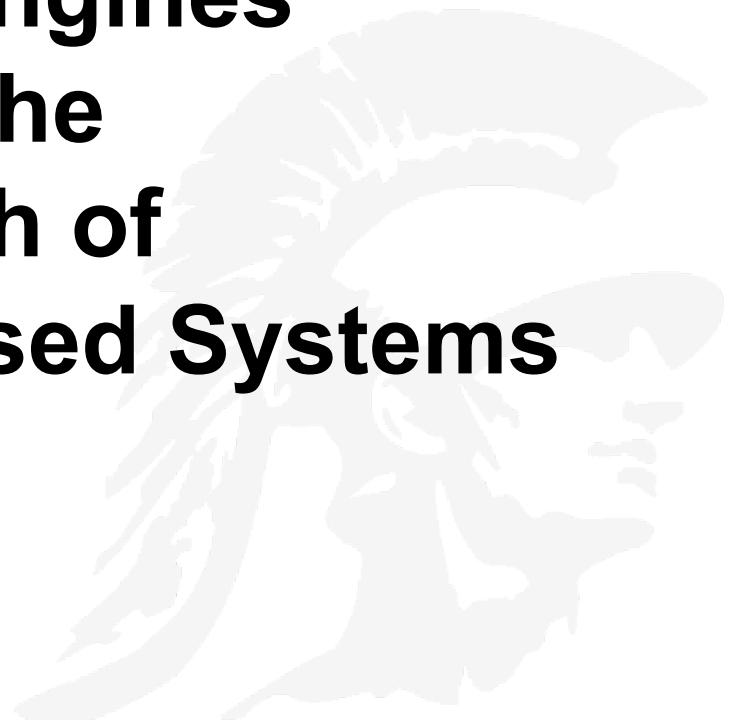


# Search Engines and the Growth of Knowledge-Based Systems



# Is Elvis Alive

**Ask.com - Yes**

is elvis alive

Ads related to: is elvis alive

[One Night In Memphis - Number One Tribute](#)  
www.presleyperkinslewiscash.net/ (212) 268-6969  
Number one tribute to Elvis Presley, Carl Perkins, Jerry Lee Lewis & Johnny Cash

Schedule About the Show  
Contact Us Reviews

We Found [Elvis Fake - Get Their Information Online](#) - truthfinder.com  
www.truthfinder.com/Records  
Search for Elvis fake's Arrests, Traffic Tickets, Addresses & More!

Related Search

[Photographic Proof That Elvis Is Alive](#) [Proof That Elvis Is Alive](#)  
[Elvis Theories](#) [Evidence That Elvis Is Alive](#)

Web Results

'ELVIS NOT DEAD' Graceland groundsman filmed THIS MONTH is ...  
www.express.co.uk/news/weird/683314/ELVIS-NOT-DEAD-Graceland-groundsman-fil...  
Jun 29, 2016 ... But ever since Elvis Presley's death was announced on August 16, 1977, ... But some YouTubers think they have found Elvis alive and well.

Top 10 Reasons (Some Believe) That Elvis Presley is Still Alive (Part ...  
overment.al.com/content/top-10-reasons-some-believe-that-elvis-presley-is-still-alive-p...  
Apr 30, 2014 ... Okay, so when we left off last week, we'd just learned that not only was Elvis Presley, the King of Rock and Roll, supposedly not only not dead, ...

**Bing.com - Yes**

is elvis alive

Also try: [Proof Elvis Faked His Death](#) · [Autopsy Pictures of Elvis](#) · [Is Elvis Alive ...](#)

11,900,000 RESULTS Any time →

**Elvis Presley still alive?** (September 2016 update) - [Mediamass](#)  
en.mediama...net/people/elvis-presley/alive.html  
News of Elvis Presley's death on August 16, 1977 stunned the world. Ever since, millions of fans worldwide have come to believe the singer's death was a hoax and ...

**ELVIS PRESLEY - I'M ALIVE - YouTube**  
www.youtube.com/watch?v=7B0WtYAl0lw  
The TRUTH Now Declassified! ELVIS PRESLEY is Alive, and Has made His Comeback. This Information Is Being Kept From The Public Eye, The News Media, , And ...

**Videos of is elvis alive**  
bing.com/videos

ELVIS IS ALIVE - DNA Evidence | Elvis is Alive 2015 | Is Elvis Alive? | Is Elvis alive? conspiracy hoax?

**Google.com - No**

is elvis alive

About 17,400,000 results (0.46 seconds)

Elvis Presley / Died

August 16, 1977, Memphis, TN



Since his reported death on August 16, 1977, Elvis Aaron Presley has been sighted in cities all across America. There is one city however that has gained a greater notoriety than others for Elvis sightings: Kalamazoo, Michigan. Is Elvis alive and residing in Kalamazoo?

**Elvis Presley death mystery - Classic Bands**  
www.classicbands.com/MysteryofElvisPresley.html

Bing.com - Yes

Google.com - No

**Wolfram Alpha - No**

is elvis alive

WolframAlpha computational knowledge engine

Input interpretation: **Elvis Presley alive?**

Result: **No**

Sources Download page POWERED BY THE WOLFRAM LANGUAGE

**2 Yes'es and 2 No's;  
text matching alone is insufficient  
we need to “understand” the query**

# KnowledgeBases

- To move away from just using keyword matching, search engines borrowed techniques developed by AI researchers
- A *knowledgebase* (KB) is a technology used to store complex structured and unstructured information used by a computer system.
- A knowledge-based system consists of two elements:
  1. a *knowledge-base* that represents facts about the world, and
  2. an *inference engine* that can reason about those facts (and use rules and other forms of logic to deduce new facts or highlight inconsistencies)
- The term "knowledge-base" was coined to distinguish this form of knowledge store from the more common and widely used term *database*
- Examples: *Freebase*, *Google's Knowledge Graph*, *Apple's Siri*, *IBM's Watson*

## Keywords are Placed Within Concepts

- Google has adopted a knowledgebase;
- E.g. Google Keyword Trends are now listed by entities in their knowledgebase
- The representation of knowledge in a knowledgebase is an *object model*
  - Sometimes called an *ontology*
  - Includes classes, subclasses and instances
- A **taxonomy** is usually only a hierarchy of concepts (i.e. the *only relation* between the concepts is parent/child, or subClass/superClass, or broader/narrower)
- In an **ontology**, *arbitrary complex relations* between concepts can be expressed as well, e.g. (*X marriedTo Y*; or *A worksFor B*; or *C locatedIn D*, etc )
- **Search engines utilize this linked, structured data in many ways, such as**
  - direct answers to queries
  - enhanced displays in many varieties of engaging visual formats, e.g. see query “Picasso” in Google

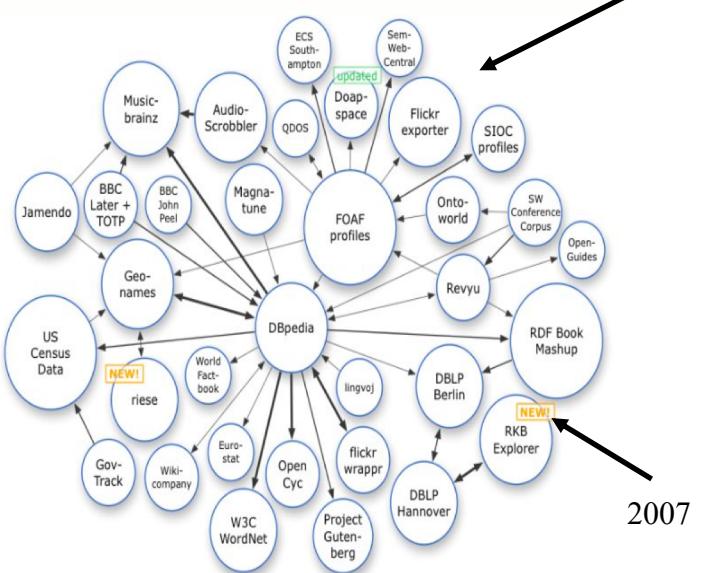
Trending ▾ Actors	Trending ▾ Animals	Trending ▾ Athletes
1 Bill Paxton	1 Giraffe	1 Charles Oakley
2 Melissa McCarthy	2 Lion	2 Tom Brady
3 Jamie Lynn Spears	3 Lobster	3 Fab Melo
4 O. J. Simpson	4 Goat	4 O. J. Simpson
5 Jimmy Kimmel	5 Skunk	5 DeMarcus Cousins
... More	... More	... More
Trending ▾ Authors	Trending ▾ Baseball players	Trending ▾ Baseball teams
1 Frederick Douglass	1 Derek Jeter	1 LSU Tigers baseball
2 Marcia Clark	2 Jackie Robinson	2 Ole Miss Rebels baseball
3 Jennifer Ashton	3 Greg Maddux	3 Texas A&M Aggies baseball
4 Dr. Seuss	4 Brandon Phillips	4 South Carolina Gamecocks baseb...

Actors, Animals, Athletes, etc are all elements within Google's knowledgebase

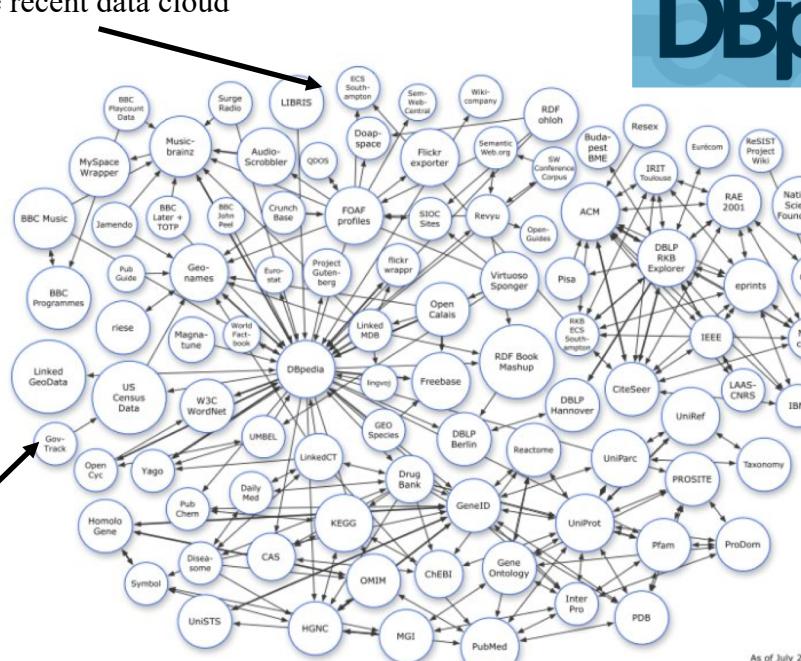
# An Early Open KnowledgeBase Still Available

