

Web Semântica

Webinar BAD



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Conteúdos

- Parte I: Guia turístico e exemplos;
- Parte II: Princípios básicos e teoria.



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Apresentação

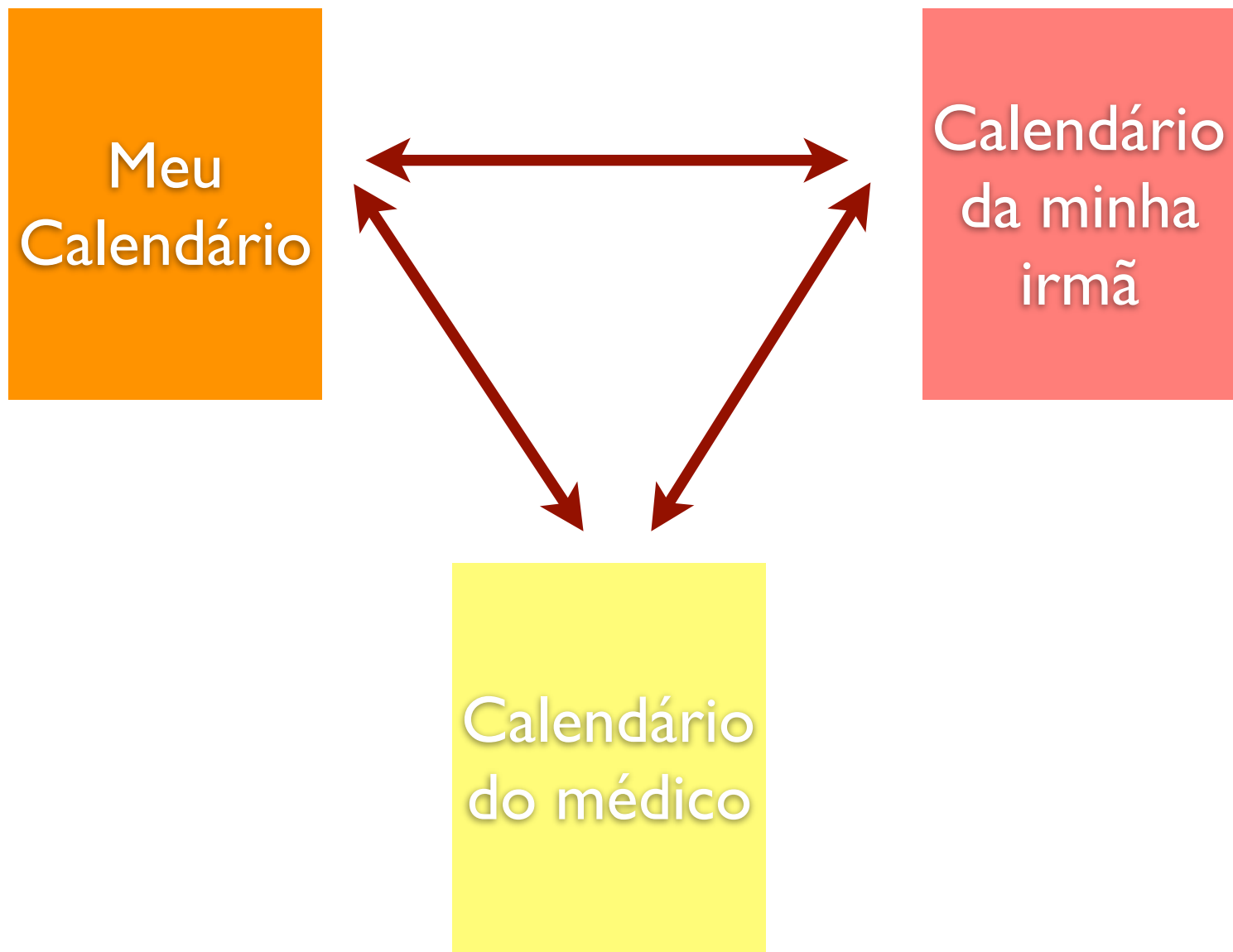


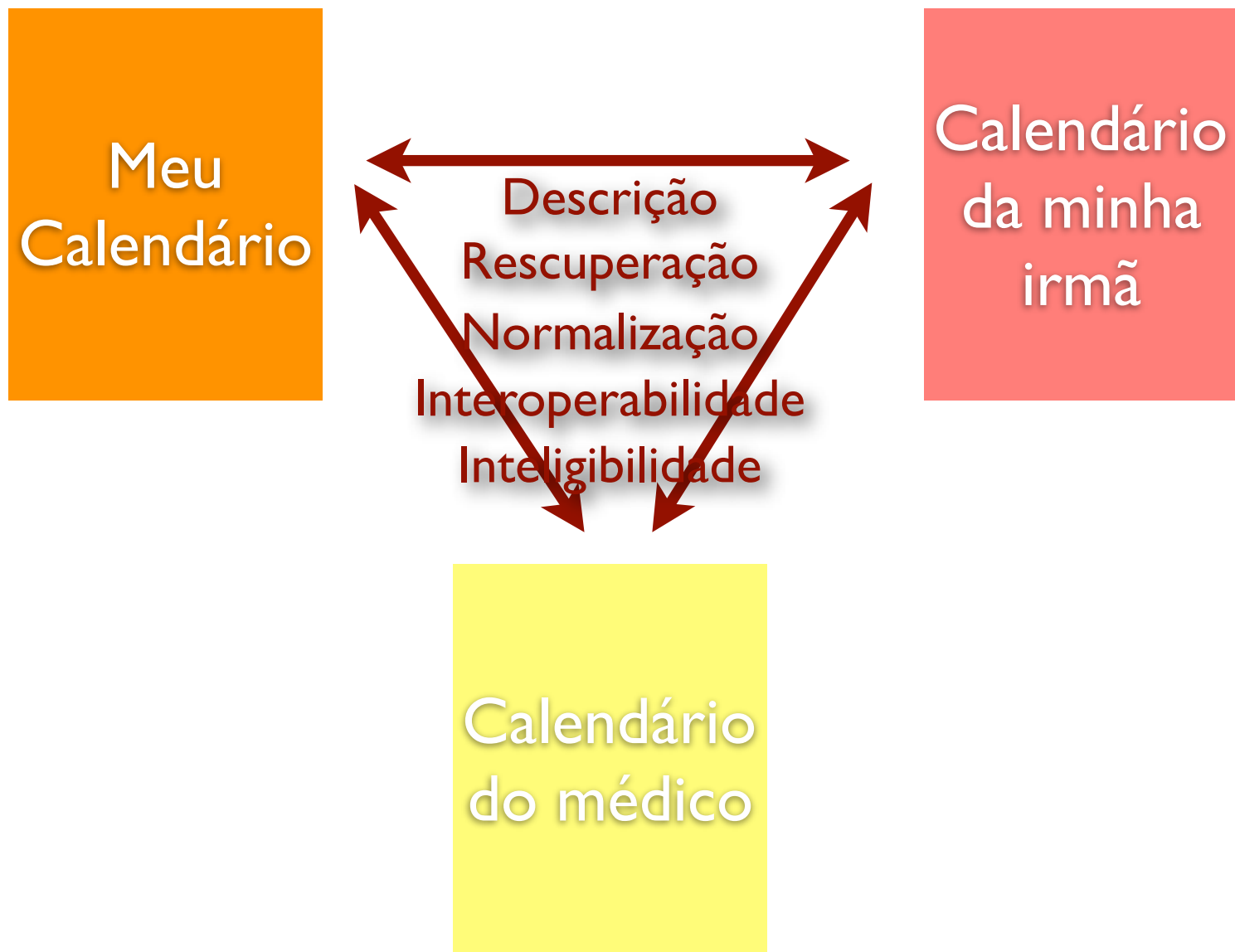
- Docente no Departamento de Sistemas de Informação da Universidade do Minho
- Membro do DCMI Advisory Board
- <http://www.dsi.uminho.pt/~analice>





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Informação sobre os Dados de forma legível
por máquinas - **Esquemas**



Informação sobre os Recursos / Coisas de
forma legível pelas máquinas - **Dados**



