

# Thinking Big: Web Scale AI

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Sept 4<sup>th</sup> 2009



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Sept 4<sup>th</sup> 2009

People

- Knowledge in minds
- Transfer by speech, sketches

Texts

- Knowledge in books
- Transfer by visiting libraries, public readings

Texts 2.0

- Knowledge in mass market books, films, newspapers, journals, television, radio
- Transfer by replication, broadcast

Web 1.0

- Knowledge in Web pages, pdf/ps files, passive DBs, some audio
- Transfer by authoring then browsing, searching

Web 2.0

- Knowledge in fluid constructs (wikis, complex evolving DBs/RDF stores, blogs, social network pages) , web services across all media, distributed across many sites.
- Transfer by collaborative construction, active notification, alerts, SMSs, social notification, mash-ups ...

Web 3.0

- Knowledge understood by the web (KBs, probabilistic KBs, semantically enhanced texts, DBs, services)
- Transferred by assistive, cooperative software that understands users needs, desires, limitations, and assembles/derives the right knowledge services

Scarce

Abundant

Overwhelming



# Human knowledge evolution



**Valve Surgery**

Search

## Semantic Search Results

## Intelligent Search

### Semantic Search Results

#### [A. Marc Gillinov, M.D.](#)

A. Marc Gillinov, M.D. Specialties: Minimally invasive mitral valve, aortic valve, and tricuspid valve surgery; mitral **valve repair**, surgical... Gillinov, M.D. has performed 125 **heart-valve repair** operations at [http://tomcat/html-content/gillinov\\_GillinovHeartValveRepair.html](http://tomcat/html-content/gillinov_GillinovHeartValveRepair.html) (cached)

#### [Valve Disease](#)

AV Repair or Replace + Other AV Repair or Replacements AV = Aortic [http://tomcat/html-content/Valve\\_Disease](http://tomcat/html-content/Valve_Disease)

#### [Nicholas G. Smedira, M.D.](#)

Nicholas G. Smedira, M.D. Specialties: Heart replacement, off-pump coronary artery bypass surgery, [http://tomcat/html-content/smedira\\_html](http://tomcat/html-content/smedira_html)

#### [Joseph F. Sabik III, M.D.](#)

Joseph F. Sabik III, M.D. Specialties: Adult cardiac surgery, off-pump coronary artery bypass surgery, [http://tomcat/html-content/sabik\\_html](http://tomcat/html-content/sabik_html) (cached)

#### [Eric E. Roselli, M.D.](#)

Eric E. Roselli, M.D. Specialties: Adult cardiac surgery and replacement, high-risk valve surgery, [http://tomcat/html-content/roselli\\_html](http://tomcat/html-content/roselli_html) (cached)

#### [Gosta B. Pettersson, M.D., Ph.D.](#)

Gosta B. Pettersson, M.D., Ph.D. Specialties: Aortic and mitral **valve repair/replacement**, [http://tomcat/html-content/pettersson\\_html](http://tomcat/html-content/pettersson_html)

#### A. Marc Gillinov, M.D.

**Specialties:** Minimally invasive mitral valve, aortic valve, and tricuspid valve surgery; mitral valve repair, surgical treatment and minimally invasive surgery for atrial fibrillation; off-pump coronary artery bypass surgery; and high-risk mitral valve surgery.

**Medical Degree:** Johns Hopkins University School of Medicine, Baltimore, Maryland

**Special Training:** Johns Hopkins University School of Medicine, Baltimore, Maryland

A native Clevelander, Dr. Gillinov spent the summers of 1978 to 1980 dividing his time between working at Cleveland Clinic and playing tennis. He still enjoys both activities.



Gillinov, M.D. has performed 125 **heart-valve repair** operations at the Cleveland Clinic Foundation since 1998.



This graph, based on a small sample of patient data, is given for demonstration purposes only.

# Content adaptation: heart valve repair



## Intelligent Search

coronary artery

Search

### Semantic Search Results

#### A. Marc Gillinov, M.D.

Gillinov, M.D. has performed 316 **coronary artery** operations at the Cleveland Clinic... invasive mitral valve, **aortic** valve, and tricuspid valve surgery repair, surgical treatment and minimally invasive surgery for atrial fibrillation; off-pump **coronary** artery bypass surgery  
[http://tomcat/html-content/gillinov\\_GillinovCoronaryArtery.html](http://tomcat/html-content/gillinov_GillinovCoronaryArtery.html) (cached)

#### Nicholas G. Smedira, M.D.

and heart-lung transplantation, ventric  
grafting, myectomy, reoperations, and  
[http://tomcat/html-content/smedira\\_h](http://tomcat/html-content/smedira_h)

#### Gosta B. Pettersson, M.D., Ph.D.

Adult acquired heart disease (including  
complex **coronary artery** surgery; aortic  
<http://tomcat/html-content/pettersson>

#### Joseph F. Sabik III, M.D.

Joseph F. Sabik III, M.D. Specialties: A  
surgery, off-pump **coronary** artery byp  
[http://tomcat/html-content/sabik\\_.html](http://tomcat/html-content/sabik_.html)

#### Coronary Disease

Primary isolated CABG refers to a pat  
images... excellent long-term patency  
[http://tomcat/html-content/Coronary\\_D](http://tomcat/html-content/Coronary_D)

#### Bruce W. Lytle, M.D.

Bruce W. Lytle, M.D. Chairman, D  
diseases, reoperations, diseases of th  
[http://tomcat/html-content/lytle\\_.html](http://tomcat/html-content/lytle_.html)

#### A. Marc Gillinov, M.D.

**Specialties:** Minimally invasive mitral valve, aortic valve, and tricuspid valve surgery; mitral valve repair, surgical treatment and minimally invasive surgery for atrial fibrillation; off-pump coronary artery bypass surgery; and high-risk mitral valve surgery.

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Gillinov, M.D. has performed 125 heart valve repair operations at the Cleveland Clinic Foundation since 1998.



