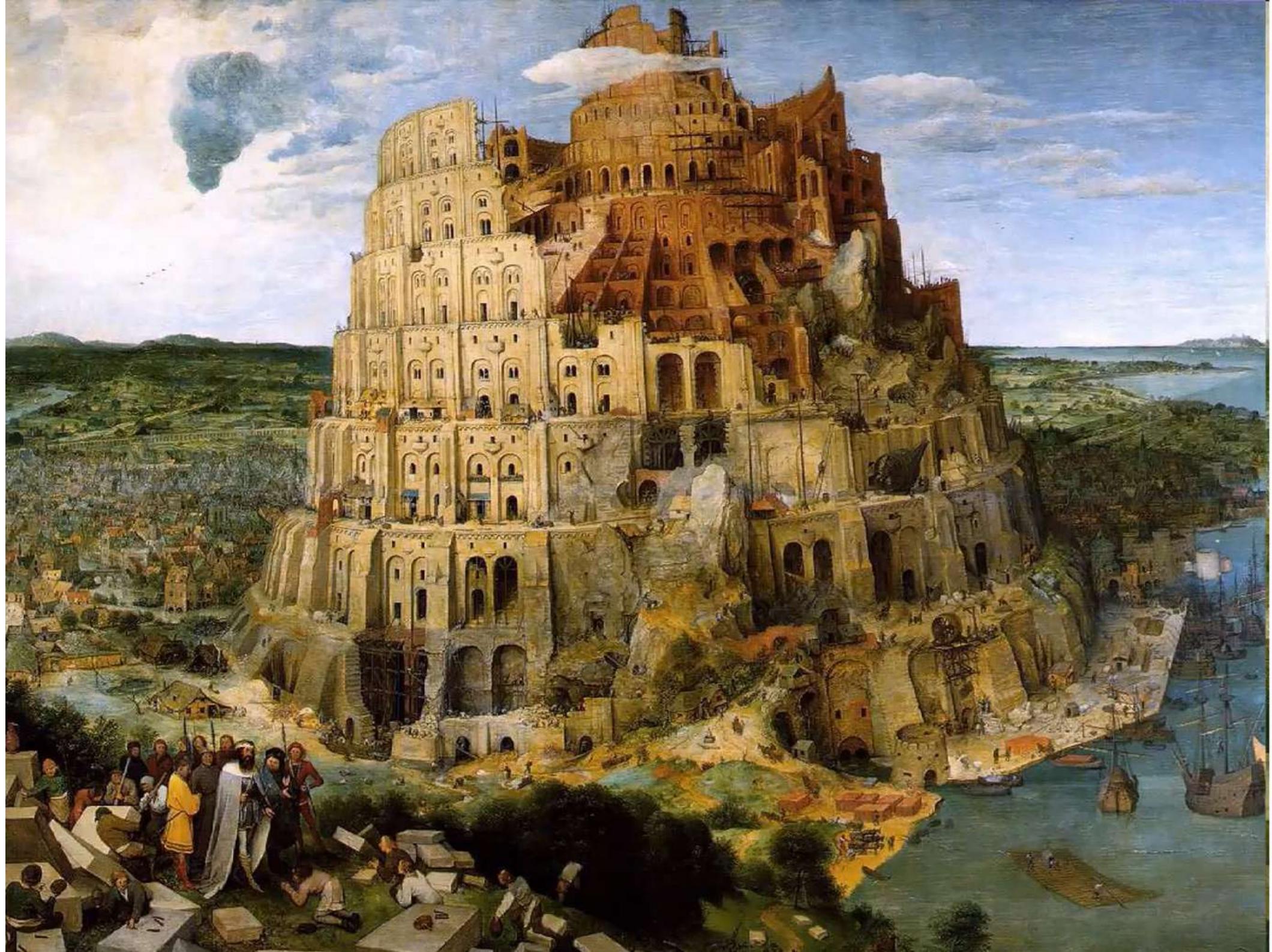


The real power of the Web?

- ◆ To be distributed
- ◆ → its potential is all about
aggregation of informative resources







**Massachusetts
Institute of
Technology**



The Babel Tower of the Web...

- ◆ “Send a rose to my girlfriend”



Babel Tower...

◆ <html>

...

Box of Roses ...

price: 15 dollars

...

Babel Tower...

◆<HTML>...

From editor The Dark Rose...

... price 7.50 dollars, the book "The Art
of Masochism"... (!!)



The Semantic Web

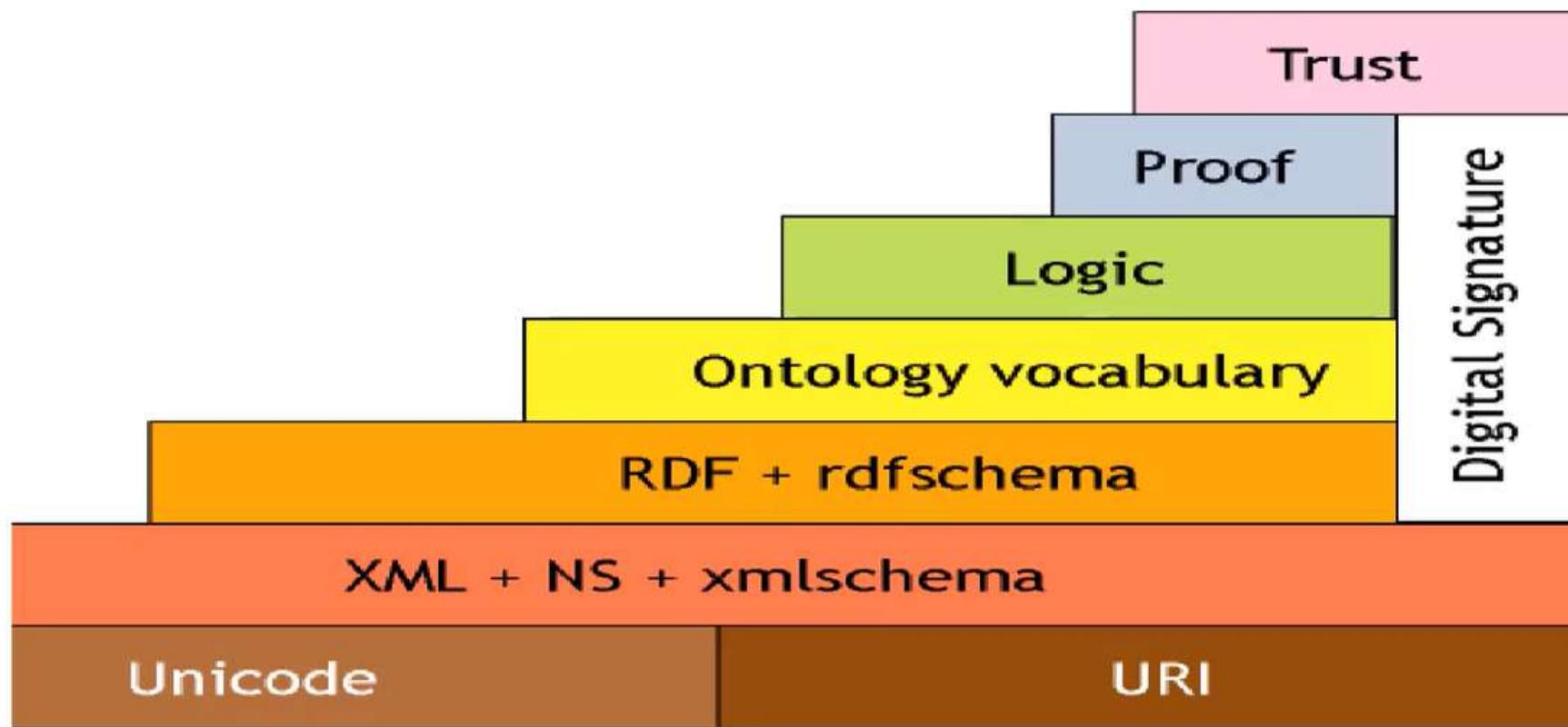


- ◆ Tries to facilitate automatic aggregation of information...
- ◆ ... and even more, try to enable ***automatic reasoning*** on such information

How?

- ◆ Adding... “semantics” (meaning) in the appropriate way, so to enable information understanding and reuse

The Semantic Web Tower ("classic" version)



Base technology: RDF



- ◆ **Resource Description Framework:** Framework to describe resources
- ◆ The milestone of the “Web2”: a universal language to express information on the web and beyond
- ◆ It describes relationships and concepts

The RDF model

- ◆ Technically, an “enriched entity-relationship” knowledge model
- ◆ Base grammar:
- ◆ A “sentence” is made by:
subject predicate object