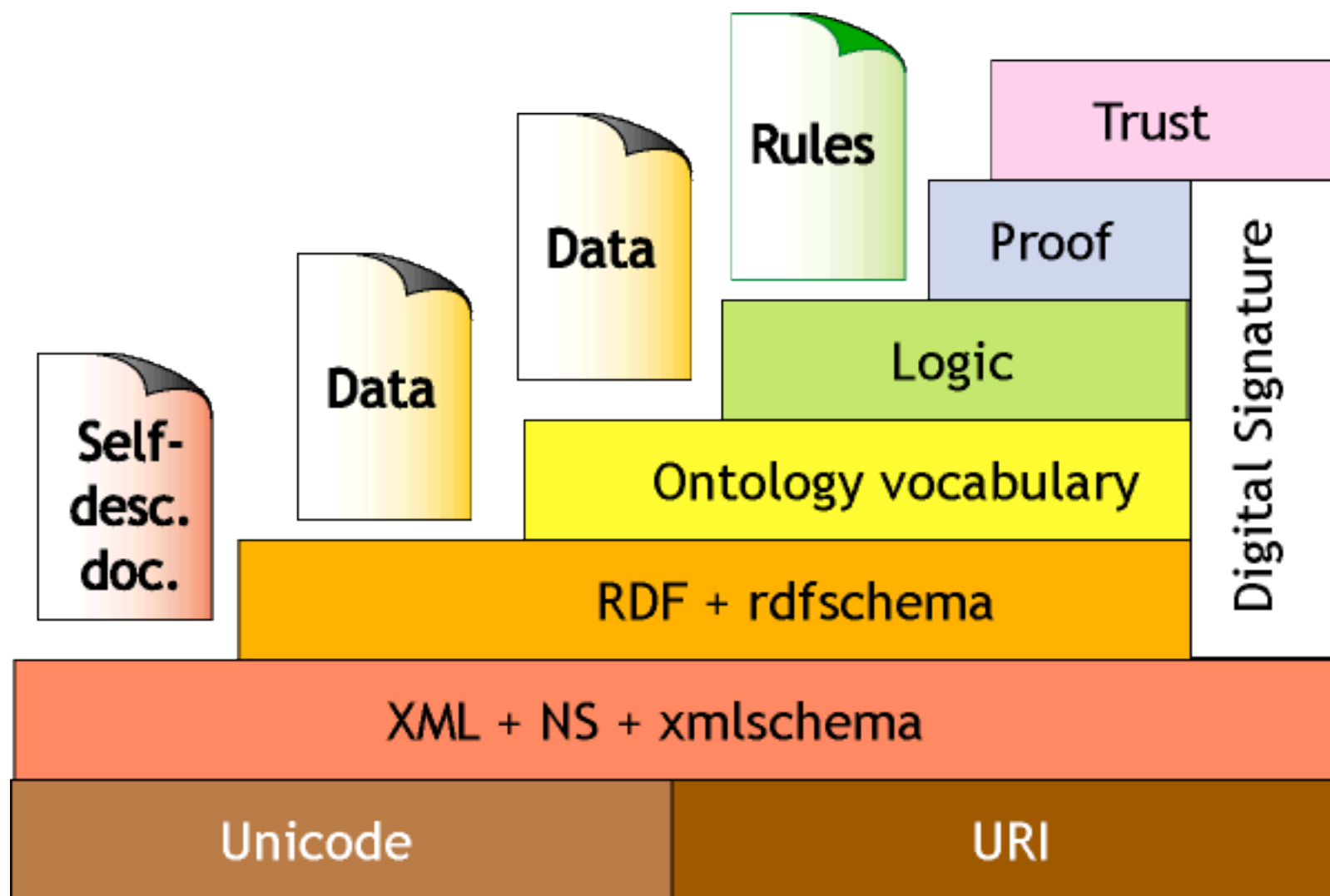
Recursos / **Coisas**

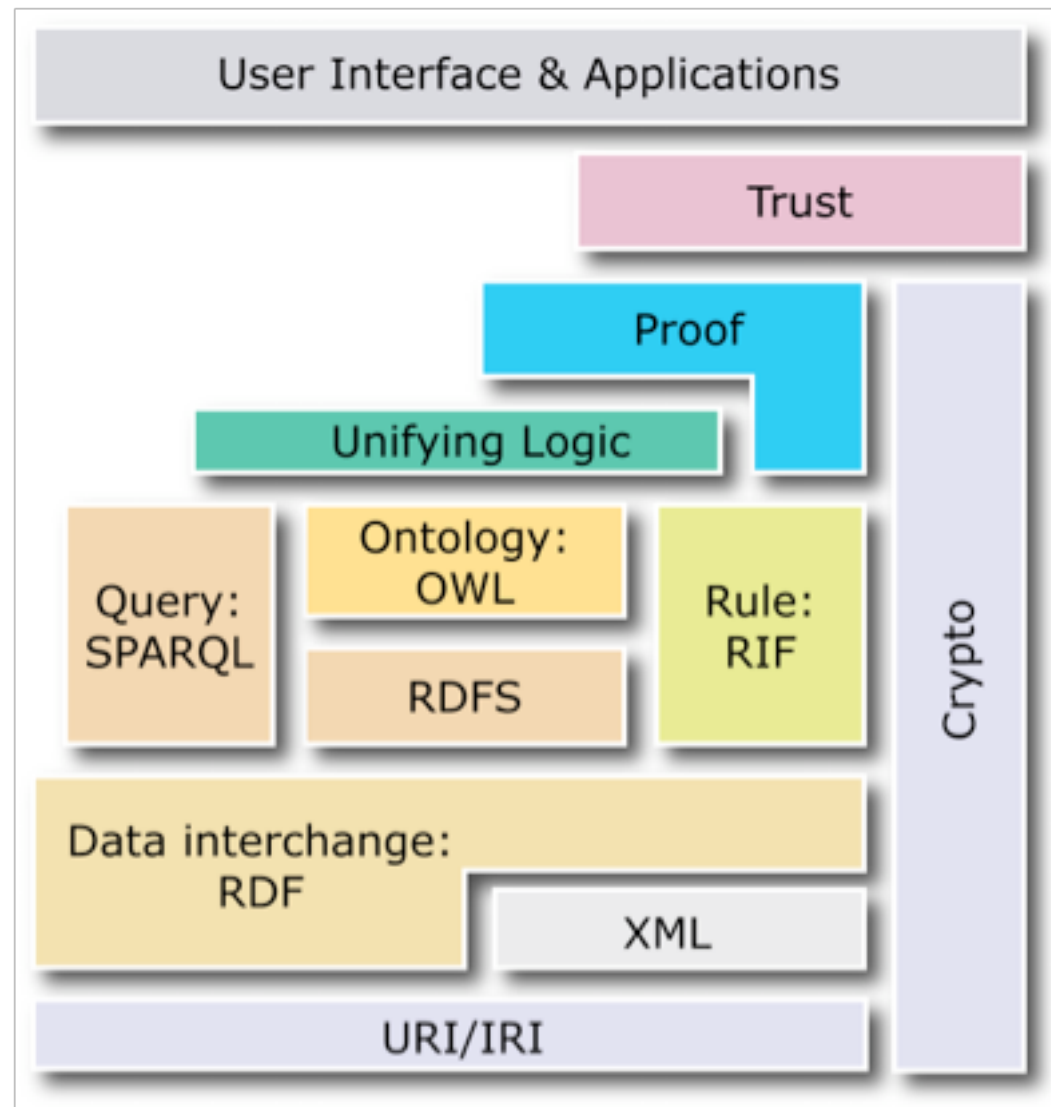
Linked
Data

Web Semântica: Dados Ligados



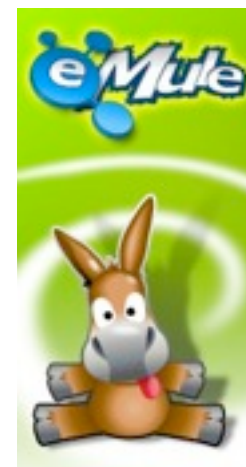
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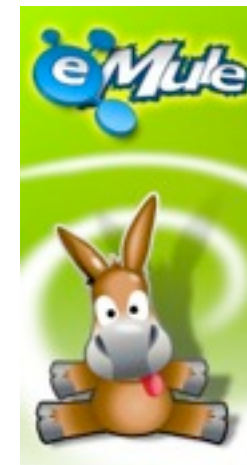




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references
isReferencedBy
location
authorLocation
subject
type
dateIssued
dateModified

...



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Descrição

Recuperação



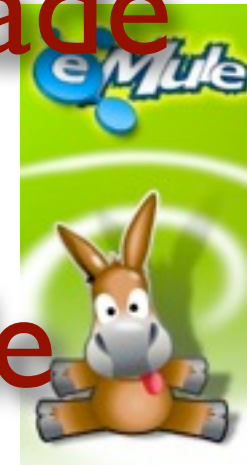
Normalização



Interoperabilidade



Inteligibilidade



references
isReferencedBy
location
authorLocation
subject
type
dateIssued
dateModified
...



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Recuperação



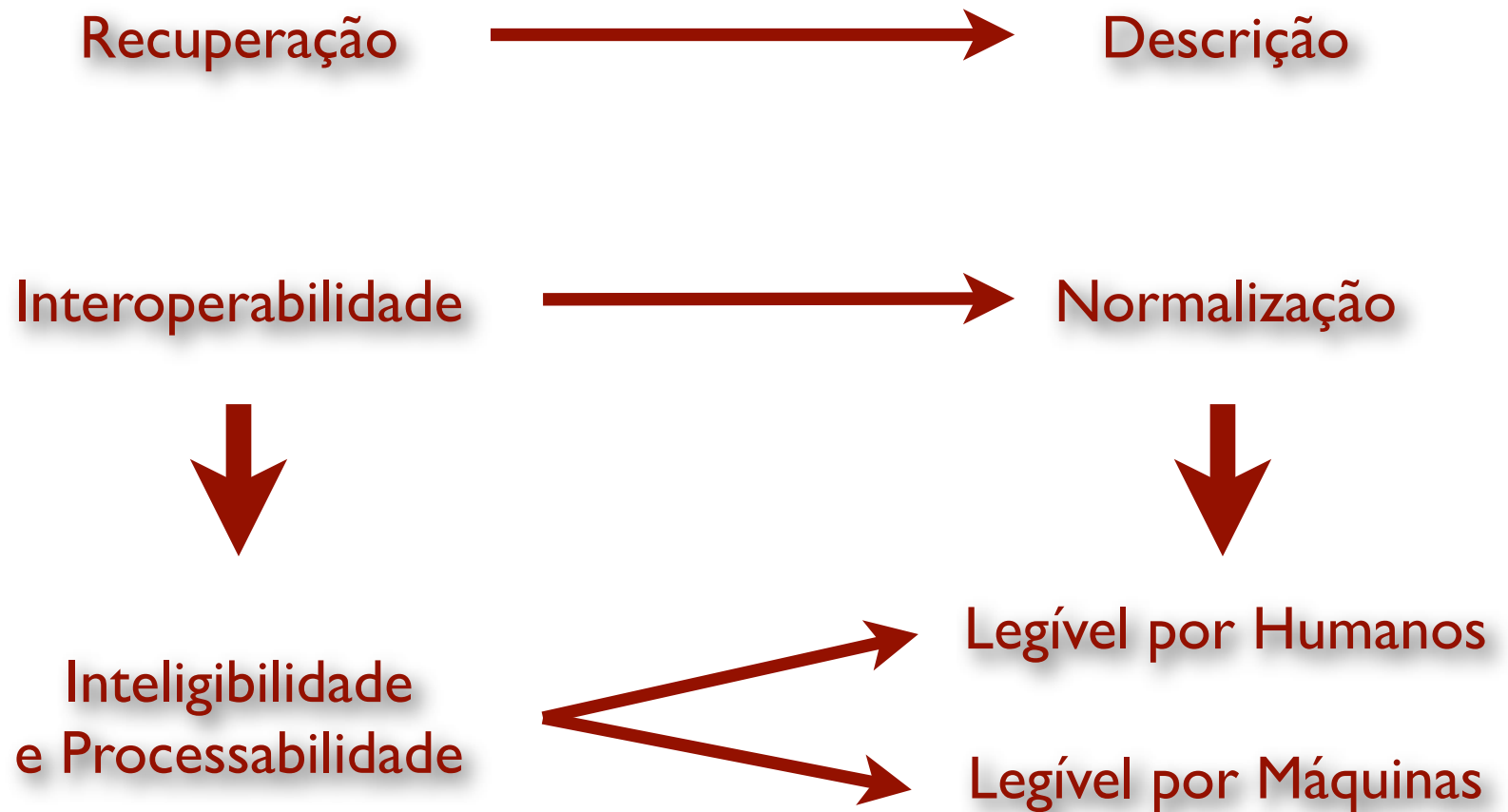
Descrição

Interoperabilidade



Normalização







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

Experimentem:

- Where is Istanbul?
- What time is it in Istanbul?
- What's the distance from Istanbul to Ankara?
- What's the nearest sea to Istanbul?
- Who is the Prime Minister of Turkey?
- What's the chemical formula for salt?
- 22 June



Q: What's happening here?