This graph, based on a small sample of patient data, is given for demonstration purposes only.

#### A. Marc Gillinov, M.D.

**Specialties:** Minimally invasive mitral valve, aortic valve, and tricuspid valve surgery; mitral valve repair, surgical treatment and minimally invasive surgery for atrial fibrillation; off-pump coronary artery bypass surgery; and high-risk mitral valve surgery.

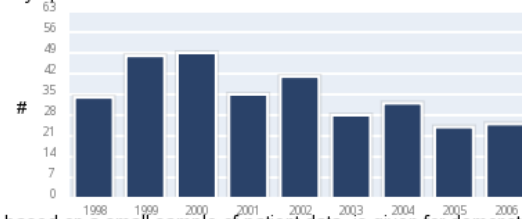
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A native Clevelander, Dr. Gillinov spent the summers of 1978 to 1980 dividing his time between working at Cleveland Clinic and playing tennis. He still enjoys both activities.



Gillinov, M.D. has performed 316 coronary artery operations at the Cleveland Clinic Foundation since 1998.



This graph, based on a small sample of patient data, is given for demonstration purposes only.

# Content adaptation: coronary artery

▼ **Query:** If FAC\_24911 is powered down, what is compromised?

**Answer:** managing personnel data

▼ **Because:**

FILE\_1425 is a physical copy of Personnel Organizer Pro.

Personnel Organizer Pro is a personnel management program.

Personnel management programs are primarily intended to be used to manage personnel data.

FILE\_1425 is installed on INF\_SYS\_1425.

FAC\_24911 is powered down.

INF\_SYS\_1425 is an information system located at the facility FAC\_24911.

▼ **Detailed Justification:**

▼ Managing personnel data is compromised.

▼ FILE\_1425 is incapable of playing the "information used" role in managing personnel data.

▶ **Inaccessible files are incapable of performing their intended functions.**

▶ FILE\_1425 is a physical copy of Personnel Organizer Pro.

▼ Personnel Organizer Pro is capable of playing an "information used" role in managing personnel data.

▶ Personnel Organizer Pro is a personnel management program.

▶ Personnel management programs are capable of playing "information used" roles in managing personnel data.

**45<sup>th</sup>'s Space Wing Hurricane Preparedness**

# The Cyc Analytic Environment

Reasoning-based, question answering

The screenshot displays the Cyc Analytic Environment interface. At the top, there are tabs for 'Task Info', 'Document Search', 'Concepts', and 'Queries'. The 'Queries' tab is active. Below the tabs, there is a search bar containing the text 'Find patients with bacteremia after a pericardial window'. To the right of the search bar are 'Find' and 'Stop' buttons. Below the search bar, the 'Search Results' section is expanded, showing a tree view of the query. The tree view includes 'Find patients with bacteremia after a pericardial window' and 'Simple Questions'. Under 'Simple Questions', there are several lines of text representing the query's structure, such as 'The patient ID for PATIENT is \_\_\_\_', 'PATIENT is the patient involved in \_\_\_\_ and PATIENT is the patient involved in \_\_\_\_', 'PATIENT is the patient involved in \_\_\_\_ and \_\_\_\_ is a pericardial window.', '\_\_\_\_ is a case of bacteremia.', '\_\_\_\_ involves \_\_\_\_', '\_\_\_\_ is after \_\_\_\_', 'PATIENT is the \_\_\_\_ procedure performed on \_\_\_\_', and '\_\_\_\_ contain \_\_\_\_'. A context menu is open over the 'Simple Questions' section, showing options: 'Copy Query Text', 'Open', 'Delete', and 'Combine selected queries'. The 'Combine selected queries' option is highlighted. Below the 'Simple Questions' section, there is a 'Keyword Search' section and a 'CCF Query Library' section. The 'CCF Query Library' section shows a list of queries, including 'CAEUser : Generic Medical Research Task Environment' and 'Search History'. A tooltip is visible over the 'Attempt to combine the two queries' option in the 'CCF Query Library' section.

Task Info Document Search Concepts Queries

Find patients with bacteremia after a pericardial window Find Stop

Search Results

- Find patients with bacteremia after a pericardial window
  - Simple Questions
    - The patient ID for PATIENT is \_\_\_\_.
    - PATIENT is the patient involved in \_\_\_\_ and PATIENT is the patient involved in \_\_\_\_.
    - PATIENT is the patient involved in \_\_\_\_ and \_\_\_\_ is a pericardial window.
    - \_\_\_\_ is a case of bacteremia.
    - \_\_\_\_ involves \_\_\_\_.
    - \_\_\_\_ is after \_\_\_\_.
    - PATIENT is the \_\_\_\_ procedure performed on \_\_\_\_.
    - \_\_\_\_ contain \_\_\_\_.
  - Keyword Search
- CCF Query Library
  - CAEUser : Generic Medical Research Task Environment
  - Search History

Copy Query Text  
Open  
Delete  
Combine selected queries

Attempt to combine the two queries

User-assisted query understanding



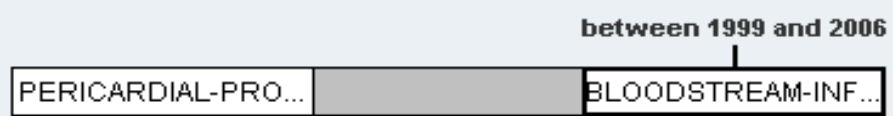
Task Info [X] Document Search [X] Concepts [X] Queries [X]

- Give the values of *BLOODSTREAM-INFECTION*, *ID* and *PERICARDIAL-PROCEDURE* such that:
- All of the following are true
  - The patient ID for *PATIENT* is *ID*.
  - PERICARDIAL-PROCEDURE* is a pericardial window.
  - PATIENT* is the patient involved in *PERICARDIAL-PROCEDURE*.
  - BLOODSTREAM-INFECTION* is a case of bacteremia.
  - PATIENT* is the patient involved in *BLOODSTREAM-INFECTION*.
  - PERICARDIAL-PROCEDURE* is before *BLOODSTREAM-INFECTION*.
  - BLOODSTREAM-INFECTION* happened between 1999 and 2006.