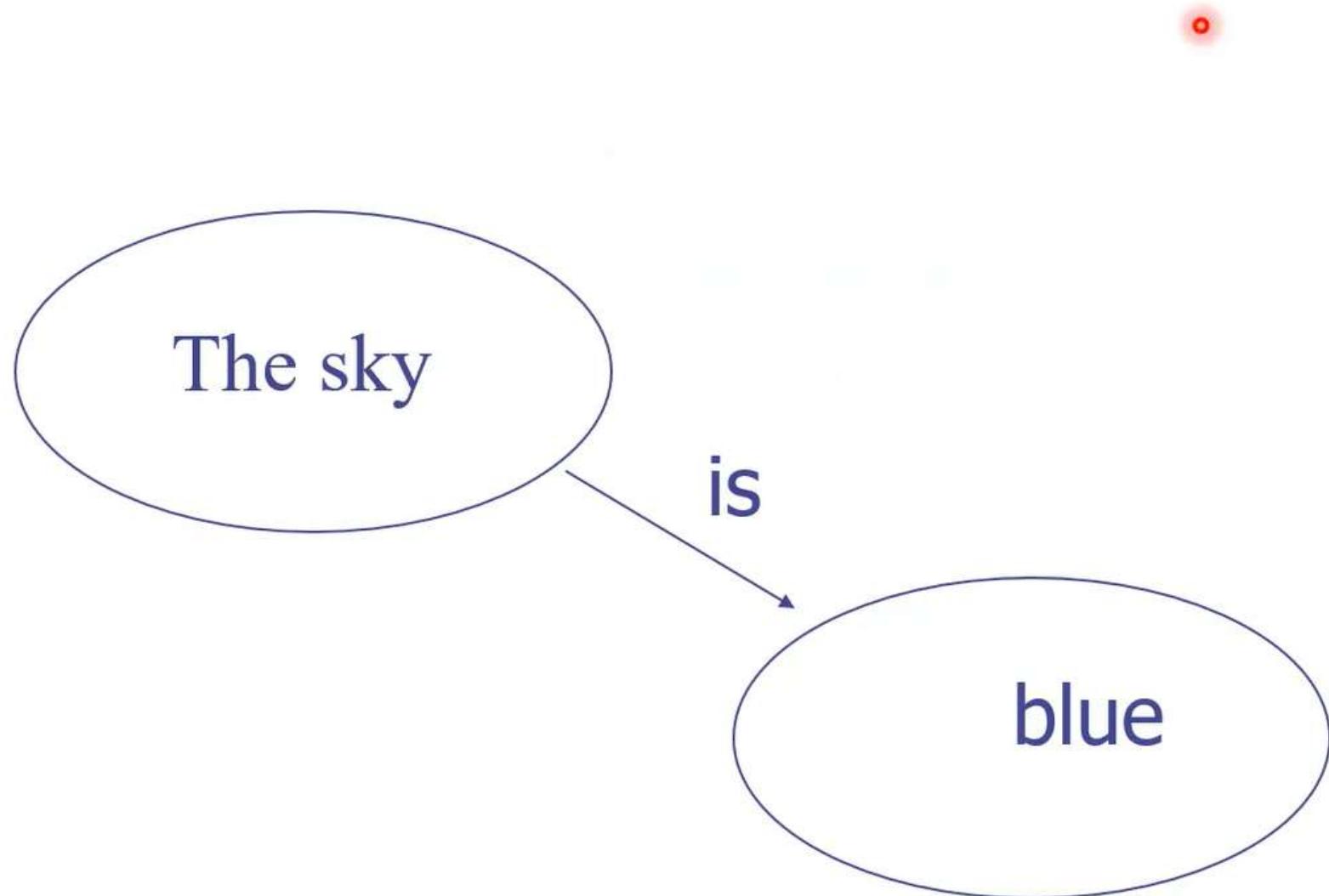


The RDF model

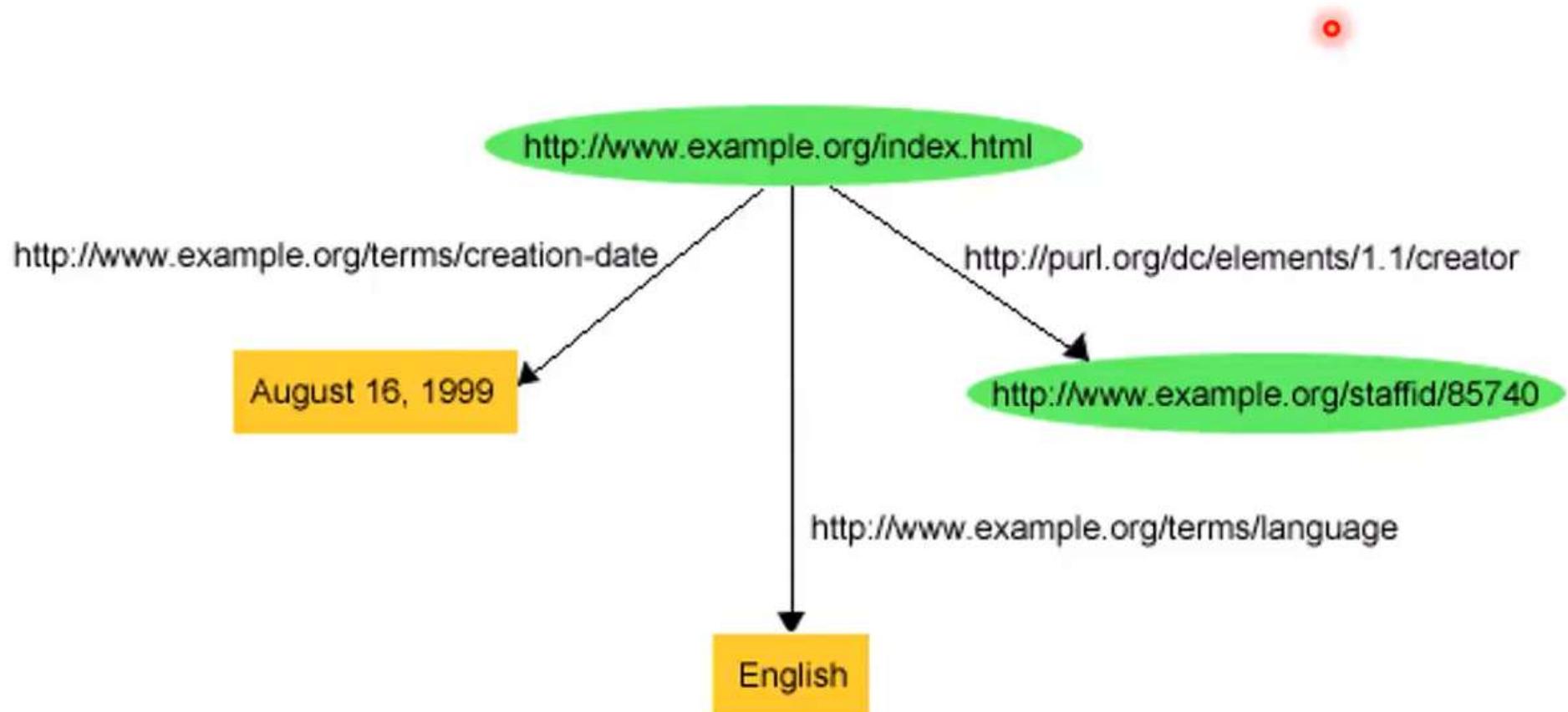
- ◆ Essentially, this is the backbone of RDF..
- ◆ With more power ("enriched"):
referencing, quoting, bags etc etc



RDF as a graph



RDF as graph...



Writing RDF?

- ◆ Many possibilities! Remember RDF is a model, that can then be written in various ways!
- ◆ Two most used ways:
 - ◆ As XML (specific dialect)
 - ◆ As N-triples

As XML...

- ◆ <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:exterm="http://www.example.org/terms">
 <rdf:Description
 rdf:about="http://www.example.org/index.html">
 <exterm:creation-date>August 16, 1999
 </exterm:creation-date> </rdf:Description>
 <rdf:Description
 rdf:about="http://www.example.org/index.html">
 <exterm:language>English</exterm:language>
 </rdf:Description>
</rdf:RDF>

N-triples

- ◆ Subject predicate object.
Subject predicate object.

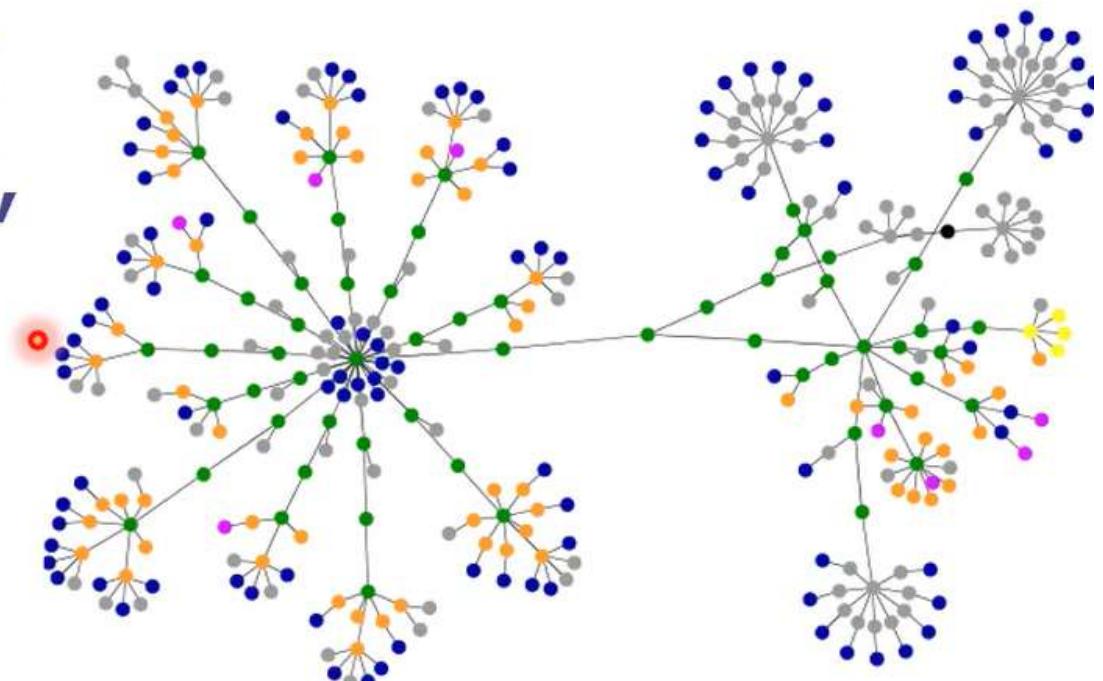
...

N-triple example

- ◆ <<http://www.example.org/index.html>>
<<http://purl.org/dc/elements/1.1/creator>>
<<http://www.example.org/staffid/85740>>.
<<http://www.example.org/index.html>>
<<http://www.example.org/terms/creation-date>> "August 16, 1999" .
<<http://www.example.org/index.html>>
<<http://www.example.org/terms/language>>
> "English" .

