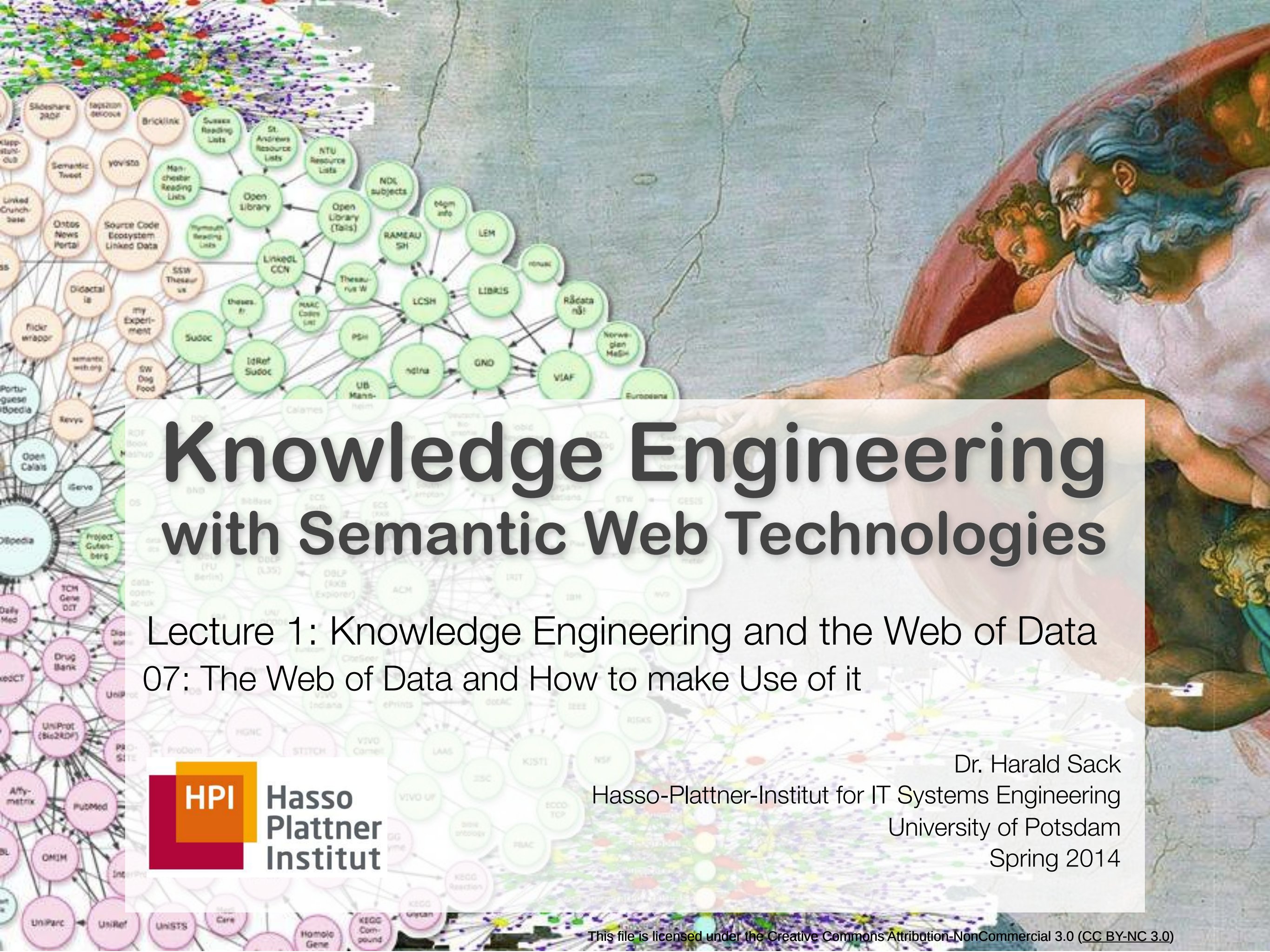




Knowledge Engineering with Semantic Web Technologies

Lecture 1: Knowledge Engineering and the Web of Data
07: The Web of Data and How to make Use of it



Dr. Harald Sack
Hasso-Plattner-Institut for IT Systems Engineering
University of Potsdam
Spring 2014



Lecture 1: Knowledge Engineering and the Web of Data

Open HPI - Course: Knowledge Engineering with Semantic Web Technologies

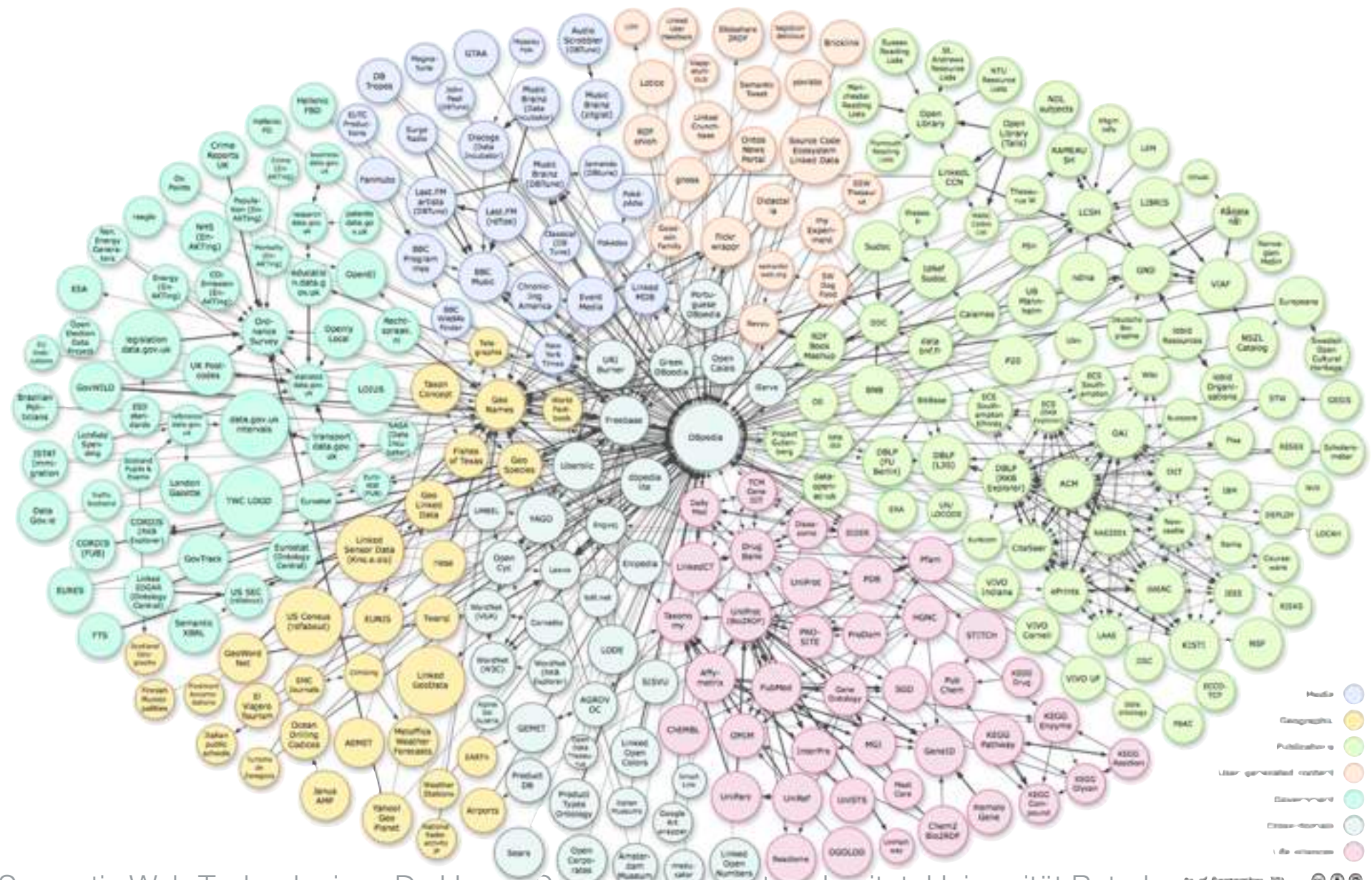
07: The Web of Data and how to make use of it

