Web Semântica e Processamento de Linguagem Natural na prática

Newton Calegari

PUC-SP

Web Semântica e contexto

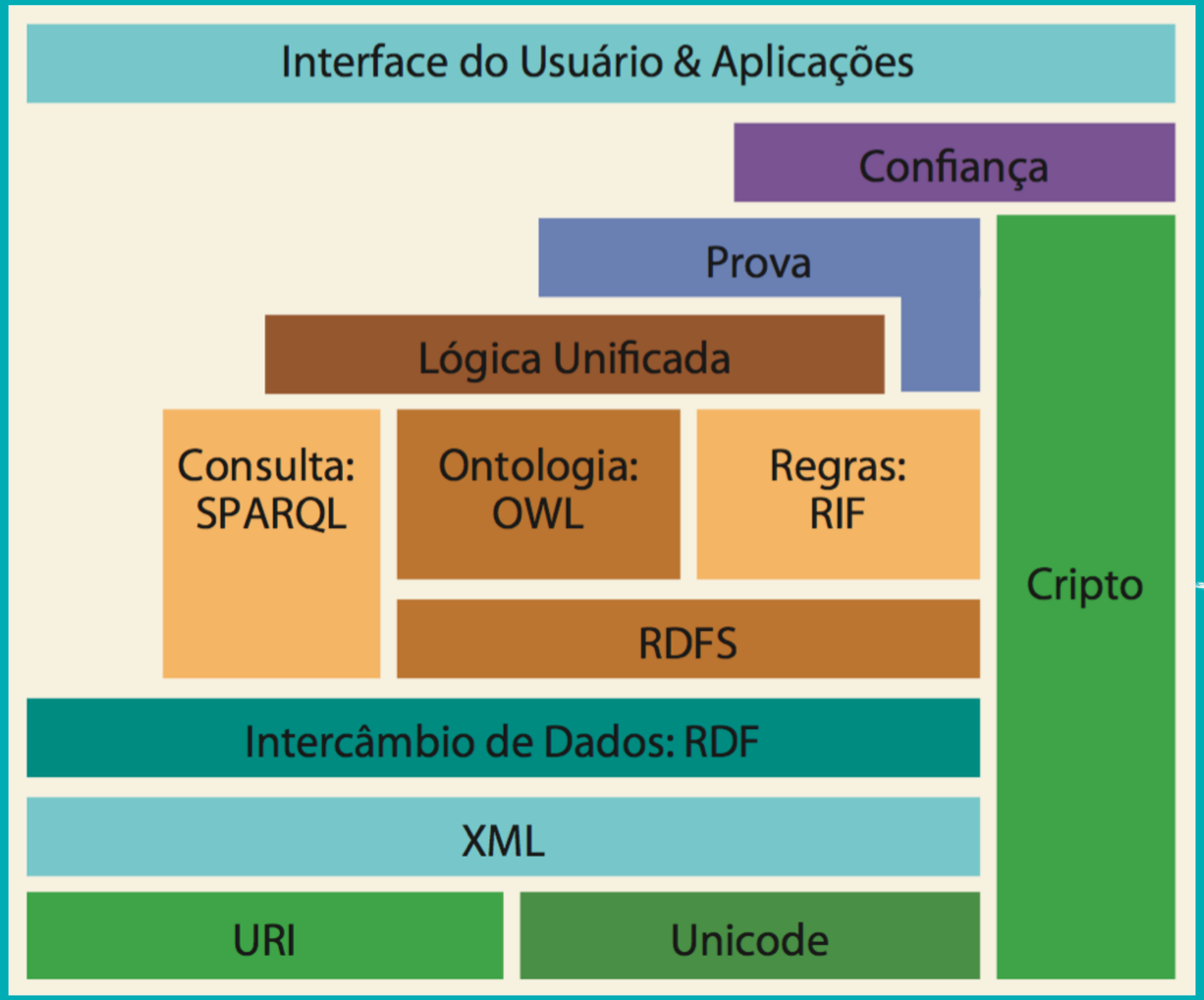
Os fundamentos da Web Semântica
A pilha tecnológica da Web Semântica
Ontologias e Vocabulários
Estado da arte e exemplos

Web Semântica

Berners-Lee et al., 2001

A Web Semântica tem por objetivo **descrever o significado da informação** publicada na Web com a finalidade de habilitar a realização de consultas baseadas no entendimento preciso da semântica daquela informação.

(RODRÍGUEZ-ROCHA et al., 2015)



Semantic Web Stack

Camadas

UNICODE e URI

URI É uma sequência de caracteres que identifica um recurso físico ou abstrato. Teve sua sintaxe genérica definida na RFC 2396 (1998).

IRI A RFC 3987 (2005) propõe a padronização de uma extensão para URI, utilizando o conjunto de caracteres universais (Unicode/ISO 10646) a fim de permitir a internacionalização dos identificadores de recursos.

URL É um subconjunto do conjunto de URI. As URL fornecem a localização dos recursos descrevendo seu mecanismo de acesso primário. Portanto, quando recursos identificados na Web possuírem informação referente ao protocolo de acesso, seus identificadores serão definidos como URL.

http://google.com

https://newtoncalegari.com.br/about

https://twitter.com/newtoncalegari

https://www.w3.org/People/Berners-Lee/

https://www.w3.org/People/Berners-Lee/#Bio

XML (Linguagens de serialização)

XML (*Extensible Markup Language*) como a linguagem de marcação para criação de documentos compostos de dados estruturados.

```
<Books>
    <Book ISBN="0553212419">
        <title>Sherlock Holmes: Complete Novels...
        <author>Sir Arthur Conan Doyle</author>
    </Book>
    <Book ISBN="0743273567">
        <title>The Great Gatsby</title>
        <author>F. Scott Fitzgerald</author>
    </Book>
    <Book ISBN="0684826976">
        <title>Undaunted Courage</title>
        <author>Stephen E. Ambrose</author>
    </Book>
    <Book ISBN="0743203178">
        <title>Nothing Like It In the World</title>
        <author>Stephen E. Ambrose</author>
    </Book>
</Books>
```

```
<Books>
    <Book ISBN="0553212419">
        <title>Sherlock Holmes: Complete Novels...
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    </Book>
    <Book ISBN="0743273567">
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    </Book>
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        <title>Undaunted Courage</title>
        <author>Stephen E. Ambrose</author>
    </Book>
    <Book ISBN="0743203178">
        <title>Nothing Like It In the World</title>
        <author>Stephen E. Ambrose</author>
    </Book>
</Books>
```

```xml
<Books>
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        <title>Sherlock Holmes: Complete Novels...
        <author>Sir Arthur Conan Doyle</author>
    </Book>
    <Book ISBN="0743273567">
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        <author>F. Scott Fitzgerald</author>
    </Book>
    <Book ISBN="0684826976">
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    </Book>
    <Book ISBN="0743203178">
        <title>Nothing Like It In the World</title>
        <author>Stephen E. Ambrose</author>
    </Book>
</Books>
```

XML

JSON-LD

TURTLE

N3

RDFa

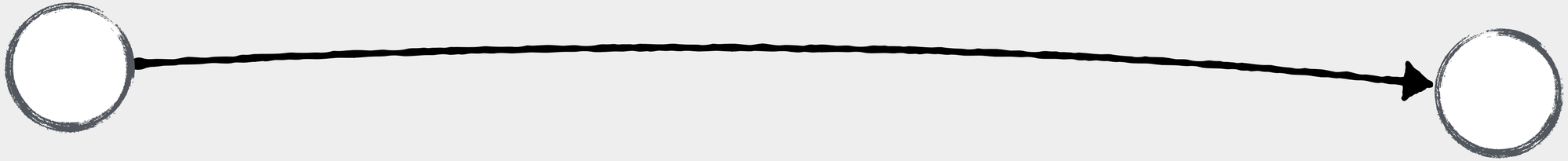
JSON-LD

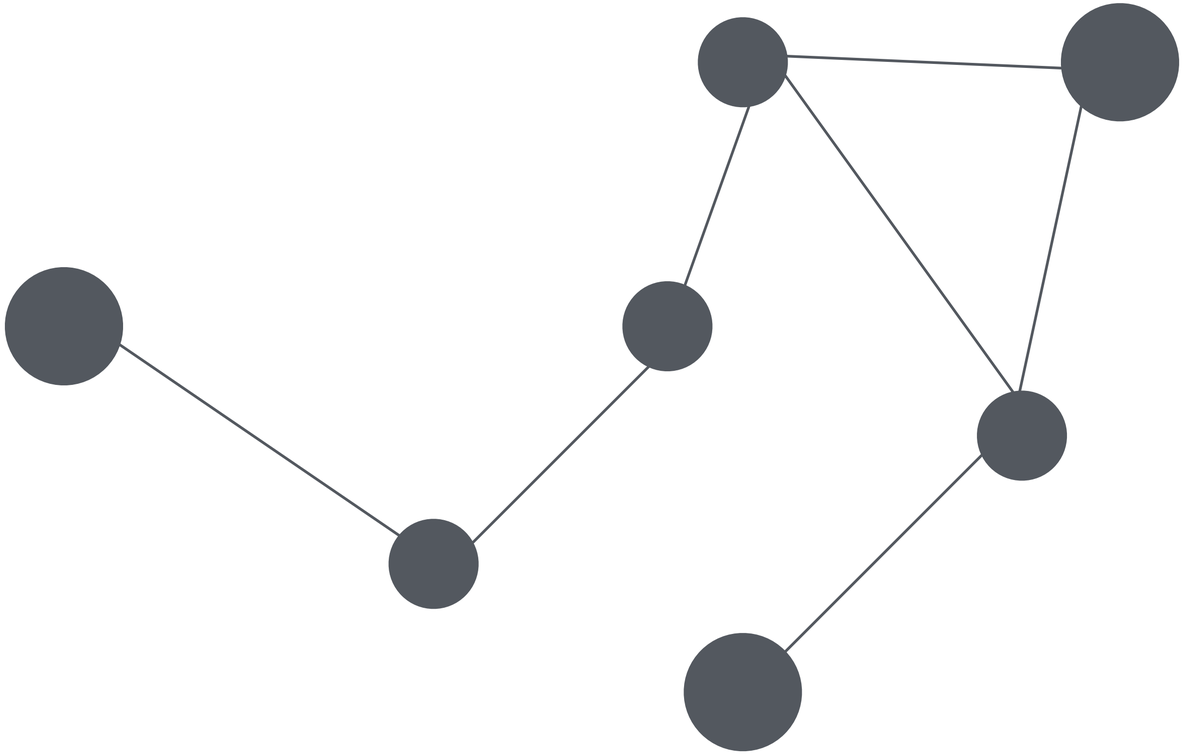
```
{
  "@context": "http://schema.org/",
  "@type": "Person",
  "name": "Jane Doe",
  "jobTitle": "Professor",
  "telephone": "(425) 123-4567",
  "url": "http://www.janedoe.com"
}
```

