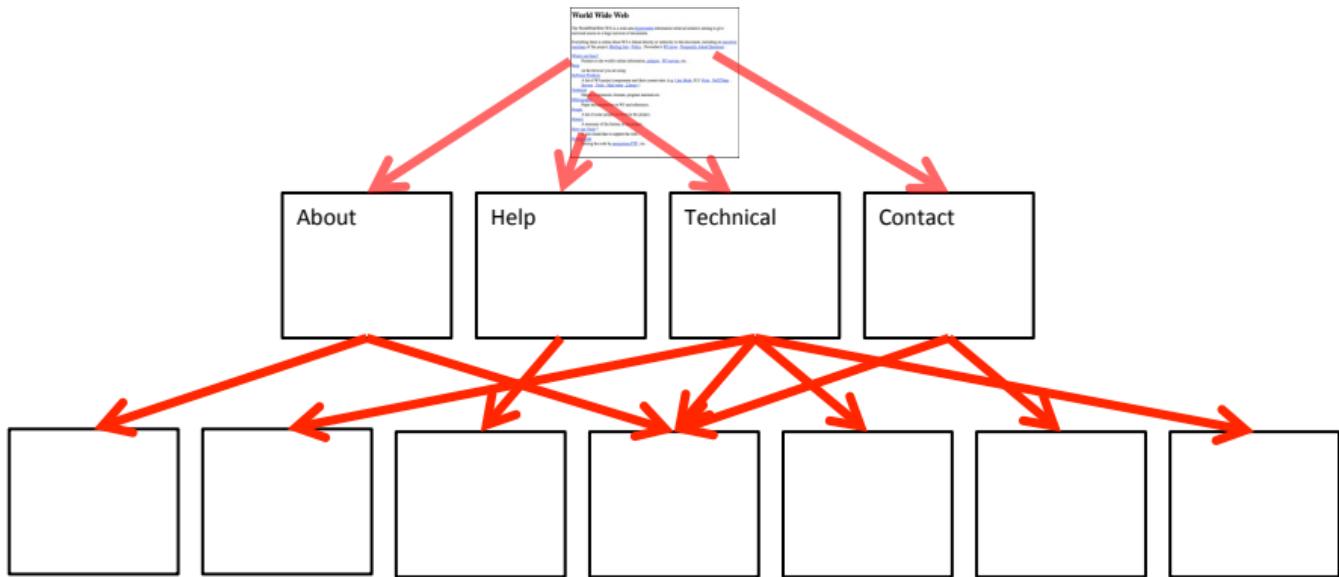
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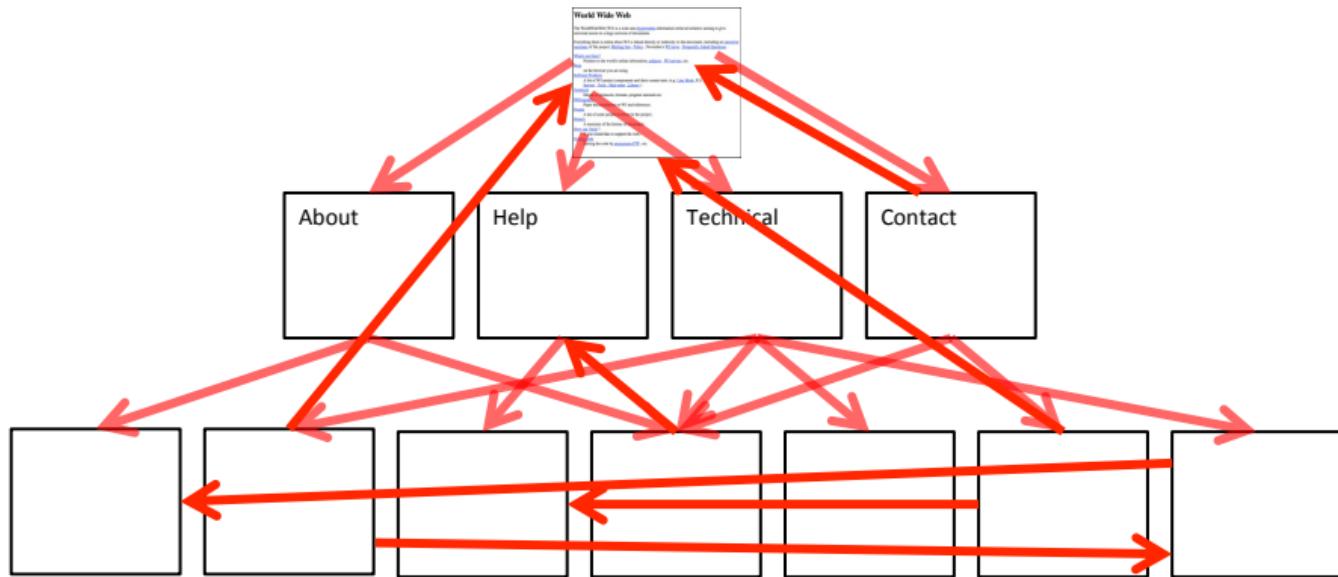
Nodes and Links