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O que se passa aqui?



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The Free Encyclopedia

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Aragonés



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Article Discussion

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Istanbul

From Wikipedia, the free encyclopedia

Coordinates: 41.01224°N 28.976018°E

Istanbul (Turkish: *İstanbul*), historically known as **Byzantium** and **Constantinople**^[2] (see the **names of Istanbul** for further information) is the largest city in **Turkey** with a population of 13.1 million, which is 17.8% of Turkey's population.^[3] Istanbul is also a **megacity**, as well as the cultural, economic, and financial centre of **Turkey**. The city covers 39 districts of the **Istanbul province**.^[4] It is located on the **Bosphorus Strait** and encompasses the natural harbour known as the **Golden Horn**, in the northwest of the country. It extends both on the European (**Thrace**) and on the Asian (**Anatolia**) sides of the **Bosphorus**, and is thereby the only metropolis in the world that is situated on two **continents**. Istanbul is a designated **alpha world city**.

During its long history, Istanbul has served as the capital of the **Roman Empire** (330–395), the **Eastern Roman (Byzantine) Empire** (395–1304 and 1361–1453) and the **Eastern Roman (Byzantine) Empire** (330–395). During its long history, Istanbul has served as

Istanbul

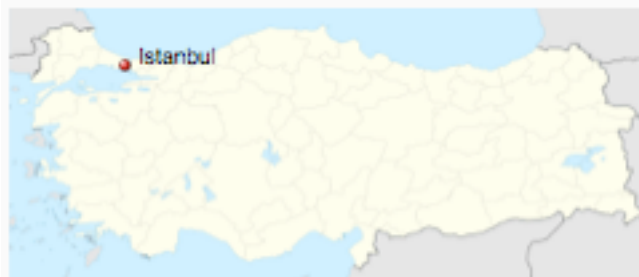


Top: Topkapı Palace – Hagia Sophia – Blue Mosque
Center: Beyoğlu; Galata Tower; Maiden's Tower
Bottom: Bosphorus Bridge connecting Europe and Asia, with the skyline of Levent financial district.

Bottom: Bosphorus Bridge connecting Europe and Asia, with the skyline of Levent financial district.
Center: Beyoğlu; Galata Tower; Maiden's Tower
Top: Topkapı Palace – Hagia Sophia – Blue Mosque



Logo



Location in Turkey

Coordinates:  41°01'N 28°58'E

Country	 Turkey
Region	Marmara
Province	Istanbul
Established	
- Byzantium	c. 660 BC ^[note 1]
- Constantinople	330 AD
- Istanbul	1453 (Ottoman Turkish) 1923 (Modern Turkish) 1930 (internationally)
Districts	39
Government	
- Mayor	Kadir Topbaş (AKP)
Area	
- Metro ^[note 2]	5,343 km ² (2,062.9 sq mi)
Population (2010-12-31) ^[1]	
- Urban	13,255,685 (1st Turkish) and (20th World)
- Urban density	2,481/km ² (6,425.8/sq mi)
Time zone	EET (UTC+2)
- Summer (DST)	EEST (UTC+3)
Postal code	34000 to 34850
Area code(s)	(+90) 212 (European side) (+90) 216 (Asian side)



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<http://wiki.dbpedia.org/FacetedSearch>



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exemplos

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Use Cases

Datasets

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Online Access

Datasets

Use Cases

Faceted Wikipedia Search

Faceted Wikipedia Search allows users to ask complex queries, "How many kilometers?" or "Which Skyscrapers in China have more than 50 floors?" on Wikipedia. The answers to these queries are not generated using Google or Yahoo, but are generated based on structured information that Wikipedia has. Wikipedia Search thus allows you to query Wikipedia like a structured intelligence.

structured intelligence.

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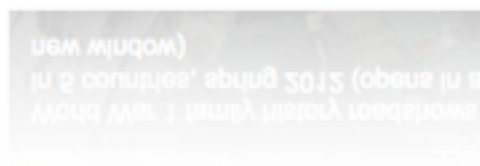
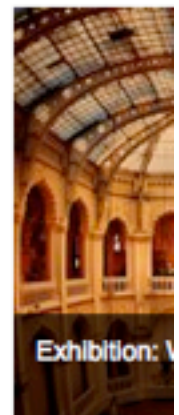
<http://www.europeana.eu>



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Search

Help



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[http://www.bbc.co.uk/ontologies/
programmes/2009-09-07.shtml](http://www.bbc.co.uk/ontologies/programmes/2009-09-07.shtml)



Programmes ontology

This Version 2009-09-07, <http://purl.org/ontology/po/2009-09-07.shtml> (rdf)
Latest Version <http://purl.org/ontology/po/>
Previous Version <http://purl.org/ontology/po/2009-04-17.shtml>

Authors of this document [Yves](#)

[Patrick Sinclair](#)

[Nicholas J Humfrey](#)

[Michael Smethurst](#)

Source: [http://www.bbc.co.uk/ontologies/
programmes/2009-09-07.shtml](http://www.bbc.co.uk/ontologies/programmes/2009-09-07.shtml)

Copyright © 2007-2009 the

@prefix tags: <<http://www.holygoat.co.uk/owl/redwood/0.1/tags/>>.

@prefix skos: <<http://www.w3.org/2004/02/skos/core#>>.

@prefix dcterms: <<http://purl.org/dc/terms/>>.

@prefix frbr: <<http://purl.org/vocab/frbr/core#>>.

@prefix : <<http://purl.org/ontology/po/>>.

<<http://purl.org/ontology/po/>>

a owl:Ontology;

rdfs:label "Programmes ontology";

rdfs:comment ""

A vocabulary for programme data.

It defines concepts such as brands, series, episodes, broadcasts, etc.

"";

dc:creator <<http://moustaki.org/foaf.rdf#moustaki>>;

dc:contributor <<http://www.aelius.com/njh#me>>;

dc:contributor <<http://metade.org/foaf.rdf#me>>;

dc:date "\$Date: 2009/02/20 16:00:00 \$";

owl:imports

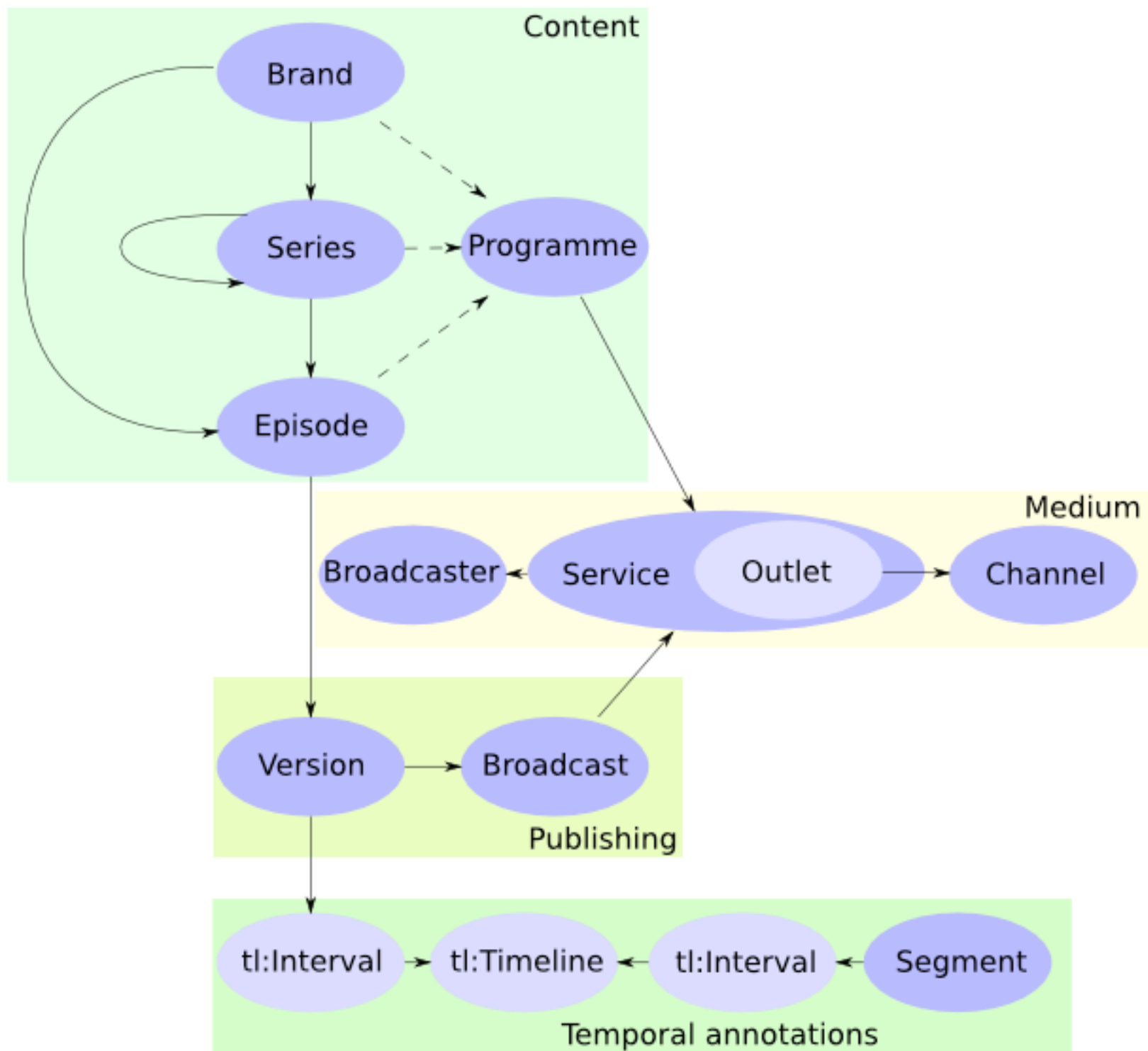
<<http://purl.org/NET/c4dm/event.owl>>,

<<http://purl.org/NET/c4dm/timeline.owl>>



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Fonte: [http://www.bbc.co.uk/go/ontologies/programmes/2009-09-07.shtml/ext/_auto/-/http://purl.org/
ontology/po/2009-09-07.n3](http://www.bbc.co.uk/go/ontologies/programmes/2009-09-07.shtml/ext/_auto/-/http://purl.org/ontology/po/2009-09-07.n3)



http://dbpedia.org/page/BBC_Television

About: BBC Television

An Entity of Type : [television production companies of the United Kingdom](#), from Named G
dbpedia.org

BBC Television is a service of the British Broadcasting Corporation. The corporation, which has operated in the from its own studios since 1932, although the start of its regular service of television broadcasts is dated to 2 No

Property	Value
dbpedia-owl:abstract	BBC Television is a service of the British Broadcasting Corporation. The 1927, has produced television programmes from its own studios since 19
dbpprop:hasPhotoCollection	http://www4.wiwiss.fu-berlin.de/flickrwrappr/photos/BBC_Television
dbpprop:id	tv
dbpprop:title	BBC TV
dbpprop:wikiPageUsesTemplate	dbpedia:Template:Bbc.co.uk
dcterms:subject	category:Peabody_Award_winners category:Commercial-free_television_networks category:Television_production_companies_of_the_United_Kingdom category:BBC_television
rdf:type	yago:Commercial-freeTelevisionNetworks yago:TelevisionProductionCompaniesOfTheUnitedKingdom



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<http://dbpedia.org/sparql>

OpenLink Virtuoso SPARQL Query

This query page is designed to help you test OpenLink Virtuoso SPARQL protocol endpoint.