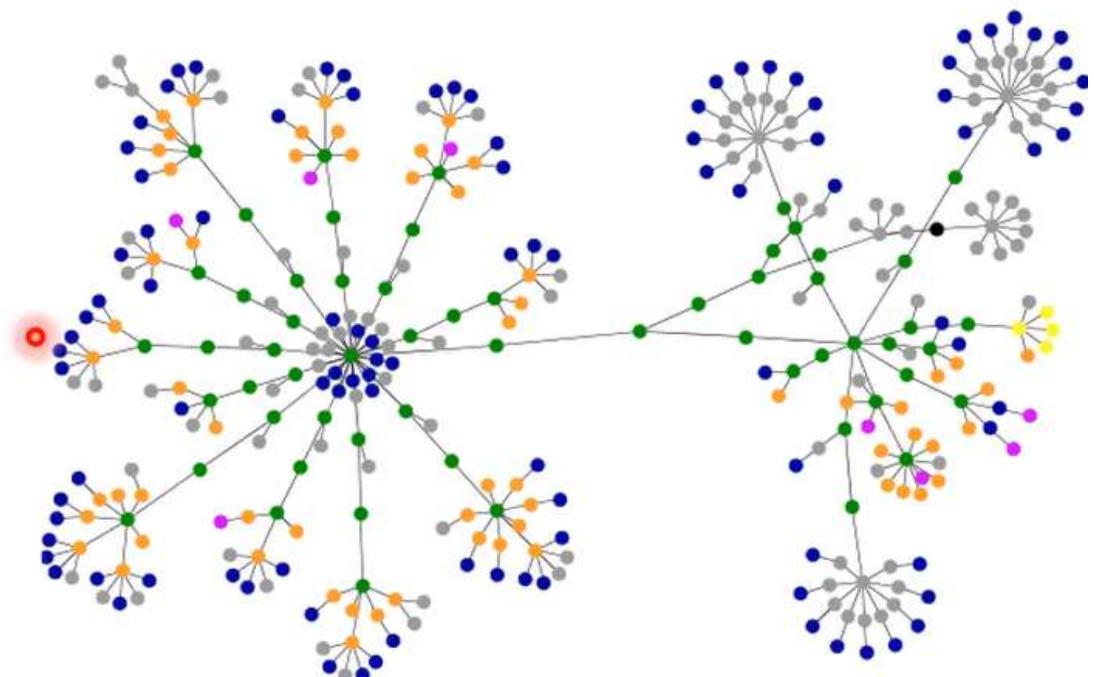
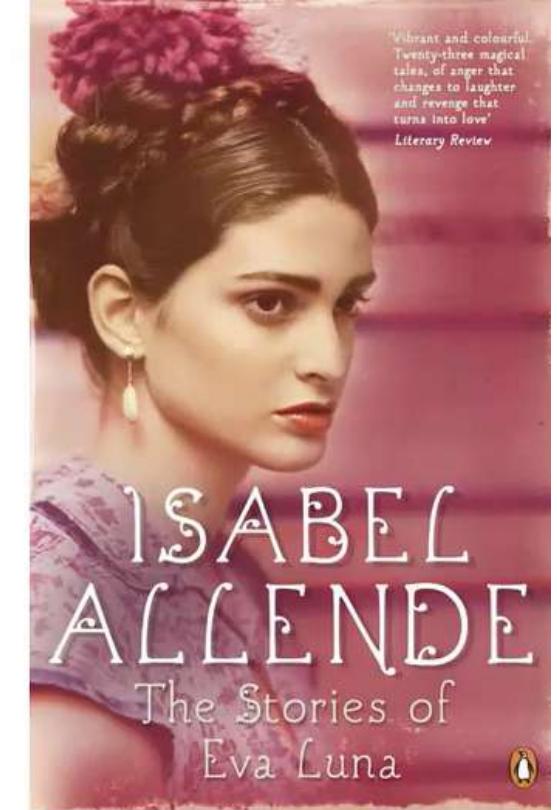
RDF and aggregation

- ◆ RDF enables easy aggregation of information sources
- ◆ Because essentially, merging graphs (a forest) gives again graphs
- ◆ The graphs doesn't always stay distinct, but they can melt together...



Melting? How?

◆ Via URLs (URIs),
the names of the web!

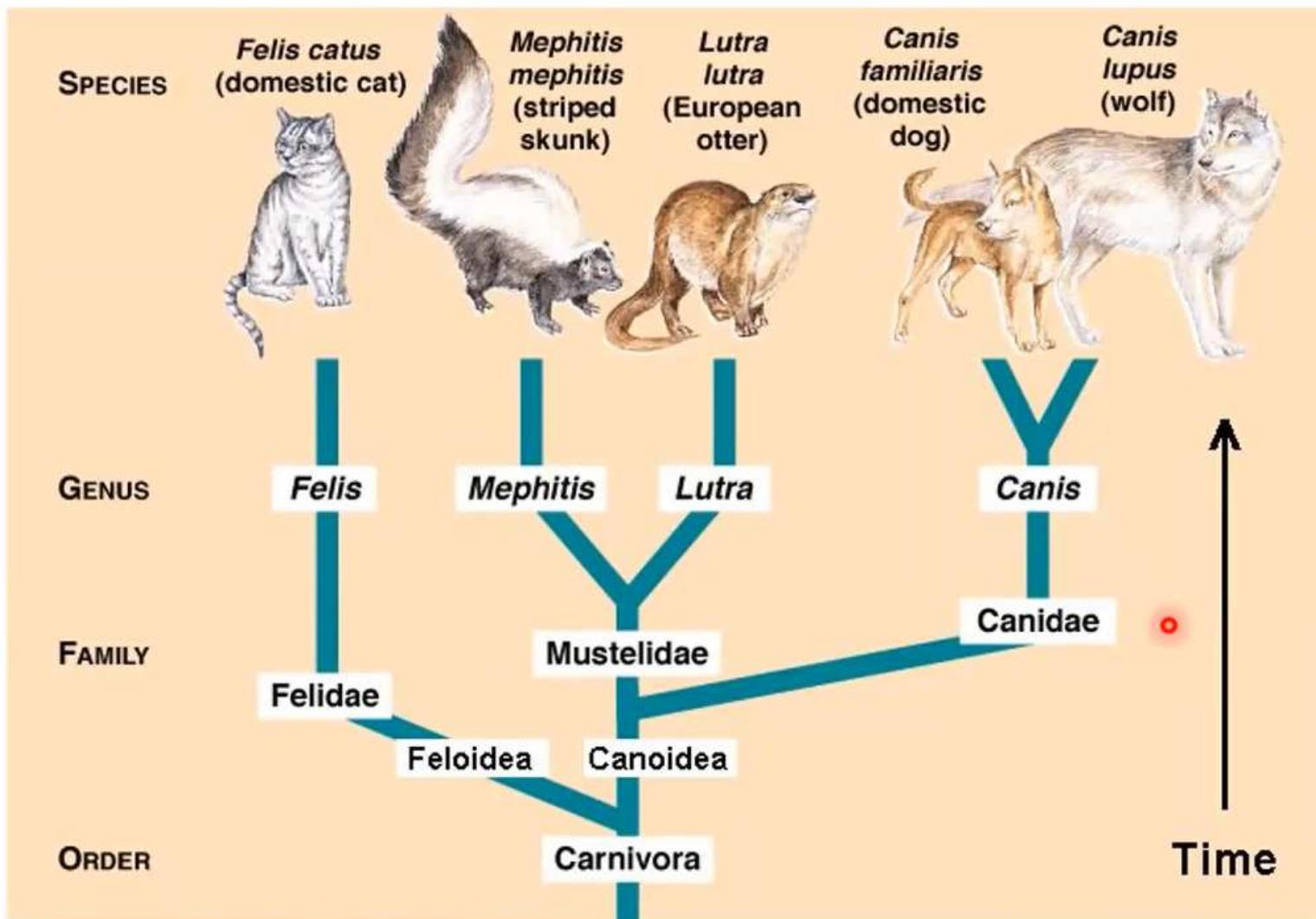


Is RDF enough...?

- ◆ No (as we saw in the Semantic Web Tower...)
- ◆ RDF gives the basic layer (basic model and merging for aggregation), then to do more we need more

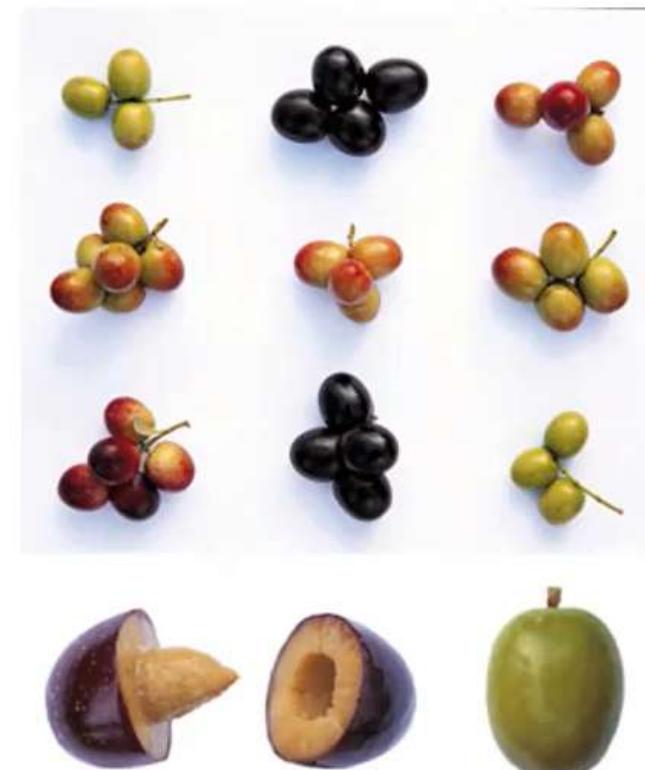
What do we want as a minimum?

- ◆ To *classify* information



Ontologies

- ◆ Systems for information classification
- ◆ Information of “type X”, where here “type” is a ***semantic type***



Types

- ◆ Classic “type” in computer science: the datatype
- ◆ Examples: integers, strings, URIs etc
- ◆ They give information on the *syntactic format* of the object



Types (cont.)