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

Original data cloud. More recent data cloud



2007



As of July 2009

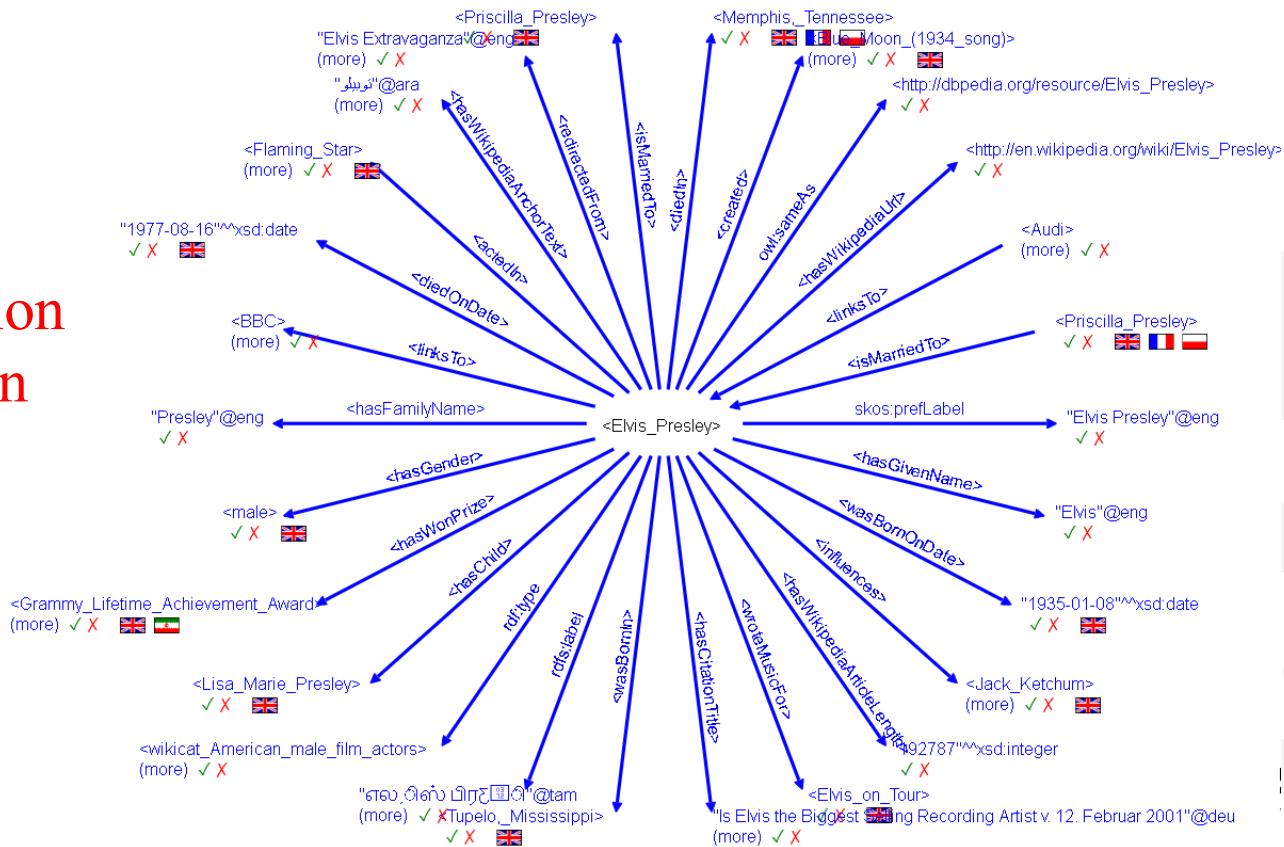
**DBpedia** is a **crowd-sourced** community effort to extract structured information from Wikipedia and make this information available on the Web.

Data is represented using RDF and accessed using SPARQL (see W3C for details)

As of September 2013, there are more than 45 million interlinks between DBpedia and external datasets, e.g. US Census, Music Brainz, BBC, NY Times, etc

# Close Up: A KnowledgeBase for Elvis

## Information Extraction



"Elvis Presley, the first and greatest American rock-and roll star, died yesterday at the age of 42."

Content  
analytics

# Types of Knowledge For a KnowledgeBase

Elvis Presley type American singer  
Elvis Presley type Baritone  
American singer subclassOf singer  
Elvis Presley sang All Shook Up  
Elvis Presley bornIn Tupelo  
id11: Elvis Presley marriedTo Priscilla Presley  
id11 validDuring [1967, 1977]  
Elvis Presley „has twin brother“ Jesse Garon  
Elvis Presley „possibly has origin“ Cherokee  
Elvis Presley knownAs „The King of R&R“

**taxonomic knowledge**

**factual knowledge**

**temporal knowledge**

**emerging knowledge**

**terminological  
knowledge**

Taxonomies are narrower than ontologies since ontologies include a larger variety of relation types. Mathematically, a hierarchical **taxonomy** is a tree structure of classifications for a given set of objects An ontology is a directed, labeled, cyclic graph.

# History of Digital KnowledgeBases

1984, D. Lenat

**Cyc****WordNet**from humans  
for humans
$$\text{guitarist} \subset \{\text{player}, \text{musician}\}$$

$$\subset \text{artist}$$

**A.I. expert systems of the 1980s tried to incorporate knowledge and reasoning**

$$\forall x: \text{human}(x) \Rightarrow (\exists y: \text{mother}(x,y) \wedge \exists z: \text{father}(x,z))$$

4.5 M English articles  
20 M contributors

First order predicate logic

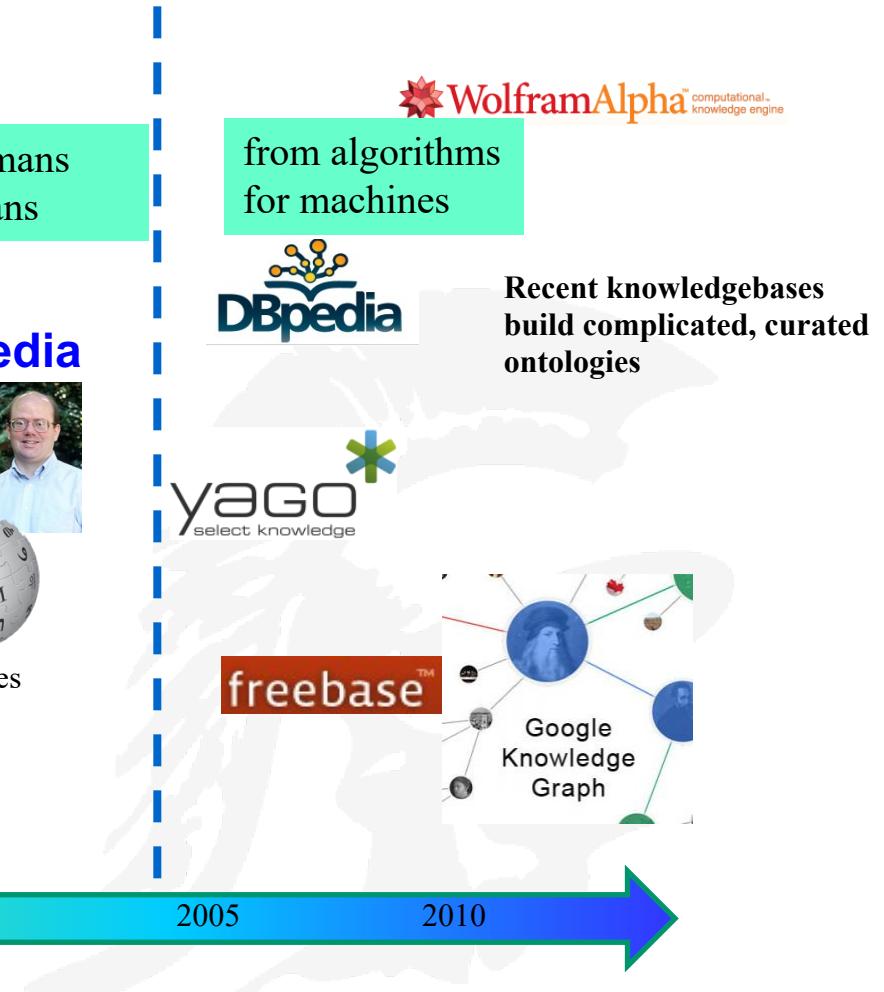
1985

1990

2000

2005

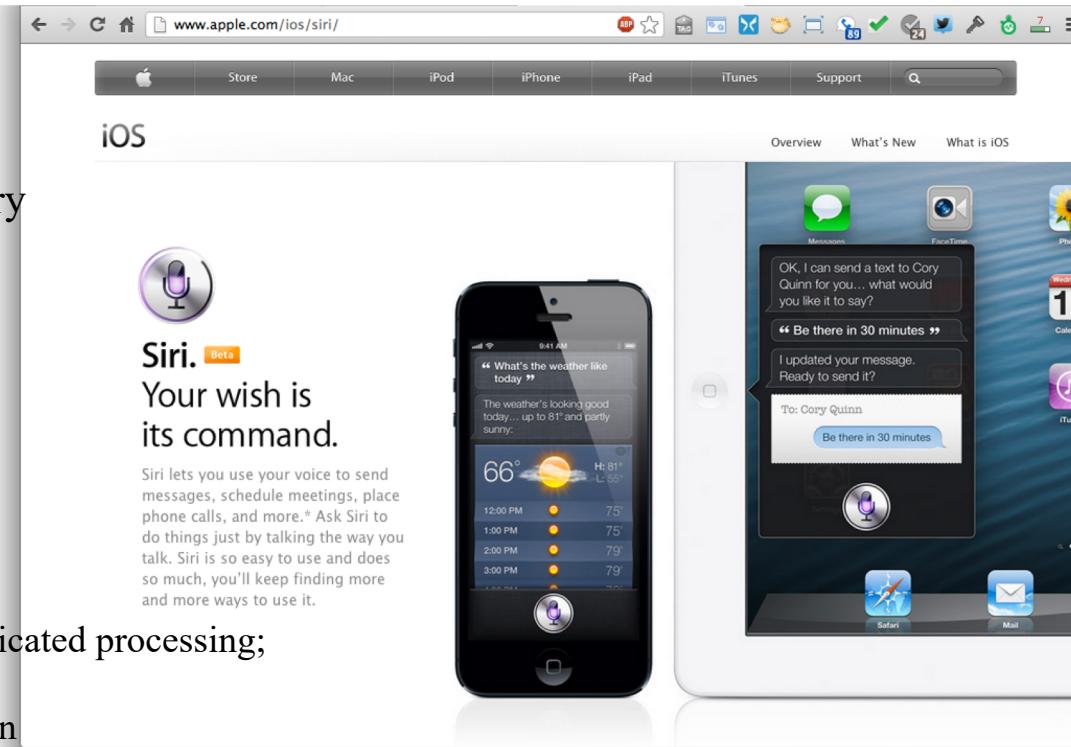
2010



# Apple's SIRI Relying on a KnowledgeBase

## The SIRI challenge

1. Convert speech to text
2. Convert text to entities
3. Convert entities to a query
4. Retrieve results
5. Interpret results
6. Convert back to speech