OpenHPI - Course Semantic Web Technologies - Lecture 1: The Web of Data

The Web of Data and how we make use of it

Linked Data

- Linked Open Data (LOD) denote publicly available (RDF) Data in the Web, identified via URI and accessible via HTTP. Linked data link to other data via URI.

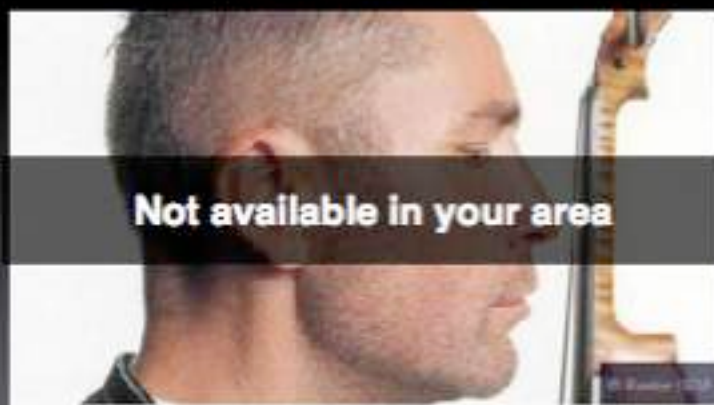


The 'Web of Data'

- >81 billion facts
- >800 million links
(Mar. 2014)

Johann Sebastian Bach

Born 21 März 1685. Died 28 Juli 1750.



Not available in your area

EMBED

BBC PROMS

Nigel Kennedy And His Band Play Bach

At the late night Prom, Nigel Kennedy and his band play arrangements of pieces by Bach.

JOHANN SEBASTIAN BACH 1-4 OF 18

Featured on: BBC MUSIC SHOWCASE



NIGEL KENNEDY
AND HIS BAND
PLAY...



NIGEL KENNEDY
PLAYS...



BRIAN ENO - THE
BIRTH OF...



J.S. BACH IN...

Biography

Born in the German town of Eisenach, J.S. Bach was a chorister then violinist before taking his first organist post at Arnstadt while still a teenager. It was in Weimar, as court organist from 1708, that Bach began to produce monthly cantatas, and wrote many of his great organ works, as well as organ transcriptions of concertos by Vivaldi.

In 1717 Prince Leopold offered him the position of Kapellmeister at Cöthen, where he wrote the Brandenburg Concertos, the four Orchestral Suites and the violin concertos, and married his second wife Anna Magdalena, who bore 13 children. Bach's fearsome duties in his final job, as Kantor of the Thomasschule in Leipzig from 1723 until his death, involved teaching Latin and Music, choir-training, and writing and directing music for the services.

Nevertheless he managed also to write the Mass in B minor, the six choral Motets, The Art of Fugue, The Musical Offering and Goldberg Variations during this time. His inventive contrapuntalism became unfashionable soon after his death until the early 19th century, since when his reputation has remained unquestioned.

Profile © Edward Bhesania

Links & Information

LINKS

Biography at jbsbach.org and pbs.org/wnet/gper/education/bach.html

Wikipedia article on [Johann Sebastian Bach](#)

IMDb at imdb.com/name/nm0001925

Last.fm page on [Johann Sebastian Bach](#)

Discogs at [discogs.com/artist/Johann Sebastian Bach](http://discogs.com/artist/Johann+Sebastian+Bach)

MusicBrainz entry on [Johann Sebastian Bach](#)

PERSONAL RELATIONSHIPS

Parent of [Johann Christoph Friedrich Bach](#), [Johann Christian Bach](#), [Wilhelm Friedemann Bach](#) and [Carl Philipp Emanuel Bach](#)

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Composers A-Z

Explore more composers and their works at Radio 3

Composers A-Z

Discover the music of the great composers with Radio 3

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BBC MUSIC SHOWCASE

Watch and listen to exclusive music clips

Clips From Latest Album Review



Keyboard Concertos (piano: Alexandre Tharaud)

1. Concerto for keyboard and orchestra BWV1054 in D minor - I Allegro
2. Concerto for keyboard and orchestra BWV1054 in D minor - II Adagio