Consult the [Virtuoso Wiki page](#) describing the service or the [Online Virtuoso Documentation](#) section [RDF Database and SPARQL](#).

There is also a rich Web based user interface with sample queries. You can access it at [http://dbpedia.org/sparql](#).

Query

Default Graph URI

<http://dbpedia.org>

(Security restrictions of this server do not allow you to retrieve remote RDF data. The administrator can change them, according to these [instructions](#).)

Query text

```
SELECT ?abstract
FROM NAMED <http://dbpedia.org>
WHERE {
  <http://dbpedia.org/resource/Civil_engineering>
  <http://dbpedia.org/ontology/abstract> ?abstract.
  FILTER langMatches( lang(?abstract), 'en')
}
```

abstract

"Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works such as bridges, roads, canals, dams and buildings. Civil engineering is the oldest engineering discipline after military engineering, and it was defined to distinguish non-military engineering from military engineering. It is traditionally broken into several sub-disciplines including environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. Civil engineering takes place on all levels: in the public sector from municipal through to federal levels, and in the private sector from individual homeowners through to international companies."@en



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There is also a rich Web based user interface with sample queries. You can access it at: [/isparql](#).

Query

Default Graph URI

<http://dbpedia.org>

(Security restrictions of this server do not allow you to retrieve remote RDF data; administrator can change them, according to these [instructions](#).)

Query text

```
SELECT ?abstract
FROM NAMED <http://dbpedia.org>
WHERE {
  <http://dbpedia.org/resource/Civil_engineering>
  <http://dbpedia.org/ontology/abstract> ?abstract.
  FILTER langMatches( lang(?abstract), 'pt')
}
```

abstract

"Texto em itálico"[[Ficheiro:FalkirkWheelSide 2004 SeanMcClean. jpg|300px|right|thumb|Exemplo de uma obra de construção civil na Escócia, Reino Unido: o Falkirk Wheel, que é uma obra fluvial para transposição de barcos.] Engenharia civil é o ramo da engenharia que projecta e executa obras como edifícios, pontes, viadutos, estradas, barragens e outras obras da engenharia hidráulica fluvial e da Hidráulica Marítima, assim como da engenharia sanitária. Os termos Construção civil e Engenharia civil são originados de uma época em que só existiam apenas duas classificações para a Engenharia sendo elas Civil e Militar. A Engenharia militar era destinada apenas aos militares e a Engenharia civil destinada aos demais cidadãos. Com o tempo, a Engenharia civil, que englobava todas as áreas, foi se dividindo, e hoje conhecemos várias divisões, como a elétrica, mecânica,



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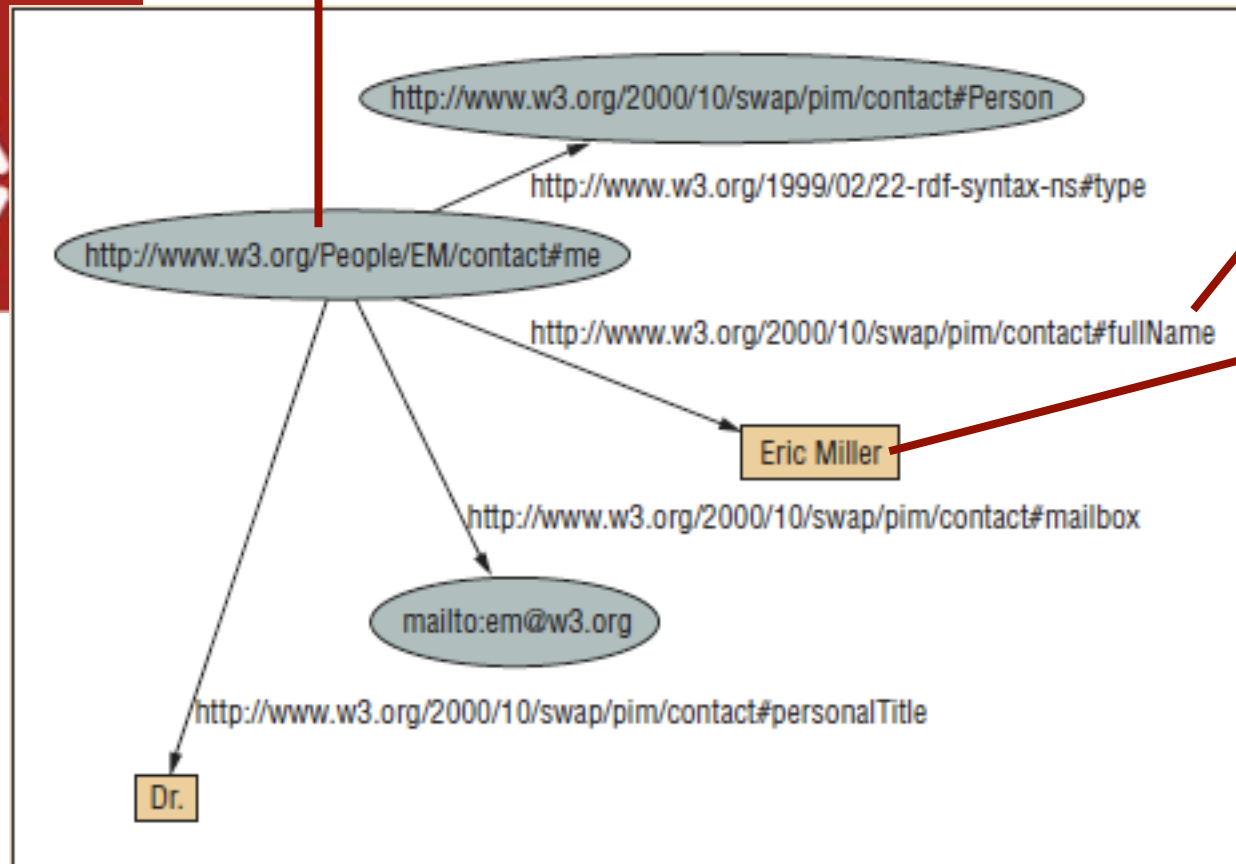
Dos documentos aos dados e à integração (I) - como?



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(I) Berners-Lee, T., Hendler, J., & Lassila, O. (2001, maio). The Semantic Web: A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities. *Scientific American*. Recuperado de <http://www.scientificamerican.com/article.cfm?id=the-semantic-web>

Sujeito



Predicado

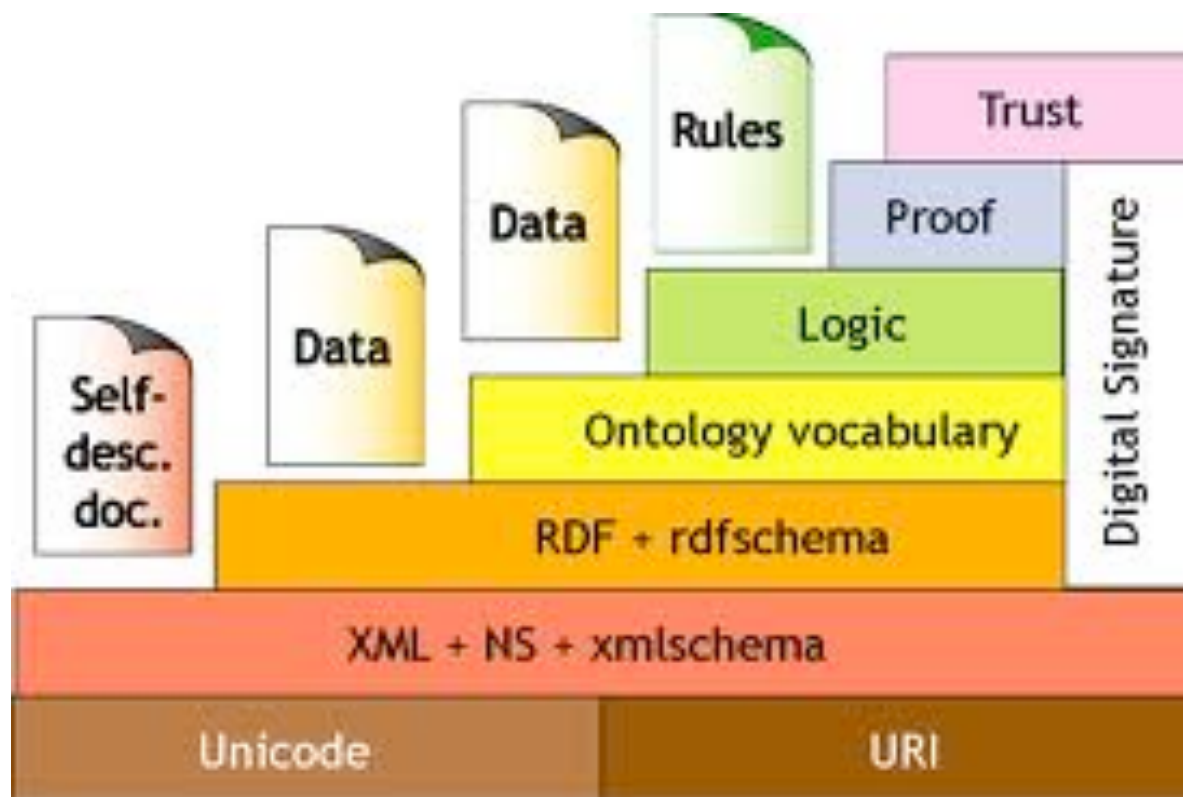
Objecto

Resource Description Framework (RDF)



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Fuente: Shadbolt, N., Hall, W., & Berners-Lee, T. (2006). The semantic web revisited. IEEE intelligent systems, 21(3), 105-110.