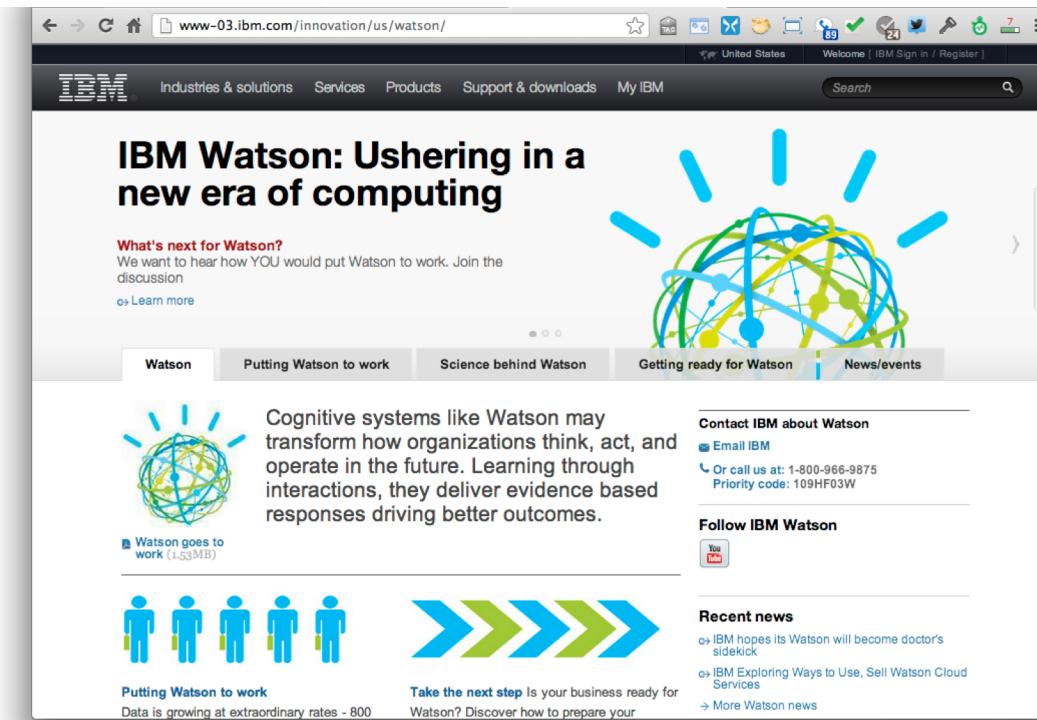
Siri uses Apple servers for complicated processing;

Formal techniques include:

- Automated speech recognition
- Parts of Speech tagging
- Question/Answer analysis
- Database interfaces to Wolfram, OpenTable, etc
- Transforming machine output to natural language
- Text-to-speech processing

SIRI needs lots of semantic data about entities in the world  
 Similar problems are faced by Amazon Echo, Google Home,

# IBM's Watson Relying on a KnowledgeBase

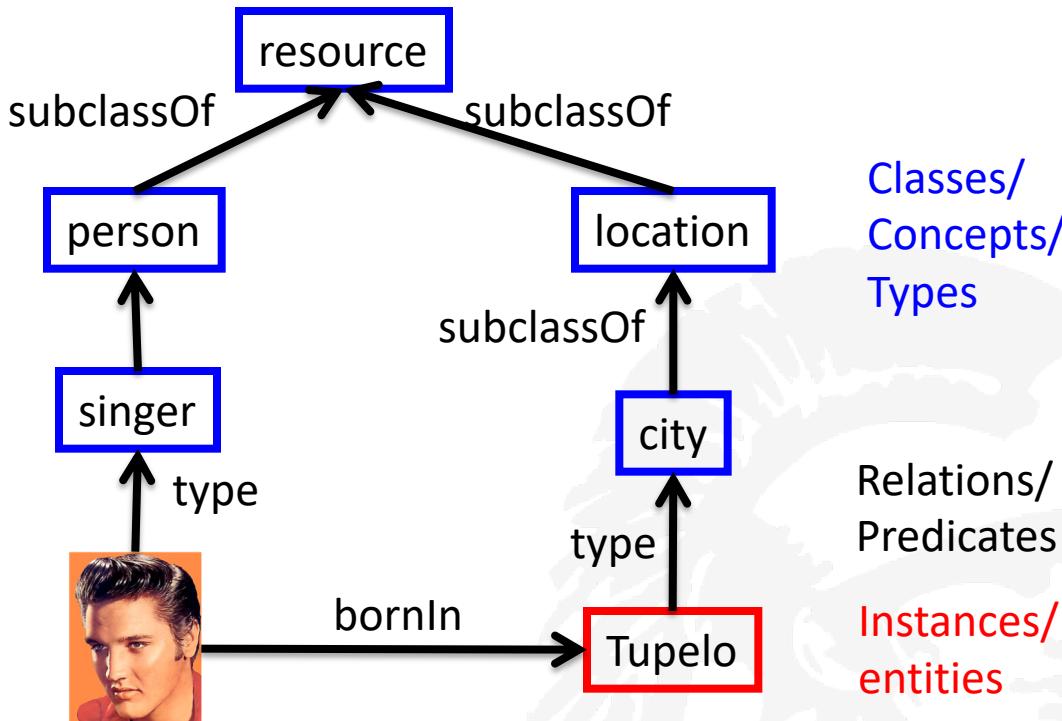


The screenshot shows the IBM Watson website at [www-03.ibm.com/innovation/us/watson/](http://www-03.ibm.com/innovation/us/watson/). The main title is "IBM Watson: Ushering in a new era of computing". A sub-section titled "What's next for Watson?" encourages user interaction. Below this, a large graphic of a brain-like network of nodes and connections is shown. A video thumbnail titled "Watson goes to work (1:53MB)" is available. The page features several tabs: Watson, Putting Watson to work, Science behind Watson, Getting ready for Watson, and News/events. Under "Putting Watson to work", it says "Data is growing at extraordinary rates - 800". Under "Take the next step", it says "Is your business ready for Watson? Discover how to prepare your". On the right, there are sections for "Contact IBM about Watson" (Email IBM, Call 1-800-966-9875), "Follow IBM Watson" (YouTube icon), and "Recent news" (links to IBM hopes its Watson will become doctor's sidekick, IBM Exploring Ways to Use, Sell Watson Cloud Services, and More Watson news).

IBM used Semantic Web technology and data in Watson, for a short video see  
[https://www.youtube.com/watch?v=\\_Xcmh1LQB9I](https://www.youtube.com/watch?v=_Xcmh1LQB9I) (8 min video)

And a tutorial on Watson:

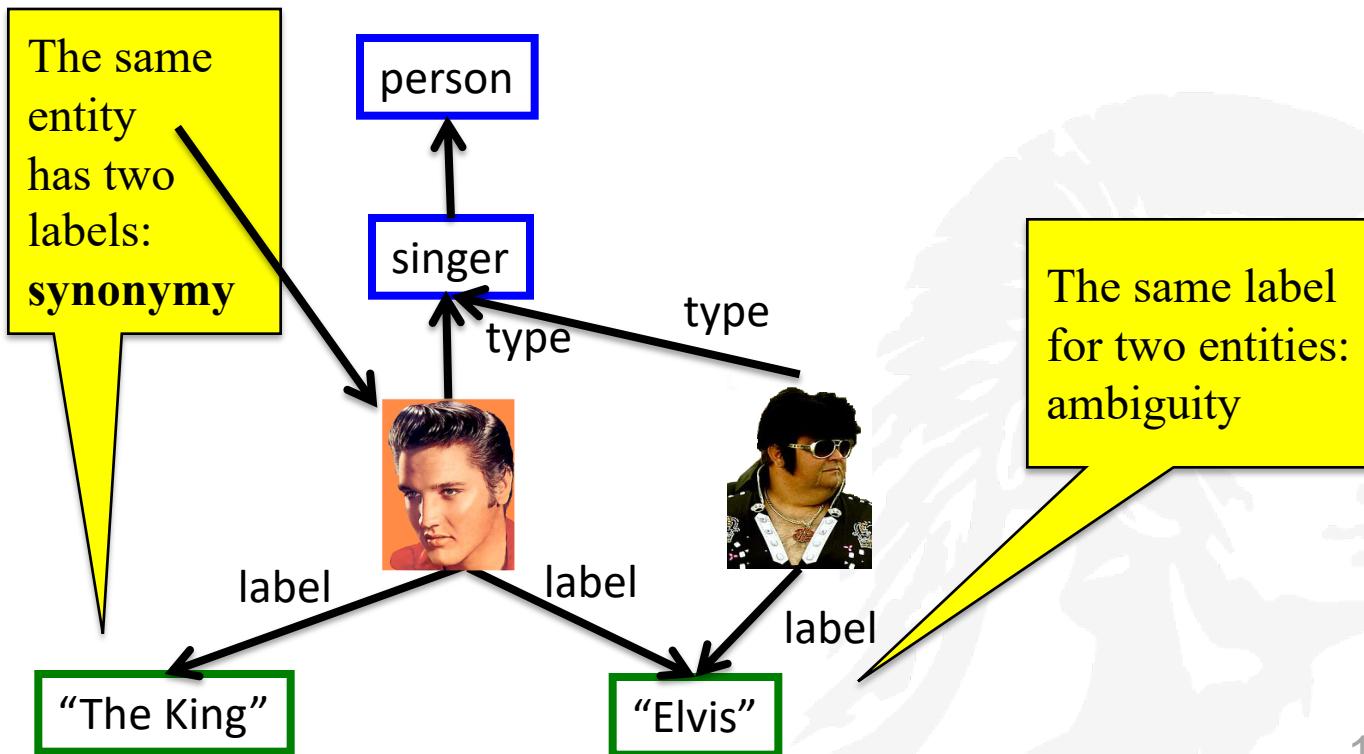
<http://iswc2011.semanticweb.org/tutorials/semantic-web-technology-in-watson/>



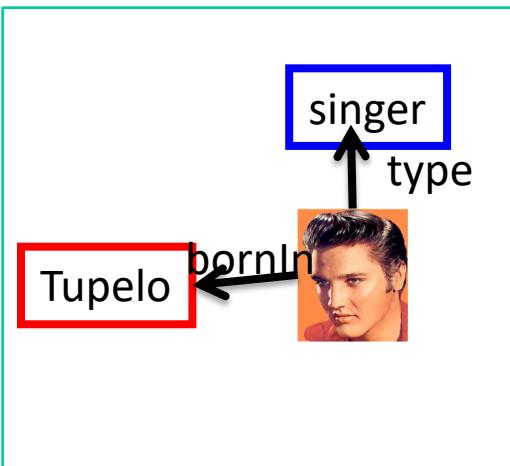
A knowledgebase can be seen as a directed labeled multigraph, where the nodes are entities and the edges relations.

A **multigraph** is a graph which is permitted to have multiple edges that have the same end nodes. Two vertices may be connected by more than one edge

## An Entity Can Have Different Labels



- Resource Description Format (RDF) is a W3C spec used for creating ontologies;
  - <https://www.w3.org/RDF/>
  - An RDF triple consists of: (subject, predicate, object)
  - Sometimes "RDF Ontology" and "KnowledgeBase (KB)" are used synonymously.

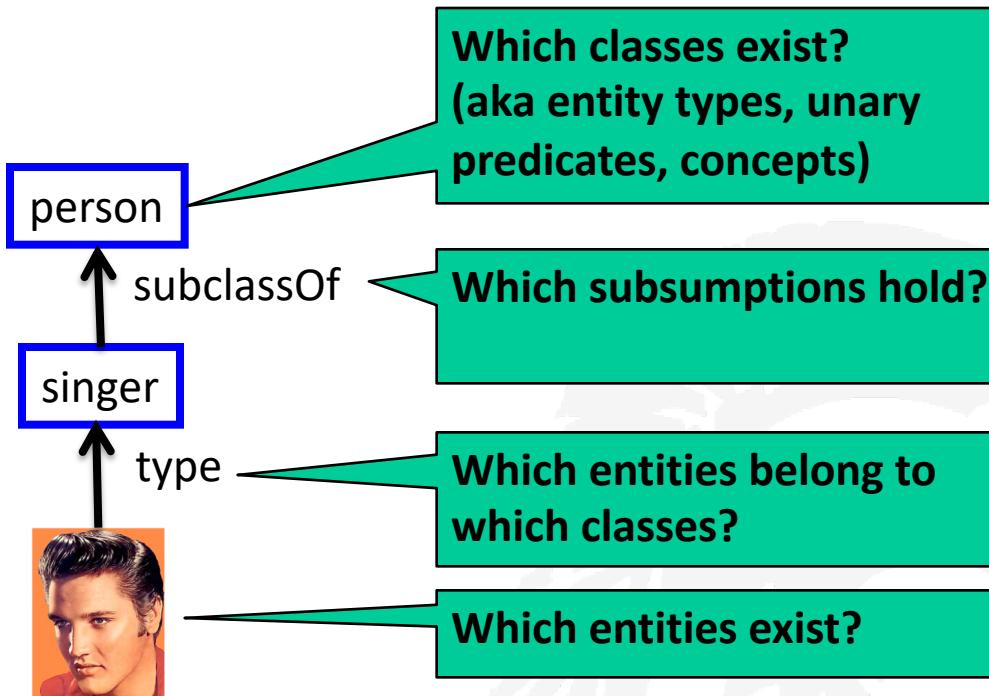
**Graph notation:****Different Notations for a KnowledgeBase****Triple notation:** \_\_\_\_\_

Subject	Predicate	Object
Elvis	type	singer
Elvis	bornIn	Tupelo
...	...	...