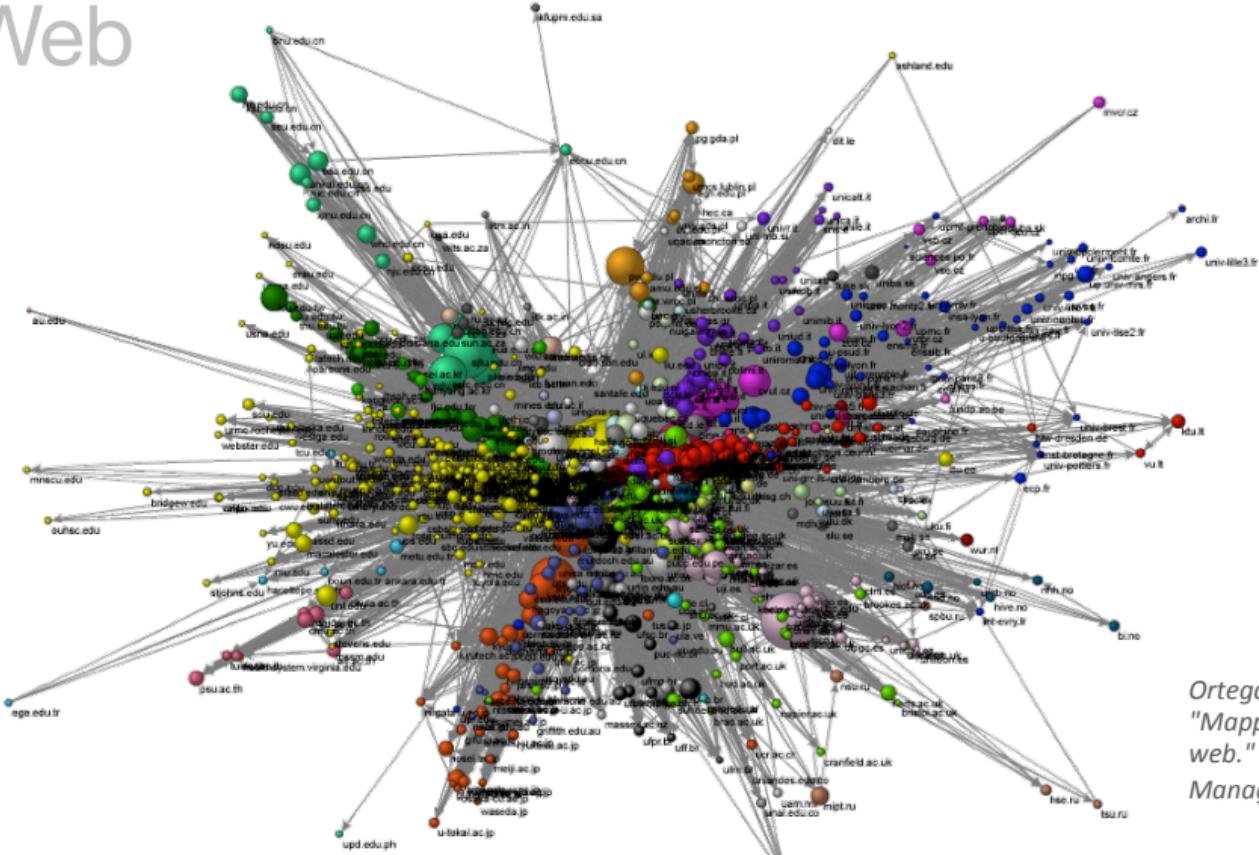
Nodes and Links



Nodes and Links



A Web

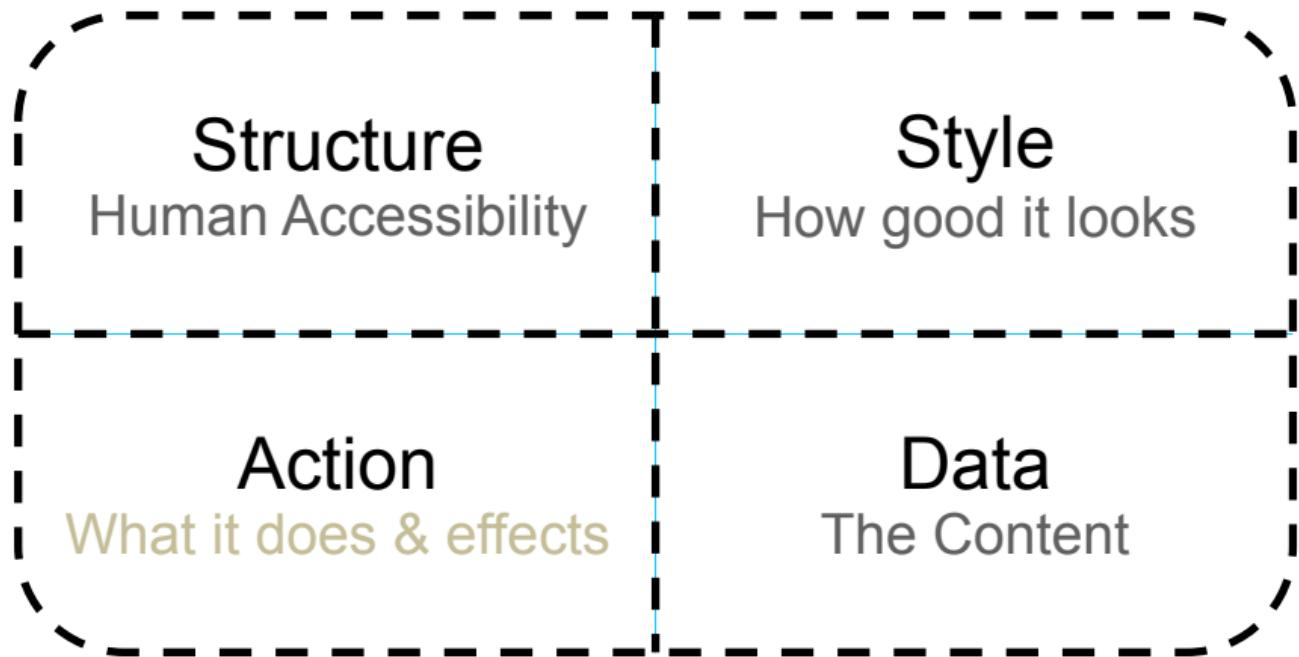


Ortega, Jose Luis, and Isidro F. Agullo.
"Mapping world-class universities on the web." *Information Processing & Management* 45.2 (2009): 272-279.

The Web



Building Blocks



HTML

Here is some **really important** text!

Remember that in the morning we start at **<time>9:30am</time>**

<blink>

This text is likely to annoy you.

</blink>

<marquee>

</marquee>



HTML

<h>**World Wide Web**</h>

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<h1>This is heading 1</h1>

<h2>This is heading 2</h2>

<h3>This is heading 3</h3>

<h4>This is heading 4</h4>

<h5>This is heading 5</h5>

<h6>This is heading 6</h6>



A Link

`Link to BBC News`



HTML 5

<menu>
<figure>
<nav>
<input>
<header>
<section>
<footer>

<summary>
<details>
<legend>
<label>
<title>
<option>
<a>

<blink>
<marquee>



Why Markup?