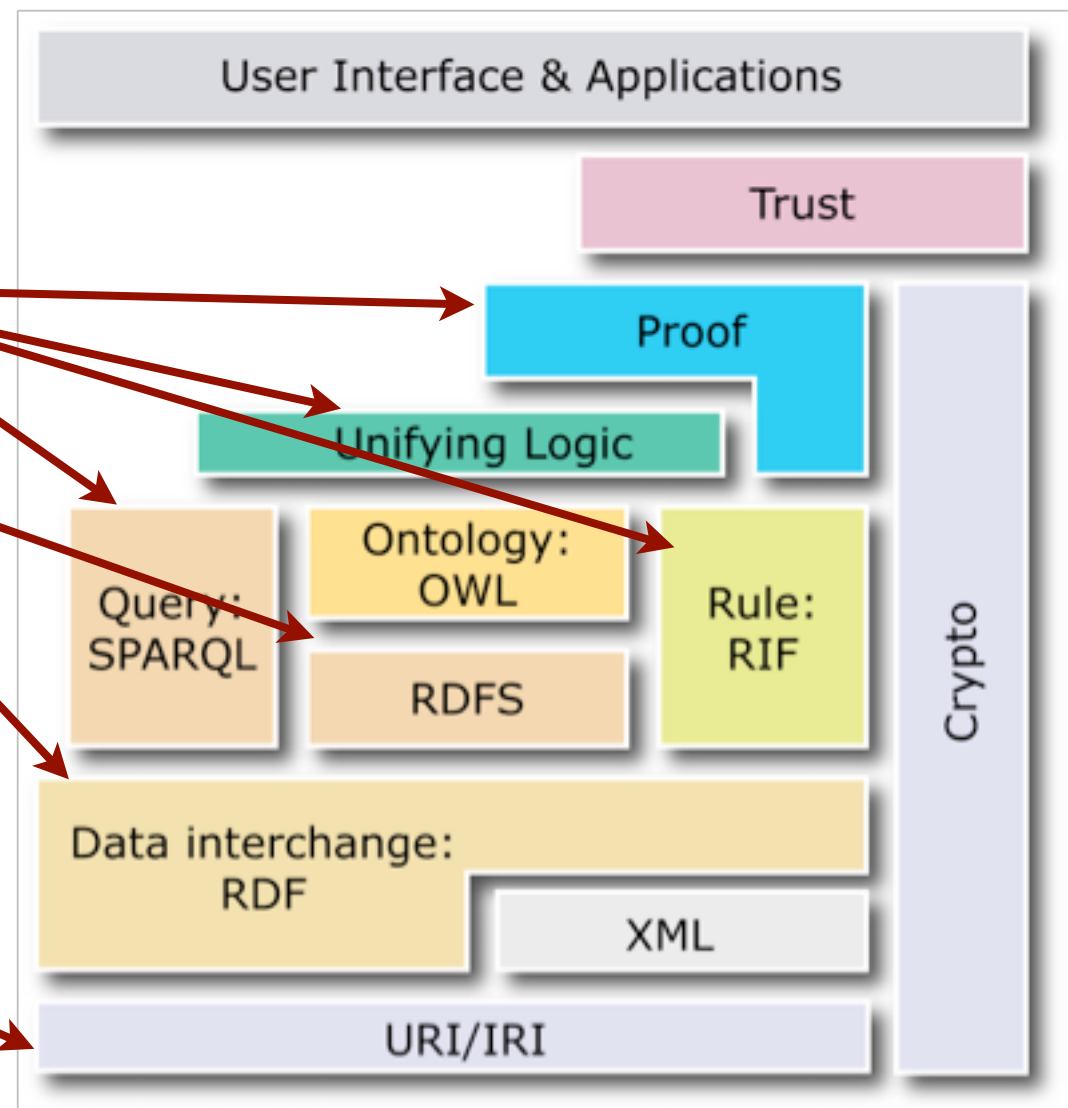


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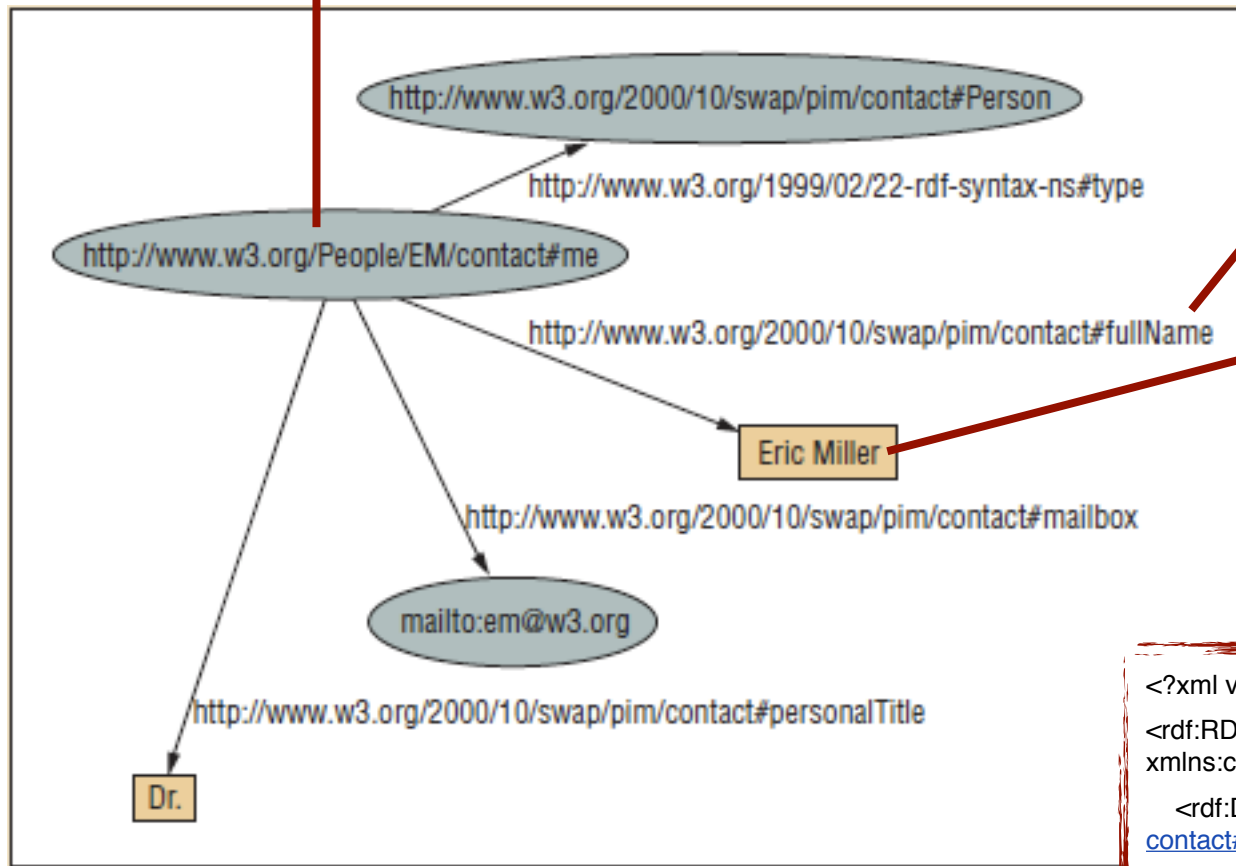
- Regras (*rules*) e inferência;
- Ontologias;
- *Triple Stores* - RDF;
- Transposição para RDF (de HTML, XML...);
- *Universal Resource Identifier* (URI).



Sujeito

Predicado

Objecto



```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:contact="http://www.w3.org/2000/10/swap/pim/contact#">
  <rdf:Description rdf:about="http://www.w3.org/2000/10/swap/pim/
    contact#me">
    <rdf:type rdf:resource="http://www.w3.org/2000/10/swap/pim/
      contact#Person"/>
    <contact:fullName>Eric Miller</contact:fullName>
    <contact:mailbox rdf:resource="mailto:em@w3.org"/>
    <contact:personalTitle>Dr.</contact:personalTitle>
  </rdf:Description>
</rdf:RDF>
```

Resource Description Framework (RDF)



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A Web Semântica fornece um enquadramento comum que permite que os **dados** sejam **partilhados e reutilizados** através de **fronteiras** impostas pelas **aplicações, empresas ou comunidades**

(...)

Baseia-se no RDF.

(W3C SWA, consultado em 03/01/2007)





Dados



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O que são os dados?

- Às páginas Web, serviços Web, tudo o que seja identificável - a DCMI e o W3C apelidam-os de **recursos** ou **sujeitos**;
- Aos atributos destes recursos, às relações que suportam com outros recursos - a DCMI apelida-os de **elementos** ou de propriedades; o W3C apelida-os de **propriedades** ou **predicados**;
- Aos valores dos atributos relacionados com as propriedades - a DCMI apelida-os de valores e o W3C apelida-os de **valores** ou **objetos**.

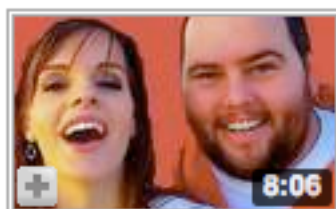


Exemplos de Recursos



Spotlight: Valentine's Day

Naturally, we all love YouTube, but for these couples either met through the site or they use their channels to share their love.



OUR LOVE STORY!