Played By

Since December 2008



Breakfast
BBC Radio 3



Desert Island Discs
BBC Radio 4



In Tune
BBC Radio 3



The Early Music Show
BBC Radio 3

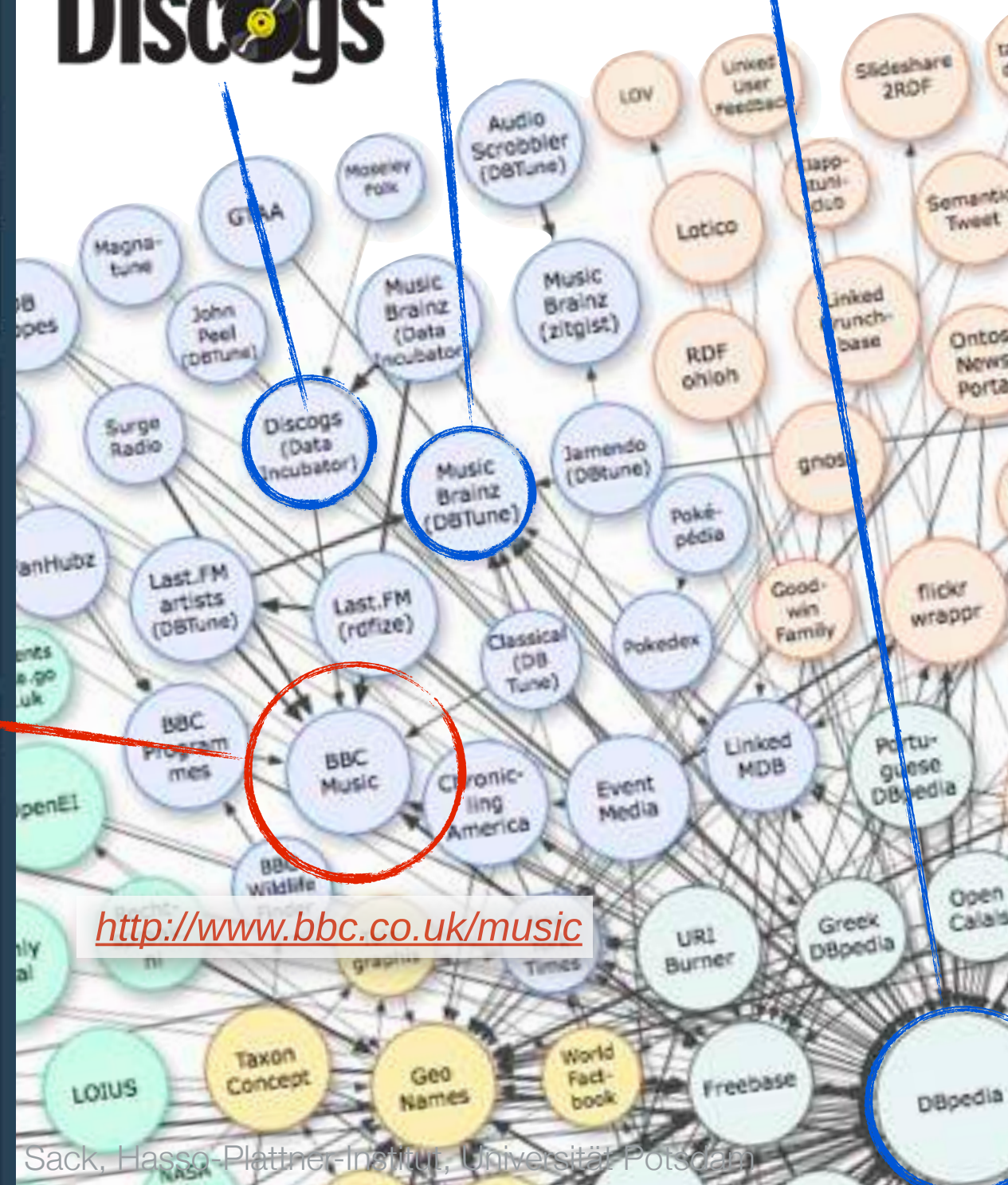


MusicBrainz



DBpedia

Discogs



<http://www.bbc.co.uk/music>

What is so special about the BBC Music Website?

- Information is dynamically aggregated from external, publicly available data (Wikipedia, MusicBrainz, Discogs,...)
- no Screen Scraping
- no specialized API
- all data available as Linked Open Data
- data access via simple HTTP Request

Links & Information

- data is always up-to-date without manual interaction

Wikipedia article on Johann Sebastian Bach

IMDb at imdb.com/name/nm0001925

Last.fm page on [Johann Sebastian Bach](http://www.last.fm/music/Johann+Sebastian+Bach)

Discogs at [discogs.com/artist/Johann Sebastian Bach](http://www.discogs.com/artist/Johann+Sebastian+Bach)

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Clips From Latest Album Review



Keyboard Concertos (piano: Alexandre Tharaud)

- 1 Concerto for keyboard and orchestra BWV1054 in D minor - I Allegro
- 2 Concerto for keyboard and orchestra BWV1054 in D minor - II Adagio

Played By

Since December 2008



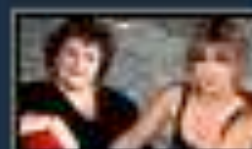
Breakfast
BBC Radio 3



Desert Island Discs
BBC Radio 4



In Tune
BBC Radio 3



The Early Music Show
BBC Radio 3

What about a Search Engine that understands your query...?

Search Engines - Document Retrieval

- Search Engine Query String: **"Jaguar of 2000"**



What about a Search Engine that understands your query...?

Search Engines - Document Retrieval

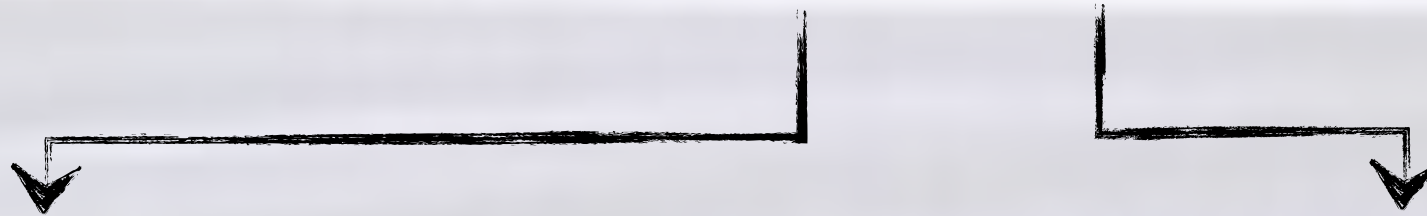
- Search Engine Query String: **"Jaguar of 2000"**



- Refine ,jaguar'
CAR or ANIMAL or OPERATINGSYSTEM etc. ?
Refine: **CAR**

Search Engines - Document Retrieval

- Search Engine Query String: **"Jaguar of 2000"**



- Name: **Jaguar E Type**
- Category: **Car**
 - ...
 - ConstructionYear *<Integer>*
 - technicalParameter
 - CylinderCapacity *<Integer>*
 - Power *<Integer>*
 - ...
 - ...

Knowledge Representation
(Ontologie, Linked Data)

Search Engines - Document Retrieval

- Search Engine Query String: **"Jaguar of 2000"**



- Name: **Jaguar E Type**
- Category: **Car**
 - ...
 - ConstructionYear <Integer>
 - technicalParameter
 - CylinderCapacity <Integer>
 - Power <Integer>
 - ...
 - ...

- Refine ,2000'
ConstructionYear or technicalParameter ?
Refine: **ConstructionYear**

Knowledge Representation
(Ontologie, Linked Data)

Search Engines - Document Retrieval

- General Problems:
 - correct interpretation of query string
 - correct identification of entities
 - automatic disambiguation
 - usability
 - personalization



There is already semantic data out there....

jaguar



WebImagesMapsShoppingMore

Set your locationSort: DefaultView: List

Show only

☐ New items

Price

☐ Up to \$450

☐ \$450 – \$1,000

☐ \$1,000 – \$2,000

☐ Over \$2,000

\$

to

\$

Go

Seller

☐ eBay

☐ Guitar Center

☐ zZounds

☐ Musicians Friend

☐ Sweetwater

More



[2006 JAGUAR XK COUPE in Midnight Black by AUTOart in 1:18 Scale](#)
\$109.51 from Mint Models
Authentic replica with detailed interior. A finished model kit and work of art.



[Gucci new jackie jaguar print shoulder bag Size OS](#)
\$3,090.00 from Gucci.com
Instantly recognizable and unmistakably stylish, the contemporary flair of the New Jackie is fashion at its most vibrant.; animalier jaguar ...