Ask  
Save  
New Tab  
Stop

Palette

BLOODSTREAM-INF...  
PERICARDIAL-PRO...



Context: always Edit...

Results: All Time limit: 600

More...

Answers

Bloodstream infection	Id	Pericardial procedure

Justify Fact Sheet Visualize Visualize All

## Hamas Leader's Son Among 19 Killed in Israeli-Palestinian Conflicts

Tuesday, January 15, 2008

Associated Press

 [E-Mail](#) |  [Print](#) |  [Digg This!](#) |  [del.icio.us](#)

**GAZA CITY, Gaza Strip — Israeli troops killed a son of Gaza's most powerful leader along with 18 other Palestinians on Tuesday in the bloodiest day of fighting in the coastal area since Hamas militants seized control last summer.**

As fighting raged in Gaza, a Hamas sniper shot and killed an Ecuadorean volunteer working in the potato fields of an Israeli border farm. That killing, and Tuesday's high death toll, stoked the flames of violence at a time when Israel and Palestinian moderates are making halting attempts to talk peace.

• [Click here to view photos.](#)

Tuesday's bloodshed began before dawn when Israeli infantry, tanks and helicopters pushed into northern Gaza in what the military said was a routine operation aimed at Palestinian militants who launch rocket barrages at Israeli towns near Gaza almost every day.

Three Palestinian civilians were killed in the ensuing fighting, along with 18 armed militants — one of them Hussam Zahar, 24, the son of hard-line Hamas leader Mahmoud Zahar. The Israelis pulled out Tuesday with no casualties. A later airstrike on militants firing rockets into Israel killed two more Hamas men.

## Hamas Leader's Son Among 19 Killed in Israeli-Palestinian Conflicts

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Mortgage Rates at 4

### Mahmoud Zahar

**Known**

**Teach**

**Followups**

☒ person

☐ Hamas leader

[Click to suggest something else](#)

#### Additional Names

[Click to add another name](#)

cuadorean volunteer working in the  
y's high death toll, stoked the flames of  
making halting attempts to talk peace.

, tanks and helicopters pushed into  
aimed at Palestinian militants who  
y day.

ong with 14 armed militants — one of  
ahmoud Zahar. The Israelis pulled out  
ockets into Israel killed two more

Hospital in Gaza City, a weeping  
Mahmoud Zahar held his lifeless son's bloodied head in his



## Hamas Leader's Son Among 19 Killed in Israeli-Palestinian Conflicts

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**Mortgage Rates at 4**

### Mahmoud Zahar

**Known**

**Teach**

**Followups**

☒ person

☒ Hamas leader

[Click to suggest something else](#)

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## Hamas Leader's Son Among 19 Killed in

Is  
**Individual :** [MahmoudZahar](#)

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**Bookkeeping Assertions :**

- [\(myCreator MahmoudZahar CycAdministrator\)](#) in [BookkeepingMt](#)
- [\(myCreationTime MahmoudZahar 20080118\)](#) in [BookkeepingMt](#)
- [\(myCreationSecond MahmoudZahar 165058\)](#) in [BookkeepingMt](#)

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**Mt :** [UniversalVocabularyMt](#)  
**isa :** [MIndividual](#)

• **Mt :** [\(ContextOfPCWInterpretationFn CWSentence--7 CycAdministrator \(DayFn 18 \(MonthFn January \(YearFn 2008\)\)\)\)](#)  
**isa :** [M\(SubcollectionOfWithRelationToFn Person hasLeaders Organization-Hamas\)](#)

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**Mt :** [UniversalVocabularyMt](#)  
[M\(inProgressTerm MahmoudZahar\)](#)

them Hussam Zahar, 24, the son of hard-line Hamas leader [Mahmoud Zahar](#). The Israelis pulled out Tuesday with no casualties. A later airstrike on militants firing rockets into Israel killed two more Hamas men.



# Leaders of organizations that operate in Gaza and have killed Israelis

## Search Results

Leaders of organizations that operate in Gaza and have killed Israelis

### Simple Fragments

\_\_\_\_\_ happened in the Gaza Strip.  
\_\_\_\_\_ happened in Gaza City, the West Bank and Gaza.

\_\_\_\_\_ is an Israeli.  
\_\_\_\_\_ is an organization.  
\_\_\_\_\_ holds the position of \_\_\_\_\_ in the Gaza Strip.  
\_\_\_\_\_ holds the position of \_\_\_\_\_ in Gaza City, the West Bank and Gaza.

\_\_\_\_\_ is a leader of \_\_\_\_\_.  
\_\_\_\_\_ was killed during \_\_\_\_\_.

### General Fragments

\_\_\_\_\_ happened in \_\_\_\_\_.  
\_\_\_\_\_ operates in \_\_\_\_\_.

\_\_\_\_\_ is true  
\_\_\_\_\_ happens in the Gaza Strip.  
\_\_\_\_\_ is a leader of *CULPRIT*.  
\_\_\_\_\_ happened during *PHYSICAL-DESTRUCTION-EVENT*.  
\_\_\_\_\_ is a perpetrator in *PHYSICAL-DESTRUCTION-EVENT*.  
\_\_\_\_\_ is an organization.

Continue

Save

New Tab

Reset

64 answers  
Timed out

Culprit	Sources
HAMAS	 9  3  4 (12 more)
HAMAS	 9  3  4 (13 more)
HAMAS	  10  3 (17 more)
HAMAS	 2  9  3 (15 more)
HAMAS	 9  3  4 (13 more)

Fact Sheet

Visualize

Visualize All

Export

Export UC

# Using Acquired Knowledge

Task Info

Document Search

Concepts

Network Analysis

Queries

he killed Isra

Israelis

killed

Gaza

organization

Leaders

Search Result

Leaders of

Gaza and

Simple

Status: Idle

M

▼ Query: What values of  $X$  and *CULPRIT* are there such that

- some Asian was killed during some physical destruction event,
- *CULPRIT* operates in [the Gaza Strip](#),
- *CULPRIT* was a perpetrator in that physical destruction event,
- and  $X$  is a leader of *CULPRIT*?