23 hours ago
208,024 views
★★★★★
shavcarl



Surprise Marriage Proposal
4 months ago
1,018,048 views
★★★★★
CTFxC



Making the World's Knowledge Computable

Today's Wolfram|Alpha is the first step in an



computing... More about Wolfram|Alpha »

Stephen Wolfram's intro

One-page summary

Examples



D-LIB MAGAZINE

doi:10.1045/dlib.magazine | ISSN:1082-9873



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Exemplos de Propriedades

- Para um artigo científico: autor, título, título da revista científica, volume, número, data de publicação,...;
- Para um vídeo: título, realizador, produtor, duração, tamanho (em Bytes? KB?...),...;
- Para uma imagem - título, autor, resolução, tamanho,...;



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Exemplos de Objectos

- “Tim Berners-Lee”
- “16/02/2010”
- “JPEG”
- “Semantic Web”
- <http://dublincore.org>

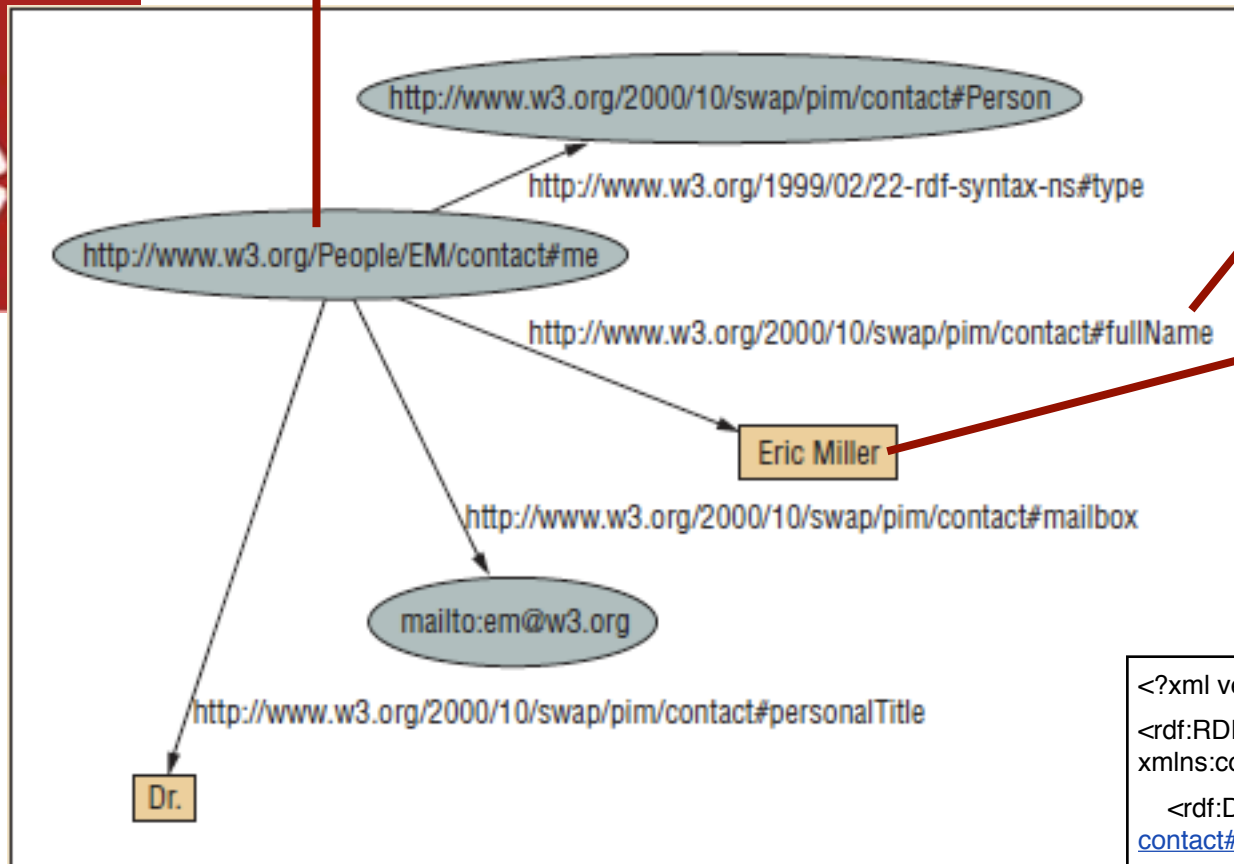
Este objecto pode
ser sujeito de uma
nova declaração
(*statement*)



Sujeito

Predicado

Objecto



```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:contact="http://www.w3.org/2000/10/swap/pim/contact#">
  <rdf:Description rdf:about="http://www.w3.org/2000/10/swap/pim/
    contact#me">
    <rdf:type rdf:resource="http://www.w3.org/2000/10/swap/pim/
      contact#Person"/>
    <contact:fullName>Eric Miller</contact:fullName>
    <contact:mailbox rdf:resource="mailto:em@w3.org"/>
    <contact:personalTitle>Dr.</contact:personalTitle>
  </rdf:Description>
</rdf:RDF>
```

Resource Description Framework (RDF)



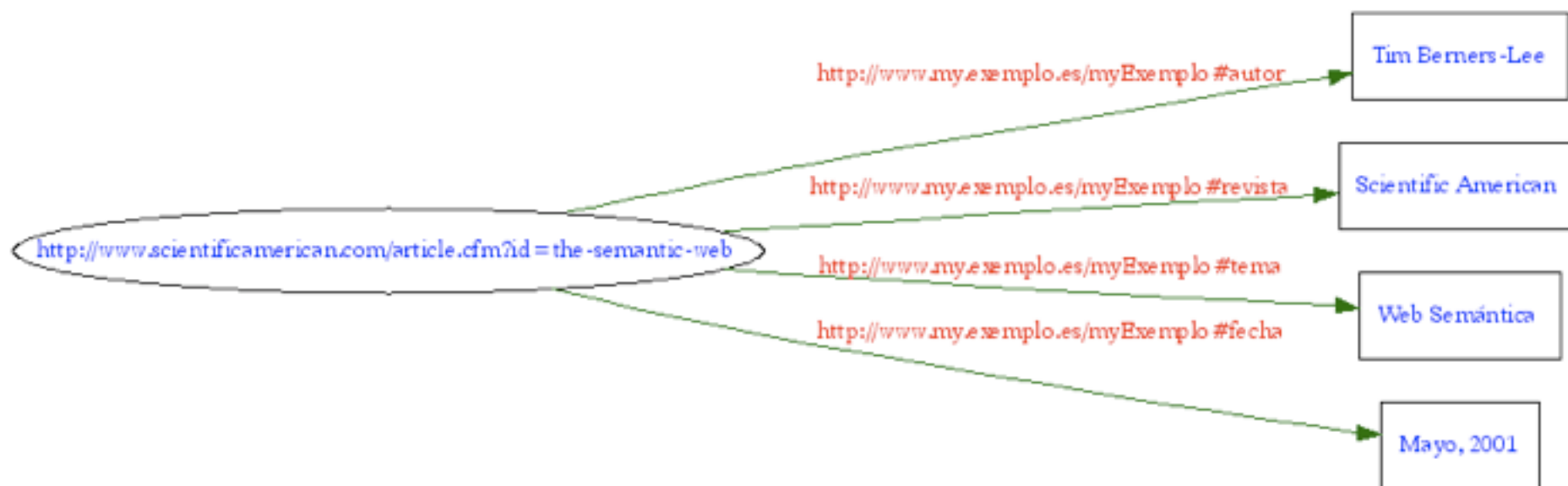
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Posso fazer as seguintes declarações:

- "O autor do artigo referido por <http://www.scientificamerican.com/article.cfm?id=the-semantic-web> é Tim Berners-Lee; o assunto do artigo é a Web Semântica; o artigo foi publicado em Maio de 2001 na revista Scientific American"
- “O autor do artigo referido por <http://www.scientificamerican.com/article.cfm?id=the-semantic-web> é Tim Berners-Lee e o seu email é timbl@w3.org”



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RDF parsed at the W3C RDF Validation Service at <http://www.w3.org/RDF/Validator/>



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RDF parsed at the W3C RDF Validation Service at <http://www.w3.org/RDF/Validator/>



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Inteligibilidade pelas máquinas



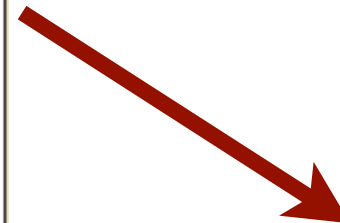
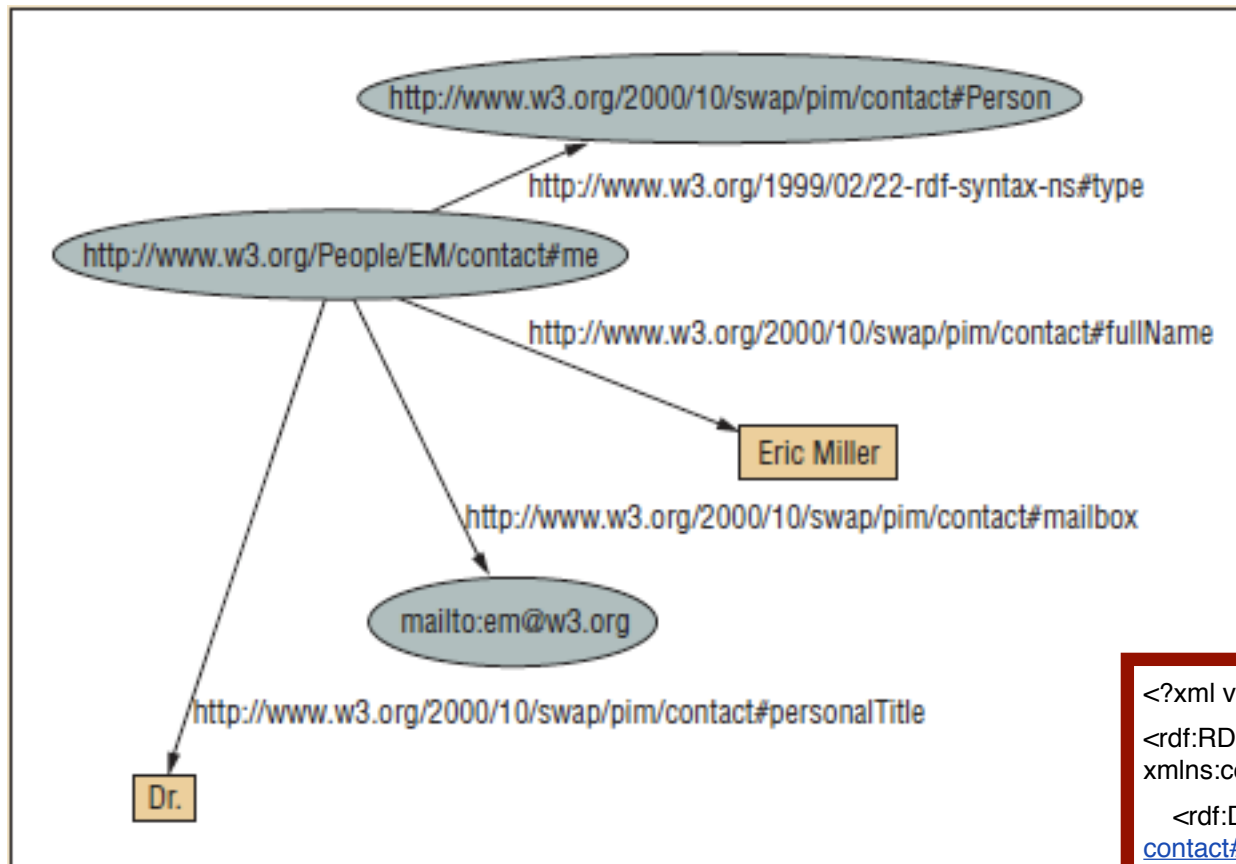
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Para serem inteligíveis pelas máquinas os recursos devem ser descritos numa linguagem que as máquinas entendam (SQL, C#, Java, HTML, XML, RDF,...);