- Helps your browser to render the page
- Critical for screen readers!
- Adds semantics about importance of elements.
- Aids search engines





HTML 5

| | | | | | | | | | | | | | | | | | | | | | |
|-------|----------|------|------|-----|--------|-----|------|------------|----|------------|----------|----------|----------|----|---------|---------|-------|--------|--------|----------|---------|
| html | | | | | | | | | | | | | | | | | | | col | table | |
| head | span | | | | | | | | | | | | | | | | | | div | fieldset | form |
| title | a | | | | | | | | | | | | | | | | | | body | h1 | section |
| meta | rt | dfn | em | i | small | ins | s | br | p | blockquote | legend | optgroup | address | h3 | nav | menu | th | | | | |
| base | rp | abbr | time | b | strong | del | kbd | hr | ol | dl | label | option | datalist | h4 | article | command | tbody | | | | |
| link | noscript | q | var | sub | mark | bdi | wbr | figcaption | ul | dt | input | output | keygen | h5 | footer | summary | thead | | | | |
| style | script | cite | samp | sup | ruby | bdo | code | figure | li | dd | textarea | button | progress | h6 | hgroup | details | tfoot | | | | |
| | | | | | | | | | | | | | | | | | | img | area | map | |
| | | | | | | | | | | | | | | | | | | embed | object | param | |
| | | | | | | | | | | | | | | | | | | source | iframe | canvas | |
| | | | | | | | | | | | | | | | | | | track | audio | video | |

HTML5



The Language of the Web

HTML5



CSS3



JAVASCRIPT



Building Blocks





Web Building Blocks Exercise

The Web



Markup for data



Markup

```
<book>
    <title>Winnie the Pooh</title>
    <author>A. A. Milne</author>
</book>
```

Markup for anything

http://www.slashdot.org/slashdot.xml - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://www.slashdot.org/slashdot.xml

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE backslash [
  <!-- Backslash DTD -->
  <!-- This is a simple XML Schema DTD -->
  <!-- It defines a single element type, 'backslash' -->
  <!-- This element contains a sequence of zero or more 'xpair' elements -->
  <!-- Each 'xpair' element contains two 'xs:string' attributes -->
  <!-- The first attribute is named 'xaxis' and the second is 'yaxis' -->
  <!-- The schema also defines a complex type 'xpair' -->
  <!-- This type has a sequence of three elements: 'property', 'value', and 'unit' -->
  <!-- The 'property' and 'value' elements have type 'xs:string' -->
  <!-- The 'unit' element has type 'xs:double' -->
]>
```

<backslash xmlns:backslash="http://slashdot.org/backslash.dtd">

- <story>
- <title>TheKompany's Shawn Gordon Responds In Full</title>
- <url>http://slashdot.org/article.pl?sid=01/07/20/1637220</url>
- <time>2001-07-20 18:30:28</time>
- <author>timothy</author>
- <department>what's-good-for-thekompany</department>
- <topic>linuxbiz</topic>
- <comments>3</comments>
- <section>interviews</section>
- <image>topiclinuxbiz.gif</image>
- </story>
- <story>
- <title>GNOME Usability Study Report</title>
- <url>http://slashdot.org/article.pl?sid=01/07/20/1752205</url>
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- <author>michael</author>
- <department>press-ctrl-alt-shift-k-q-z-to-continue</department>
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- <comments>68</comments>
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- </story>
- <story>
- <title>None Unimplementable?</title>
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- <time>2001-07-20 17:14:39</time>
- <author>Hemos</author>
- <department>keeping-things-proprietary</department>
- <topic>microsoft</topic>
- <comments>132</comments>
- <section>articles</section>
- <image>topicms.gif</image>
- </story>

Done

http://localhost:1410/GenericHandlerDemo/Default.atom - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Local intranet