Answer:

*CULPRIT*: [HAMAS](#)  
 $X$ : [Mahmoud Zahar](#)

▼ Because:

[HAMAS's](#) headquarters is in [the Gaza Strip](#). <sup>1</sup>  
[Mahmoud Zahar](#) was a leader of [HAMAS](#) on January 15, 2008. <sup>2</sup>  
[HAMAS](#) was a perpetrator in [the Jerusalem, Israel terrorist attack on August 19, 2003](#). <sup>3</sup>, <sup>4</sup>  
[Avraham Bar-Or](#) was killed during [the Jerusalem, Israel terrorist attack on August 19, 2003](#). <sup>5</sup>  
[Avraham Bar-Or](#) was an [Israeli](#). <sup>5</sup>

▶ Detailed Justification:

▼ External Sources:

<sup>1</sup> [SAIC Legacy Assertions, Science Applications International Corporation](#) .  
<sup>2</sup> [Hamas Leader's Son Among 19 Killed in Israeli-Palestinian Conflicts](#) .  
<sup>3</sup> "Patterns of Global Terrorism 2003", *United States Department of State*, April 2004, <http://www.state.gov/>  
<sup>4</sup> [Encyclopedia of the Orient, LexicOrient.com, http://www.i-cias.com/e.o/hamas.htm](#) .  
<sup>5</sup> [TKB Fact Entry Source Sit Report Fatal Terrorist Attacksin Israelsincethe Declarationof Principles 6](#)

Continue

Save

New Tab

Reset

64 answers

Timed out

2 more)

3 more)

7 more)

15 more)

3 more)

Support UC

Justified and Sourced Answers

## Facts and Rules (from 1998, 2003)

Mt : [InternationalOrganizationDataMt](#)  
([internationalOrganizationMemberCountries](#)  
[AfricanUnion](#) [Congo-Brazzaville](#))  
([internationalOrganizationMemberCountries](#)  
[UnitedNationsOrganization](#) [Congo-Brazzaville](#))

([implies](#) ([and](#)  
    ([isa](#) ?COUNTRY [IndependentCountry](#))  
    ([territoryOf](#) ?COUNTRY ?LAND)  
    ([geographicalSubRegions](#) [ContinentOfAfrica](#)  
        ?LAND))  
    ([internationalOrganizationMemberCountries](#)  
    [OrganizationOfAfricanUnity](#) ?COUNTRY))

Republic of the Congo is a member of  
Organization of African Unity, the  
United Nations, and African Union.

### Automated Reasoning

```
(implies (and
  (isa ?COUNTRY IndependentCountry)
  (territoryOf ?COUNTRY ?LAND)
  (geographicalSubRegions ContinentOfAfrica ?LAND)
  (internationalOrganizationMemberCountries
   OrganizationOfAfricanUnity ?COUNTRY)) in
 InternationalOrganizationDataMt
 (territoryOf Congo-Brazzaville
  TerritoryFn Congo-Brazzaville)) in
 WorldPoliticalGeographyDataVocabularyMt
 (properGeographicalSubRegions ContinentOfAfrica
  TerritoryFn Congo-Brazzaville)) in
 WorldGeographyMt :GENLPREDS (genlPreds
 properGeographicalSubRegions geographicalSubRegions)
 in InternationalOrganizationDataMt
 :ISA (isa Congo-Brazzaville IndependentCountry) in
 InternationalOrganizationDataMt
```



beta  
Republic of the Congo



inCyc

#### General:

- [Likouala](#), [Niari](#), [Kouilou](#), [Pool](#), and [Bouenza](#) are a geographical subregion of Republic of the Congo.
- [Niari](#), [Kouilou](#), [Pool](#), [Bouenza](#), [Likouala](#), [Cuvette](#), [Plateaux](#), and 3 others are a geopolitical subdivision of Republic of the Congo.
- [Brazzaville](#), [Cuvette](#), [Plateaux](#), [Sangha](#), and [Lekoumou](#) are a geographical subregion of Republic of the Congo.
- [Central African Republic](#)
- and [Democratic Republic of the Congo](#) border on Republic of the Congo.
- Republic of the Congo borders on [Cameroon](#).
- [Gabon](#) and [Angola](#) border on Republic of the Congo.

Republic of the Congo is an [African country](#), a [people's republic](#), and a [republic](#).

- Republic of the Congo is east of [Gabon](#).
- [Democratic Republic of the Congo](#) is east of Republic of the Congo.

# Knowledge for People



## Slovenia



### General:

[Ljubljana, Slovenia](#), [Koper, Slovenia](#), [Ljubljana, Slovenia](#), [Portoroz, Slovenia](#), and [Maribor, Slovenia](#) are in Slovenia.

Slovenia borders on [Italy](#), [Croatia](#), [Hungary](#), and [Austria](#). Slovenia is northwest of [Croatia](#).

[Brezovica](#) is a geopolitical subdivision of Slovenia. Slovenia has been a geopolitical subdivision of [the European Union](#) since the beginning of May 2004. [Bohinj](#) is a geopolitical subdivision of Slovenia. [Bohinj](#) and [Brezovica](#) are a geographical subregion of Slovenia.

Slovenia is an elected member of the Security Council, a Balkan country, and an [eastern European country](#).

- [Italy](#) is west of Slovenia.
- Slovenia is west of [Hungary](#).

Slovenia is northeast of [Italy](#). The capital city of it is [Ljubljana](#). Slovenia is south of [Austria](#). Slovenia was a geopolitical subdivision of [Yugoslavia](#) after 1922 and before 1992.

### Group Membership:

Slovenia is a member of [the United Nations](#).