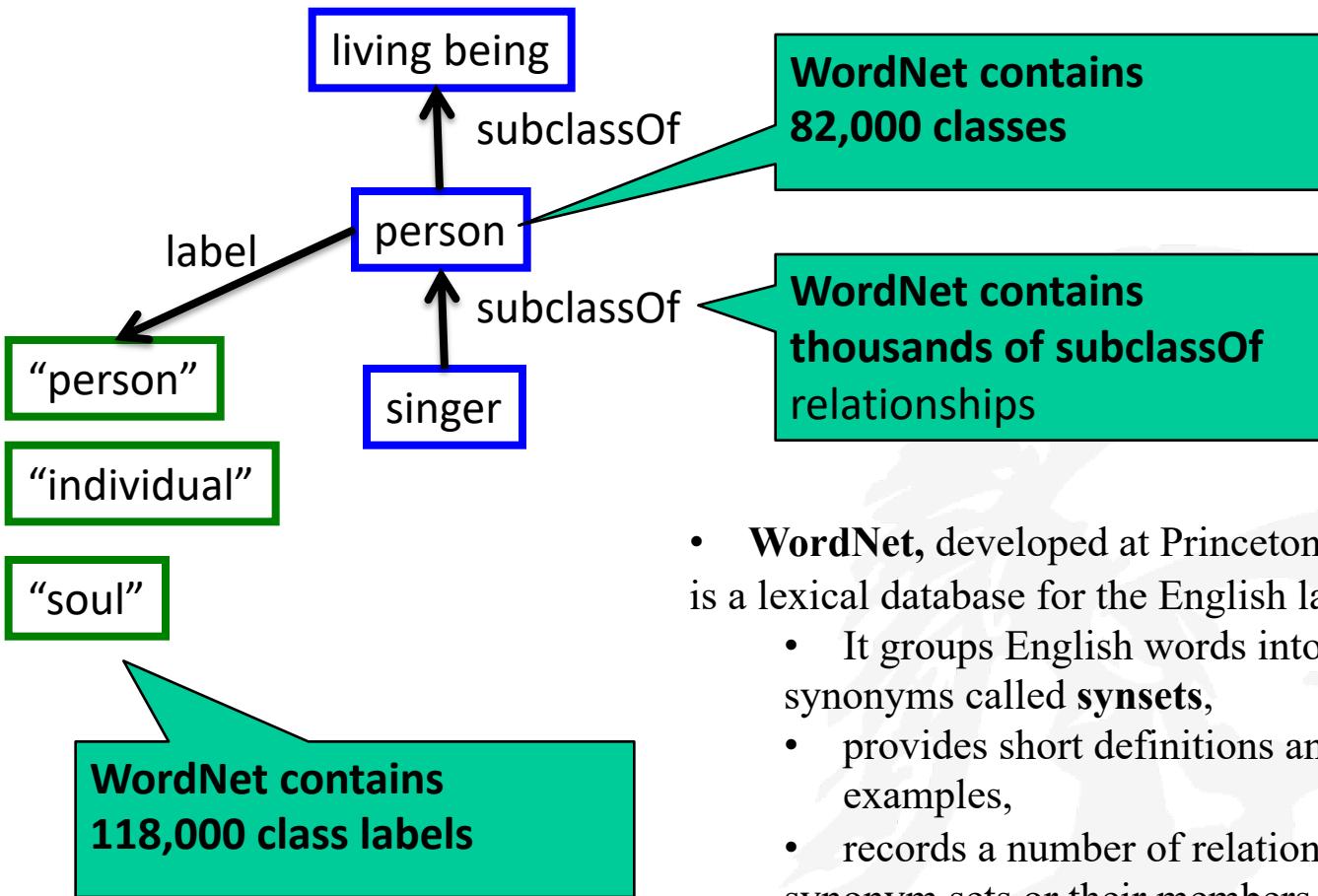
**Logical notation:** \_\_\_\_\_

type(Elvis, singer)  
bornIn(Elvis, Tupelo)

## To Build a Knowledgebase One Must Find Classes and Instances



# WordNet is a Lexical DataBase



- **WordNet**, developed at Princeton, is a lexical database for the English language.
  - It groups English words into sets of synonyms called **synsets**,
  - provides short definitions and usage examples,
  - records a number of relations among these synonym sets or their members.

15

## WordNet Example: superclass of Person

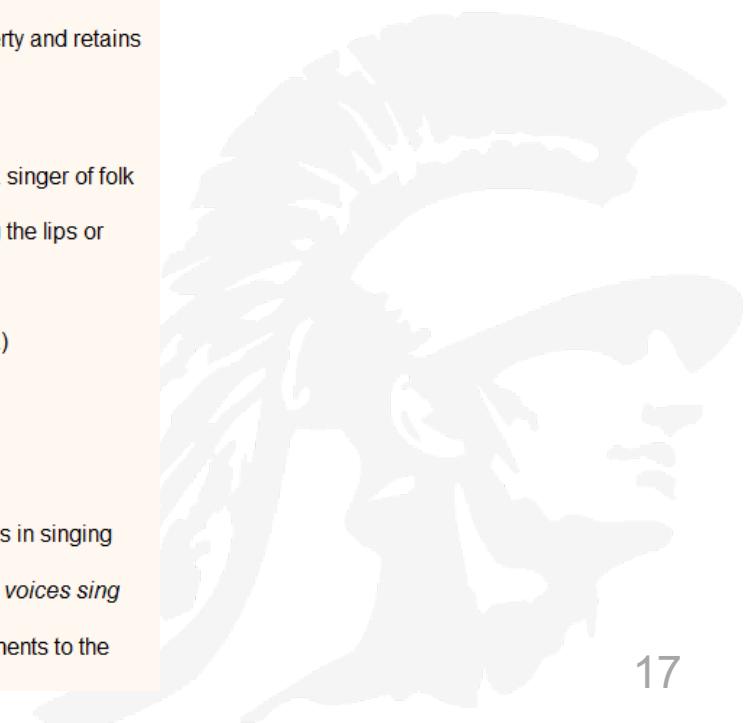
- S: (n) [person](#), [individual](#), [someone](#), [somebody](#), [mortal](#), [soul](#) (a human being)  
*"there was too much for one person to do"*
  - [direct hyponym](#) / [full hyponym](#)
  - [part meronym](#)
  - [member holonym](#)
  - [direct hypernym](#) / [inherited hypernym](#) / [sister term](#)
    - S: (n) [organism](#), [being](#) (a living thing that has (or can develop) the ability to act or function independently)
      - S: (n) [living thing](#), [animate thing](#) (a living (or once living) entity)
        - S: (n) [whole](#), [unit](#) (an assemblage of parts that is regarded as a single entity) *"how big is that part compared to the whole?"*; *"the team is a unit"*
        - S: (n) [object](#), [physical object](#) (a tangible and visible entity; an entity that can cast a shadow) *"it was full of rackets, balls and other objects"*
        - S: (n) [physical entity](#) (an entity that has physical existence)
          - S: (n) [entity](#) (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))

Note the terms:

- **hyponym**
  - More specific
- **Holonym**
  - Denoting the whole
- **Hypernym**
  - A broad or superordinate

# WordNet Example: subclass of Singer

- S: (n) **singer**, vocalist, vocalizer, vocaliser (a person who sings)
  - direct hyponym / full hyponym
    - S: (n) alto (a singer whose voice lies in the alto clef)
    - S: (n) baritone, barytone (a male singer)
    - S: (n) bass, basso (an adult male singer with the lowest voice)
    - S: (n) canary (a female singer)
    - S: (n) caroler, caroller (a singer of carols)
    - S: (n) castrato (a male singer who was castrated before puberty and retains a soprano or alto voice)
    - S: (n) chorister (a singer in a choir)
    - S: (n) contralto (a woman singer having a contralto voice)
    - S: (n) crooner, balladeer (a singer of popular ballads)
    - S: (n) folk singer, jongleur, minstrel, poet-singer, troubadour (a singer of folk songs)
    - S: (n) hummer (a singer who produces a tune without opening the lips or forming words)
    - S: (n) lieder singer (a singer of lieder)
    - S: (n) madrigalist (a singer of madrigals)
    - S: (n) opera star, operatic star (singer of lead role in an opera)
    - S: (n) rapper (someone who performs rap music)
    - S: (n) rock star (a famous singer of rock music)
    - S: (n) songster (a person who sings)
    - S: (n) soprano (a female singer)
    - S: (n) tenor (an adult male with a tenor voice)
    - S: (n) thrush (a woman who sings popular songs)
    - S: (n) torch singer (a singer (usually a woman) who specializes in singing torch songs)
    - S: (n) voice ((metonymy) a singer) "he wanted to hear trained voices sing it"
    - S: (n) warbler (a singer; usually a singer who adds embellishments to the song)



## WordNet Example: Instances

- S: (n) singer, vocalist, vocalizer, vocaliser (a person who sings)
  - direct hyponym / full hyponym
  - has instance
    - S: (n) Bailey, Pearl Bailey, Pearl Mae Bailey (United States singer (1918-1990))
    - S: (n) Cash, Johnny Cash, John Cash (United States country music singer and songwriter (1932-2003))
    - S: (n) Chevalier, Maurice Chevalier (French actor and cabaret singer (1888-1972))
    - S: (n) Dietrich, Marlene Dietrich, Maria Magdalene von Losch (United States film actress (born in Germany) who made many films with Josef von Sternberg and later was a successful cabaret star (1901-1992))
    - S: (n) Dylan, Bob Dylan (United States songwriter noted for his protest songs (born in 1941))
    - S: (n) Fitzgerald, Ella Fitzgerald (United States scat singer (1917-1996))
    - S: (n) Garland, Judy Garland (United States singer and film actress (1922-1969))
    - S: (n) Horne, Lena Horne, Lena Calhoun Horne (United States singer and actress (born in 1917))
    - S: (n) Iglesias, Julio Iglesias (Spanish singer noted for his ballads and love songs (born in 1943))
    - S: (n) Jackson, Mahalia Jackson (United States singer who did much to popularize gospel music (1911-1972))
    - S: (n) Jackson, Michael Jackson, Michael Joe Jackson (United States singer who began singing with his four brothers and later became a highly successful star during the 1980s (born in 1958))

only 32 singers !?