```
<feed xmlns="http://www.w3.org/2005/Atom">
```

- <id>www.somedomain.com</id>
- <title>MyWebSite.com</title>
- <link>http://mywebsite.com</link>
- <updated>2006-07-28T11:48:05Z</updated>
- <author>
- <name>Mr.Abcd</name>
- <email>someemail@somedomain.com</email>
- </author>
- <entry>
- <title>Title 1</title>
- <id>www.somedomain.com</id>
- <updated>2006-07-26T12:00:00Z</updated>
- <link>http://www.someurl.com</link>
- <summary>Description 1</summary>
- </entry>

Done



Data Exchange

eXtensible Markup Language

Forms the basis for hundreds of XML formats



Resource Description Framework

Enforces a structured relationship between elements



The Web



Problems with XML

Unbelievably, XML is a challenge for a machine to parse.

All the parsers ever built are either a little crap, hard to use, or slow.

XML has no pre-defined schema or semantics



Problems with XML

Unbelievab

```
<v>  
  <x>  
    <y> a="ppppp" </y>  
  <z>  
    <w>qqqqqq </w>  
  </z>  
  </x>  
</v>
```

e to parse.

All the parsers

hard to use, or

XML has no pre-defined syntax or semantics

Introducing RDF

The **R**esource **D**escription **F**ramework is a syntax.
(It is not a file format)



The RDF syntax is similar to classic conceptual modeling approaches such as entity–relationship or class diagrams (from databases).