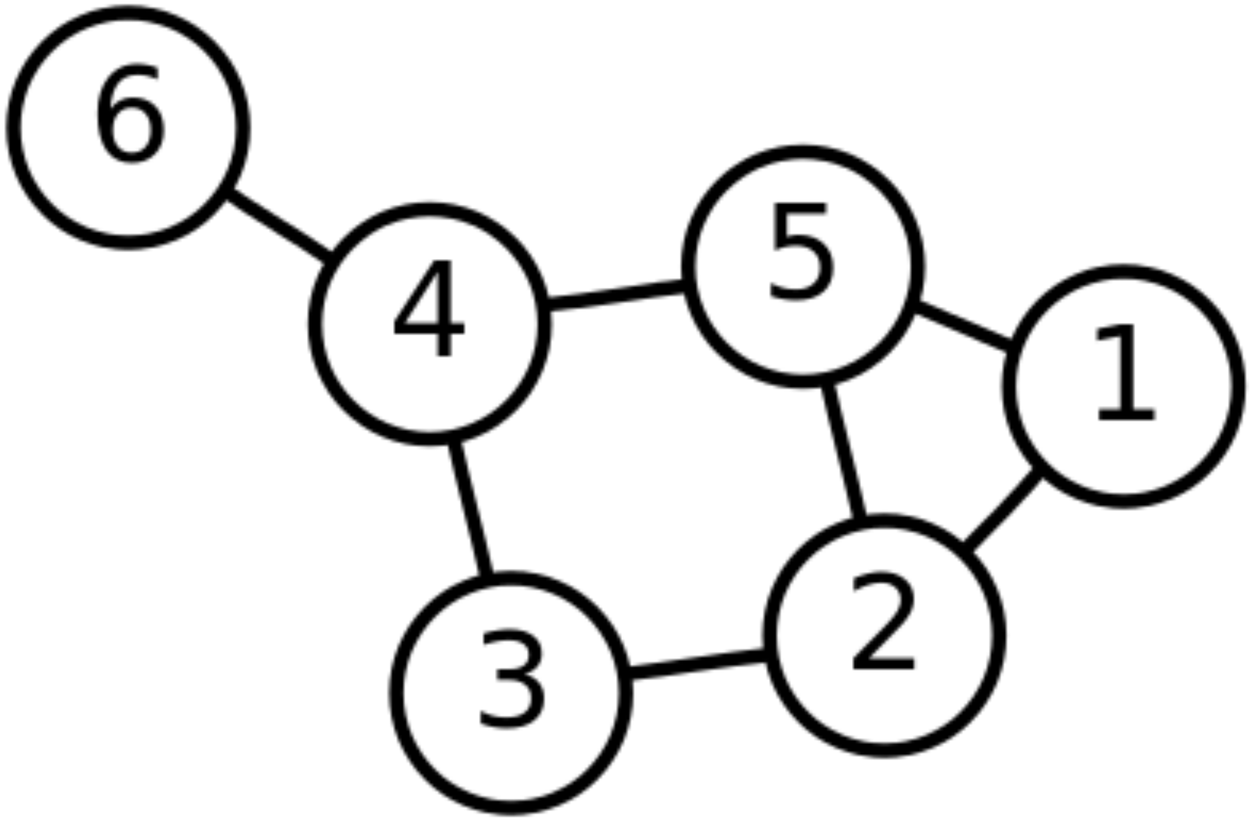
RDF (Resource Description Framework)

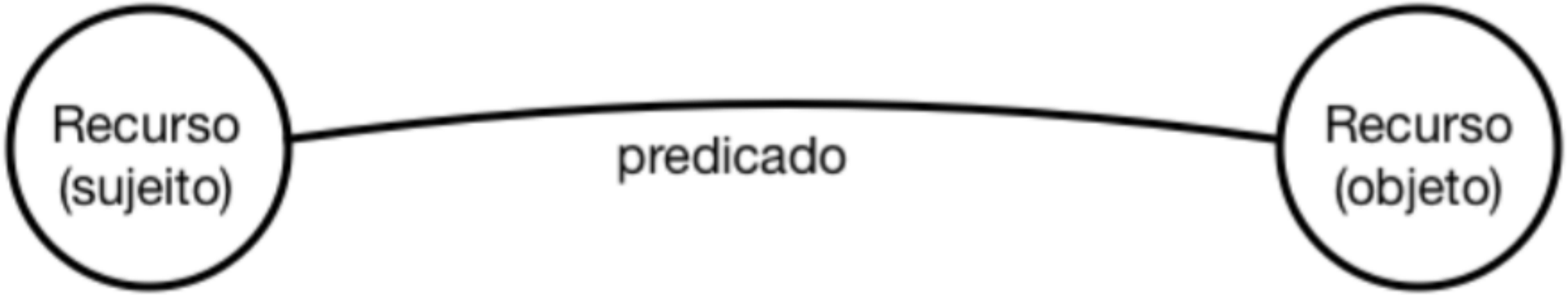
RDF

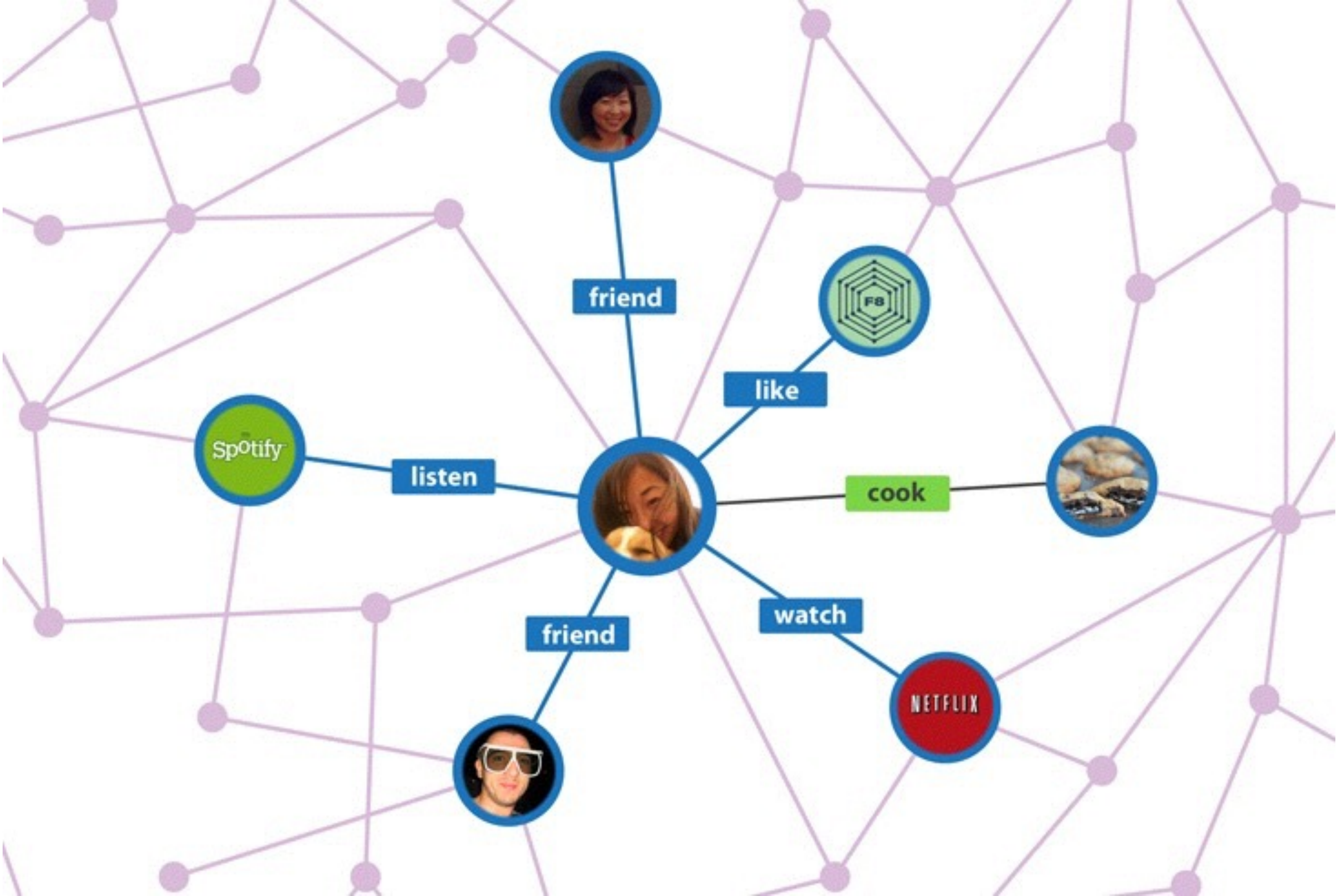
sujeito	predicado	objeto
Demi Getschko	conhece	Vint Cerf