- ◆ Semantic type → they provide the meaning of the objects
- ◆ They are more general, because they abstract from the syntactical representation



Examples

- ◆ P2P (Peer to Peer): e.g., Kazaa, Bearshare, Gnutella
- ◆ MP3 songs exchange
- ◆ **RIIA** (Recording Industry Association of America)...
- ◆ and the Usher case....(part 2)

Usher - Yeah! (Official Video) ft. X +

https://www.youtube.com/watch?v=GxBSyx85Kp8

usher

YouTube

Search

SIGN IN

The video player displays a scene from the 'Yeah!' music video. Usher is in the center, wearing a dark shirt and jeans, surrounded by a crowd of people dancing in a dimly lit club setting with blue stage lights. A 'vevo' logo is visible in the bottom right corner of the video frame. The video progress bar shows 0:23 / 4:12.

#Usher #Yeah #LilJon

Usher - Yeah! (Official Video) ft. Lil Jon, Ludacris

615,526,043 views • Apr 17, 2015

4M DISLIKE SHARE SAVE ...

Usher - Love in This Club (Official Music Video) ft. Youn...
Usher 6:15
186M views • 12 years ago

Mix - Usher - Yeah! (Official Video) ft. Lil Jon, Ludacris
YouTube

Beast Mode Hip Hop
YouTube Music
Updated today

Akon - Smack That (Official Music Video)
Akon 4:12
829M views • 11 years ago

PIT BULL - HIP HOP 2021 - Greatest Hits - New Album...
Happy Songs Playlist 1:53:02
2M views • 5 months ago

Best Romantic Songs Ed Sheeran, Lady Gaga, Maroon 5...
Happy Songs Playlist 3:34:38
3.1M views • 1 month ago

Deep Emotions 2021 | Deep House • Nu Disco • Chill Hous...
Black MixTape 2:48:53
7M views • 5 months ago

YouTube IT

Search

Usher - Love in This Club (Official Music Video) ft. Yo... Play

The Chromatics - Swift - VLC media player

Manage

File

Media Playback Audio Video Subtitle Tools View Help

Pin to Quick Access

00:05 -02:39

OneDrive - Personal

This PC

Network

0:23 / 4:12

#Usher #Yeah #LilJon

Usher - Yeah! (Official Video) ft. Lil Jon

615,526,043 views • Apr 17, 2015

4M DISLIKE SHARE SAVE ...

House • Nu Disco • Chill Hous...
Black MixTape 7M views • 5 months ago

3 items 1 item selected 2.04 KB

Properties Open Select all
Edit Select none
History Invert selection

Open Search usher-part2

Type Size

File folder Text Document 2 KB

Shortcut 3 KB

Search usher-part2

0:48:53

https://www.youtube.com/watch?v=GxBSyx85Kp8

Usher - Yeah! (Official Video) ft. Lil Jon

https://www.youtube.com/watch?v=GxBSyx85Kp8

Search usher

SIGN IN

KARAOKEtxt - Notepad

We know that gamma ray explosions happen randomly all over the sky
(It's like a lottery: a ticket for each square degree)
You see a FLASH! and then there's not another till about a day has gone by
(But that depends upon detector sensitivity)
In just a moment they spew energy worth (That's pretty fast)
A value we can't even fathom on Earth (It's really vast!)
But just what's giving rise to gamma ray sparked skies?
Is it the death cry of a massive star or black hole birth?
(Or both, or both? or both!)

Swiftly swirling, gravity twirling
Neutron stars about to collide
Off in a galaxy so far away
Catastrophic interplay
A roller coaster gamma ray ride
Superbright explosion then
Never to repeat again
How are we supposed to know?
How about a telescope rotation
Swiftly onto the location
Of its panchromatic afterglow?

In just a moment gamma ray bursts reach a peak and swiftly fade from view
(It's like a beacon shining clear across the Universe)
But they leave embers in the longer wavelengths fading for a day or two
(It's exponential -- it decays forever)

#Usher #Yeah #LilJon

Usher - Yeah! (Official Video) ft. Lil Jon

3 items 1 item selected 1.97 KB

4M DISLIKE SHARE SAVE ...

615,526,043 views • Apr 17, 2015

House • Nu Disco • Chill Hous...

Black MixTape

7M views • 5 months ago

2:48:53

Usher - Yeah! (Official Video) ft. Lil Jon

Mute Start Video Security Participants Chat Polls New Share Pause Share Annotate

https://www.youtube.com/watch?v=GxBSyx85Kp8

You are screen sharing

Stop Share

YouTube

KAROKE.txt - Notepad

File Edit Format View Help

File Home Share View

Clipboard Organise New

Pin to Quick access Copy Paste Cut Copy path Move to Copy to Delete Rename New item Easy access Properties Open Select all

Copy shortcut Paste shortcut

Search Ast

UNIPD > WIM-partial > lezioni > lezione11 > usher-part2 > Ast

Search Ast

Quick access

- MM
- DATA (D:)
- Desktop
- Documents
- Pictures
- Installed
- Downloads

AstroCappella Swift Song_files
Official NASA Swift Home Page_files
USHER2
AstroCappella Swift Song.htm
big-bang.jpg
dawnoftime1.jpg
Official NASA Swift Home Page.htm
politechbot_com and RIAA.htm

Date modified

Type

Size

OneDrive - Personal

This PC

Network

#Usher #Yeah #LilJon

Usher - Yeah! (Official Video) ft. Lil Jon

615,526,043 views • Apr 17, 2015

4M DISLIKE SHARE SAVE ...

House • Nu Disco • Chill Hous...