4 guitarists

5 scientists

0 enterprises

2 entrepreneurs

WordNet classes  
lack instances ✎



## Steve Jobs

From Wikipedia, the free encyclopedia

*For the biography, see [Steve Jobs \(biography\)](#).*

**Steven Paul Jobs** (/dʒɒbz/; February 24, 1955 – October 5, 2011)<sup>[4][5]</sup> was an American businessman and inventor widely recognized as a charismatic pioneer of the personal computer revolution.<sup>[6][7]</sup> He was co-founder, chairman, and chief executive officer of Apple Inc. Jobs also co-founded and served as chief executive of Pixar Animation Studios; he became a member of the board of directors of The Walt Disney Company in 2006, following the acquisition of Pixar by Disney.

In the late 1970s, Apple co-founder Steve Wozniak engineered one of the first commercially successful lines of personal computers, the Apple II series. Jobs directed its aesthetic design and marketing along with A.C. "Mike" Markkula, Jr. and others. In the early 1980s, Jobs was among the first to see the commercial potential of Xerox PARC's mouse-driven graphical user interface, which led to the creation of the Apple Lisa (engineered by Ken Rothmuller and John Couch) and, one year later, creation of Apple employee Jef Raskin's Macintosh.

After losing a power struggle with the board of directors in 1985, Jobs left Apple and founded NeXT, a computer platform development company specializing in the higher-education and business markets. NeXT was eventually acquired by Apple in 1996, which brought Jobs back to the company he co-founded, and provided Apple with the NeXTSTEP codebase, from which the Mac OS X was developed.<sup>[8]</sup> Jobs was named Apple advisor in 1996, interim CEO in 1997, and CEO from 2000 until his resignation. He oversaw the development of the iMac, iTunes, iPod, iPhone, and iPad and the company's Apple Retail Stores.<sup>[9]</sup> In 1986, he acquired the computer graphics division of Lucasfilm Ltd, which was spun off as Pixar Animation Studios.<sup>[10]</sup> He was credited in *Toy Story* (1995) as an executive producer. He remained CEO and majority shareholder at 50.1 percent until its acquisition by The Walt Disney Company in 2006,<sup>[11]</sup> making Jobs Disney's largest individual shareholder at seven percent and a member of Disney's Board of Directors.<sup>[12][13]</sup>

In 2003, Jobs was diagnosed with a pancreas neuroendocrine tumor. Though it was initially treated, he reported a hormone imbalance, underwent a liver transplant in 2009, and appeared progressively thinner as his health declined.<sup>[14]</sup> On medical leave for most of 2011, Jobs resigned as Apple CEO in August that year and was elected Chairman of the Board. On October 5, 2011, Jobs died of respiratory arrest related to his metastatic tumor. He

# Wikipedia is a Rich Source of Instances

Wikipedia founders



Jimmy  
Wales



Larry  
Sanger

Steve Jobs



Jobs holding a white iPhone 4 at Worldwide Developers Conference 2010

Born	Steven Paul Jobs February 24, 1955 <sup>[1][2]</sup> San Francisco, California, U.S. <sup>[1][2]</sup>
Died	October 5, 2011 (aged 56) <sup>[2]</sup> Palo Alto, California, U.S.
Nationality	American
Alma mater	Reed College (dropped out)

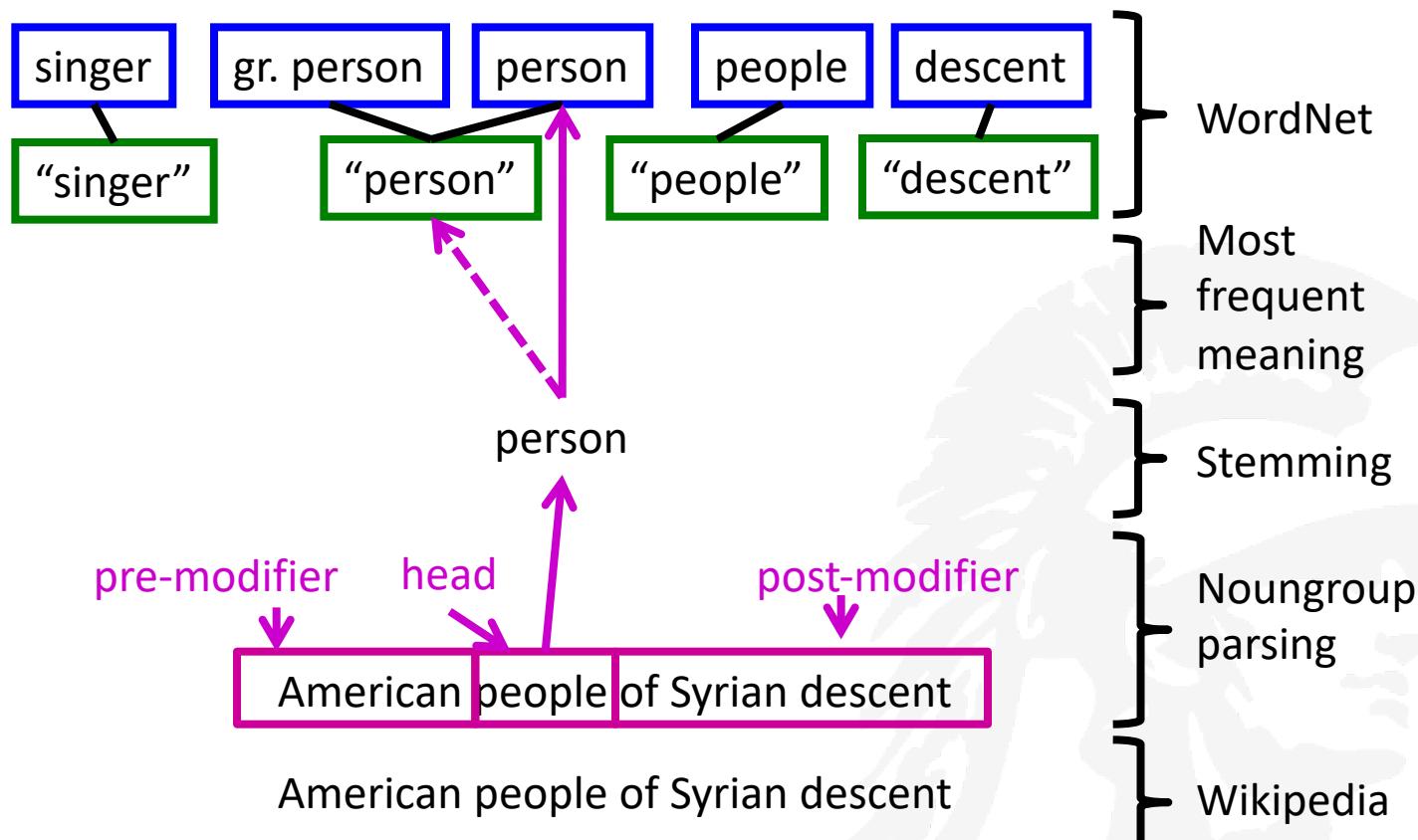
## Wikipedia's Categories Also Contain Classes

Categories: Steve Jobs | 1955 births | 2011 deaths | American adoptees | American billionaires  
| American chief executives | American computer businesspeople | American industrial designers  
| American inventors | American people of German descent | American people of Swiss descent  
| American people of Syrian descent | American technology company founders | American Zen Buddhists  
| Apple Inc. | Apple Inc. employees | Businesspeople from California | Businesspeople in software  
| Cancer deaths in California | Computer designers | Computer pioneers | Deaths from pancreatic cancer  
| Disney people | Internet pioneers | National Medal of Technology recipients | NeXT  
| Organ transplant recipients | People from the San Francisco Bay Area | Pescetarians  
| Reed College alumni

But: categories do not form a taxonomic hierarchy  
There is no ISA hierarchy



# Combining Wikipedia Categories to WordNet

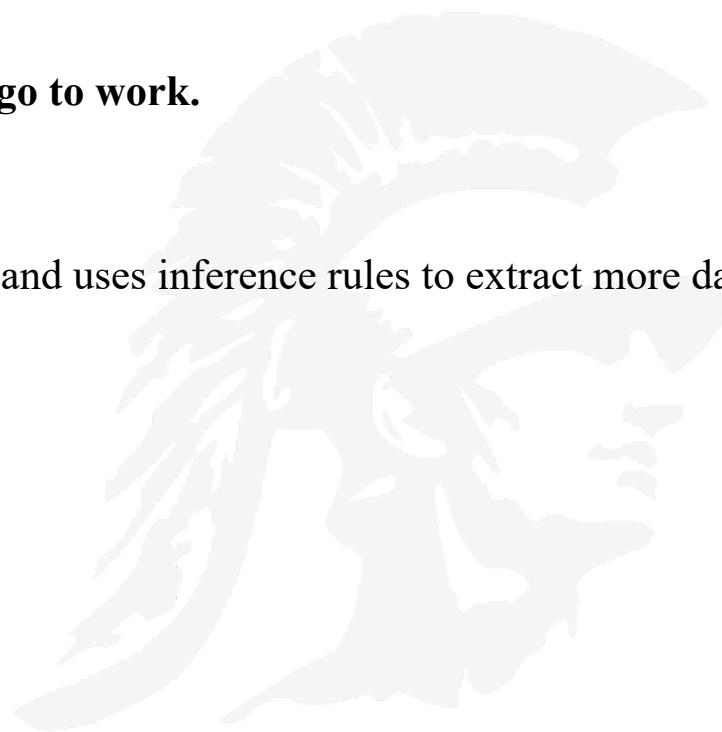


# Inferencing on KnowledgeBases

- An **inference engine** is a component of a system that applies logical rules to a knowledgebase to deduce new information
- This process is ongoing as each new fact in the knowledgebase can trigger additional rules in the inference engine.
- Inference engines work primarily in one of two modes: forward chaining and backward chaining
  - **Forward chaining** starts with the known facts and asserts new facts.
  - **Backward chaining** starts with goals, and works backward to determine what facts must be asserted so that the goals can be achieved.
- An inference engine cycles through three sequential steps: match rules, select rules, and execute rules
- The execution of the rules will sometimes result in new facts or goals being added to the knowledgebase which will trigger the cycle to repeat. This cycle continues until no new rules can be matched
- Search engines typically use forward chaining

# Forward Chaining

- **Forward chaining** is the repeated application of modus ponens
- In propositional logic, ***modus ponens*** is the rule
  - “ $P$  implies  $Q$ ” and “ $P$ ” are both asserted to be true, so therefore  $Q$  must be true.”
  - Sometimes modus ponens is written as  $(( P \rightarrow Q) \text{ and } P) \rightarrow Q$
  - For Example
    - **If today is Tuesday, then John will go to work.**
    - **Today is Tuesday.**
    - **Therefore, John will go to work.**
- Forward chaining starts with the available data and uses inference rules to extract more data until a goal or endpoint is reached.