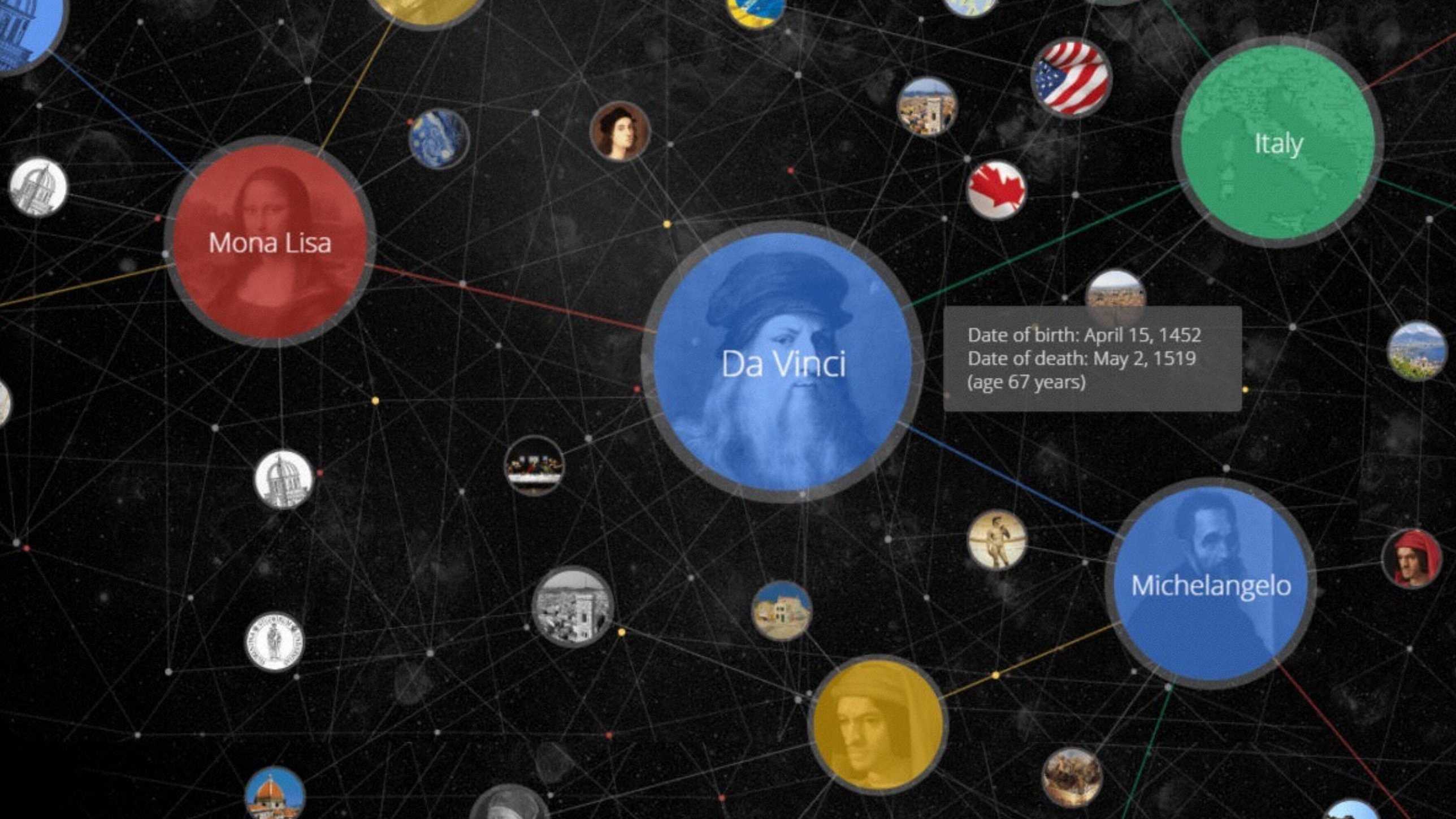





6
4
5
1
3
2

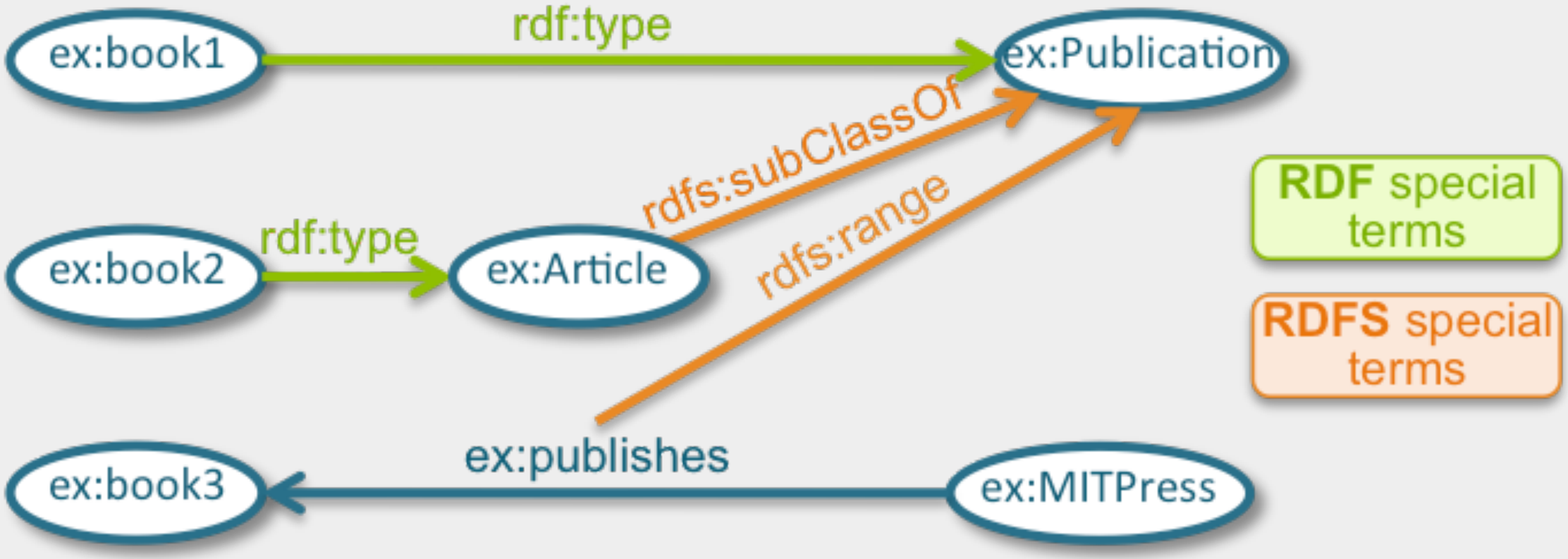

Recurso
(sujeito)
predicado
Recurso
(objeto)


friend
like
listen
cook
watch
friend
Spotify
F8
NETFLIX


Mona Lisa
Da Vinci
Date of birth: April 15, 1452
Date of death: May 2, 1519
(age 67 years)
Italy
Michelangelo

sujeito	predicado	objeto
Newton	trabalha	W3C
W3C	é uma	organização
Tim Berners-Lee	fundou	W3C

RDFS


ex:book1
rdf:type
ex:Publication
rdfs:subClassOf
rdfs:range
ex:book2
rdf:type
ex:Article
RDF special terms
RDFS special terms
ex:publishes
ex:book3
ex:MITPress

ONTOLOGIAS e VOCABULÁRIOS

machine-readable

modelo abstrato

Uma ontologia é uma <u>especificação explícita</u> e <u>formal</u> de uma <u>conceptualização</u> <u>compartilhada</u>

expressa em termos (conceitos, propriedades)

baseada em consenso

Utilizamos ontologias e vocabulários para descrever dados publicados na Web

Full Hierarchy

Schema.org is defined as two hierarchies: one for textual property values, and one for the things that they describe.

Thing

This is the main schema.org hierarchy: a collection of types (or "classes"), each of which has one or more parent types. Although a type may have more than one super-type, here we show each type in one branch of the tree only. There is also a parallel hierarchy for data types.