It is based upon the idea of making statements about resources (in particular web resources) in the form of subject-predicate-object expressions.

A Triple!



These expressions are known as triples in RDF terminology. The subject denotes the resource, and the predicate denotes traits or aspects of the resource and expresses a relationship between the subject and the object.

Events

| Event Name | Location_ID | Speaker_ID | Date | Time | Tickets Sold |
|-----------------------------|-------------|---|-----------|---------|--------------|
| Russian Delegation Training | 1 | http://id.ecs.soton.ac.uk/person/9455 | 6/9/2013 | All Day | 58/50 |
| Data as the Divine | 1 | http://data.theodi.org/people/kcorricks | 23/7/2013 | 13:00 | 23/50 |
| Open Data Intro | 2 | http://data.theodi.org/people/jtennison | 19/7/2013 | 13:00 | 58/100 |
| Open Data in Practice | 1 | http://id.ecs.soton.ac.uk/person/9455 | 7/6/2013 | 09:00 | 14/16 |
| Networking Evening | 1 | http://data.theodi.org/people/jtennison | 17/5/2013 | 14:00 | 12/20 |



| Location ID | Location Name |
|-------------|-------------------------|
| 1 | The Open Data Institute |
| 2 | Kings College, London |

| Speaker ID | Speaker Name |
|------------|-----------------|
| 1 | David Tarrant |
| 2 | Kathryn Corrick |