[Tim Wolfe NFL Collection Jacksonville Jaguars Statue](#)
\$107.20 from 10+ stores
Talented wildlife artist and sculptor Tim Wolfe has turned his talents towards your #1 team! Crafted from alabaster stone and resin, this Wild ...
Other team options: [Arizona Cardinals \(\\$107\)](#) [Atlanta Falcons \(\\$107\)](#) [More](#)



[Jaguar Classic Black by Jaguar for Men - 3.4 oz EDT Spray](#)
\$14.95 from 25+ stores
Mens · Eau de Toilette · 3.4 ounce
Released in 2009 by Jaguar, this cologne for men uses an intoxicating blend of scents. Top notes of vetiver, green apple, nutmeg, and mandarin ...
Other style options: [Amber \(\\$15\)](#) [Gold \(\\$18\)](#) [Red \(\\$15\)](#)

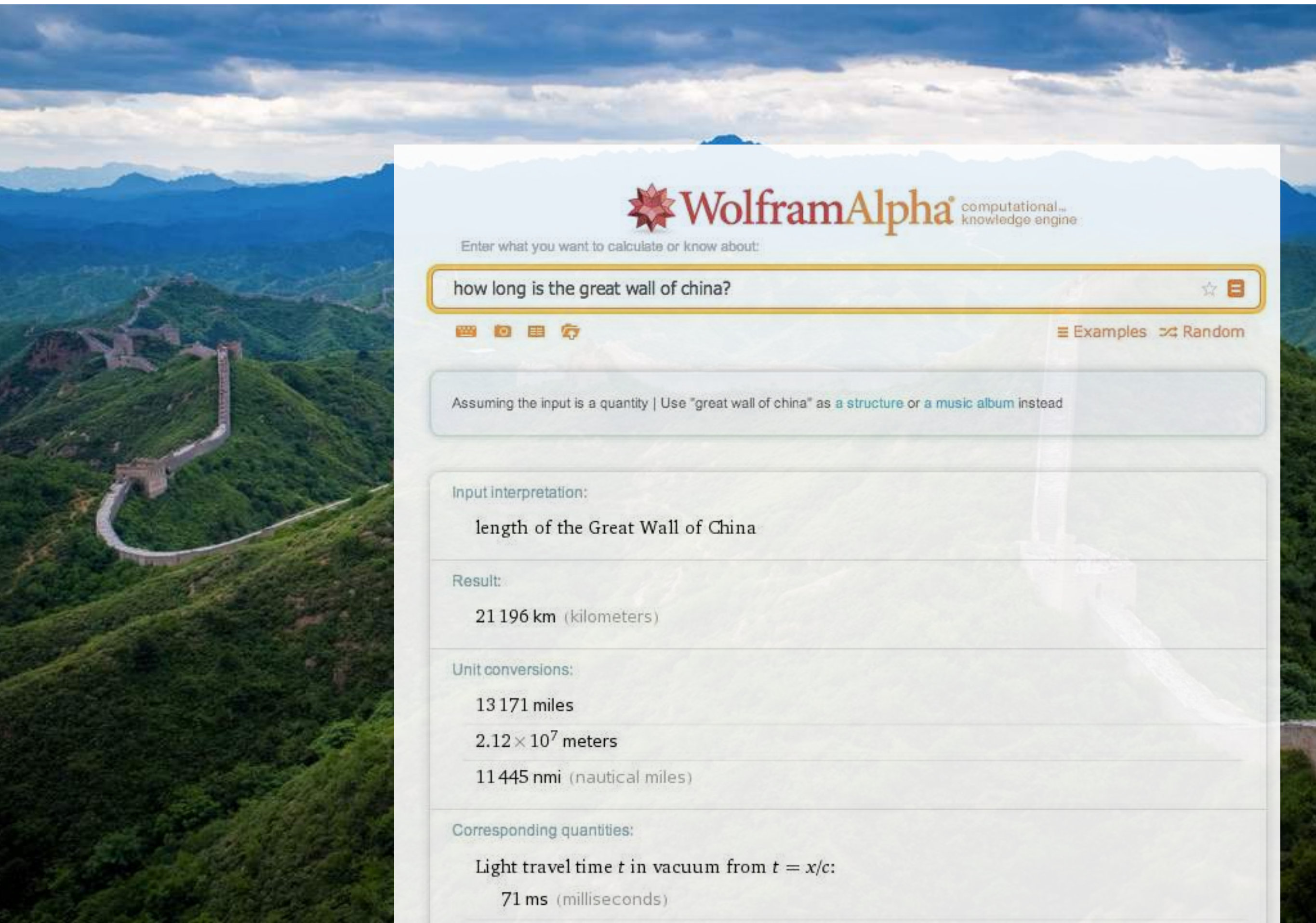


[Fender Kurt Cobain Jaguar - 3-Tone Sunburst Left Handed](#)
\$1,299.99 from 10+ stores

From Document Retrieval to Fact Retrieval



From Document Retrieval to Fact Retrieval



 **WolframAlpha** computational knowledge engine

Enter what you want to calculate or know about:

how long is the great wall of china?  

Assuming the input is a quantity | Use "great wall of china" as [a structure](#) or [a music album](#) instead

Input interpretation:
length of the Great Wall of China

Result:
21 196 km (kilometers)

Unit conversions:
13 171 miles
 2.12×10^7 meters
11 445 nmi (nautical miles)

Corresponding quantities:
Light travel time t in vacuum from $t = x/c$:
71 ms (milliseconds)