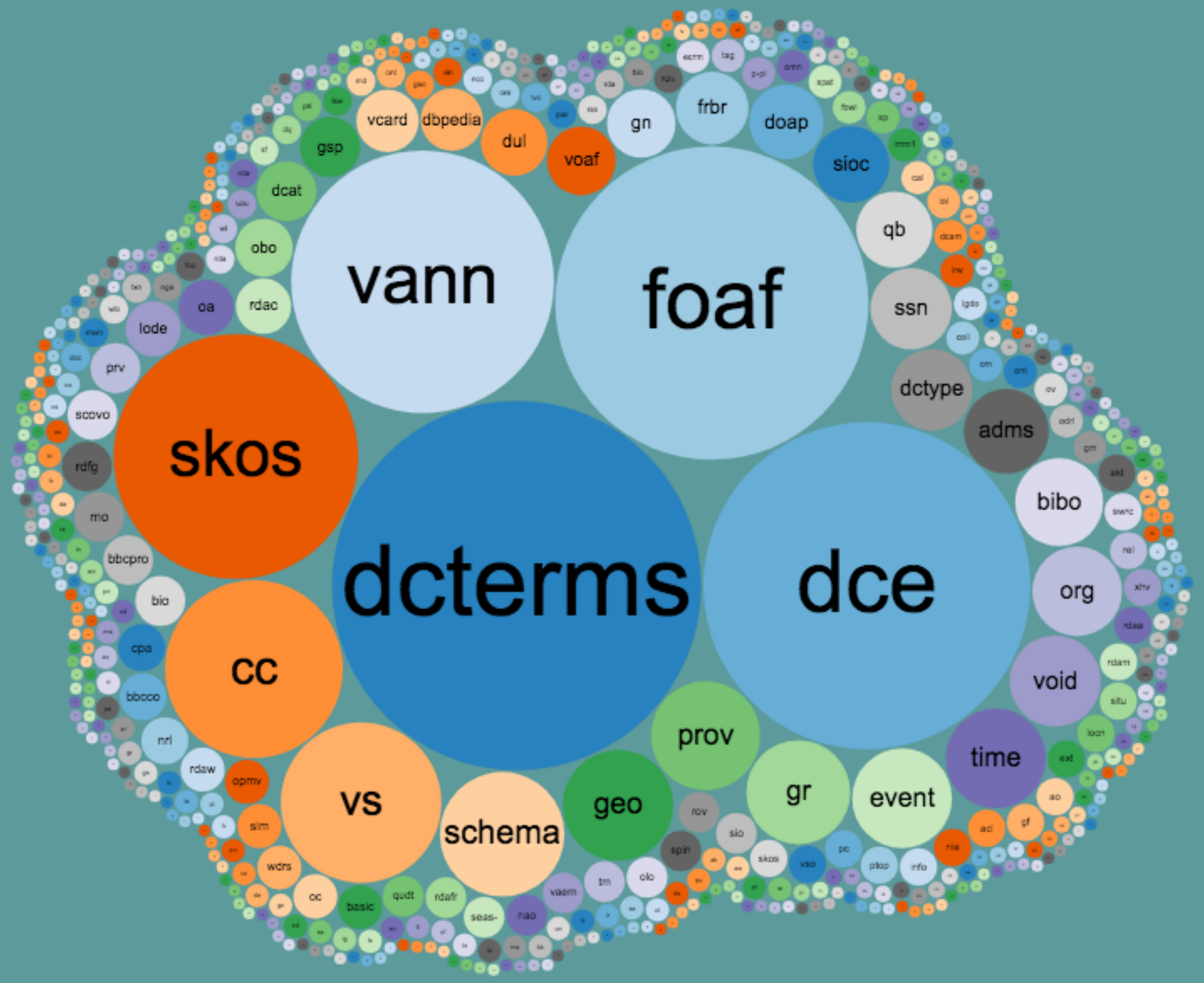
Select vocabulary view:

(•) Core vocabulary ( ) Core plus all extensions

Core plus extension vocabularies

- Thing
  - Action
    - AchieveAction
      - LoseAction
      - TieAction
      - WinAction
    - AssessAction

Linked Open Vocabularies (LOV)


vann
foaf
skos
dcterms
dce
cc
vs
schema
geo
prov
gr
event
time
void
org
bibo
adms
dctype
ssn
qb
sioc
doap
frbr
gn
voaf
dul
dbpedia
vcard
gsp
dcat
obo
rdac
oa
lode
prv
scovo
rdfg
mo
bbcpro
bio
cpa
bbcco
nrl
rdaw
opmv
sim
wdrs
cc
basic
qudt
rdafr
seas-
nao
vaem
tm
olo
spin
skos
sio
rov
pc
ptop
info
rse
act
sf
ao
ext
locn
situ
rdam
rdas
xhv
rel
swrc
akt
gm
odrl
ov
cal
lol
dcam
inv
lgdo
coll
om
ont
mrel
imm-t
fowl
sp
p-pl
omn
spat
ecrm
tag
bio
hdo
ical
ical
ical

Linked Open Vocabularies

lov.okfn.org/dataset/lov/vocabs/foaf

VOCABS TERMS AGENTS SPARQL/DUMP

Friend of a Friend vocabulary (foaf)

Metadata

URI	http://xmlns.com/foaf/0.1/
Namespace	http://xmlns.com/foaf/0.1/
homepage	http://www.foaf-project.org/
Description	FOAF is a project devoted to linking people and information using the Web. Regardless of whether information is in people's heads, in physical or digital documents, or in the form of factual data, it can be linked. @en
Language	

Libby Miller
http://data.semanticweb.org/person/libby-miller

n3

Statistics

Classes	13
Properties	62
Datatypes	0
Instances	0

Expressivity

RDF RDFS

Newton Calegari	rdf:type	**foaf:Person**
	foaf:knows	Demi Getschko

SPARQL

SPARQL é uma linguagem de consultas a fontes de dados no padrão RDF ou em formatos que possam ser convertidos para RDF, por meio de alguma outra aplicação *middleware*.

```
SELECT ...
WHERE { ... }
```

```
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbr: <http://dbpedia.org/resource/>

SELECT ?obra
WHERE {
        ?obra dbp:artist dbr:Vincent_van_Gogh
}
```

Exemplos

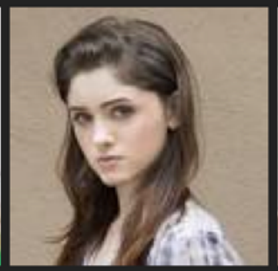
elenco stranger things

Todas | Notícias | Vídeos | Imagens | Shopping | Mais | Ferramentas de pesquisa

Stranger Things / Elenco

Winona Ryder
Joyce

Millie Brown
Eleven


Natalia Dyer
Nancy

Charlie Heaton
Jonathan

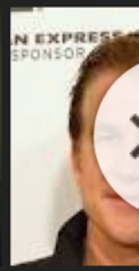
David Harbour
Chief Hopper

Gaten Matarazzo
Dustin

Caleb McLaughlin
Lucas

Noah Schnapp
Will

Finn Wolfhard
Mike


Matthew
Dr. Martin

Stranger Things - Série 2016 - AdoroCinema

www.adorocinema.com › Séries › Melhores séries › Todas as séries › Séries Drama

Stranger Things, uma série criada por Matt Duffer, Ross Duffer com Winona Ryder, **David Harbour**: Ambientada em Montauk, Long Island, conta a história de um garoto que desaparece misteriosamente. Enquanto a ... **Elenco Stranger Things**.

Stranger Things: Elenco da 1ª temporada - AdoroCinema

www.adorocinema.com/series/serie-19156/temporada-26101/**elenco**/

David Harbour · Millie Brown Personagem: Eleven. **Finn Wolfhard** Personagem: Mike. Caleb McLaughlin. Personagem: Lucas. **Gaten Matarazzo** Personagem: ...

Stranger Things – Wikipédia, a enciclopédia livre

https://pt.wikipedia.org/wiki/**Stranger_Things**

Ir para **Elenco** - Divorciada de seu marido Lonnie, Joyce depende fortemente de Jonathan para ajudá-la. **David Harbour** como o Delegado Jim Hopper.

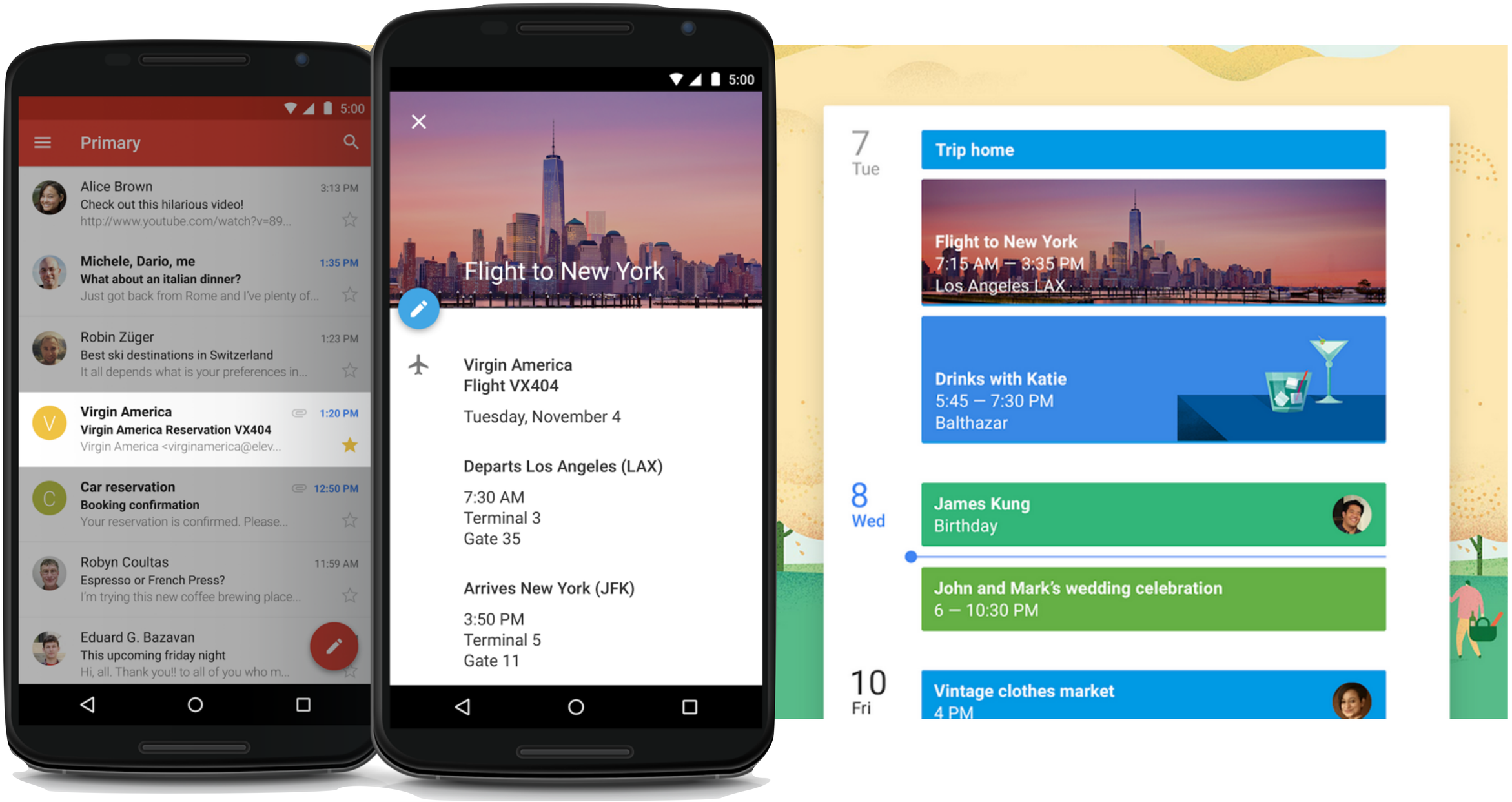
Stranger Things

Seriado de ficção científica

Stranger Things é uma websérie americana dos gêneros suspense, ficção científica e terror criada pelos irmãos Matt e Ross Duffer e distribuída pela Netflix. Wikipédia