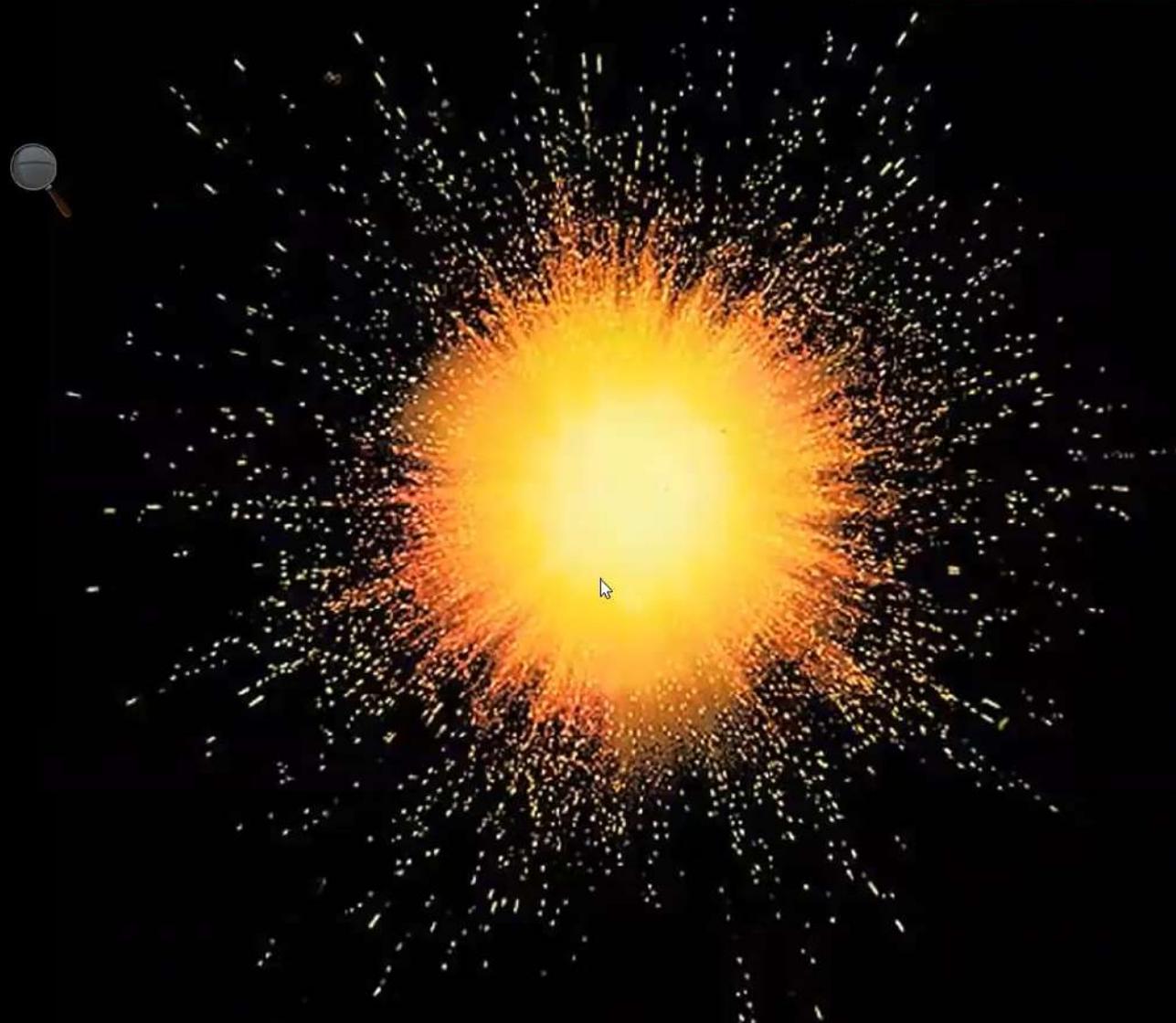
Black MixTape

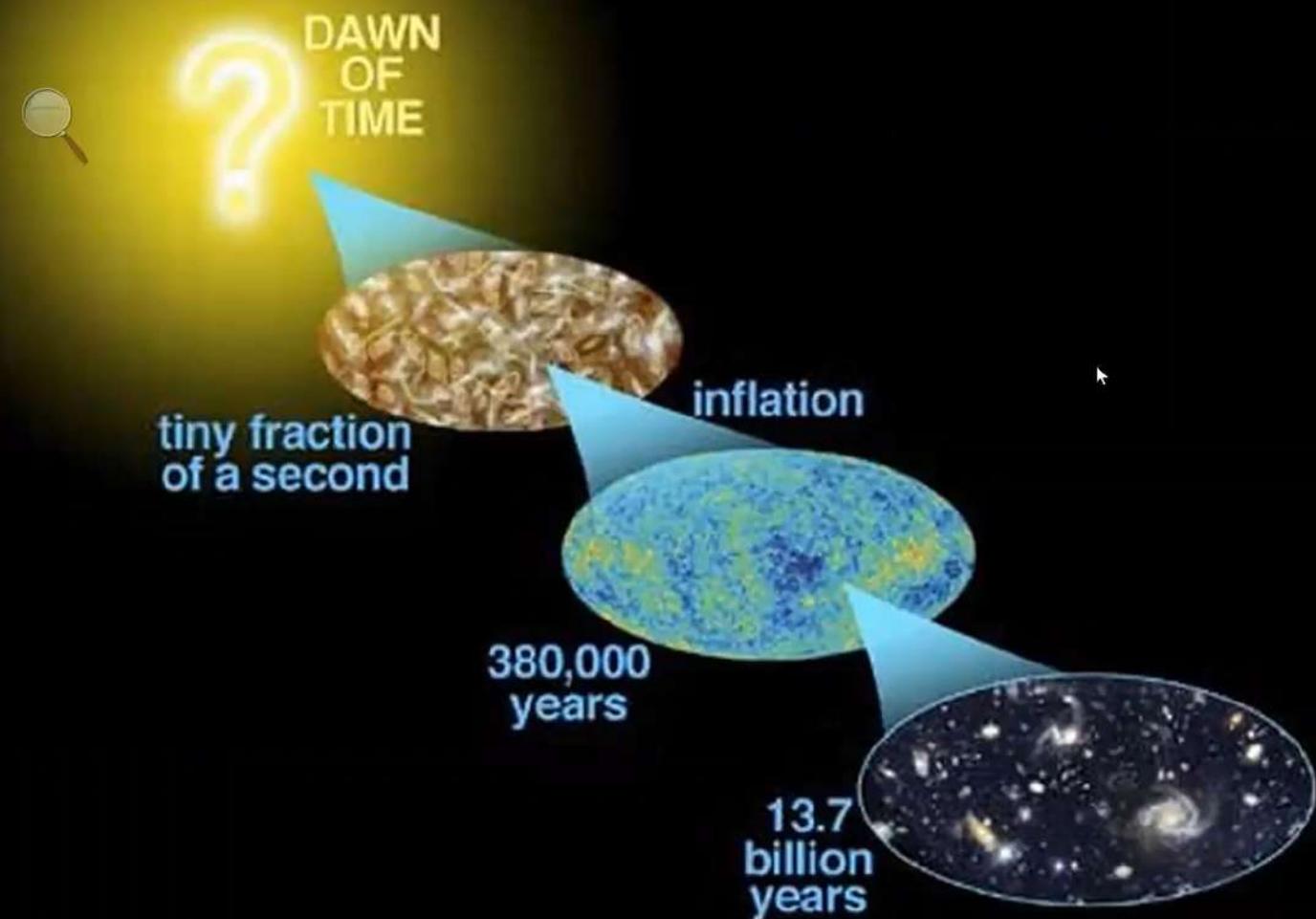
7M views • 5 months ago

You are screen sharing



Stop Share







Swift Song

[Hear the song \(MP3\)](#)

by Padi Boyd

[Song
Lyrics](#)[Activities/
Lessons](#)[Background
Information](#)[Multimedia](#)[Credits](#)

We know that gamma ray explosions happen randomly all over the sky
(It's like a lottery: a ticket for each square degree)
You see a FLASH! and then there's not another till about a day has gone by
(But that depends upon detector sensitivity)
In just a moment they spew energy worth (That's pretty fast)
A value we can't even fathom on Earth (It's really vast!)
But just what's giving rise to gamma ray sparked skies?
Is it the death cry of a massive star or black hole birth?
(Or both, or both? or both!)

Chorus:
Swiftly swirling, gravity twirling
Neutron stars about to collide
Off in a galaxy so far away
Catastrophic interplay
A roller coaster gamma ray ride
Superbright explosion then
Never to repeat again
How are we supposed to know?
How about a telescope rotation
Swiftly onto the location
Of its panchromatic afterglow?

In just a moment gamma ray bursts reach a peak and swiftly fade from view
(It's like a beacon shining clear across the Universe)
But they leave embers in the longer wavelengths fading for a day or two
(It's exponential -- it decays forever)
To solve this space age mystery is why (We wanna know)
We want to catch a thousand bursts on the fly (What makes'em go?)
Their X-ray light disperse unlock the Universe
Measure their distance from their redshift mark their spot on the sky
(They're where? They're here! They're there! They're everywhere!)

(Chorus)

Swiftly swirling, gravity twirling
Neutron stars about to collide
Off in a galaxy so far away
Catastrophic interplay
A roller coaster gamma ray ride
Superbright explosion then
Never to repeat again
How are we supposed to know?
Swift is the satellite that swings
Onto those brightly bursting things
To grab the multiwavelength answer to what makes them glow

It's like a lottery - a ticket for each square degree
It's like a beacon shining clear across the Universe
Swift is the satellite that swiftly swings all over the sky
Swift is designed to catch a burst of gamma rays on the fly

Usher - Yeah! (Official Video) ft. X AstroCappella: Swift Song X +

Mute Start Video Security Participants Chat Polls New Share Pause Share Annotate More

file:///D/MM/UNIPD/WIM-partial/lezioni/lezione11/usher-part2/Ast/AstroCappella Swift Song.htm You are screen sharing Stop Share

Swift Song [Hear the song \(MP3\)](#)

by **Padi Boyd**

We know that gamma ray explosions happen randomly all over the sky
(It's like a lottery: a ticket for each square degree)
You see a FLASH! and then there's not another till about a day has gone by
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Chorus:

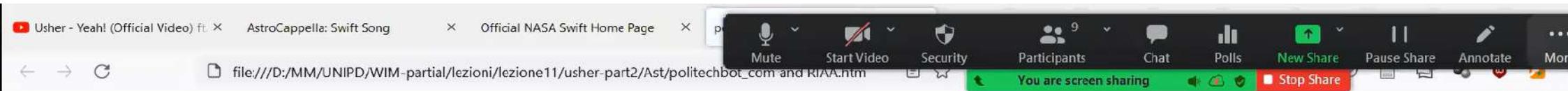
Swiftly swirling, gravity twirling
Neutron stars about to collide
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A roller coaster gamma ray ride
Superbright explosion then
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How are we supposed to know?
How about a telescope rotation
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Of its panchromatic afterglow?

Song Lyrics

Activities/ Lessons

Background information

Multimedia



Declan McCullagh's Politech



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New: Consider [making a donation](#) to Politech!

RIAA apologizes to Penn State for confusing Usher with Prof. Usher

- *Date:* Mon, 12 May 2003 19:26:49 -0400
- *To:* politech@politechbot.com
- *Subject:* FC: RIAA apologizes to Penn State for confusing Usher with Prof. Usher
- *From:* Declan McCullagh <declan@well.com>

The Chromatics song that triggered the RIAA's cease-and-desist letter:
<http://www.astrocappella.com/swift.shtml>

Listen to it here (it's really excellent -- I just ordered the AstroCappella CD):
ftp://ftp.swift.psu.edu/pub/Swift/Documents/swift_song.mp3

-Declan



http://news.com.com/2100-1025_3-1001095.html

RIAA apologizes for threatening letter

By Declan McCullagh
Staff Writer, CNET News.com
May 12, 2003, 3:16 PM PT

WASHINGTON--The Recording Industry Association of America apologized Monday to Penn State University for sending an incorrect legal notice of alleged Internet copyright violations.

The notice and subsequent apology appears to be the first time a faulty incorrect notification has been made public. The incident also shows just how easily automated programs that search for copyrighted material can be

A screenshot of a video conferencing interface, likely from a platform like Zoom or Google Meet. At the top, there are several tabs: "Usher - Yeah! (Official Video)", "AstroCappella: Swift Song", "Official NASA Swift Home Page", and a local file tab. The local file tab shows the path "file:///D/MM/UNIPD/WIM-partial/lezioni/lezione11/usher-part2/Ast/politechbot_com and RIAA.htm". The main interface includes a toolbar with "Mute", "Start Video", "Security", "Participants" (showing 9 people), "Chat", "Polls", "New Share" (highlighted in green), "Pause Share", "Annotate", and "More". A status bar at the bottom indicates "You are screen sharing".

Usher - Yeah! (Official Video) X AstroCappella: Swift Song X Official NASA Swift Home Page X file:///D/MM/UNIPD/WIM-partial/lezioni/lezione11/usher-part2/Ast/politechbot_com and RIAA.htm

Mute Start Video Security Participants Chat Polls New Share Pause Share Annotate More

You are screen sharing Stop Share

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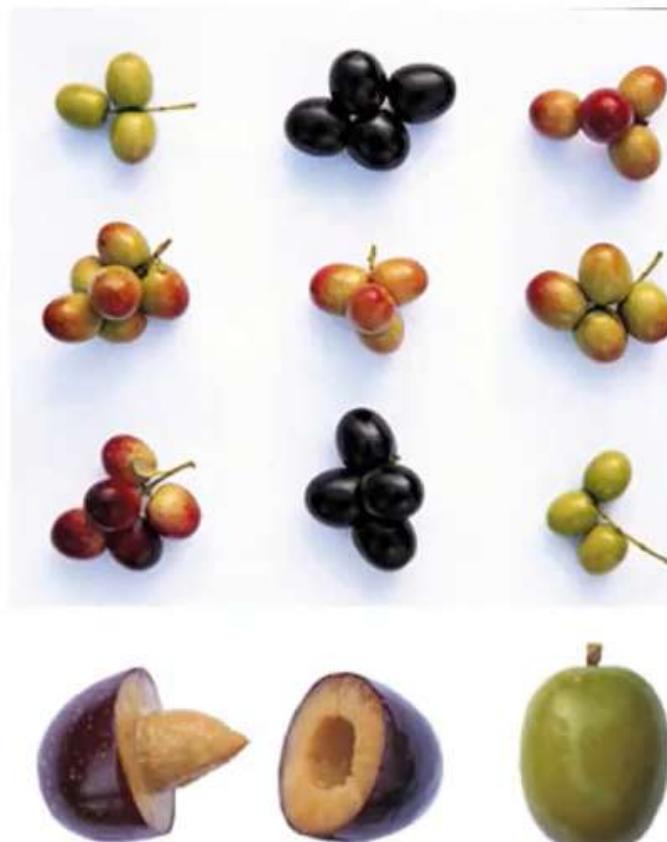
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So...