# Binary Relations and Instances

Here are some sample binary relations with their type signature, e.g.

hasAdvisor: Person × Person

graduatedAt: Person × University

bornOn: Person × Date

Here are instances of the above binary relations

hasAdvisor (JimGray, MikeHarrison)

hasAdvisor (Susan Davidson, Hector Garcia-Molina)

graduatedAt (JimGray, Berkeley)

graduatedAt (HectorGarcia-Molina, Stanford)

bornOn (JohnLennon, 9-Oct-1940)

# Instances and Relations Yield New Instances and New Relations

## Instances

(JimGray, MikeHarrison)  
(BarbaraLiskov, JohnMcCarthy)

(Surajit, Jeff)  
(Alon, Jeff)  
(Sunita, Mike)  
(Renee, Yannis)

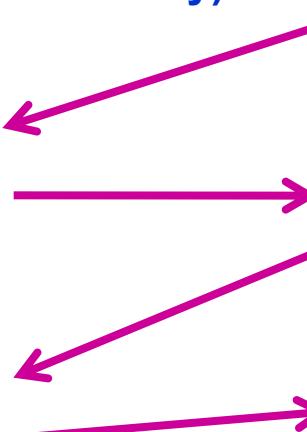
(Sunita, Soumen)  
(Soumen, Sunita)

## Relation

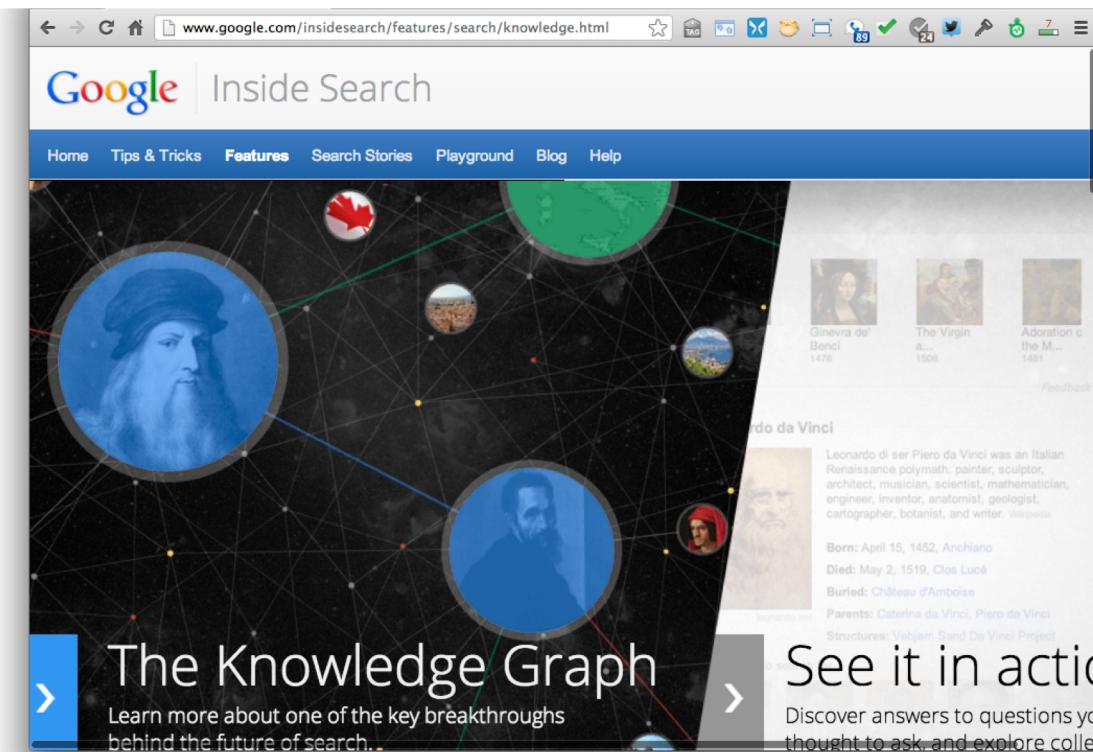
X and his advisor Y  
X under the guidance of Y

X and Y in their *research paper*  
X *co-authored with* Y

...



# Google Knowledge Graph



The screenshot shows the Google Inside Search interface. At the top, there's a navigation bar with links for Home, Tips & Tricks, Features, Search Stories, Playground, Blog, and Help. Below the navigation bar is a large graphic illustrating the Knowledge Graph. It features a network of interconnected nodes, each containing a small image or icon. A prominent node on the left is a portrait of Leonardo da Vinci. Other nodes include a Canadian flag, a landscape image, a portrait of a woman, and three smaller images related to Leonardo da Vinci's works: "Ginevra de' Benci" (1478), "The Virgin of the Rocks" (c. 1508), and "Adoration of the Magi" (c. 1481). To the right of the network, there's a detailed profile of Leonardo da Vinci with his birth date (April 15, 1452) and place of birth (Anchiano). Below this profile, there are sections for "See it in action" and "Discover answers to questions you thought to ask, and explore collect". At the bottom left, there's a call-to-action button with the text "The Knowledge Graph" and the subtext "Learn more about one of the key breakthroughs behind the future of search."

<https://www.google.com/intl/es419/insidesearch/features/search/knowledge.html>

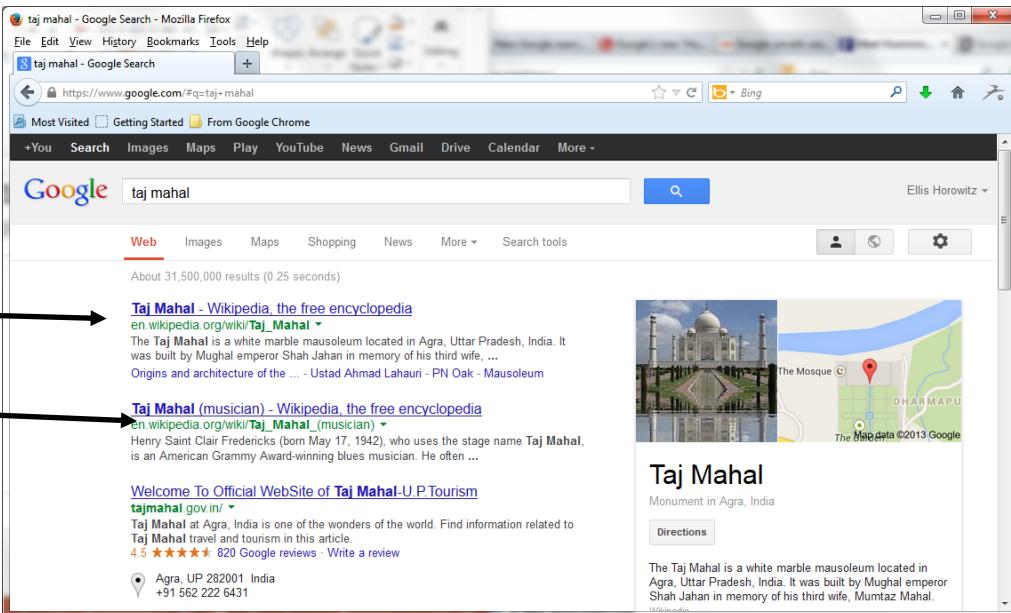
Google's slogan for the knowledge graph: "things, not strings"

<https://www.youtube.com/watch?v=mmQl6VGvX-c>

# Knowledge Graph Enhances Google Search in 3 main ways (1):

mausoleum

musician



The screenshot shows a Google search results page for the query "taj mahal". The results are filtered by "Web". The first result is a link to the Wikipedia page for the Taj Mahal, described as a white marble mausoleum. The second result is a link to the Wikipedia page for Taj Mahal (musician), described as an American blues musician. Below these are links to the official website of the Taj Mahal and a Google+ post. To the right of the search results, there is a thumbnail image of the Taj Mahal and a map showing its location in Agra, India.

**1. To improve the variety of search results,**  
 Google uses the knowledge graph to locate  
 alternate interpretations of query terms,

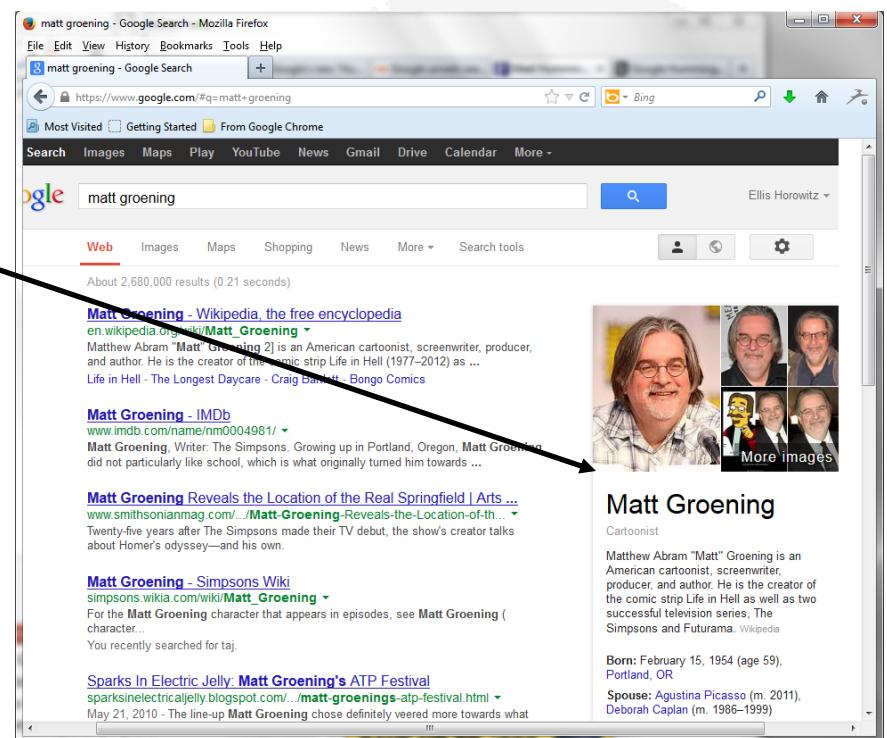
**Here it offers two of them with the same  
 name e.g.  
 "taj mahal" - the mausoleum or musician**

## Knowledge Graph Enhances Google Search in 3 main ways (2):

### 2. To provide deeper and broader results

e.g. person entities include relations such as age, birthplace, marital status, children, education, etc.,  
 here is a sample result for Matt Groening

- creator of The Simpsons
- **Go Deeper**
  - his photo
  - when he was born
  - his spouse
  - his parents
  - why he is famous
- **Go Broader**
  - other people related to Groening



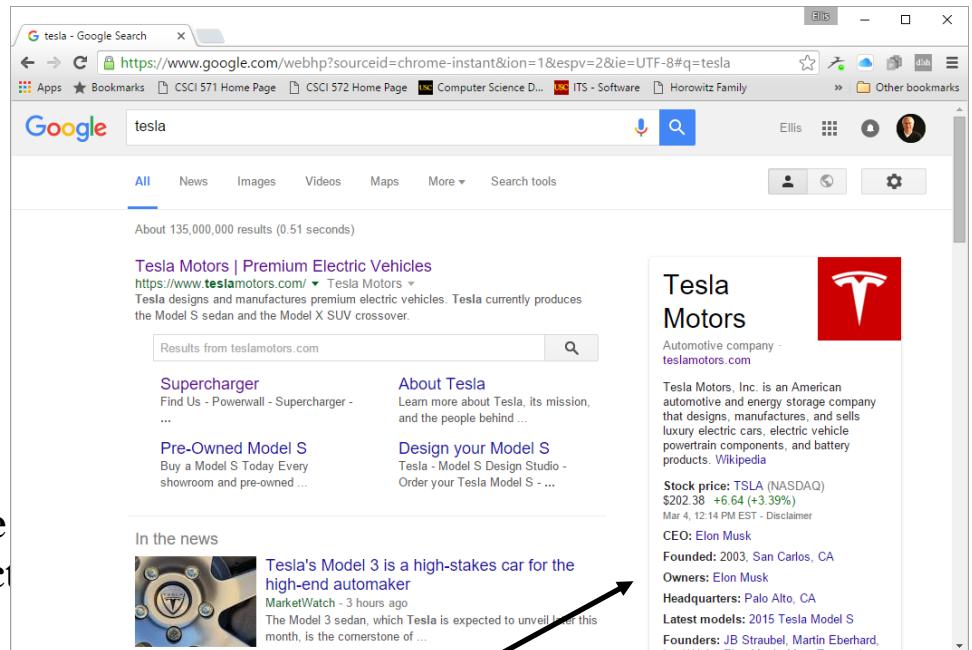
# Knowledge Graph Enhances Google Search in 3 main ways: (3)

### 3. To provide the best summary

the knowledge graph exploits the relationships among the entities  
e.g. the query “Tesla”

The knowledge graph allows Google to summarize relevant content around that topic, including key facts you’re likely to need for that particular thing. E.g.