Emissora original: Netflix

Número De Episódios: 8


5:00
Primary
Alice Brown
3:13 PM
Check out this hilarious video!
http://www.youtube.com/watch?v=89...
Michele, Dario, me
1:35 PM
What about an italian dinner?
Just got back from Rome and I've plenty of...
Robin Züger
1:23 PM
Best ski destinations in Switzerland
It all depends what is your preferences in...
Virgin America
1:20 PM
Virgin America Reservation VX404
Virgin America <virginamerica@elev...
Car reservation
12:50 PM
Booking confirmation
Your reservation is confirmed. Please...
Robyn Coultas
11:59 AM
Espresso or French Press?
I'm trying this new coffee brewing place...
Eduard G. Bazavan
This upcoming friday night
Hi, all. Thank you!! to all of you who m...
5:00
Flight to New York
Virgin America
Flight VX404
Tuesday, November 4
Departs Los Angeles (LAX)
7:30 AM
Terminal 3
Gate 35
Arrives New York (JFK)
3:50 PM
Terminal 5
Gate 11
7
Tue
Trip home
Flight to New York
7:15 AM – 3:35 PM
Los Angeles LAX
Drinks with Katie
5:45 – 7:30 PM
Balthazar
8
Wed
James Kung
Birthday
John and Mark's wedding celebration
6 – 10:30 PM
10
Fri
Vintage clothes market
4 PM

Lava Lite Classic Lava Lamp, Purple/Blue - Walmart.com

Walmart › Lava-2118-Lava-Lite-Classic-...

★★★½☆ Rating: 3.5 - 60 votes - $13.17 - In stock

Mobile-friendly - Buy Lava Lite Classic Lava Lamp, Purple/Blue at Walmart.com.

IBM

Computer hardware company

ibm.com

International Business Machines Corporation is an American multinational technology and consulting corporation, with corporate headquarters in Armonk, New York. Wikipedia

Stock price: IBM (NYSE) $150.50 +1.35 (+0.91%)
Apr 27, 5:33 PM EDT - Disclaimer

CEO: Ginni Rometty

Customer service: 1 (877) 426-6006

Sales: 1 (888) 746-7426

Headquarters: Armonk, North Castle, NY

Founder: Charles Ranlett Flint

Founded: June 16, 1911, New York City, NY

Profiles

Facebook LinkedIn Twitter YouTube Instagram

People also search for

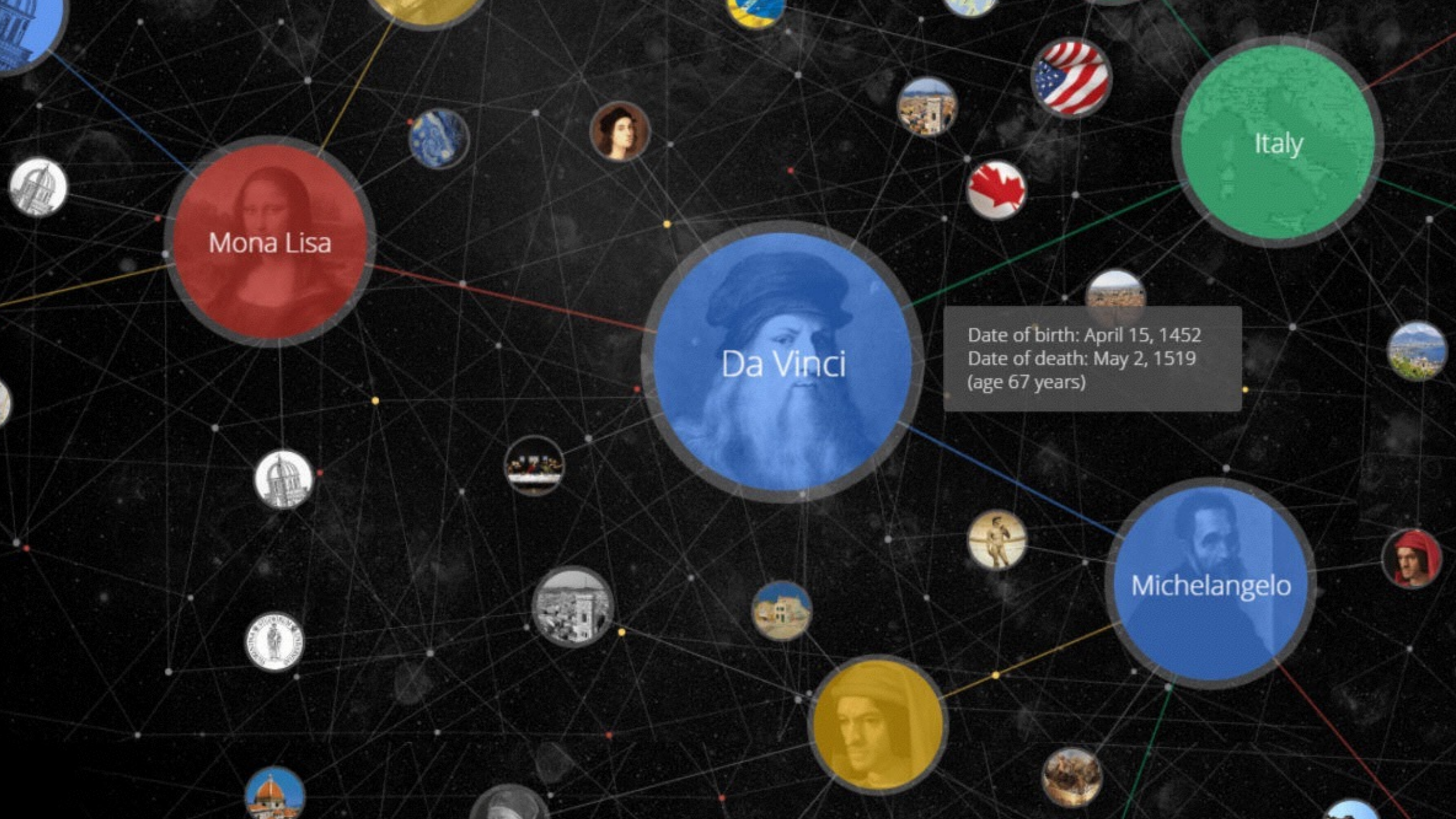
View 15+ more

Microsoft Corporation Apple Lenovo Hewlett-P… Dell

Feedback

ep 17, 2014
View Pull Request
33
View Issue
t! However

Dados estruturados no Google


Mona Lisa
Da Vinci
Date of birth: April 15, 1452
Date of death: May 2, 1519
(age 67 years)
Italy
Michelangelo

elenco stranger things

Todas | Notícias | Vídeos | Imagens | Shopping | Mais | Ferramentas de pesquisa

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Joyce

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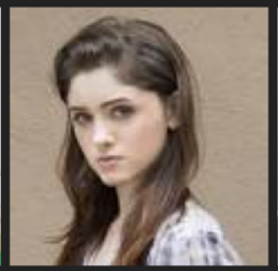
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Charlie Heaton
Jonathan

David Harbour
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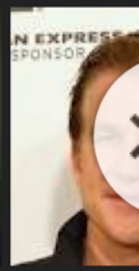
Gaten Matarazzo
Dustin

Caleb McLaughlin
Lucas

Noah Schnapp
Will

Finn Wolfhard
Mike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Emissora original: Netflix

Número De Episódios: 8

Google

qual a idade do papa francisco?

Todas | Notícias | Shopping | Vídeos | Imagens | Mais | Ferramentas de pesquisa

Aproximadamente 386.000 resultados (0,47 segundos)

Papa Francisco / Idade

79 anos

17 de dezembro de 1936

Papa Bento XVI
89 anos

Donald Trump
70 anos

Barack Obama
55 anos

Feedback

Papa Francisco – Wikipédia, a enciclopédia livre

https://pt.wikipedia.org/wiki/**Papa_Francisco**

Francisco (em latim: Franciscus; Buenos Aires, **17 de dezembro de 1936**), nascido como Jorge ..... de implementar políticas que protejam os menores de **idade** e colaborar com as autoridades civis nas investigações de possíveis crimes.

Infância e juventude · Companhia de Jesus · Episcopado · Pontificado

G1 - Papa Francisco diz que seu reinado será breve e que não se ...

g1.globo.com/.../**papa-francisco**-diz-que-seu-reinado-sera-breve-e-que-nao-se-sente-s...