### Affiliations:

[Maribor, Slovenia](#), [Koper, Slovenia](#), [Ljubljana, Slovenia](#), [Portoroz, Slovenia](#), and [Ljubljana, Slovenia](#) are in Slovenia.

- [Brezovica](#) and [Bohinj](#) are a geopolitical subdivision of Slovenia.
- Slovenia has been a geopolitical subdivision of [the European Union](#) since the beginning of May 2004.
- Slovenia was a geopolitical subdivision of [Yugoslavia](#) after 1922 and before 1992.

The capital city of Slovenia is [Ljubljana](#). Slovenia is a member of [the United Nations](#).

### Miscellaneous:

Slovenia is inhabited by many Croats, Slovenes, and Serbians.

Slovenian is among the national languages of Slovenia. The concept "Slovenian" is conceptually related to the concept "Slovenia".

Slovenia's telephone country code is 386. Muslim people are one of the primary types of people inhabiting Slovenia. Slovenia is obliged to follow the Universal Declaration of Human Rights. Slovenia bought goods or services from [Algeria](#) in 1997.

From 1998 or earlier to at least November 1999, Slovenia was an elected member of [the Security Council](#). Slovenia was an elected member of the Security Council after 1997 and before December 31, 1999.

[How was this page created?](#)

# Logistics

OpenCyc (Current): [ <http://sw.opencyc.org/concept/Mx4r8qkxXAW-QdmV1JNL5SFyIA> ]

OpenCyc (Versioned): [ <http://sw.opencyc.org/2008/06/10/concept/Mx4r8qkxXAW-QdmV1JNL5SFyIA> ]

http

Search



## OpenCyc Collection: shipping container

Unique ID: [ Mx4r8qkxXAW-QdmV1JNL5SFyIA ]

English ID: [ LargePortableCargoContainer ]

English Aliases: [ "cargo container", "cargo containers", "portable cargo container", "portable cargo containers", "shipping containers" ]

A specialization of *StorageConstruct*. Each instance of *LargePortableCargoContainer* is a large (usually about 40' x 8' x 8') metal container used for shipping large quantities of goods across land (e.g., on a large truck) or overseas (e.g., on a cargo ship).

**A Type of:** storage device

**Instance of:** spatially disjoint object type, type of object

**Subtypes:**

**Instances:**

**Same as:**

<http://umbel.org/umbel/sc/LargePortableCargoContainer>

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# Logistics

OpenCyc (Current): [ <http://sw.opencyc.org/concept/Mx4rSbwOlPpYEdqAAACs71DGQ> ]

OpenCyc (Versioned): [ <http://sw.opencyc.org/2008/06/10/concept/Mx4rSbwOlPpYEdqAAACs71DGQ> ]

Search



## OpenCyc Collection: loading a vehicle

Unique ID: [ Mx4rSbwOlPpYEdqAAACs71DGQ ]

English ID: [ LoadingAVehicle ]

English Aliases: [ "had loaded a vehicle", "has loaded a vehicle", "have loaded a vehicle", "load a vehicle", "loaded a vehicle", "loads a vehicle", "will have loaded a vehicle", "will load a vehicle" ]

The collection of instances of Loading in which the toLocation is a vehicle.

**A Type of:** loading, putting something into something else

**Instance of:** type of temporally stuff-like thing

**Subtypes:**

**Instances:**

**Same as:**

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# Inferred Index

for

[Shipping](#)


order by : [predicate](#) [ontology](#)

filters : [predicate](#) [ontology](#)

index view : [inferred](#) [legal](#)

► [Browsing](#)

► [Editing](#)

[All Assertions](#) (2640)  ► [open all](#)

► via [Shipping](#) (46)

► via [ConveyingMaterials](#) (4)

► via [\(TransportViaFn TransportationDevice\)](#) (22)

► via [MaterialHandling](#) (5)

► via [TransportationEvent](#) (33)

► via [DirectedTranslation](#) (14)

► via [Conveying-Generic](#) (27)

► via [Translation-Complete](#) (5)

► via [CausingAnotherObjectsTranslationalMotion](#) (1)

► via [Translation-SingleTrajectory](#) (9)

► via [ControllingAPhysicalDevice](#) (5)

► via [SocialOccurrence](#) (11)

► via [PhysicalEvent](#) (9)

(and

(isa :ACTION [Shipping](#))

(transportees :ACTION :SUBJECT)))

C

on

OKWRTRoles  [PublicConstant](#)  [CycSecureFORT](#)

[ConveyingMaterials](#)  [DeliveryServiceEvent](#)

physical location to another. Shipping from the perspective of being done  
UPS, the US Postal Service, or Dominoes Pizza Delivery might do."

canonical [Ship-TheWord](#) 0 [IntransitiveVerbFrame](#) [Shipping](#)

canonical [Ship-TheWord](#) 0 [TransitiveNPFrame](#) [Shipping](#)

By transportees))

[TheWord](#) [Verb](#) 0 [Shipping](#))

[TransitiveNPFrame](#)

(ing)

cy

ge

ECT)))

TransitiveNPFrame

ge

TransitiveVerbFrame

# Detailed Representations

Mortgage Financing  
Patent & Other Rights  
Computer File System  
Management  
Derivative Risk  
Traffic  
Management  
Tracking Scientific  
Literature  
...etc

Overwhelming Problems



1984:

Increase human capabilities by building  
the first true Artificial Intelligence.

Revised:

Increase human capabilities by teaching the  
first true Artificial Intelligence to build itself.

Cycorp Corporate Mission



# Use Case: City on-line

- Our cities face many challenges
- Urban Computing is the ICT way to



improve the quality of life

Is public

Personal: (from Ljubliana)

Will I be late for my 11:15 talk?

Can I stop at my favourite café (le Petit Café)? Or on the highway, or in Bled?

Is there an interesting village on the way, if I leave early?

Take an umbrella? Bring a bathing suit?

ire  
ht now  
will be

g?

oving?