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```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:contact="http://www.w3.org/2000/10/swap/pim/contact#">
  <rdf:Description rdf:about="http://www.w3.org/2000/10/swap/pim/
    contact#me">
    <rdf:type rdf:resource="http://www.w3.org/2000/10/swap/pim/
      contact#Person"/>
    <contact:fullName>Eric Miller</contact:fullName>
    <contact:mailbox rdf:resource="mailto:em@w3.org"/>
    <contact:personalTitle>Dr.</contact:personalTitle>
  </rdf:Description>
</rdf:RDF>
```

Resource Description Framework (RDF)



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"O autor do artigo referido por <http://www.scientificamerican.com/article.cfm?id=the-semantic-web> é Tim Berners-Lee; o assunto do artigo é a Web Semântica; o artigo foi publicado em Maio de 2001 na revista Scientific American"



```

<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:eg="http://www.meu.exemplo.pt/meuExemplo#">

  <rdf:Description rdf:about="http://www.scientificamerican.com/article.cfm?id=the-semantic-web">
    <eg:autor>Tim Berners-Lee</eg:autor>
    <eg:revista>Scientific American</eg:revista>
    <eg:assunto>Web Semântica</eg:assunto>
    <eg:data>Maio, 2001</eg:data>
  </rdf:Description>
</rdf:RDF>

```

Triples of the Data Model

Number	Subject	Predicate	Object
1	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	http://www.meu.exemplo.pt/meuExemplo#autor	"Tim Berners-Lee"
2	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	http://www.meu.exemplo.pt/meuExemplo#revista	"Scientific American"
3	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	http://www.meu.exemplo.pt/meuExemplo#assunto	"Web Semântica"
4	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	http://www.meu.exemplo.pt/meuExemplo#data	"Maio, 2001"



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“O autor do artigo referido por <http://www.scientificamerican.com/article.cfm?id=the-semantic-web> é Tim Berners-Lee e o seu email é timbl@w3.org”



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```

<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:eg="http://www.meu.exemplo.pt/meuExemplo#">

<rdf:Description rdf:about="http://www.scientificamerican.com/article.cfm?id=the-semantic-web">
    <eg:autor rdf:resource="http://www.w3.org/People/Berners-Lee"/>
</rdf:Description>

<rdf:Description rdf:about="http://www.w3.org/People/Berners-Lee/">
    <eg:email>timbl@w3.org</eg:email>
</rdf:Description>

</rdf:RDF>

```

Triples of the Data Model

Number	Subject	Predicate	Object
1	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	http://www.meu.exemplo.pt/meuExemplo#autor	http://www.w3.org/People/Berners-Lee
2	http://www.w3.org/People/Berners-Lee/	http://www.meu.exemplo.pt/meuExemplo#email	"timbl@w3.org"



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- Ser inteligível pelas máquinas não é suficiente para ser interoperável;
- É necessário reunir as condições necessárias e suficientes para ser inteligível para **qualquer** máquina na Web



Cumprimento de normas



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- A Web Semântica é acerca de duas coisas:
 - **Formatos comuns** para o intercâmbio de dados
 - **Uma linguagem** para registrar a forma como os dados se referem a objectos do mundo real

(W3C SWA, consultado em 03/01/2007)



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- Formatos comuns:
 - Os **nomes** dos atributos / propriedades;
 - Os **valores** relacionados com esses atributos / propriedades -> **esquemas de codificação** (esquemas de sintaxe e esquemas de vocabulário);
- **Linguagens** de codificação.





Informação sobre os Dados de forma legível
por máquinas - **Esquemas**



Informação sobre os Recursos / Coisas de
forma legível pelas máquinas - **Dados**



Recursos / **Coisas**

Linked
Data

Web Semântica: Dados Ligados



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Interoperabilidade



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➤ 4: Description Set Profile Interoperability

- Shared formal vocabularies and constraints in records

➤ 3: Description Set syntactic interoperability

- Shared formal vocabularies in exchangeable records

➤ 2: Formal semantic interoperability

- Shared vocabularies based on formal semantics

➤ 1: Shared term definitions

- Shared vocabularies defined in natural language

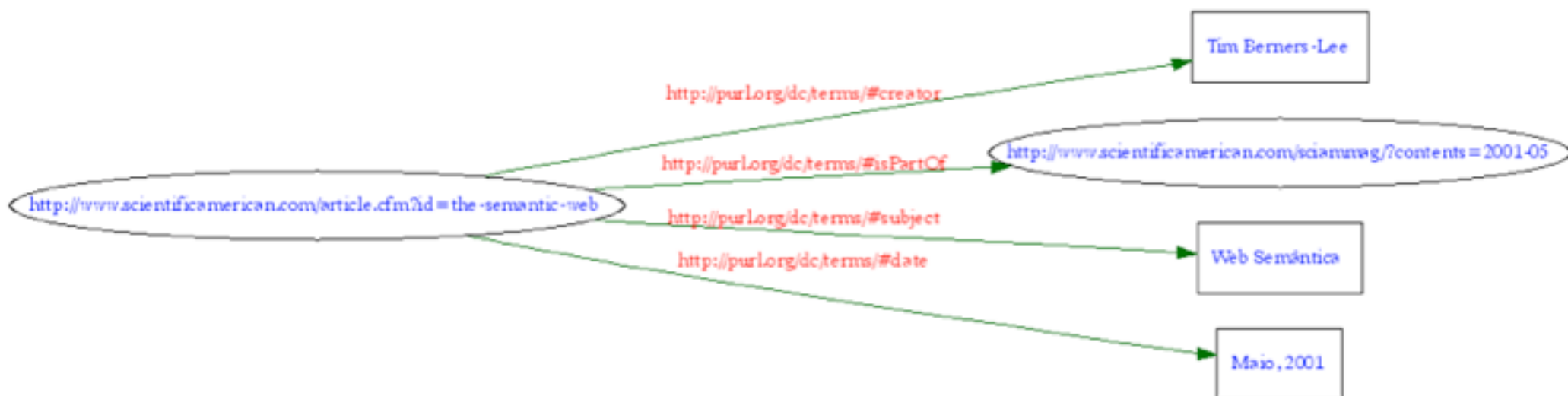




- Normas para os nomes dos atributos: *Dublin Core Metadata Element Set (DCMES)*, *IEEE Learning Object Metadata (IEEE LOM)*, *Publishing Requirements for Industry Standard Metadata (PRISM)*, *Friend Of A Friend (FOAF)*,...
- Normas para os valores relacionados com os atributos - esquemas de sintaxe: *W3CDTF*, *ISO 639-2*,...
- Normas para os valores relacionados com os atributos - vocabulários controlados: *MESH*, *LCSH*,...



Graph of the data model



Triples of the Data Model

Number	Subject	Predicate	Object
1	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	<code>http://purl.org/dc/terms/#creator</code>	"Tim Berners-Lee"
2	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	<code>http://purl.org/dc/terms/#isPartOf</code>	http://www.scientificamerican.com/sciammag/?contents=2001-05
3	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	<code>http://purl.org/dc/terms/#subject</code>	"Web Semântica"
4	http://www.scientificamerican.com/article.cfm?id=the-semantic-web	<code>http://purl.org/dc/terms/#date</code>	"Maio, 2001"



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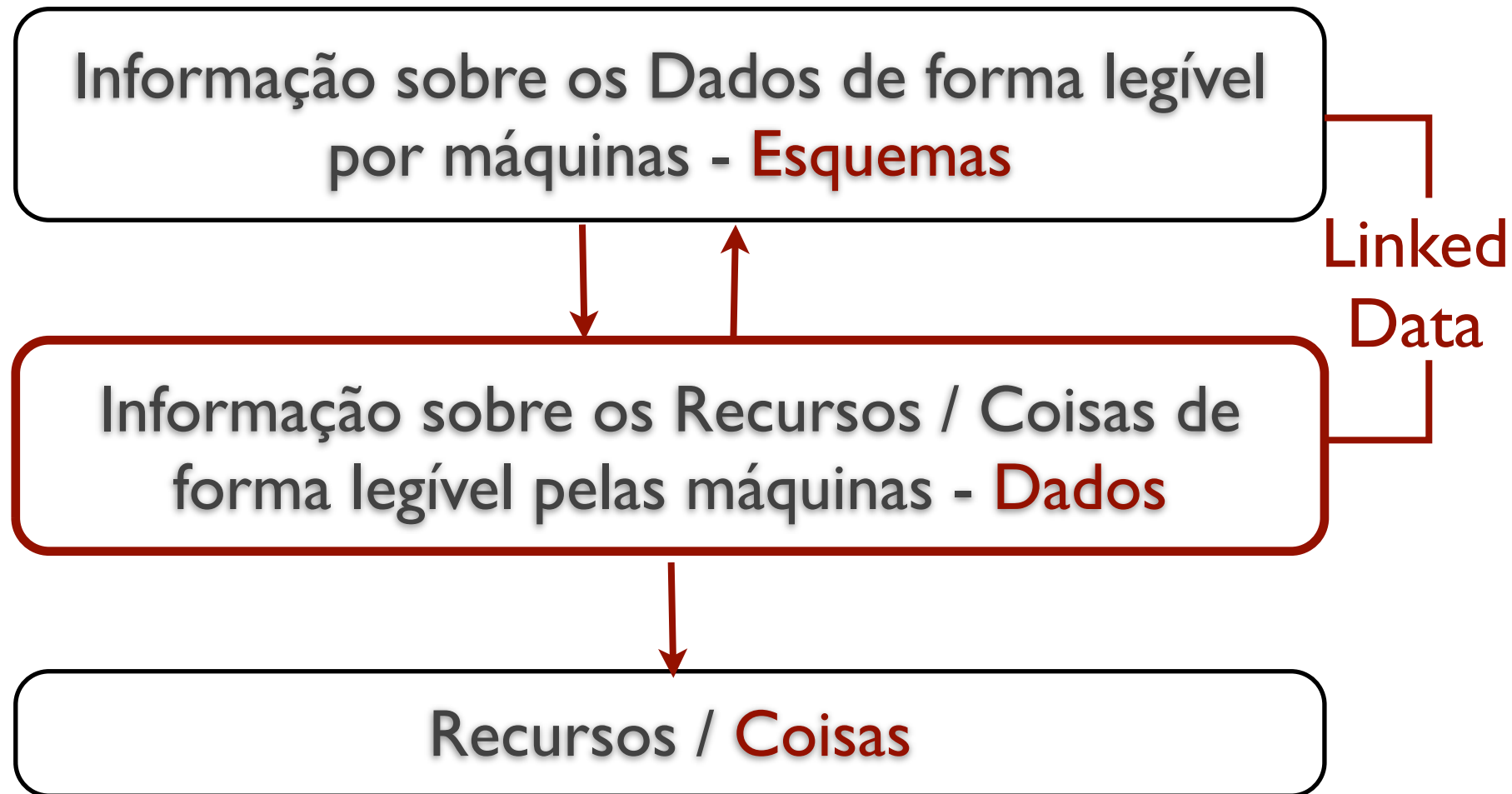
<http://creativecommons.org/licenses/by-nc-sa/2.5>