- ◆ Syntactic type (datatype):
- ◆ “Usher” is of ***string*** type
- ◆ Semantic type:
- ◆ “Usher” is a ***singer*** type



The semantic types...



- ◆ ... are more commonly called ***classes***
- ◆ So, an ***ontology*** is basically composed by a ***collection of classes***. Each classe can contain objects, and so these objects ***belong*** to a class



Example

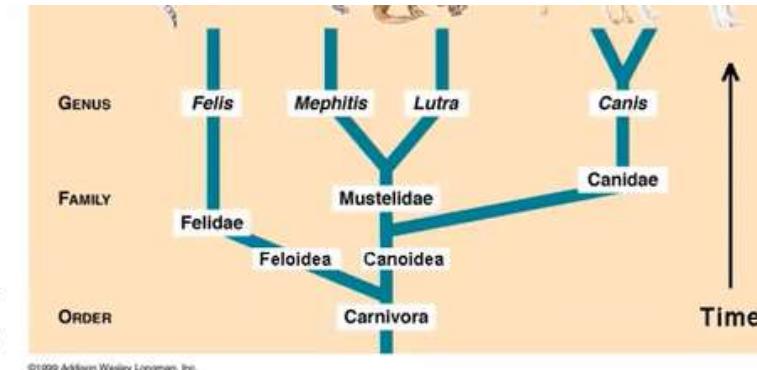


- ◆ Wine ontology:
- ◆ Red wines, white wines, pink wines, Merlot, Cabernet, Chardonnay etc...
- ◆ The class “red wines” can contain the objects “Merlot bottle from 1999”, “Cabernet bottle” and so on.



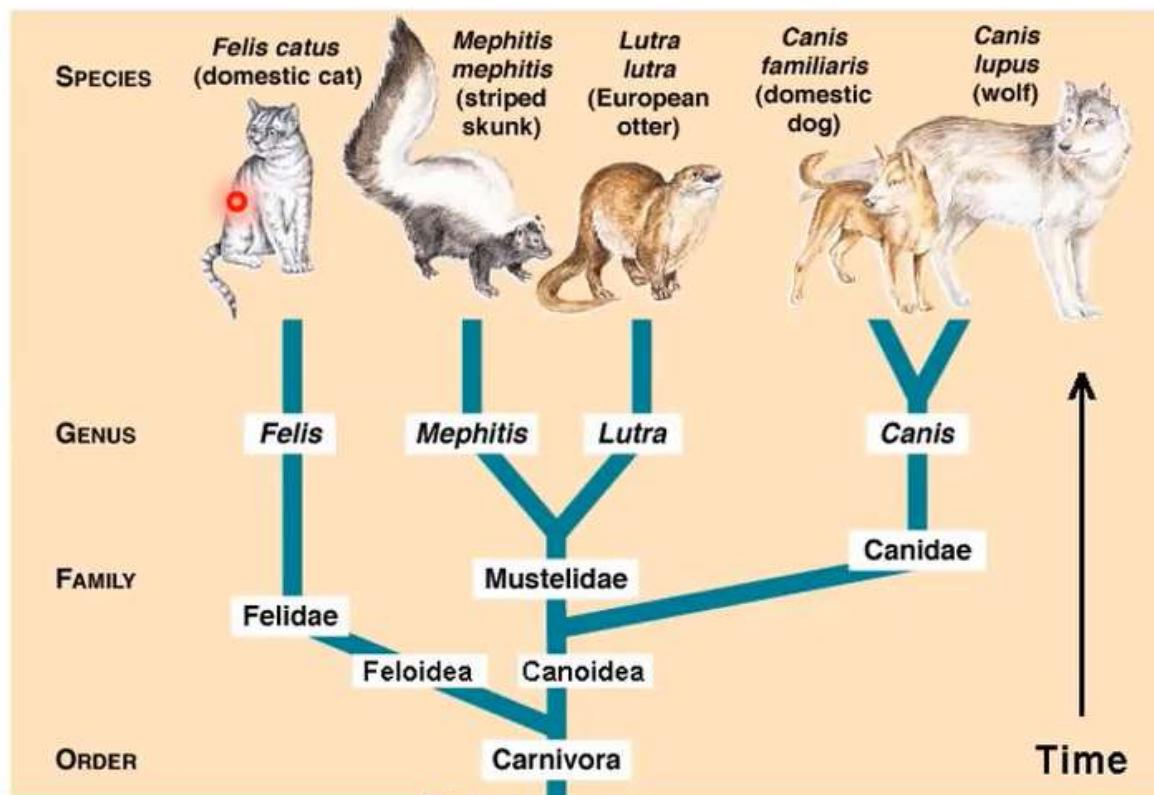
Structure

- ◆ The interesting thing is that an ontology can also have an internal structure (so, not just being a “flat” collection of classes)
- ◆ The easiest structure is the so-called ***hierarchical structure***
 - ◆ → a class can be contained in another class, and so on



So...

❖ In general, the hierarchical structure is provided by a ***containment*** relationship among classes, that can be true or false



More structure = more power



- ◆ For instance, we can now perform information *integrity check*, and also *deductions* (reasoning)

How do we support ontologies in the Semantic Web?



- ◆ Via **RDF Schema**: the standard^o the enriches RDF with the basic support for ontologies management

RDF Schema main features



- ◆ [Class](#)
- ◆ [rdfs:subClassOf](#)
- ◆ [Individual](#)



RDF-Schema (cont.)



- ◆ [rdf:Property](#)
- ◆ [rdfs:subPropertyOf](#)
- ◆ [rdfs:domain](#)
- ◆ [rdfs:range](#)



Example



- ◆ “eat” can be defined as a property
- ◆ Subproperty of the “act” property
- ◆ With domain “animals”
- ◆ And with range “food”

RDF-Schema power level?

- ◆  RDF-Schema provides basic support: what is called the ***taxonomic*** layer
- ◆ Taxonomies are the first step, that can be further enriched
- ◆ For instance, thinking again about the RDF model...

The big advantage of RDF...



- ◆ → reducing almost to zero the complexity of *information aggregation*



But...?



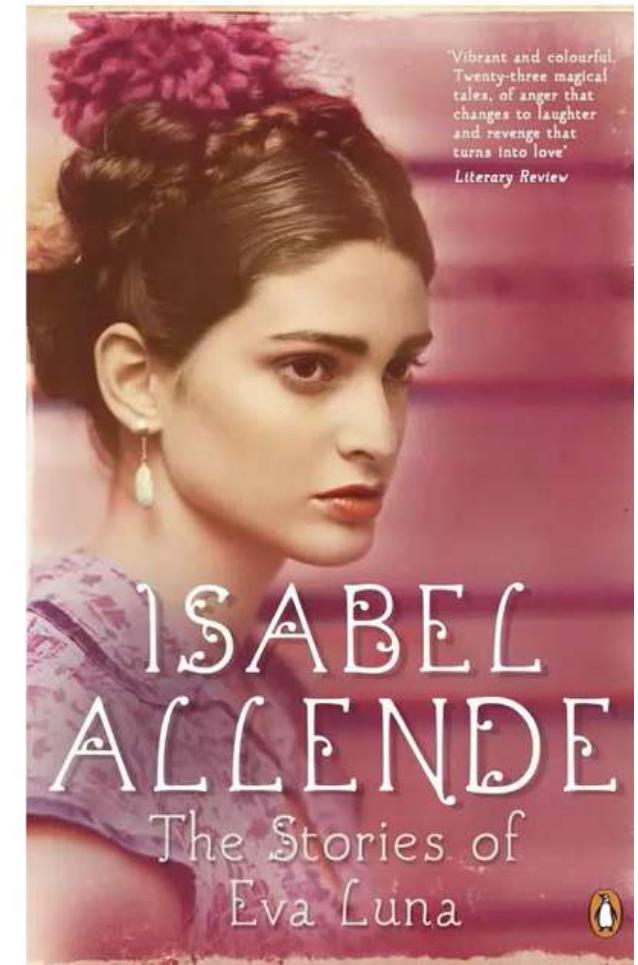
- ◆ How do we properly establish the “connections” among different instances of information?



We said it before, no?



- ◆ Via the URLs (URIs), the names^o of the Web



Tim Berners-Lee...