REAL TIME



LAST WEEK

↑ San Giovanni La  
↓ Celosco

REAL TIME

REAL TIME 13:55

low high

# Use case: Drug Discovery

FDA white paper Innovation or Stagnation (March 2004):

## Problem development

"developers have no choice but to use the **tools of the last century** to assess this century's candidate solutions."

"industry scientists often look at the entire product area, and use tools used in **areas other** than their own."

*"Show me any potential links between this compound's drug class, to*

$(Q_1)$

$Q_1$

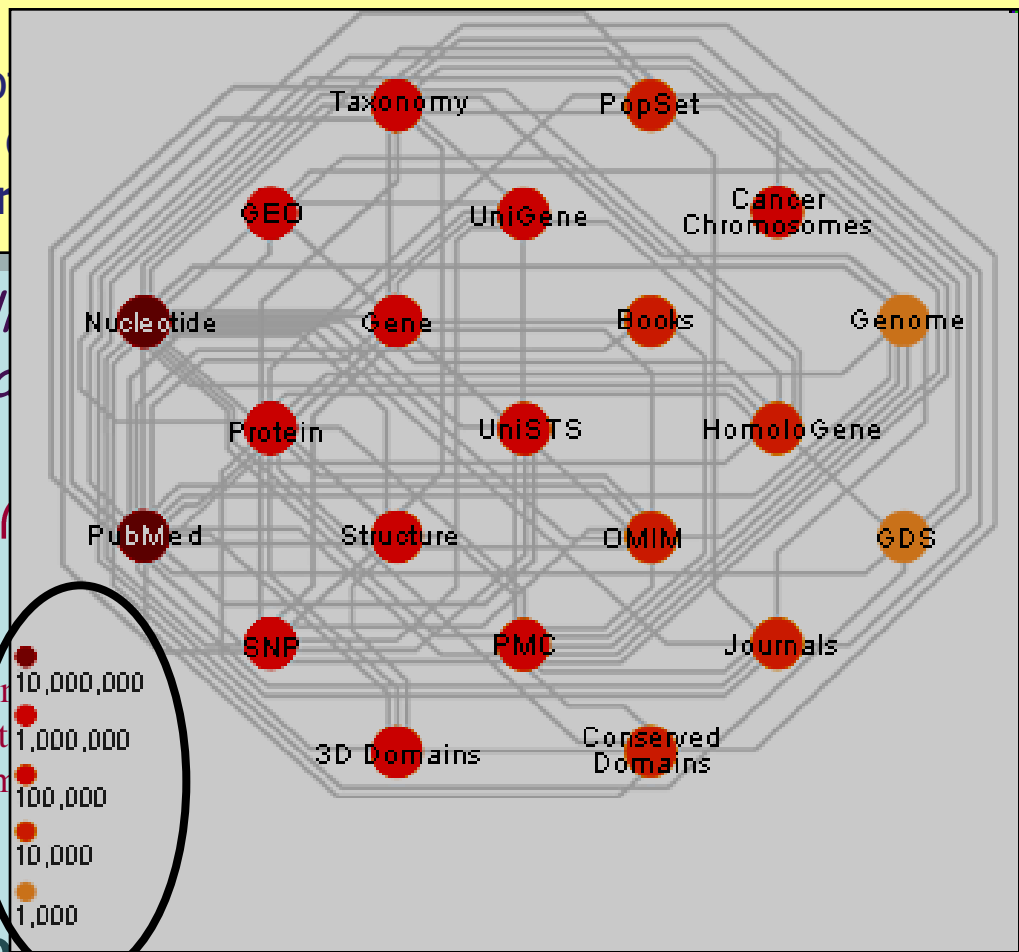
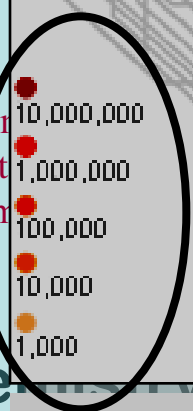
Show me all liver toxicity associated with the target or the pathway.

Genetics

$Q_2$

"Show me all liver toxicity associated with similar compounds."

Chemistry



Current: linking but no inference

Cyc Analytical Environment: CAE knowledge entry

File Edit Tools Window Help

Task Info Document Search Concepts Related-to Query Creator Queries

Find Stop

- \* ARG1 acts on some part of thoracic aorta,
- \* ARG1 is an endovascular procedure that is a stent placement,
- \* ARG1 happened in Cleveland Clinic main campus,
- \* and ARG1 happens sometime between June 2002 and May 2004.

Ask  
Save  
New Tab  
Stop

# Medical Outcome Studies.

Huge numbers of patients;  
Diverse representations

Answer

▼ Temporal Relation  
The latest interval is (ARG1 ARG2) TIME.  
The earliest interval is (RELATION A true is TIME).  
EVENT occurs and LATER-D

Status: Idle Message:

“Who had an endovascular stent placement on their thoracic aorta at CCF’s main campus between June, 2002, and May, 2004?”

## Mississippi River

From Wikipedia, the free encyclopedia

For the river in Canada, see [St. Lawrence](#).

The **Mississippi River** is the second longest river system in North America, with a length of 2,320 miles (3,734 km). It has the largest drainage basin in the world, with a mouth in the Gulf of Mexico.

The Mississippi River is the largest river system in the United States, with a length of 3,900 miles (6,300 km) and a discharge of 572,000 cu ft/s (16,200 m³/s).

The name Mississippi is derived from the Anishinaabe word *misissipi* ("Big River").

Contents

- 1 Geography
  - 1.1 Upper Mississippi
    - 1.1.1 Source
    - 1.1.2 Tributaries
  - 1.2 Lower Mississippi
  - 1.3 Communities
  - 1.4 Bridge crossings
- 2 Watershed
  - 2.1 Drainage area
  - 2.2 Outflow
  - 2.3 Discharge
- 3 History
  - 3.1 Course changes
  - 3.2 Native Americans
  - 3.3 European exploration
    - 3.3.1 18th century
  - 3.4 19th century
    - 3.4.1 Steamboats
    - 3.4.2 Civil War
  - 3.5 20th century
  - 3.6 21st century
- 4 Recreation

## Roman Empire

From Wikipedia, the free encyclopedia  
(Redirected from [Roman empire](#))

"*Imperium Romanum*", *Latin* for "Roman Empire", redirects here. For the video game, see *Imperium Romanum (video game)*.