Exemplo SKOS



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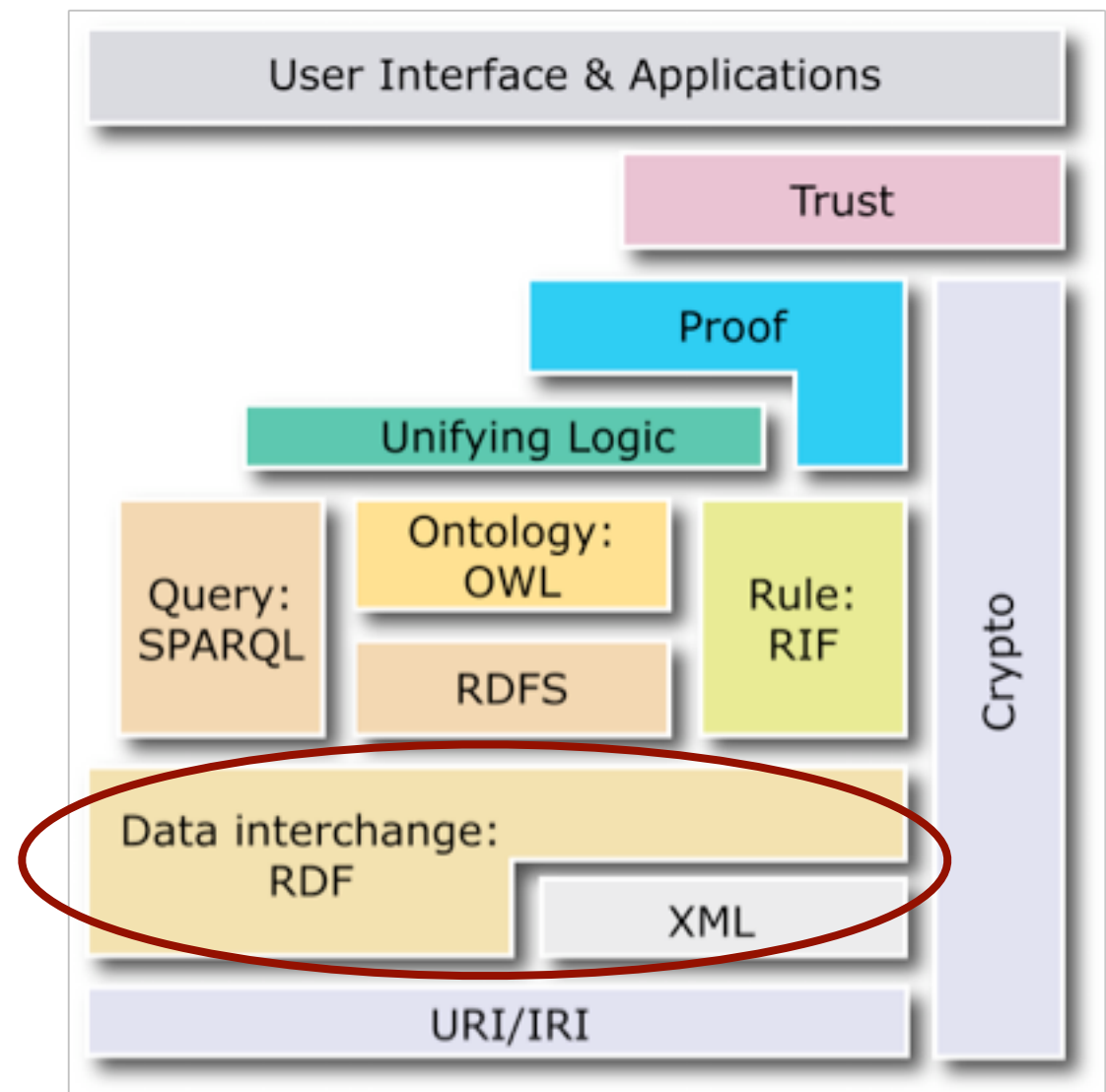


Web Semântica: Dados Ligados



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Nível mais básico





- Precisamos de ter muito cuidado com a semântica associada às propriedades e aos valores
- Utilizando, por exemplo, esquemas de codificação



Exemplo: pesquisa na Europeana

Explore Europe's cultural collections

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[Refine your search](#)

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[Help](#)

Matches for: **who:"Vieira da Silva" > TYPE:IMAGE**



Results 1 - 4 of 4 Page: [1](#)



Assiette à dessert du service Diane



La Bibliothèque



La véranda



La Grande chambre bleue



Results 1 - 4 of 4 Page: [1](#)



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Creator: [Vieira da Silva Maria-Elena \(1908-1992\)](#) , | ▶

Date: [1966]

Type: [Peintures](#) | ▶

Data provider: [Agence photographique de la Réunion des Musées Nationaux](#) | ▶

Provider: [moteur Collections ; France](#) | ▶ [France](#) | ▶

???

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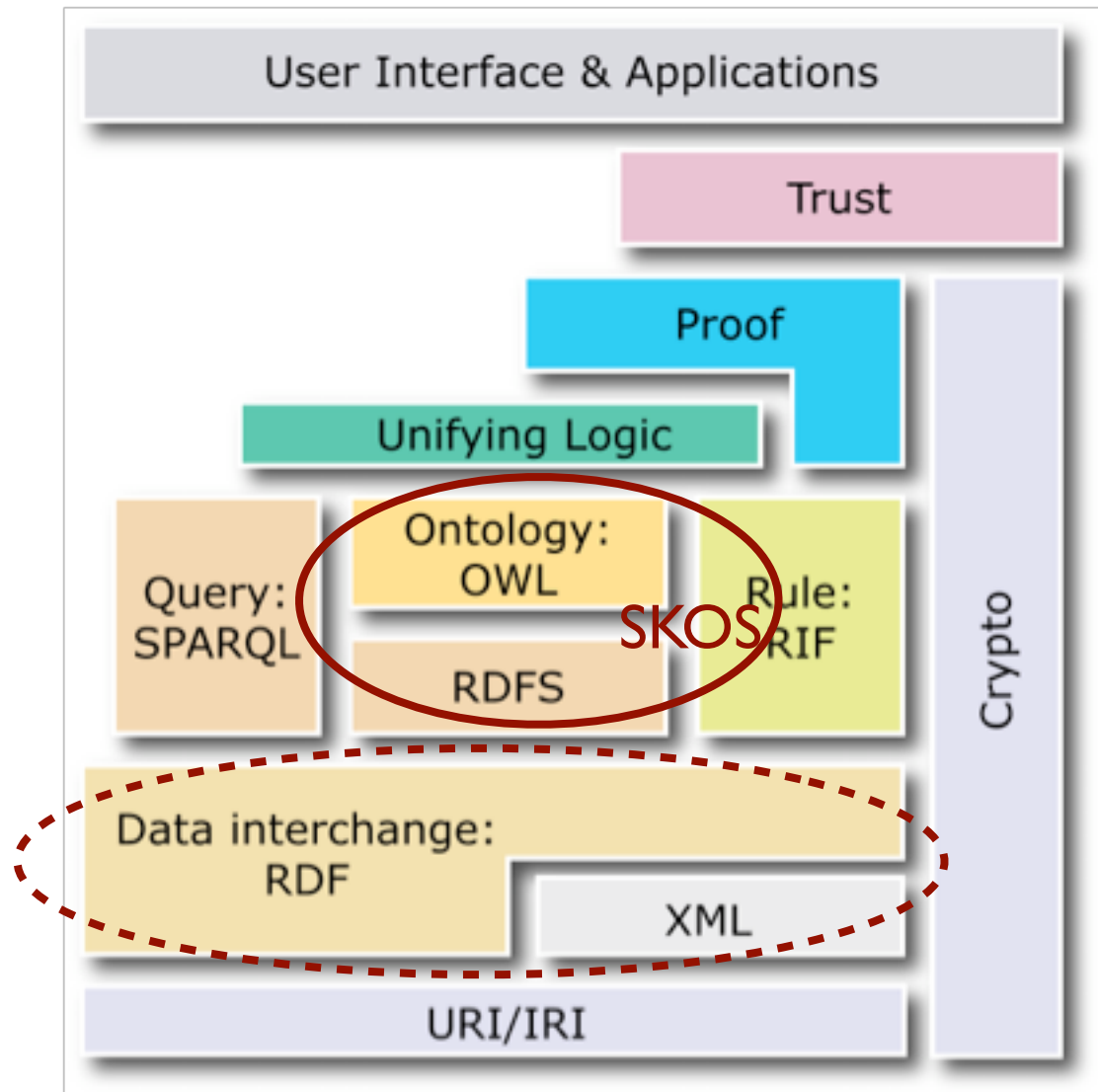


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... quase no fim...





Questões

Café com metadados em Português e
Castelhano é na **Cafeteria DCMI** no
Facebook



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