13 de mar de 2015 - **Francisco**, de 78 anos, descarta um limite de **idade** ao pontificado já que considera que "o papado tem algo de última instância", e que não ...

Papa Francisco

Francisco, nascido como Jorge Mario Bergoglio, é o 266.º Papa da Igreja Católica e atual Chefe de Estado do Vaticano, sucedendo o Papa Bento XVI, que abdicou ao papado em 28 de fevereiro de 2013. Wikipédia

Nascimento: 17 de dezembro de 1936 (79 anos), Flores, Buenos Aires, Argentina

Nacionalidade: Argentino

Cargo: Soberano do Estado da Cidade do Vaticano desde 2013

Educação: Milltown Institute of Theology and Philosophy (1980–1980), mais

Irmãos: Alberto Bergoglio, Oscar Adrian Bergoglio, María Elena Bergoglio, Marta Regina Bergoglio

Obras

Ver mais 45

The Name of God Is Mercy
2016

Dear Pope Francis: The Pope...
2016

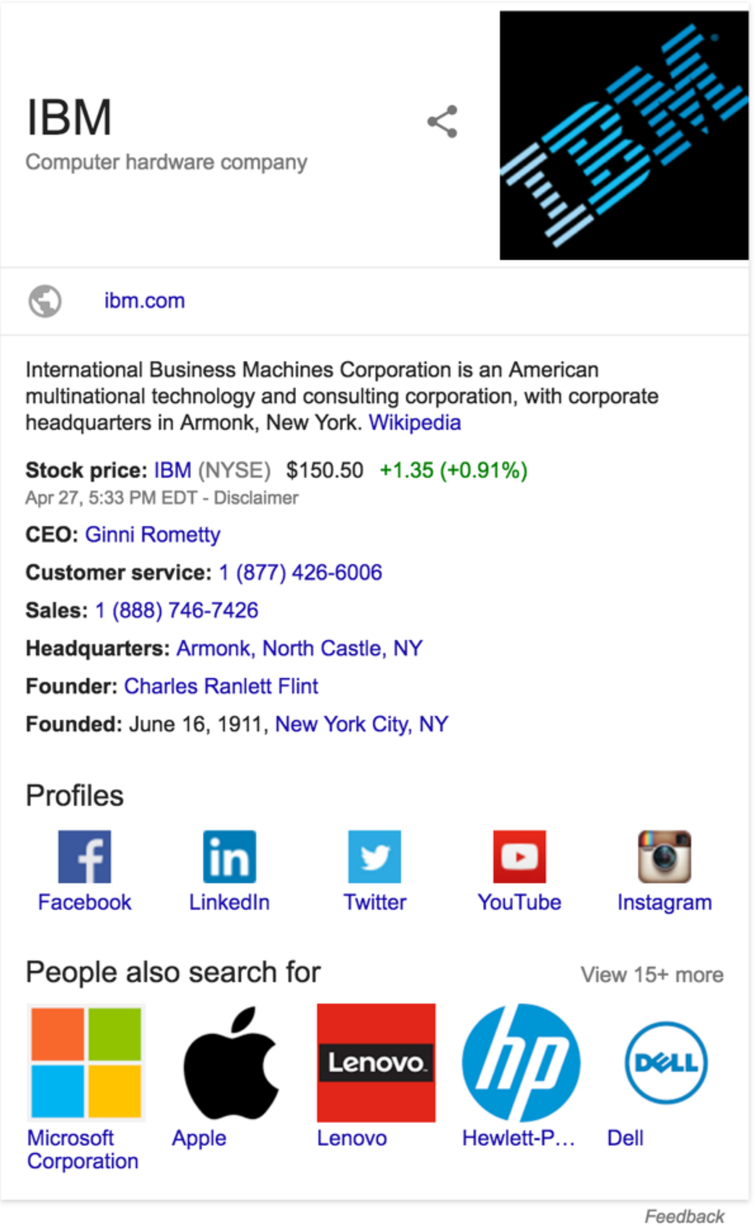
Evangelii Gaudium
2013

Laudato si'
2015

Sobre o Céu e a Terra
2010

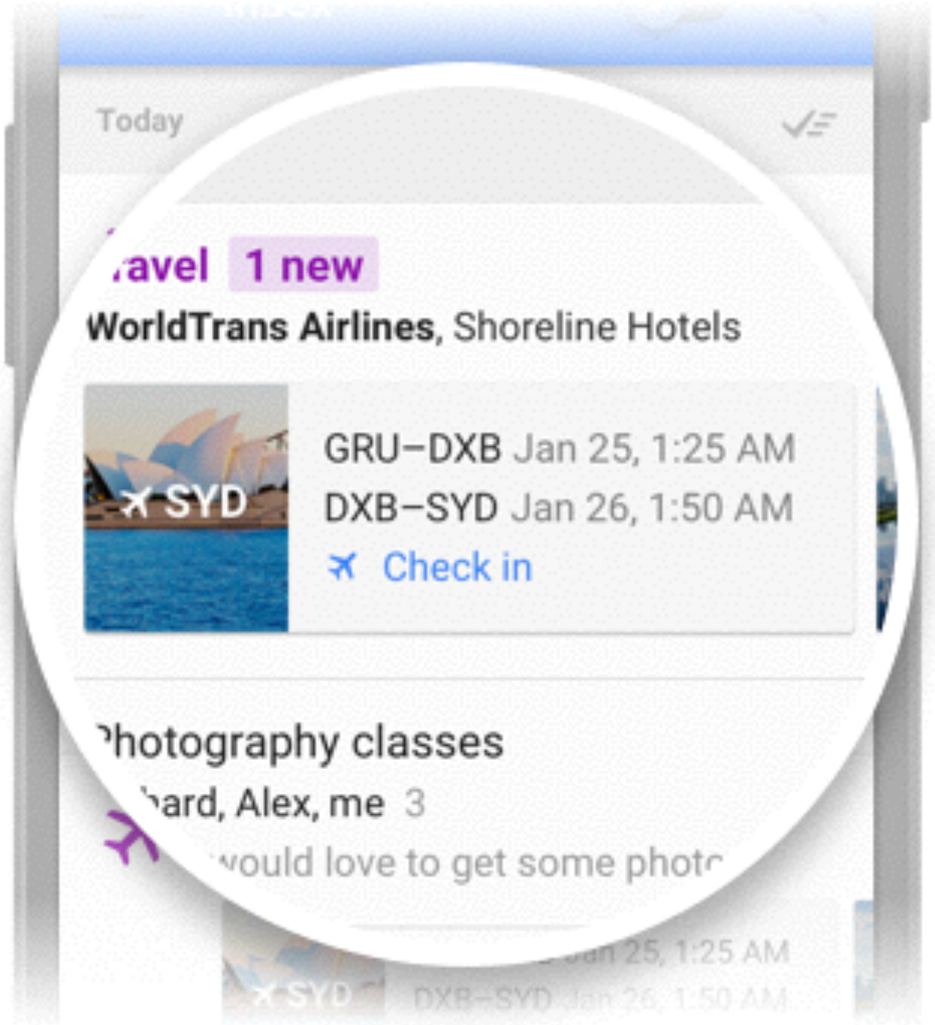
Feedback

Knowledge Graph cards



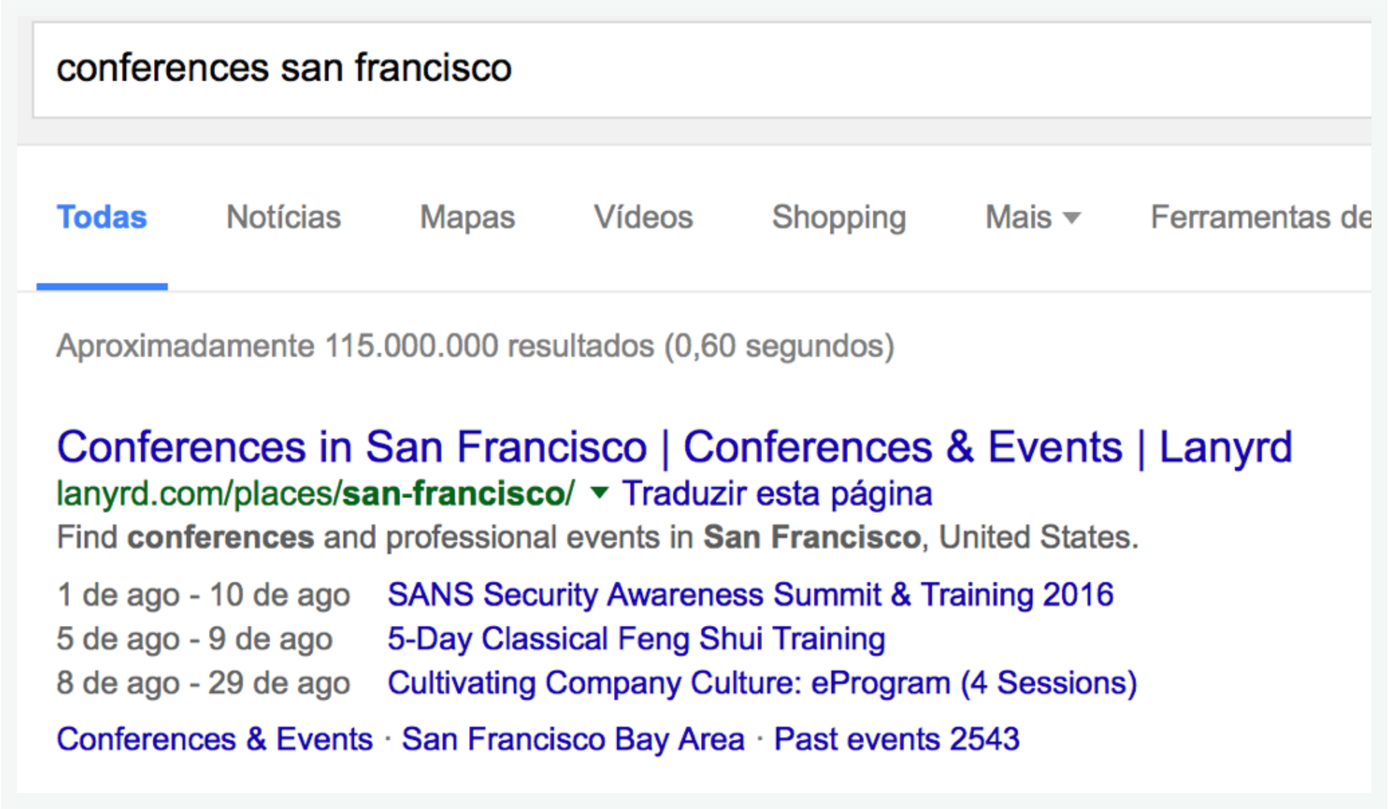
GMail Actions

GMail Highlights



Rich Snippets

(Events)



Rich Snippets

(Reviews)

Legal, como faz?