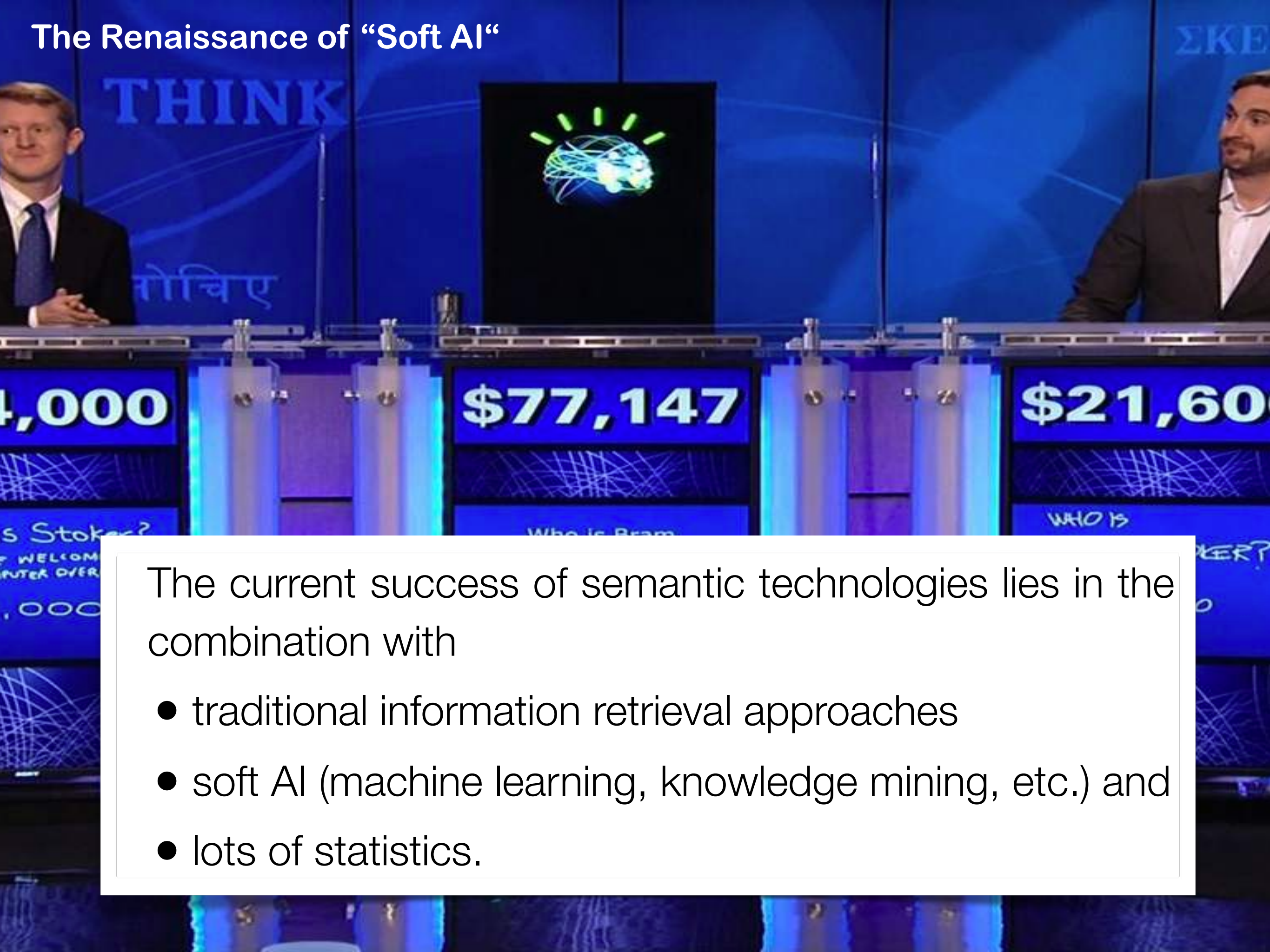
The Renaissance of “Soft AI”



The image shows a Jeopardy! game board with three contestants standing behind their respective podiums. The background is blue with the word "THINK" in large letters. A central screen displays a glowing green brain with neural connections. The contestants' scores are displayed on the top of their podiums. The questions and answers are displayed on the screens in front of them.

Contestant	Score	Question	Answer
Left	\$24,000	Who is Stoker?	(\$ FOR ONE WELCOME OUR NEW COMPUTER OVERLORDS) \$1,000
Center	\$77,147	Who is Bram Stoker?	\$17,973
Right	\$21,600	WHO IS BRAM STOKER?	\$5600

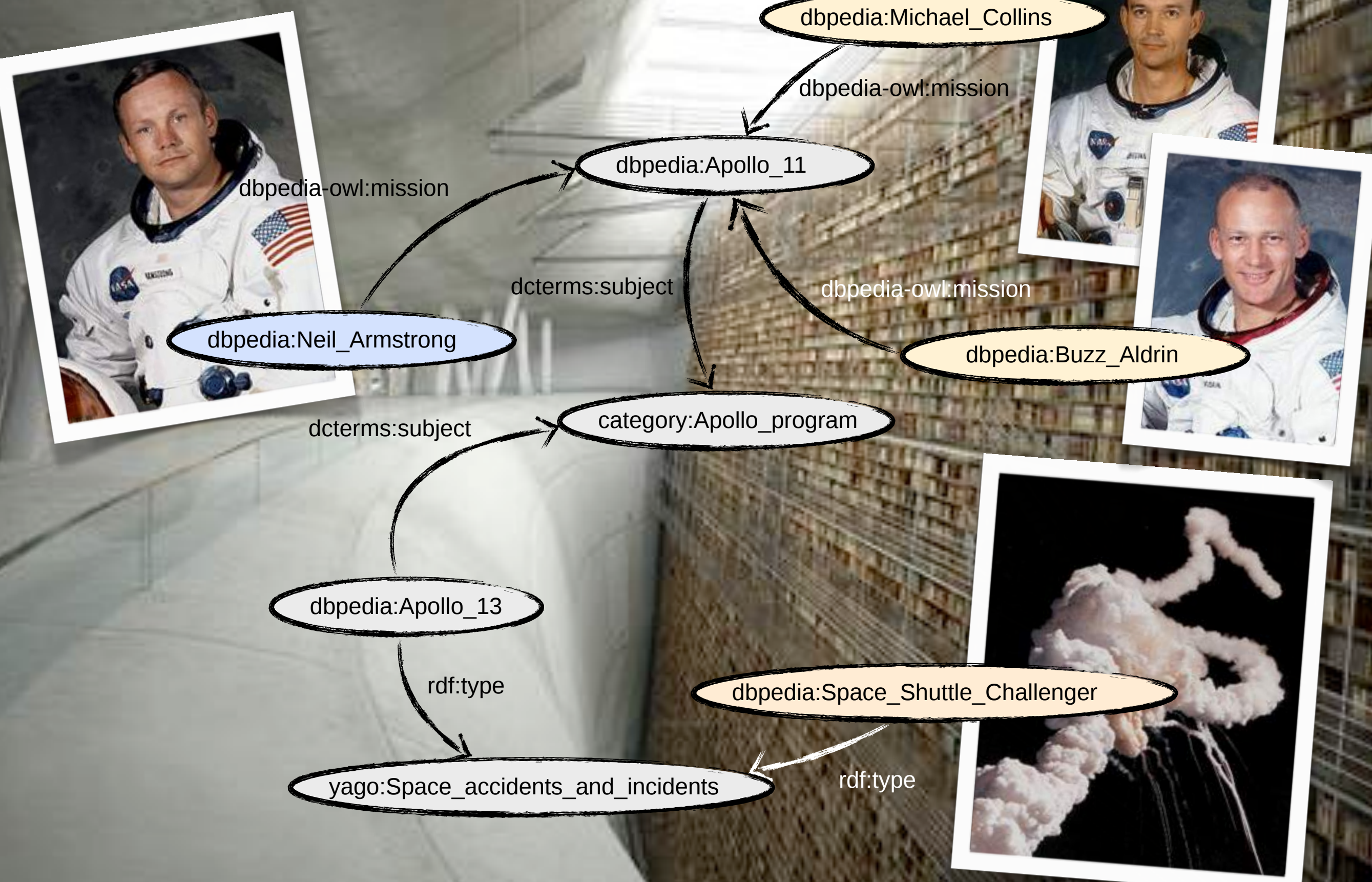
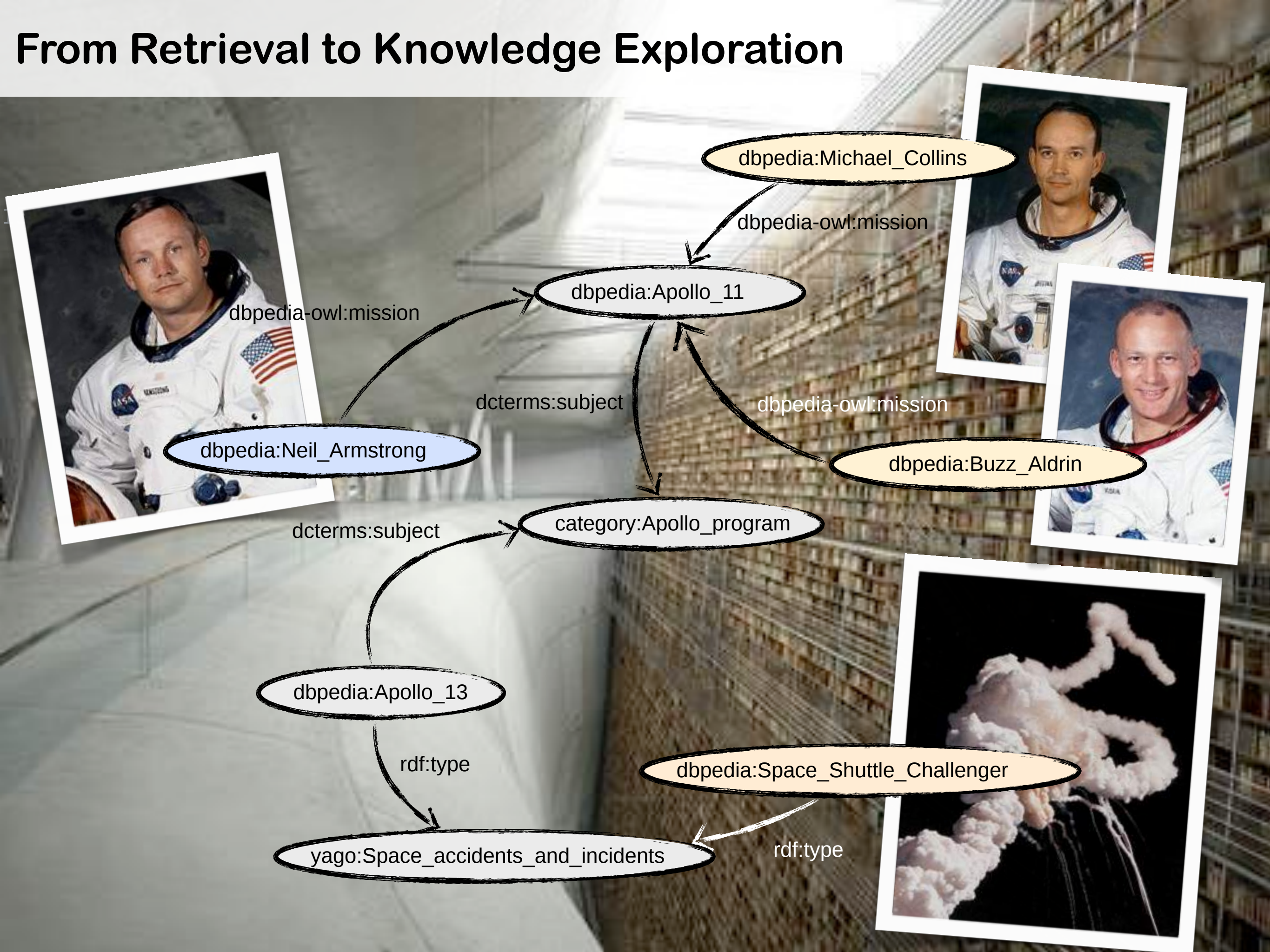
The Renaissance of “Soft AI”