... and the axioms of Web Architecture



Axiom 0: Universality 1



- ◆ Any resource anywhere can be given a URI



Axiom 0a: Universality 2



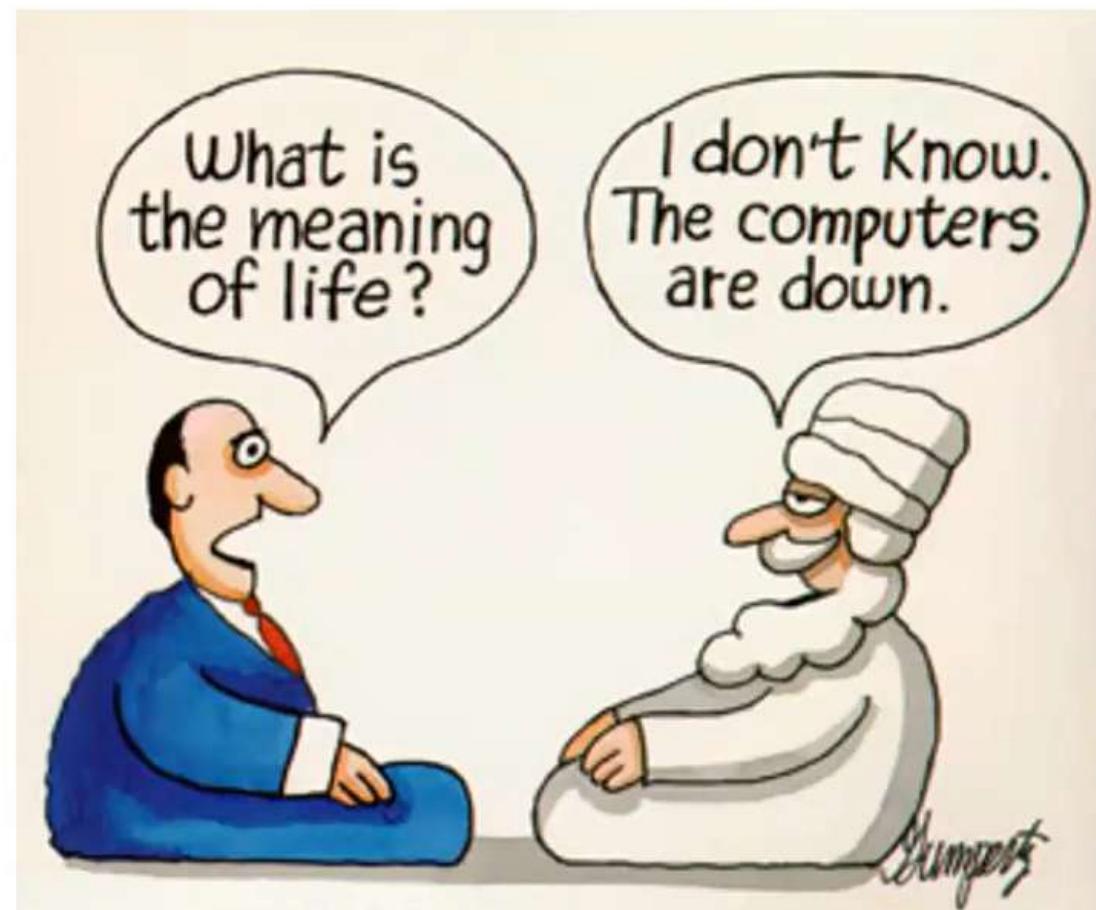
- ◆ Any resource of significance **should** be given a URI



But... the right name?



- ◆ Sometimes it's not so easy to find the right name...

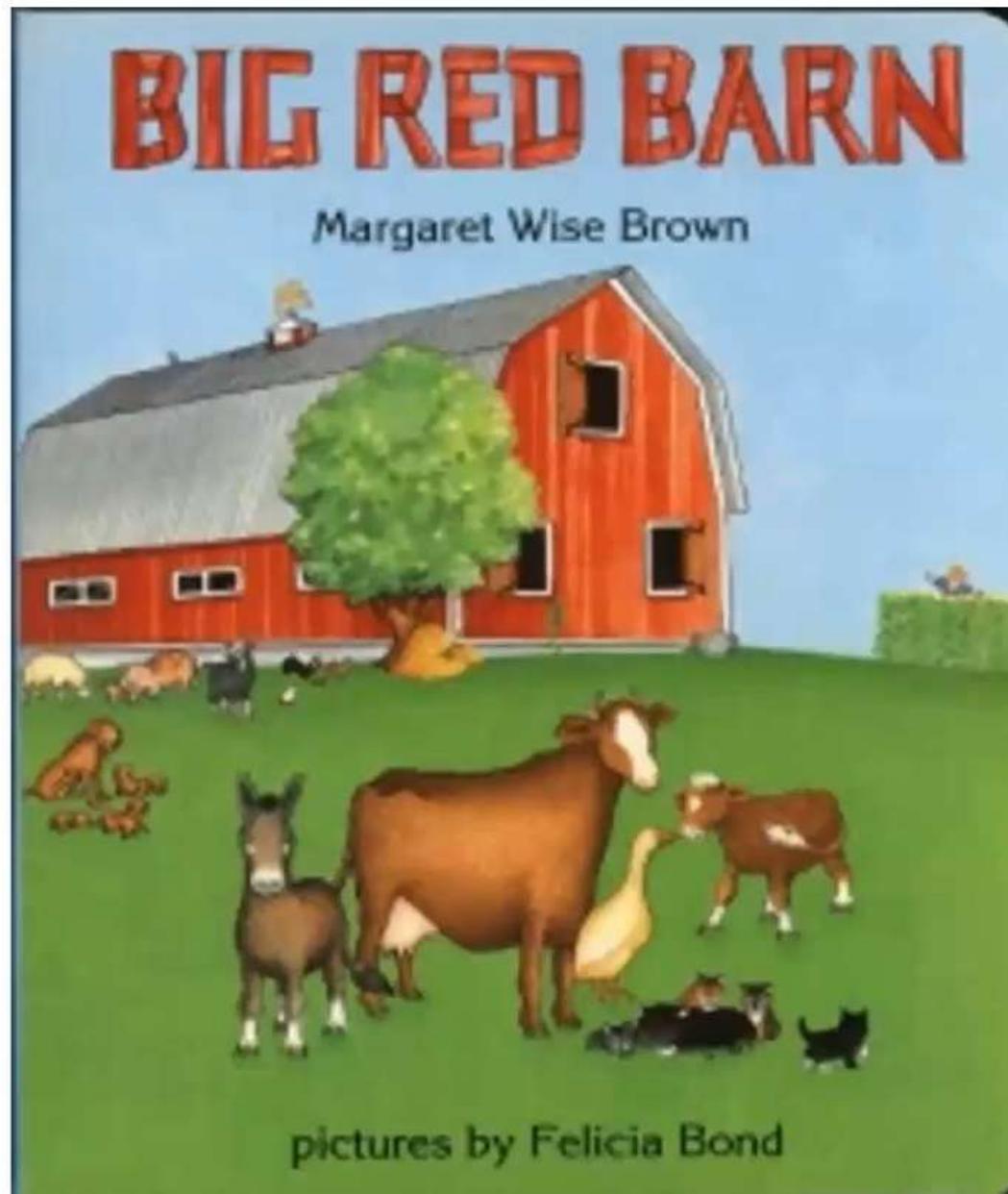


The problems with URIs...



- ◆ Problem: find the right concept^o
- ◆ **URI Variant problem:** in general, there can be many variants (URIs) for the same concept
- ◆ **URI Variant:** usefulness of URIs decreases exponentially with the number of *variants*

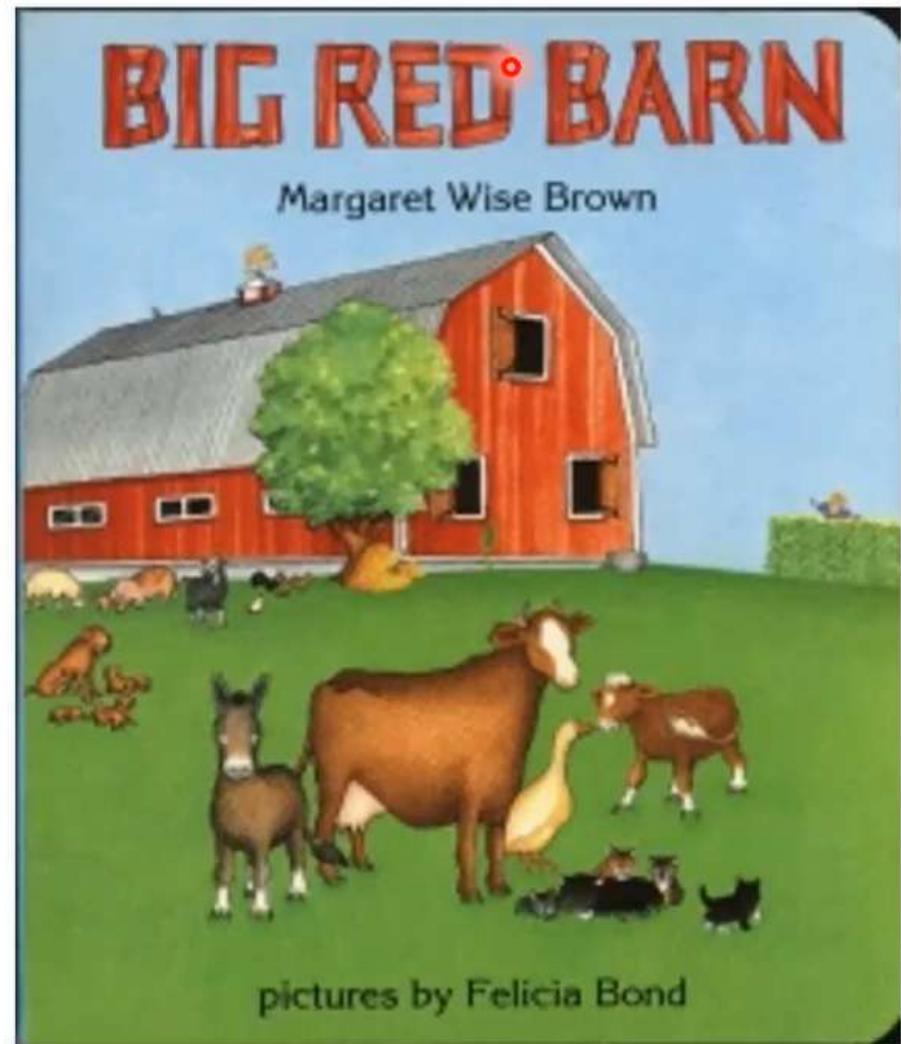
URI Variant: meaning...