W3C Recommendation

RDFa Lite 1.1 - Second Edition

W3C Recommendation 17 March 2015

This version:
http://www.w3.org/TR/2015/REC-rdfa-lite-20150317/
Latest published version:
http://www.w3.org/TR/rdfa-lite/
Implementation report:
http://www.w3.org/2010/02/rdfa/wiki/CR-ImplementationReport
Previous version:
http://www.w3.org/TR/2014/PER-rdfa-lite-20141216/
Previous Recommendation:
http://www.w3.org/TR/2012/REC-rdfa-lite-20120607/
Editor:
Manu Sporny, Digital Bazaar, Inc.

Please check the **errata** for any errors or issues reported since publication.

This document is also available in this non-normative format: diff to previous version

The English version of this specification is the only normative version. Non-normative translations may also be available.

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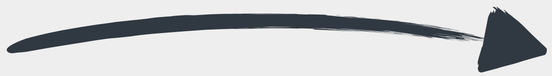
Abstract

RDFa Lite is a minimal subset of RDFa, the Resource Description Framework in attributes, consisting of a few attributes that may be used to express machi

RDFa (Lite)

4 propriedades para começarmos



`vocab`

`property`

`typeof`

`content`

```
<p>
  O FrontInBH ocorre no dia 06/08/2016!
</p>
```

@vocab

```
<p vocab="http://schema.org/">
  O FrontInBH ocorre no dia 06/08/2016!
</p>
```

@typeof

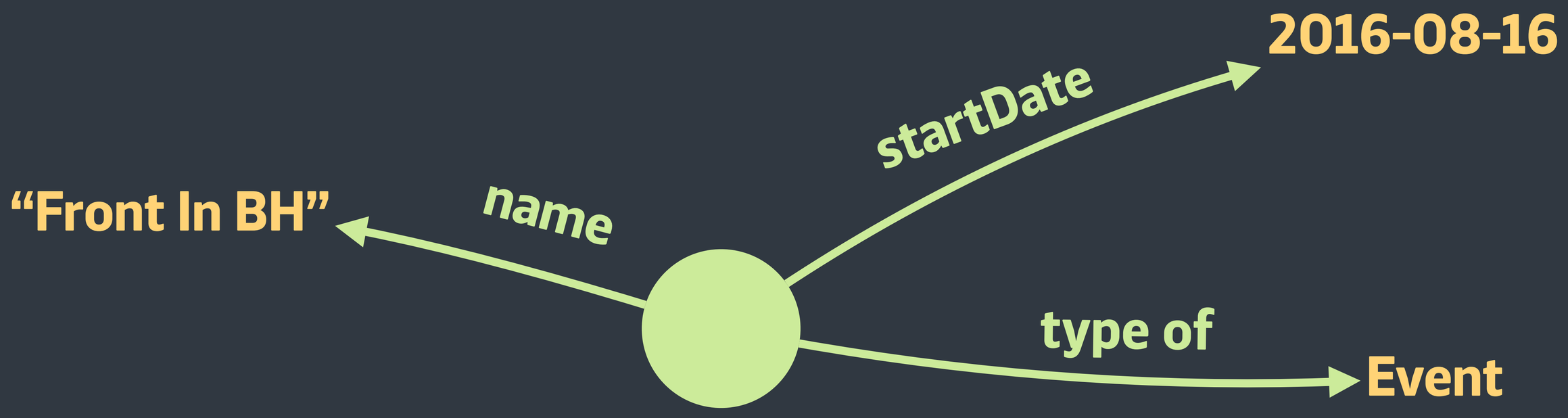
```
<p vocab="http://schema.org/"
  typeof="Event">
  O FrontInBH ocorre no dia 06/08/2016!
</p>
```

@property

```
<p vocab="http://schema.org/"
   typeof="Event">
  O <span property="name">FrontInBH</span>
  ocorre no dia 06/08/2016!
</p>
```

@content

```
<p vocab="http://schema.org/"
  typeof="Event">
  O <span property="name">FrontInBH</span>
  ocorre no dia
  <span property="startDate"
      content="2016-08-16T08:00">
    06/08/2016</span>!
</p>
```



www.frontinbh.com.br

W3C Recommendation

JSON-LD 1.0

A JSON-based Serialization for Linked Data

W3C Recommendation 16 January 2014

This version:
http://www.w3.org/TR/2014/REC-json-ld-20140116/
Latest published version:
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Niklas Lindström

Please refer to the **errata** for this document, which may include some normative corrections.

This document is also available in this non-normative format: diff to previous version

The English version of this specification is the only normative version. Non-normative translations may also be available.

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JSON-LD Playground Documentation Specifications Branding

JSON for Linking Data

Data is messy and disconnected. JSON-LD organizes and connects it, creating a better Web.

Linked Data

Linked Data empowers people that publish and use information on the Web. It is a way to create a network of standards-based, machine-readable data across Web sites. It allows an application to start at one piece of Linked Data, and follow embedded links to other pieces of Linked Data that are hosted on different sites across the Web.

A Simple Example

```
{
  "@context": "http://json-ld.org/contexts/person.jsonld",
  "@id": "http://dbpedia.org/resource/John_Lennon",
  "name": "John Lennon",
  "born": "1940-10-09",
  "spouse": "http://dbpedia.org/resource/Cynthia_Lennon"
}
```

JSON-LD

JSON-LD is a lightweight Linked Data format. It is easy for humans to read and write. It is based on the already successful JSON format and provides a way to help JSON data interoperate at Web-scale. JSON-LD is an ideal data format for programming environments, REST Web services, and unstructured databases such as CouchDB and MongoDB.

json-ld.org

Developer Checklist

Prepare Your Content
Create Quality Pages
Associate Your Online Resources
Use AMP HTML
Make Mobile-friendly Websites
Add Voice Actions

Index Your Content
Introduction to Indexing
Create a List of URLs
Submit URLs to Google

Help Google Present You
Introduction to Structured Data
Enhance Your Site's Attributes
Mark Up Your Content Items
Mark Up Your Lists

Introduction to Structured Data

Structured data refers to kinds of data with a high level of organization, such as information in a relational database. When information is highly structured and predictable, search engines can more easily organize and display it in creative ways. *Structured data markup* is a text-based organization of data that is included in a file and served from the web. It typically uses the schema.org vocabulary—an open community effort to promote standard structured data in a variety of online applications.

Structured data markup is most easily represented in JSON-LD format, which stands for JavaScript Object Notation for Linked Data. The following is a simple JSON-LD structured data example you might use for contact information for your company:

```
<script type="application/ld+json">
{
  "@context": "http://schema.org",
  "@type": "Organization",
  "url": "http://www.your-company-site.com",
  "contactPoint": [{
    "@type": "ContactPoint",
```