The current success of semantic technologies lies in the combination with

- traditional information retrieval approaches
- soft AI (machine learning, knowledge mining, etc.) and
- lots of statistics.

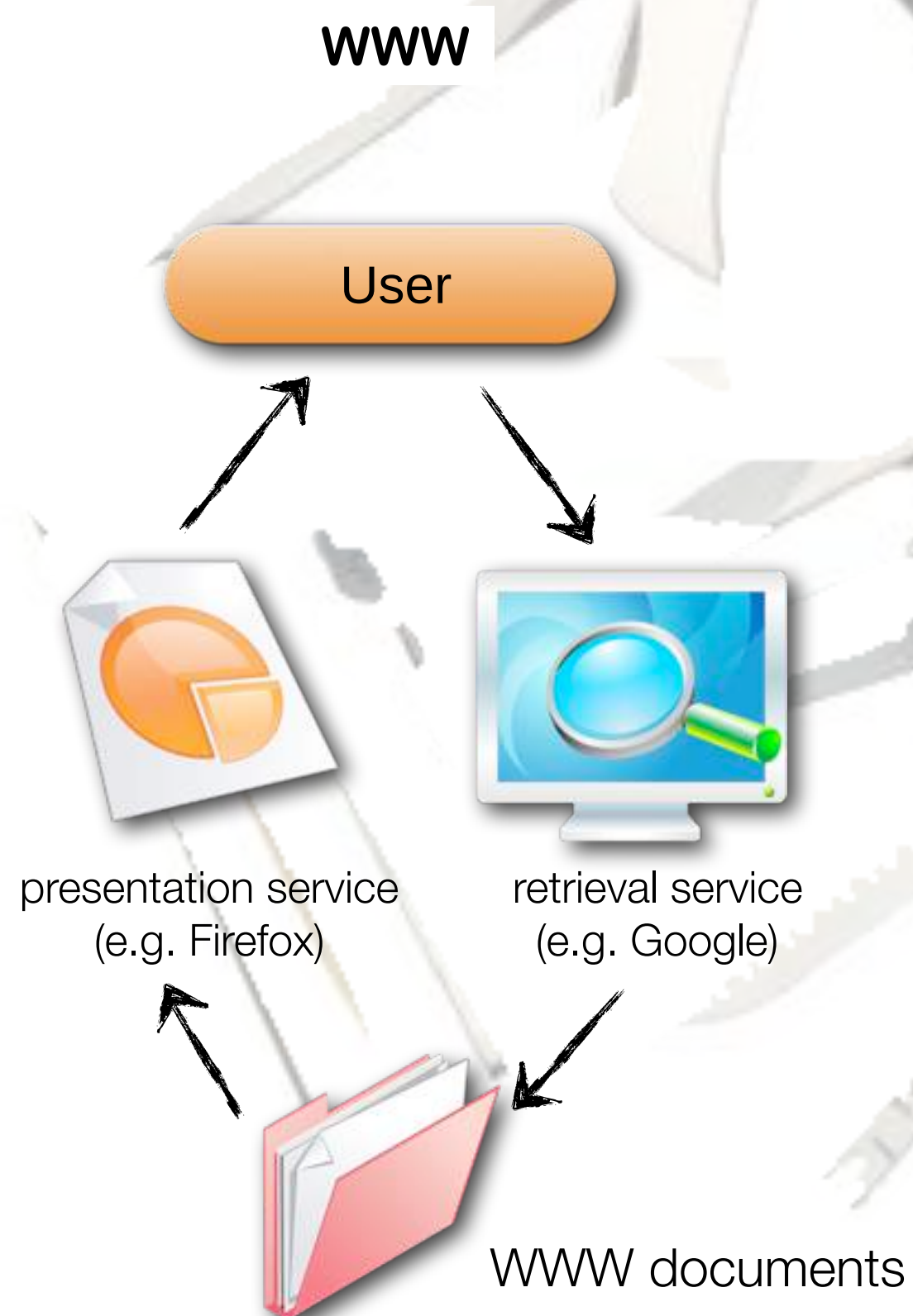
From Retrieval to Knowledge Exploration



How is it like to Surf the Semantic Web?