| 3 | Jeni Tennison |

Events

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| Networking Evening | 1 | http://data.theodi.org/people/dtarrant | | | 12/20 |

Location ID

Location Name

1

The Open Data Institute

2

Kings College, London

<http://xmlns.com/foaf/0.1/name>

Speaker ID

1

2

3

Speaker Name

David Tarrant

Kathryn Corrick

Jeni Tennison

The missing link...

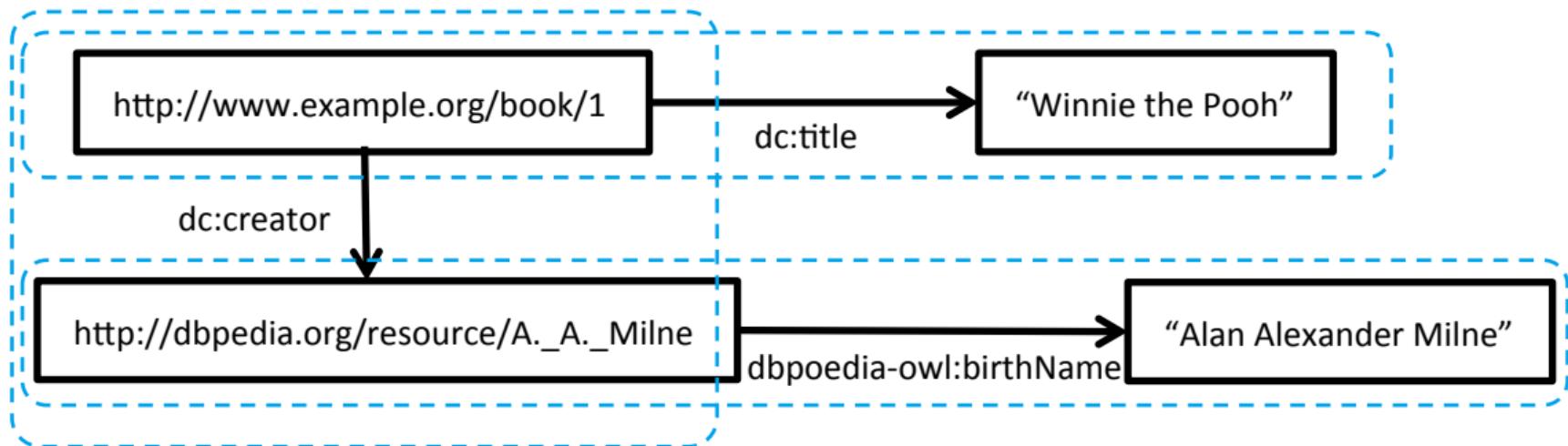
From all of these data formats there was one thing missing.

Click [here](#) to find out what it is.

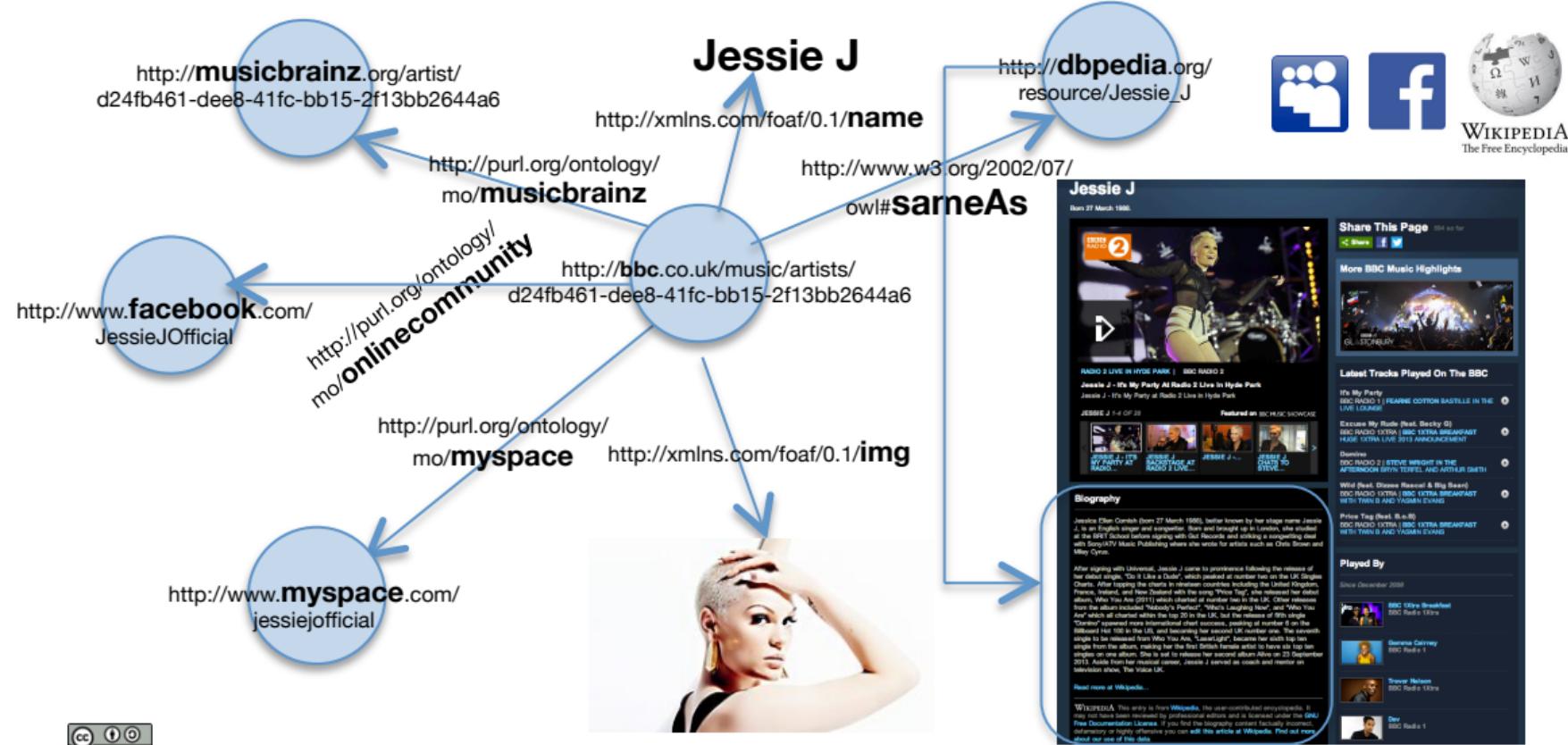


Using URIs

3 Triples



Turning Links into Content



Why RDF

One syntax!

Any system that understands the syntax can use
the data!

It is as near as we have come so far to a
common standard for knowledge transfer.



Why RDF

It encourages use of URIs to identify things.

It is the basis for the Web of Linked Data
and the Semantic Web.



Data Exchange

eXtensible Markup Language

Forms the basis for hundreds of XML formats



Resource Description Framework

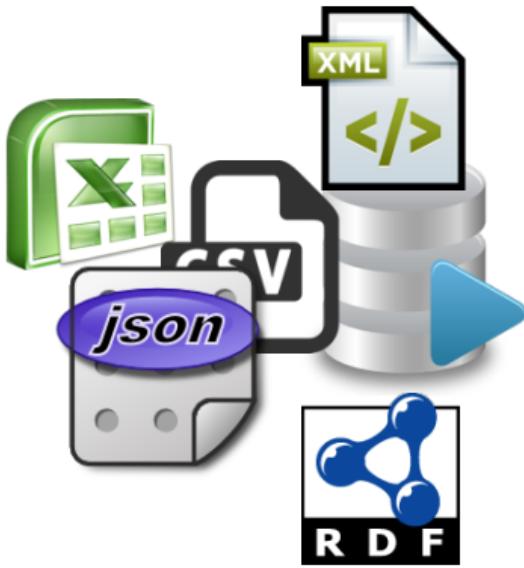
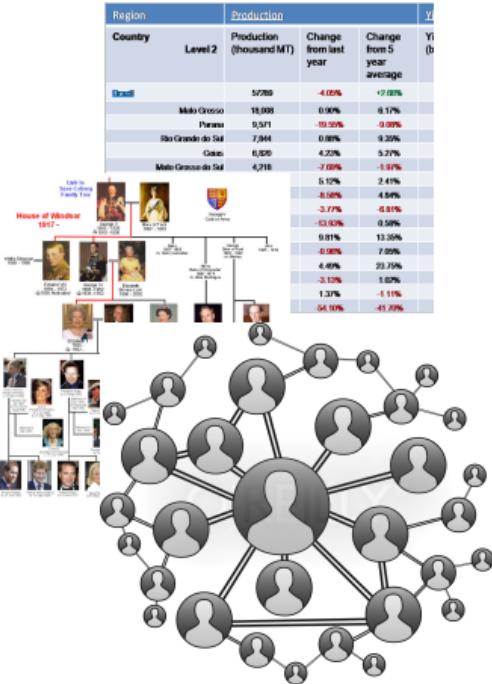
Enforces a structured relationship between elements



The Web



Recap



Square peg
round hole



Discovering Data Exercise

(Part 2 & 3)





**Knowledge
for everyone**