**Tesla Motors, Inc. is an American automotive and energy storage company that designs, manufactures, and sells luxury electric cars, electric vehicle powertrain components, and battery products**



A screenshot of a Google search results page for the query "tesla". The search bar shows "tesla". The results page includes a snippet for Tesla Motors, Inc., followed by links for Supercharger, Pre-Owned Model S, and Design your Model S. On the right side, there is a Knowledge Graph panel for Tesla Motors, Inc., which includes the company's logo, a brief description, stock price information, and a list of founders and CEO. Below the main search results, there is a section titled "In the news" with a thumbnail image of a Tesla car wheel and a brief news snippet from MarketWatch.

# Wikipedia: Transformation from Database to KnowledgeBase

## Wikipedia's Original Mission Statement

“Imagine a world in which every person on the planet shares in the sum of all human knowledge. That is what we’re doing. (for free, in the language of their choice)



# Wikipedia's scale

30 million articles, 4 million in English

16 million images

8000 views per second

500 million unique visitors per month

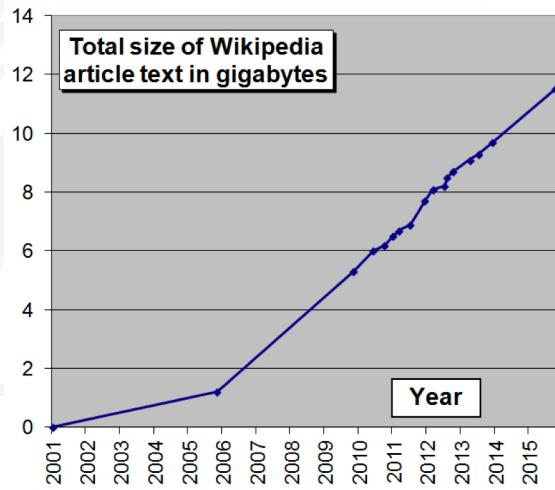
3.7 billion monthly mobile page views

2.1 billion edits, 700 million English

11.5 GBs in 2015



Jimmy Wales, Founder



# Wikipedia's volunteers

20 million registered users

120,000 active editors

1,400 administrators



... all working for free, with no  
central control

# Wikipedia's Five Pillars (5P)

## 1. Encyclopaedia

- Notable topics
- No original research (NOR)

## 2. Neutral point of view (NPOV)

- Verifiability (referencing)

## 3. Free content

- Anyone can edit
- No copyright infringements

## 4. Be civil

## 5. No firm rules



WIKIPEDIA  
The Free Encyclopedia

Main page  
Contents  
Featured content  
Current events  
Random page  
Donate

Interaction  
Help  
About Wikipedia  
Community portal  
Recent changes  
Contact page

Toolbox  
Print/export

Languages  
Alemannisch  
English  
မြန်မာဘာသာ  
অসমীয়া  
Azərbaycanca  
বাংলা  
Беларуская  
Беларускaya (тарашкевіца)  
Boarisch  
Bosanski  
Brezhoneg  
Български  
Català  
Česky  
Gymraeg  
Dansk  
Deutsch  
گلپار  
Ελληνικά<sup>1</sup>  
Español  
Esperanto  
Euskara  
فارسی  
Français  
Furlan  
Galego  
ગુજરાતી  
한국어

Project page Discussion Read Edit View history Search Log out

### Wikipedia:Five pillars

From Wikipedia, the free encyclopedia

The fundamental principles by which Wikipedia operates can be summarized in the form of five "pillars".

#### Wikipedia is an encyclopedia.

It incorporates elements of general and specialized [encyclopedias](#), [almanacs](#), and [gazetteers](#). [Wikipedia is not a soapbox](#), an [advertising platform](#), a [vanity press](#), an experiment in [anarchy](#) or [democracy](#), an [indiscriminate collection of information](#), or a web [directory](#). It is not a [dictionary](#), a [newspaper](#), or a collection of [source documents](#); that kind of content should be contributed instead to the [Wikimedia sister projects](#).

#### Wikipedia is written from a neutral point of view.

We strive for articles that document and explain the major [points of view](#) in a balanced and impartial manner. We avoid advocacy and we characterize information and issues rather than debate them. In some areas there may be just one well-recognized point of view; in other areas we describe multiple points of view, presenting each accurately and in context, and not presenting any point of view as "the truth" or "the best view". All [articles](#) must strive for [verifiable accuracy](#): unreferenced material may be removed, so please provide references. Editors' [personal experiences](#), [interpretations](#), or opinions do not belong here. That means citing [verifiable](#), [authoritative sources](#), especially on controversial topics and when the subject is a [living person](#).

#### Wikipedia is free content that anyone can edit, use, modify, and distribute.

Respect [copyright](#) laws, and do not [plagiarize](#) sources. [Non-free content](#) is allowed under [fair use](#), but strive to find free alternatives to any media or content that you wish to add to Wikipedia. Since all your contributions are [freely licensed to the public](#), no editor [owns any article](#); all of your contributions can and will be mercilessly edited and redistributed.

#### Editors should interact with each other in a respectful and civil manner.

Respect and be polite to your fellow [Wikipedians](#), even when you disagree. Apply Wikipedia [etiquette](#), and avoid [personal attacks](#). Find [consensus](#), avoid [edit wars](#), and remember that there are 4,143,499 articles on the English Wikipedia to work on and discuss. Act in good faith, and [never disrupt Wikipedia to illustrate a point](#). Be open and [welcoming](#), and [assume good faith](#) on the part of others. When conflict arises, discuss details on the [talk page](#), and follow [dispute resolution](#).

#### Wikipedia does not have firm rules.

Rules in Wikipedia are not carved in stone, as their wording and interpretation are likely to change over time. The principles and spirit of Wikipedia's rules matter more than their literal wording, and sometimes improving Wikipedia requires making an exception to a rule. [Be bold](#) (but not [reckless](#)) in updating articles and [do not worry about making mistakes](#). [Prior versions of pages are saved](#), so any mistakes can be corrected.

[Wikipedia principles](#) [show]

[Key Wikipedia policies and guidelines](#) [show]

Category (+): [WikiProject Basic Information](#) (-) (+)

This page was last modified on 15 December 2012, at 03:41.

Text is available under the [Creative Commons Attribution/Share-Alike License](#); additional terms may apply. See [Terms of use](#) for details.

[Privacy policy](#) [About Wikipedia](#) [Disclaimers](#) [Mobile view](#)

 Wikimedia  MediaWiki

# Wikipedia Statistics

- Among top 10 most visited websites
- 70% of traffic is from search engines
- Cited in over 100 U.S. court rulings

<https://stats.wikimedia.org/EN/Sitemap.htm>



The screenshot shows a Microsoft Edge browser window displaying the Wikipedia Statistics page. The URL in the address bar is <https://en.wikipedia.org/wiki/Special:Statistics>. The page itself is titled "Statistics" and contains two main sections: "Page statistics" and "Edit statistics". Below these are sections for "User statistics" and "Account creators". The "Page statistics" section includes data for Content pages, Pages, and Uploaded files. The "Edit statistics" section includes data for Page edits since Wikipedia was set up and Average edits per page. The "User statistics" section includes data for Registered users, Active registered users, and various bot and administrator categories. The "Account creators" section includes data for Bureaucrats, Pending changes reviewers, Stewards, and Account creators.

Page statistics	
Content pages	5,250,603
Pages (All pages in the wiki, including talk pages, redirects, etc.)	40,340,306
Edit statistics	
Uploaded files	853,402
Page edits since Wikipedia was set up	850,708,845
Average edits per page	21.09
User statistics	
Registered users	29,160,451
Active registered users (list of members)	118,866
(Users who have performed an action in the last 30 days)	
Bots (list of members)	368
Administrators (list of members)	1,293
Bureaucrats (list of members)	22
Pending changes reviewers (list of members)	6,667
Stewards (list of members)	0
Account creators (list of members)	123

# Organization of Wikipedia

- **Types of links**
  - *Article links*
    - links from one article to another of the same language;
  - *Category links*
    - links from an article to special “Category” pages;
  - *Interlingual links*
    - links from an article to a presumably equivalent, article in another language;
- **Types of special pages**
  - *Redirect pages*
    - short pages which often provide equivalent names for an entity
  - *Disambiguation pages*
    - a page with little content that links to multiple similarly named articles.
- **Infoboxes, templates, list pages, wikipedia commons, ...**

**WIKIPEDIA**  
The Free Encyclopedia

Main page  
Contents  
Featured content  
Current events  
Random article  
Donate to Wikipedia  
Wikipedia store

Interaction  
Help  
About Wikipedia  
Community portal  
Recent changes  
Contact page

Tools  
What links here  
Related changes  
Upload file  
Special pages  
Permanent link  
Page information  
Wikidata item  
Cite this page

Print/export  
Create a book  
Download as PDF  
Printable version

In other projects  
Wikimedia Commons  
Wikiquote

Languages  
Afrikaans  
Alemannisch  
ՀՊՀ  
Ænglisc  
العربية  
Aragonés  
Asturianu  
★ Azərbaycanca  
ئۇرپىكە<sup>تۈرى</sup>  
ພາສັກ  
Bân-lâm-gú  
Башҡортса  
Беларуская  
Беларуская  
(тарашкевіца)

Elvis Presley

From Wikipedia, the free encyclopedia  
(Redirected from Elvis presley)

“Elvis” redirects here. For other uses, see *Elvis* (disambiguation).

**Elvis Aaron Presley**<sup>[2]</sup> January 8, 1935 – August 16, 1977 was an American rock musician and actor. Regarded as one of the most significant cultural icons of the 20th century, he is often referred to as “the King of Rock and Roll”, or simply, “the King”.

Presley was born in Tupelo, Mississippi, as a twinless twin—his brother was stillborn. When he was 13 years old, he and his family relocated to Memphis, Tennessee. His music career began there in 1954, when he recorded a song with producer Sam Phillips at Sun Records. Accompanied by guitarist Scotty Moore and bassist Bill Black, RCA Victor acquired his contract in a deal arranged by Colonel Tom Parker, Presley's manager. He became a national figure in 1956, and was soon a major star. In 1957, he made his first movie, *Love Me Tender*, and became a number-one hit in the United States. He was regarded as the leading figure of rock and roll after a series of successful network television appearances and chart-topping records. His energetic interpretations of songs and sexually provocative performance style, combined with a singularly potent mix of influences across color lines that coincided with the dawn of the Civil Rights Movement, made him enormously popular—albeit controversial.

In November 1956, he made his film debut in *Love Me Tender*. In 1958, he was drafted into military service. He resumed his recording career two years later, producing some of his most commercially successful work before devoting much of the 1960s to making Hollywood films and their accompanying soundtracks, most of which were critically derided. In 1968, following a seven-year break from live performances, he returned to the stage in the acclaimed televised comeback special *Elvis*, which led to an extended Las Vegas concert residency and a string of highly profitable tours. In 1973, Presley was featured in the first globally broadcast concert via satellite, *Aloha from Hawaii*. Several years of prescription drug abuse severely damaged his health, and he died in 1977 at the age of 42.