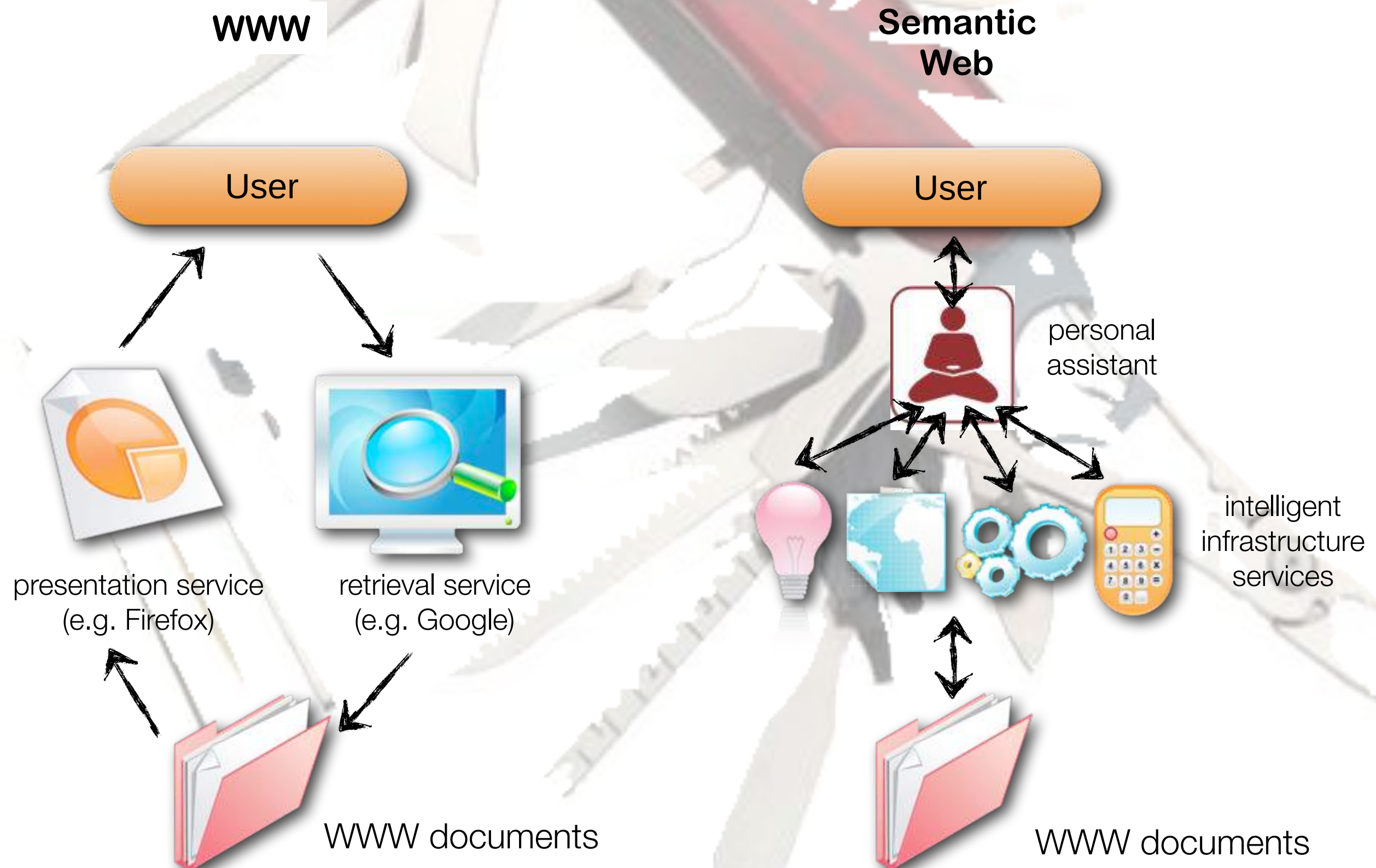
Intelligent Agents in the Semantic Web

15



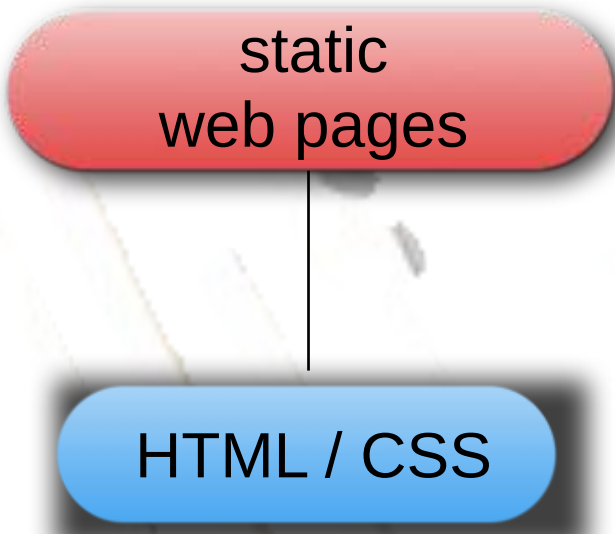
Intelligent Agents in the Semantic Web

15



3 Generations of Documents on the Web

16



static
web pages

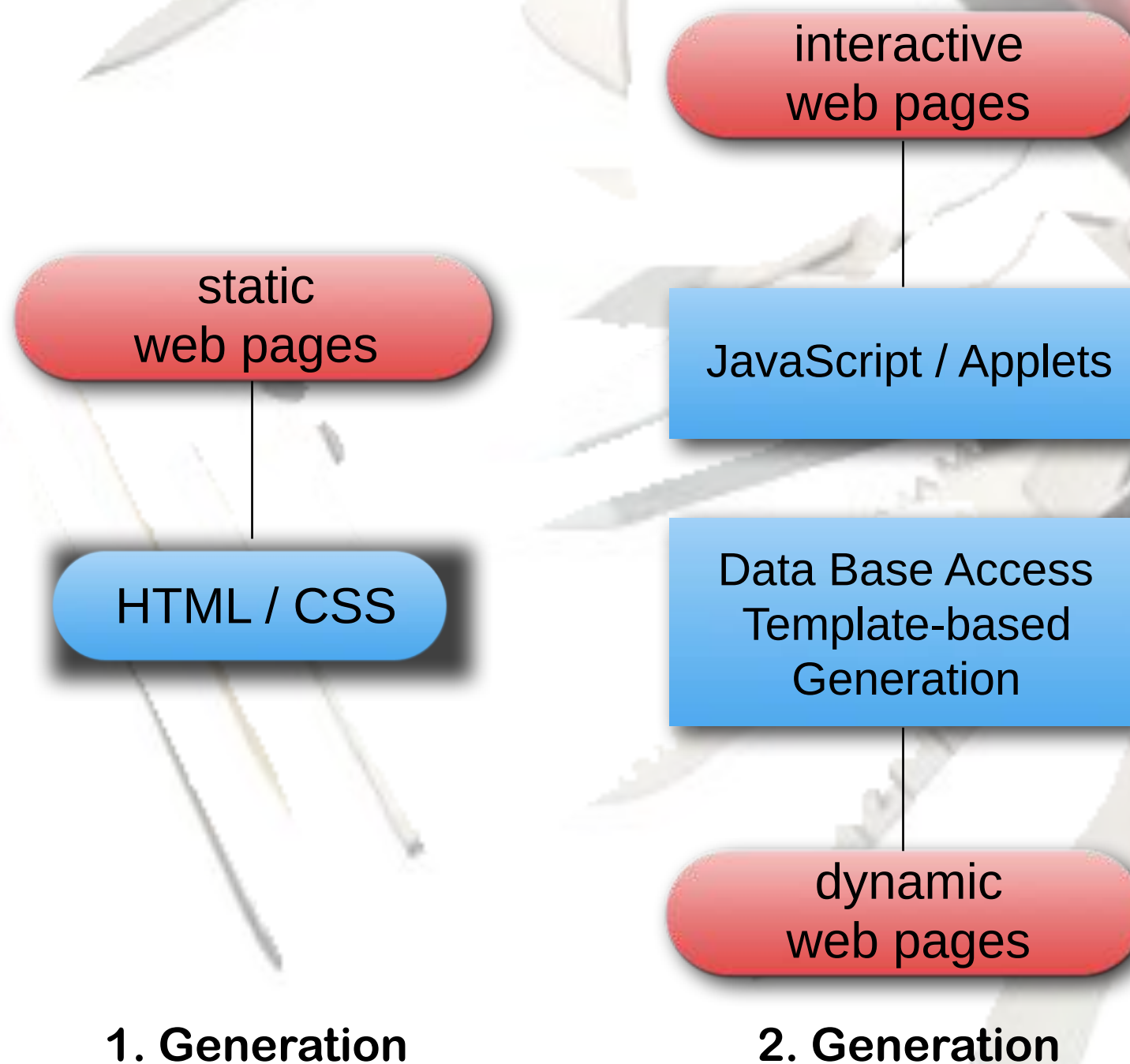
The diagram shows a red rounded rectangle containing the text 'static web pages'. A thin black vertical line extends downwards from the bottom center of this rectangle to a blue rounded rectangle below it. The background of the slide features a large, faint, red Swiss Army knife with various tools extended, symbolizing the versatility and simplicity of static web pages.

HTML / CSS

1. Generation

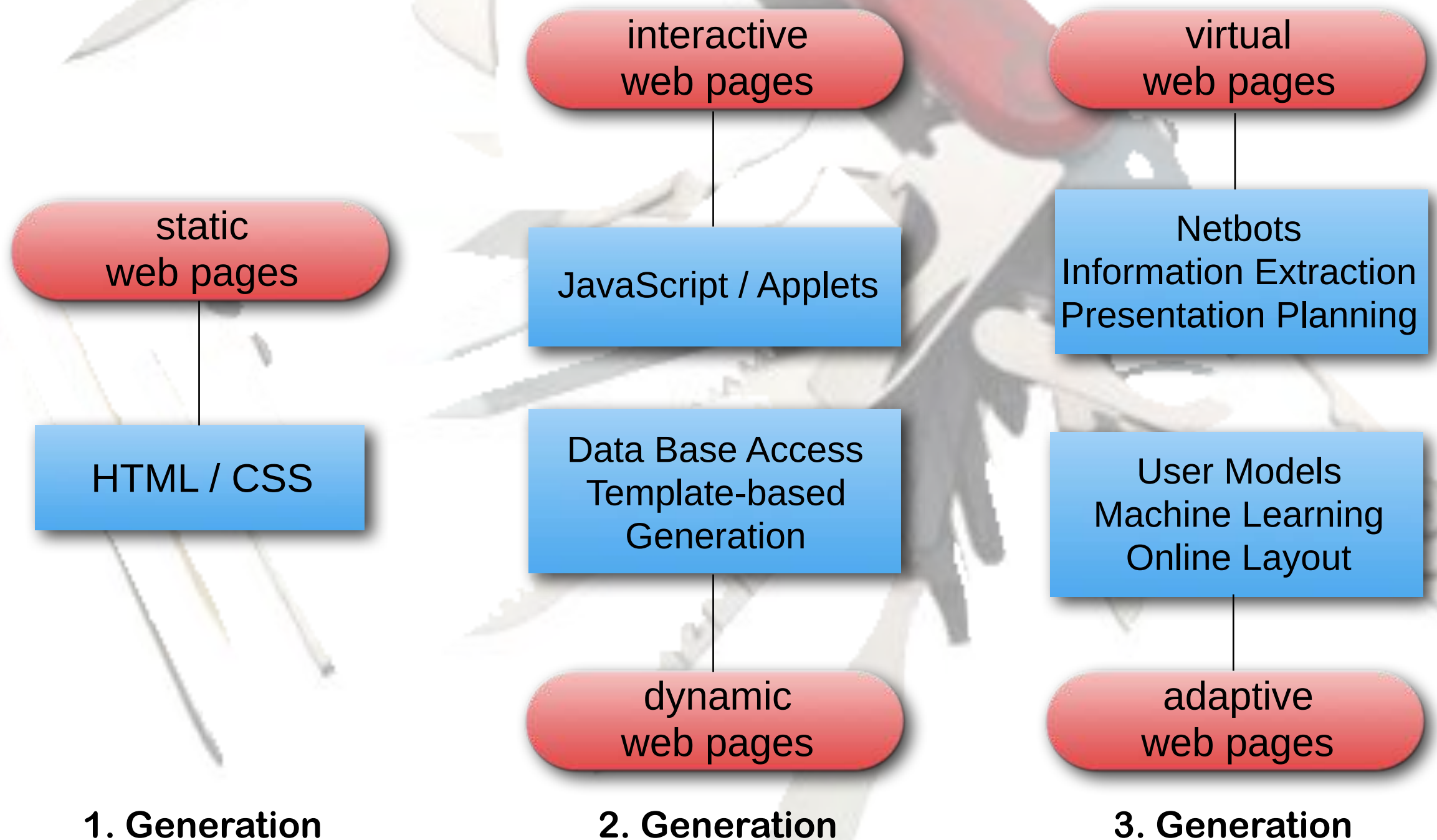
3 Generations of Documents on the Web

16



3 Generations of Documents on the Web

16



17 Toolbox of Semantic Technologies in the Web

- W3C standardized languages for knowledge representation in the Web (URIs, XML/XSD, RDF, RDFS, OWL, RIF)
- Tools to use semantic information in the Web (URIs, HTTP, RDFa, GRDDL, schema.org, ...)
- Contributions from various fields of computer science:
 - artificial intelligence
 - linguistics
 - cryptography
 - data bases
 - theoretical computer science
 - computer architecture
 - software engineering
 - systems theory
 - computer networks

Next Lecture



Lecture 2: Semantic Web Technologies - Part 1

Open HPI - Course: Semantic Web Technologies