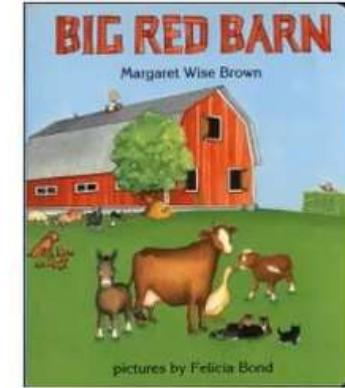
URI meaning problem with an example...



- ◆ [true story]
(Gregorian and Aubrey laying in bed snuggled up together looking at The Big Red Barn book.)



URI meaning

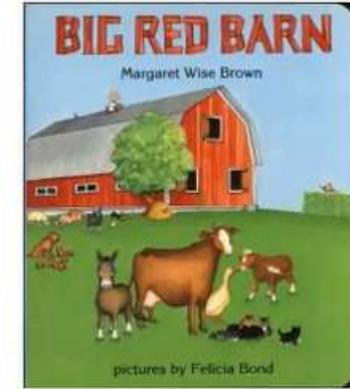


- ◆ Gregorian: (points to a cow) This is^oa cow.
- ◆ Aubrey: No.
- ◆ Gregorian: (points to a cow) *This is a cow*.
- ◆ Aubrey: No.
- ◆ Gregorian: (points to a duck) This is a duck.
- ◆ Aubrey: No.
- ◆ Gregorian: (getting frustrated) It is a duck!

URI meaning



- ◆ Natasha: (trying to smooth things over)
Ah, so it doesn't look like a duck to you
Aubrey...
- ◆ Aubrey: No.
- ◆ Gregorian: What does it look like to you
Aubrey?
- ◆ Aubrey: Book!





Ceci n'est pas une pipe.

Axiom 1: Global scope



- ◆ It doesn't matter to whom or where you specify that URI, it will have the same meaning



More power...

- ◆ The basic support provided by **RDF-Schema** has then been extended, with a specific layer in the “Semantic Web Tower”
- ◆ **OWL**
- ◆ → **Web Ontology Language**

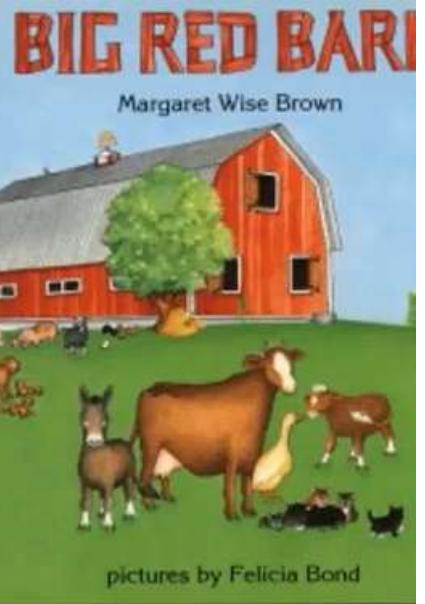


(Dis-)Equality in OWL:



- ◆ [equivalentClass](#)
- ◆ [equivalentProperty](#)
- ◆ [sameIndividualAs](#) (~ sameAs)
- ◆ [differentFrom](#)
- ◆ [allDifferent](#)





So, OWL...



- ◆ ... allows to reduce the problem due to the URI Variant Law, establishing relationship among different ontologies
- ◆ We can map (translate) from ontology to ontology

OWL (cont.)

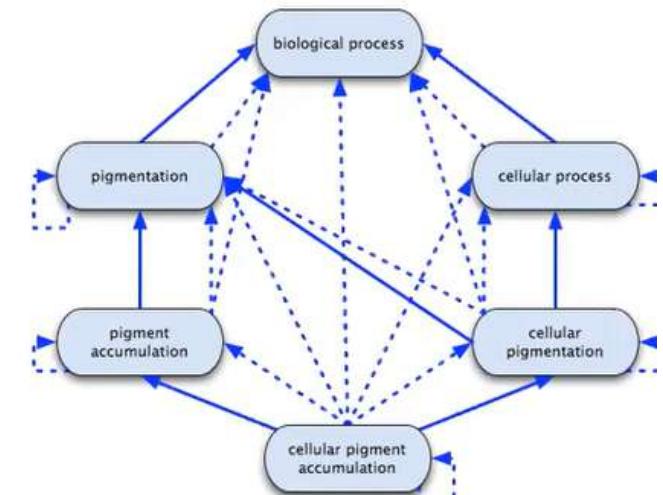


- ◆ Besides the essential concepts related to equality, OWL also adds more functionalities

OWL: More power to express properties



- ◆ [inverseOf](#)
- ◆ [TransitiveProperty](#)
- ◆ [SymmetricProperty](#)
- ◆ [FunctionalProperty](#)
- ◆ [InverseFunctionalProperty](#)



More power to handle property types



- ◆ [allValuesFrom](#)
- ◆ [someValuesFrom](#)
- ◆ [minCardinality](#)
- ◆ [maxCardinality](#)



So, more power...



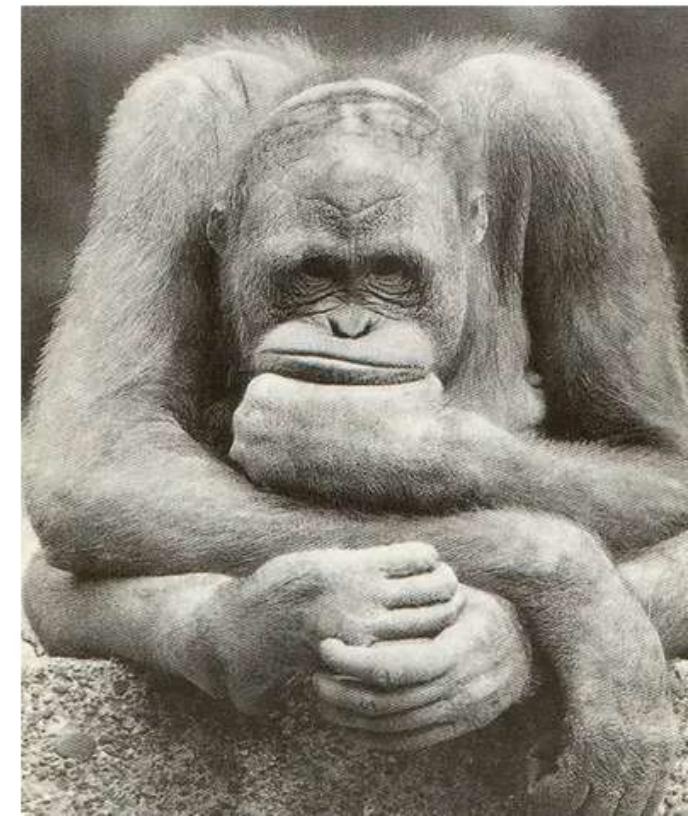
◆ ... more applications!



More power = ??

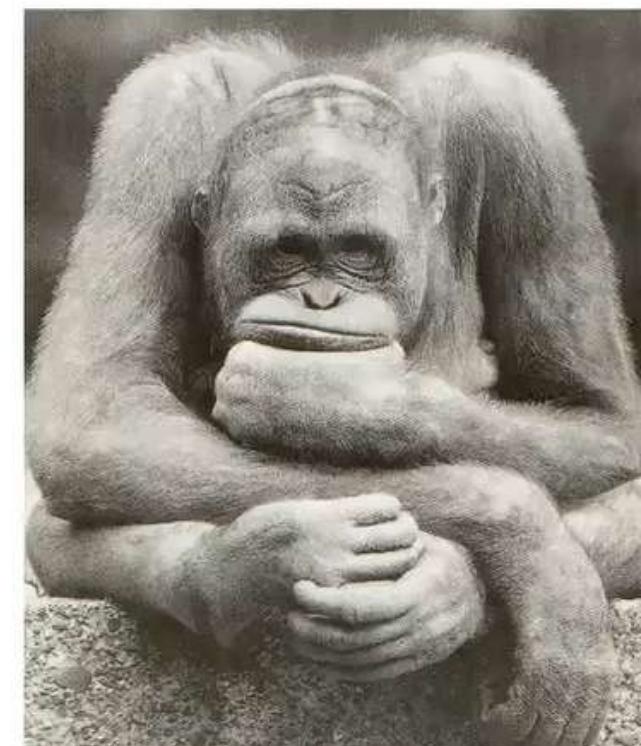


- ◆ It's information, so we would like to reason about it...
- ◆ But *how*?



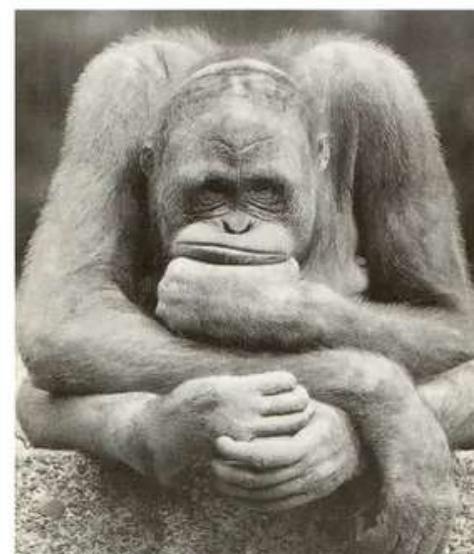
So far...

- ◆ ... we can use relationships and more to define a *logic*. what we would like is then to do automatica calculations
- ◆ → so, having an *executable logic*



But, fact...

- ❖ Already the super-simple first order logic (\forall for all, \exists exists) is not decidable
- ❖ → in computer science terms, it just means the corresponding program might not terminate (!)



And so??



- ◆ Think of other contexts...
- ◆ For instance, databases: **SQL** (!)
- ◆ In its base versions, like SQL-92, every SQL «query» (program...) terminates!
- ◆ So? Why?
- ◆ Well, SQL is not Turing-complete: so it has limited expressive power, but terminates!