For other uses, see [Roman Empire \(disambiguation\)](#).

The **Roman Empire** was the post-Republican phase of the ancient Roman civilization, characterised by an autocratic form of government and large territorial holdings in Europe and around the Mediterranean.<sup>[4]</sup> The Roman state during and after the time of the first emperor, the year-old [Roman Republic](#), which preceded it, had been warring.<sup>[nb 2]</sup> Several events are commonly proposed to mark the transition from Republic to Empire, including [Julius Caesar's](#) appointment as dictator in 49 BC, the victory of [Octavian](#) at the [Battle of Actium](#) (27 BC), the Roman Senate's granting to Octavian the *honorific* [Augustus](#) in 27 BC.

The Latin term *Imperium Romanum* (Roman Empire), proper expression where the word *imperium* denotes a territory, world under Roman rule. Roman expansion began in the 3rd century BC, reached its zenith under Emperor [Trajan](#). At this territorial peak, the Empire controlled approximately 9,500,000 km² (2,300,000 sq mi) of the Empire's vast extent and long endurance, Roman influence in religion, architecture, philosophy, law, and government of the world lasts to this day.

In the late 3rd century AD, [Diocletian](#) established the practice of alternating between two emperors, one in the western part of the empire and one in the eastern part, in order to better administer the vast territory. For the next century, with occasional periods in which one emperor ruled the entire empire, the system continued, with occasional periods in which one emperor ruled the entire empire. However, after the death of [Theodosius](#) in 395, no single emperor held genuine supremacy over a united Roman Empire.<sup>[5]</sup> The Western Roman Empire collapsed in 476 as [Romulus Augustus](#) was forced to abdicate.<sup>[6]</sup> The Eastern Roman or Byzantine Empire ended in 1453 with the capture of Constantinople by the Ottoman Turks led by [Mehmed II](#). It is difficult to give an exact date when the Roman Empire ceased to exist.

Contents [hide]

- 1 Government
  - 1.1 Emperor
  - 1.2 Senate
  - 1.3 Senators and Equestrians
    - 1.3.1 Senatorial order
    - 1.3.2 Equestrian Order
- 2 Military
  - 2.1 Legions

## Carbon

From Wikipedia, the free encyclopedia

## Slovenia

From Wikipedia, the free encyclopedia

For other uses, see [Slovenia \(disambiguation\)](#).



**This article or section has multiple issues.** Please help [improve the article](#) or discuss these issues on the [talk page](#).

- It needs **additional references or sources for verification**. Tagged since August 2009.
- It may need to be **wikified** to meet Wikipedia's [quality standards](#). Tagged since August 2009.

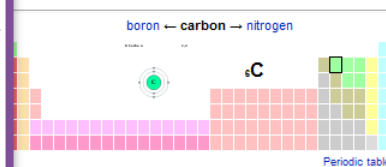
**Slovenia** (<sup>i</sup>/sloʊˈviːniə/ (help·info)), officially the **Republic of Slovenia** (Slovene: *Republika Slovenija*, <sup>i</sup>/listən/ (help·info)), is a country in Central Europe bordering Italy to the west, the Adriatic Sea to the southwest, Croatia to the south and east, Hungary to the northeast, and Austria to the north. The capital of Slovenia is Ljubljana.

Slovenia has been part of the Roman Empire; partly the Republic of Venice; the principality [Carantania](#) (only modern Slovenia's northern part); the Holy Roman Empire; the Habsburg Monarchy; the Austrian Empire (later known as Austria-Hungary); the State of Slovenes, Croats, and Serbs; the Kingdom of Serbs, Croats, and Slovenes (renamed to Kingdom of Yugoslavia in 1929); partly Kingdom of Italy; between the two World Wars occupied by Germany, Italy, Hungary, and Independent State of Croatia (1941–1945); and the Socialist Federal Republic of Yugoslavia from 1945 until independence in 1991.

Slovenia is a member of the European Union, the Eurozone, the Schengen area, the Organization for Security and Co-operation in Europe, the Council of Europe, NATO, UNESCO, WTO, and UN.

Contents [hide]

- 1 History
- 2 Politics
- 3 Administrative divisions
- 4 Tourism
- 5 Geography
- 6 Biodiversity
- 7 Economy
- 8 Transport
- 9 Communications
- 10 Demographics
- 11 Culture
- 12 Education
- 13 See also



### Republic of Slovenia Republika Slovenija



Flag



Coat of arms

**Anthem:** 7th stanza of *Zdravljica*



Location of **Slovenia** (dark green)  
– on the European continent (light green & dark grey)  
– in the European Union (light green) — [Legend]

**Capital**  
(and largest city)

Ljubljana  
46°03′N 14°30′E﻿ / ﻿

**Official languages**

Slovene<sup>1</sup>

**Demonym**

Slovenian, Slovene

**Government**

Parliamentary republic





## Slovenia



### General:

[Ljubljana, Slovenia](#), [Koper, Slovenia](#), [Ljubljana, Slovenia](#), [Portoroz, Slovenia](#), and [Maribor, Slovenia](#) are in Slovenia.

Slovenia borders on [Italy](#), [Croatia](#), [Hungary](#), and [Austria](#). Slovenia is northwest of [Croatia](#).

[Brezovica](#) is a geopolitical subdivision of Slovenia. Slovenia has been a geopolitical subdivision of [the European Union](#) since the beginning of May 2004. [Bohinj](#) is a geopolitical subdivision of Slovenia. [Bohinj](#) and [Brezovica](#) are a geographical subregion of Slovenia.