Presley is one of the most celebrated and influential musicians of the 20th century. Commercially successful in many genres, including pop, blues and gospel, he is the best-selling solo artist in the history of recorded music.<sup>[3][4]</sup> With estimated record sales of around 600 million units worldwide,<sup>[5]</sup> he won three Grammys, also receiving the Grammy Lifetime Achievement Award at age 36, and has been inducted into multiple music halls of fame.

**Contents** [hide]

1 Life and career  
1.1 1935–43: Early years  
1.2 1945–55: First recordings  
1.3 1956–58: Commercial breakthrough and controversy  
1.4 1958–60: Military service and mother's death  
1.5 1960–67: Focus on films  
1.6 1968–73: Comeback  
1.7 1973–77: Health deterioration and death

• Elvis Presley at the Internet Movie Database  
• Elvis Presley at the TCM Movie Database  
• Elvis Presley at the AllMovie Discogs  
• Elvis Presley Enterprises official site of the Elvis Presley brand  
• Elvis Presley Enterprises on Australia site  
• Elvis Presley at DMOZ label site

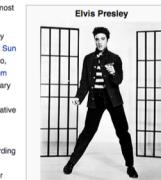
Elvis Presley

Country Music Hall of Fame 1990s

Rock and Roll Hall of Fame Class of 1996

Authority control

Categories: Elvis Presley | 1935 births | 1977 deaths | 20th-century American male actors | 20th-century American singers | American baritones | American blues singers | American country singers | American crooners | American gospel singers | American male film actors | American people of Cherokee descent | American people of French descent | American people of German descent | American people of Scotch-Irish descent | American performers of Christian music | American rock singers | American rockabilly musicians | Blues musicians from Mississippi | Burials in Tennessee | Country Music Hall of Fame inductees | Gospel Music Hall of Fame inductees | Grammy Award winners | Grammy Lifetime Achievement Award winners | Humes High School alumni | Identical twins | Las Vegas entertainers | Las Vegas musicians | Male actors from Mississippi | Male actors from Tennessee | Mississippi Blues Trail | Musicians from Tennessee | Paramount Pictures contract players | People from Memphis, Tennessee | People from Tupelo, Mississippi | American people of Norman descent | Pioneers of music genres | RCA Victor artists | Rock and Roll Hall of Fame inductees | Singers from Mississippi | Southern gospel performers | Sun Records artists | Tank personnel | Traditional pop music singers | Twin people from the United States | United States Army soldiers



infobox

Category links

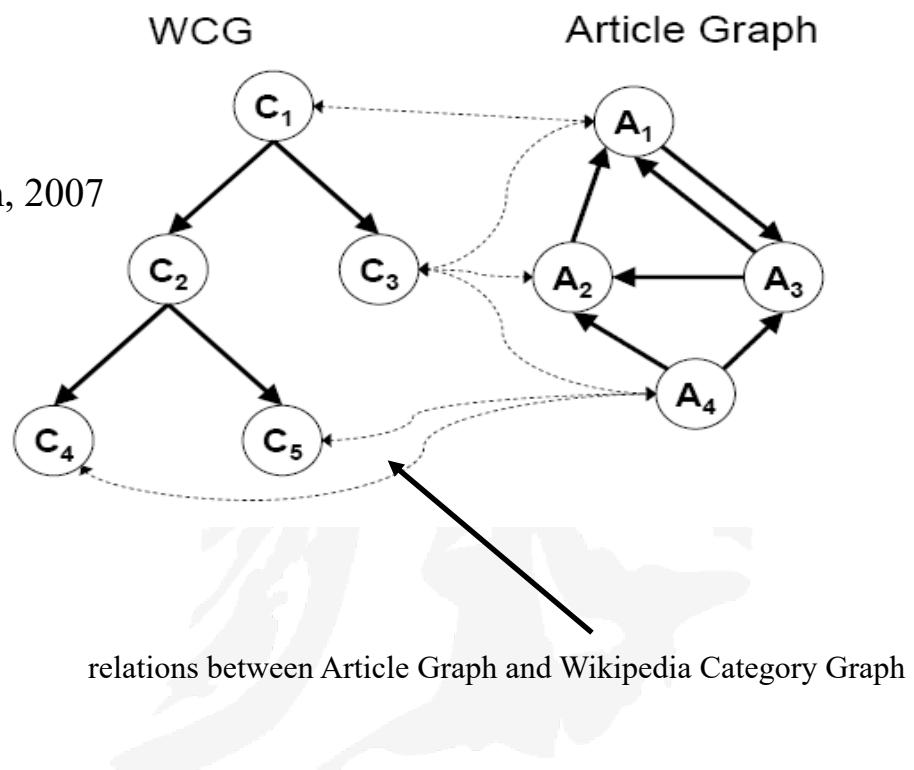
# Organization of Wikipedia

Wikipedia **articles** form a network of semantically related terms, while the **categories** are organized in a taxonomy-like structure called Wikipedia Category Graph (WCG)

See the article by Torsten Zesch and Iryna Gurevych, 2007

Wikipedia Article Graph, WAG

Wikipedia Category Graph, WCG

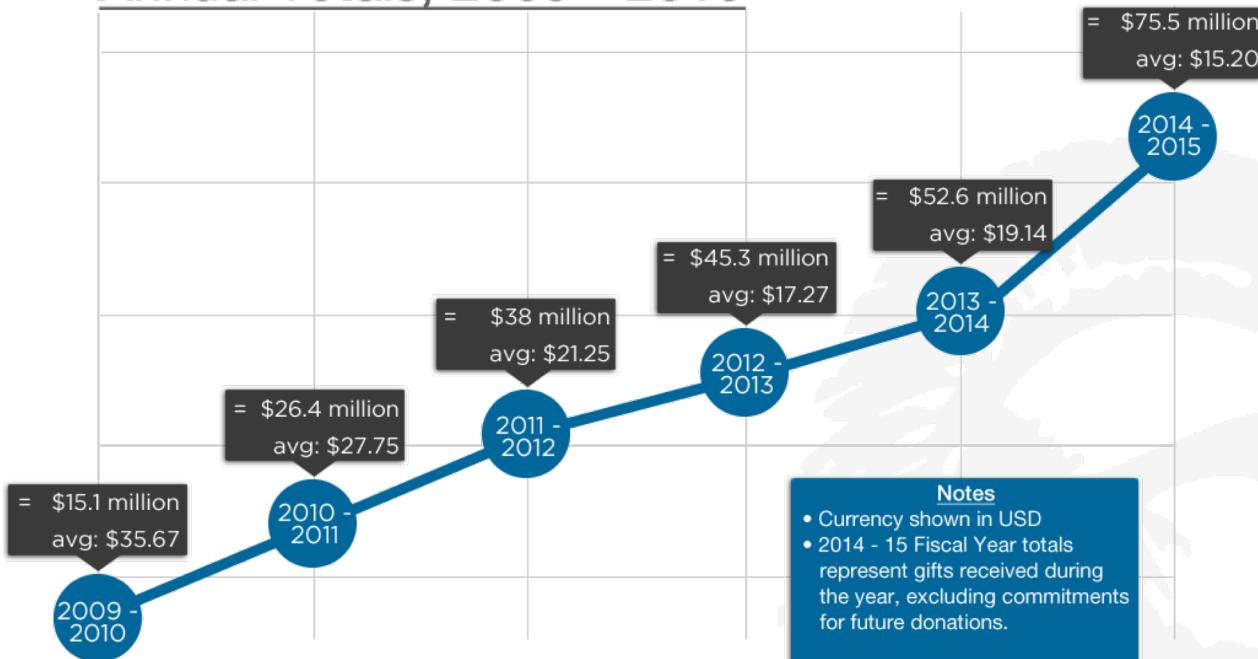


# Wikipedia Administrators

- ~1400 administrators in English
- **Block and unblock users**
- **Semi-protect pages (lock pages from being edited by unregistered and new users)**
- **Protect pages (lock pages from being edited)**
- **Edit protected pages**
- **Delete and undelete page histories**

# Wikipedia Does Not Take Advertising, Only Donations

## Annual Totals, 2009 - 2015



**ANDREW LIH • @fuzheado • #WikiconUSA**

[https://wikimediafoundation.org/wiki/2014-2015\\_Fundraising\\_Report](https://wikimediafoundation.org/wiki/2014-2015_Fundraising_Report)

# Wikimedia Foundation

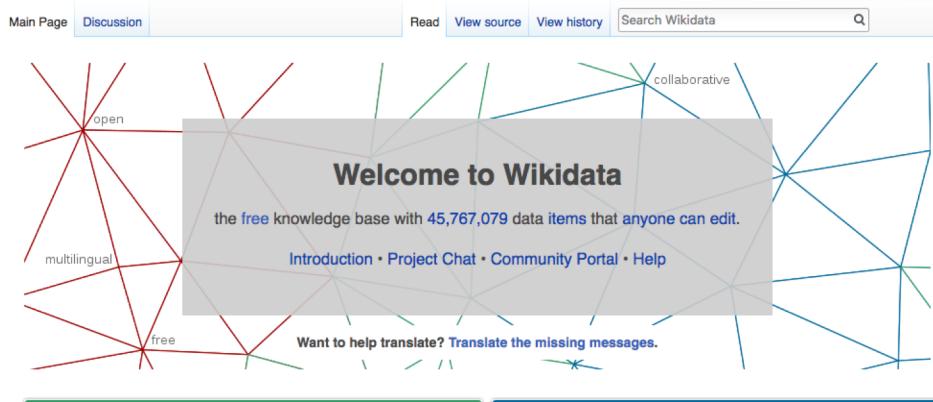
- **Wikimedia Foundation, Inc. (WMF)** is an American non-profit and charitable organization headquartered in San Francisco.
- It owns the internet domain names and hosts Wikipedia
- The foundation was founded in 2003 by Jimmy Wales as a way to fund Wikipedia and its sister projects through non-profit means
- As of 2015, the foundation employs over 280 people, with annual revenues in excess of \$75 million
- Related projects to Wikipedia:
  - **Commons** for multimedia,
  - **Wiktionary** as free dictionary, and
  - **Wikidata** for structured data.

WIKIMEDIA  
FOUNDATION

シ 𩫖 韓  
ଶ ଶ ଶ  
维

Wikidata  
*The free dictionary*

- WikiData is an effort to convert the Wikipedia data into a knowledgebase
- WikiData aims to create a free RDF-like KB about the world that can be read/edited by humans & machines
- Wikidata clients use the repository, e.g. to populate Web pages or Wikipedia infoboxes
- WikiData increases the quality and lowers the maintenance costs of Wikipedia and related projects



# Wikidata and DBpedia

- Wikidata and DBpedia are the two structured representations of Wikipedia
- Wikidata: initially populated from Wikipedia, manually curated, will master structured data for Wikipedia. Synchronized through an assortment of bots
  - Data is fairly accurate but data depth is still small
- DBpedia: automatically extracted from Wikipedia, live update, one-way extraction only.
  - Data reach is deep, but there are many problems in ontology and individual mappings, especially for non-English. E.g. United Nations is extracted as "Country". See [DBpedia Ontology and Mapping Problems](#).

# Wikidata Multilingual Coverage

- Wikidata/DBpedia has huge multilingual coverage
  - Each entity is represented in 2.11 Wikipedias on average
  - But popular entities are present in many more (up to 180); and even in one Wikipedia there are many languages
  - E.g. Lucas Cranach (German Renaissance Painter) in Wikidata: 57 lang tags, representing 44 languages and 13 language variants