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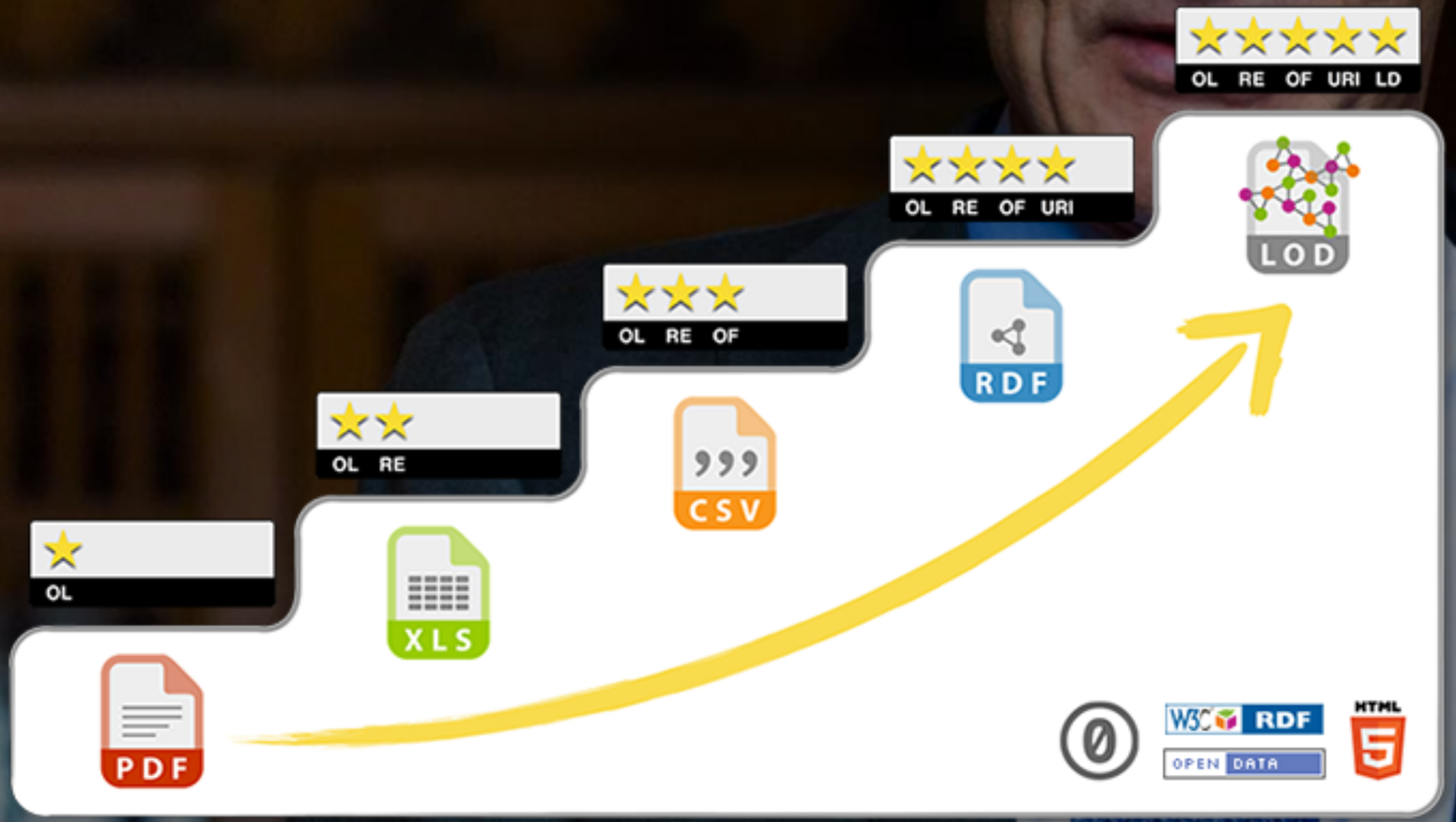
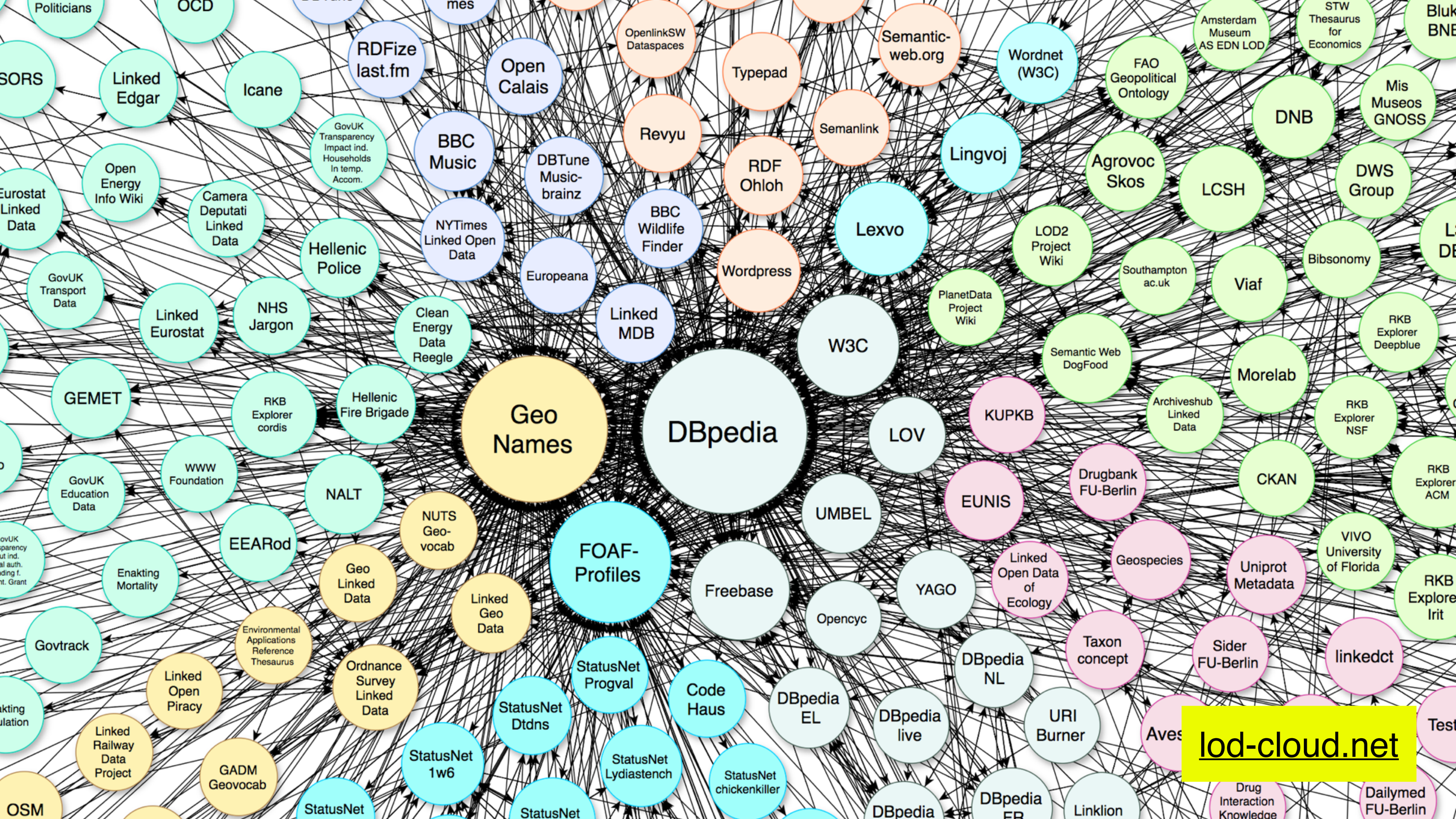
Common use cas
Markup formats a placement
Testing and publis your markup
Structured data guidelines
Technical guide
Quality guidelin
Multiple entities same page
Image markup guidelines

5 ★ OPEN DATA

Tim Berners-Lee, the inventor of the Web and Linked Data initiator, suggested a 5-star deployment scheme for Open Data. Here, we give examples for each step of the stars and explain costs and benefits that come along with it.




Politicians
OCD
SORS
Linked Edgar
Icane
RDFize last.fm
Open Calais
OpenlinkSW Dataspaces
Typepad
Semantic-web.org
Wordnet (W3C)
Amsterdam Museum AS EDN LOD
STW Thesaurus for Economics
FAO Geopolitical Ontology
DNB
Mis Museos GNOSS
GovUK Transparency Impact ind. Households In temp. Accom.
BBC Music
DBTune Music-brainz
Revyu
Semanlink
Lingvoj
Agrovoc Skos
LCSH
DWS Group
Eurostat Linked Data
Open Energy Info Wiki
Camera Deputati Linked Data
NYTimes Linked Open Data
BBC Wildlife Finder
RDF Ohloh
Lexvo
LOD2 Project Wiki
Bibsonomy
Hellenic Police
Europeana
Wordpress
Southampton ac.uk
Viaf
GovUK Transport Data
Linked Eurostat
NHS Jargon
Clean Energy Data Reegle
Linked MDB
W3C
PlanetData Project Wiki
RKB Explorer Deepblue
Semantic Web DogFood
Morelab
GEMET
RKB Explorer cordis
Hellenic Fire Brigade
Geo Names
DBpedia
LOV
KUPKB
Archiveshub Linked Data
RKB Explorer NSF
GovUK Education Data
WWW Foundation
NALT
UMBEL
EUNIS
Drugbank FU-Berlin
CKAN
RKB Explorer ACM
EEARod
NUTS Geo-vocab
FOAF-Profiles
Freebase
YAGO
Linked Open Data of Ecology
Geospecies
Uniprot Metadata
VIVO University of Florida
Enakting Mortality
Geo Linked Data
Linked Geo Data
Opencyc
Govtrack
Environmental Applications Reference Thesaurus
Ordnance Survey Linked Data
StatusNet Progval
Code Haus
DBpedia EL
DBpedia NL
Taxon concept
Sider FU-Berlin
linkedct
Linked Open Piracy
StatusNet Dtdns
DBpedia live
URI Burner
Linked Railway Data Project
GADM Geovocab
StatusNet 1w6
StatusNet Lydiastench
StatusNet chickenkiller
Drug Interaction Knowledge
Dailymed FU-Berlin
OSM
StatusNet
DBpedia
DBpedia ER
Linklion
lod-cloud.net

What Happened to the Semant

kidehen.blogspot.com.br/2015/09/what-happened-to-semantic-web.html

Kingsley Idehen's Blogger Data Space

search

Classic Flipcard Magazine Mosaic Sidebar Snapshot Timeslide

- OpenLink Structured Dat…
- Generating 5-Star Linked…
- What Happened to the S…
- Beyond Bookmarking
- DBpedia Pay-As-You-Go …
- Virtuoso Pay-As-You-Go …
- Data & Semantics
- Conceptual Data Virtualiz…

What Happened to the Semantic Web?

Situation Analysis

Over the last 15+ years, the same question about the Semantic Web has been posed innumerable times: "*Are we there yet?*"

In this post, I will demonstrate that as expected [1][2], its arrival was without fanfare, but we are inarguably there.

Semantic Web Illustration

Semantically Enhanced Linked Data Network (e.g., Semantic Web of Big Linked Open Data)

Dynamic Views theme. Powered by Blogger.

http://kidehen.blogspot.com.br/2015/09/what-happened-to-semantic-web.html

Web Semântica e Processamento de Linguagem Natural na prática

Newton Calegari

PUC-SP