Slovenia is an elected member of the Security Council, a Balkan country, and an [eastern European country](#).

- [Italy](#) is west of Slovenia.
- Slovenia is west of [Hungary](#).

Slovenia is northeast of [Italy](#). The capital city of it is [Ljubljana](#). Slovenia is south of [Austria](#). Slovenia was a geopolitical subdivision of [Yugoslavia](#) after 1922 and before 1992.

### Group Membership:

Slovenia is a member of [the United Nations](#).

### Affiliations:

[Maribor, Slovenia](#), [Koper, Slovenia](#), [Ljubljana, Slovenia](#), [Portoroz, Slovenia](#), and [Ljubljana, Slovenia](#) are in Slovenia.

- [Brezovica](#) and [Bohinj](#) are a geopolitical subdivision of Slovenia.
- Slovenia has been a geopolitical subdivision of [the European Union](#) since the beginning of May 2004.
- Slovenia was a geopolitical subdivision of [Yugoslavia](#) after 1922 and before 1992.

The capital city of Slovenia is [Ljubljana](#). Slovenia is a member of [the United Nations](#).

### Miscellaneous:

Slovenia is inhabited by many Croats, Slovenes, and Serbians.

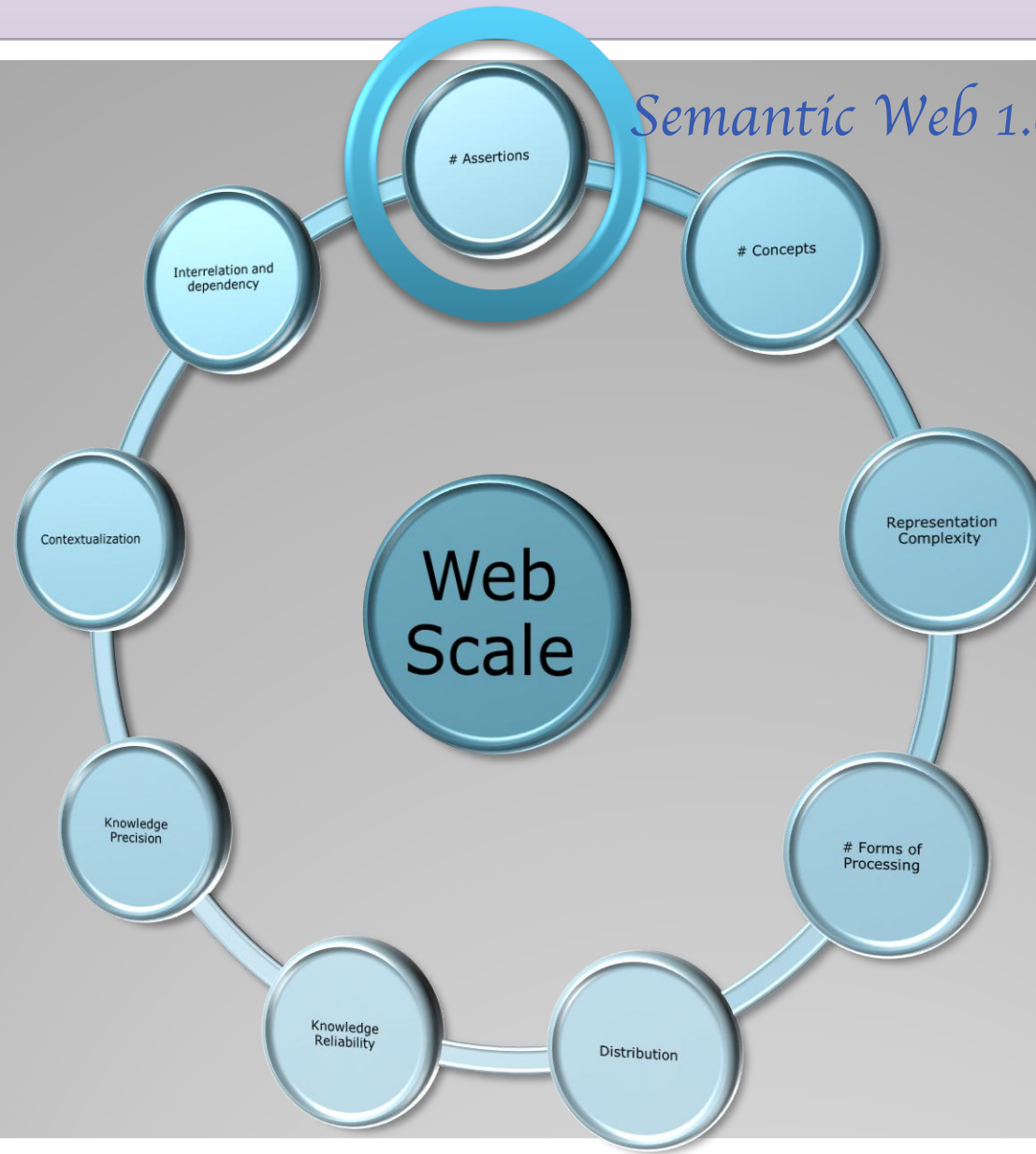
Slovenian is among the national languages of Slovenia. The concept "Slovenian" is conceptually related to the concept "Slovenia".

Slovenia's telephone country code is 386. Muslim people are one of the primary types of people inhabiting Slovenia. Slovenia is obliged to follow the Universal Declaration of Human Rights. Slovenia bought goods or services from [Algeria](#) in 1997.

From 1998 or earlier to at least November 1999, Slovenia was an elected member of [the Security Council](#). Slovenia was an elected member of the Security Council after 1997 and before December 31, 1999.

[How was this page created?](#)

## *Semantic Web 1.0*



# Elements of Scale

## LarKC

- Number of Assertions
- Diversity of Processing
- Variable reliability
- Representational variation
- Engineering Scale

## Cyc

- Number of Concepts
- Representational Complexity
- Contextualization
- Interrelatedness
- Knowledge Acquisition

Some aspects of Solutions

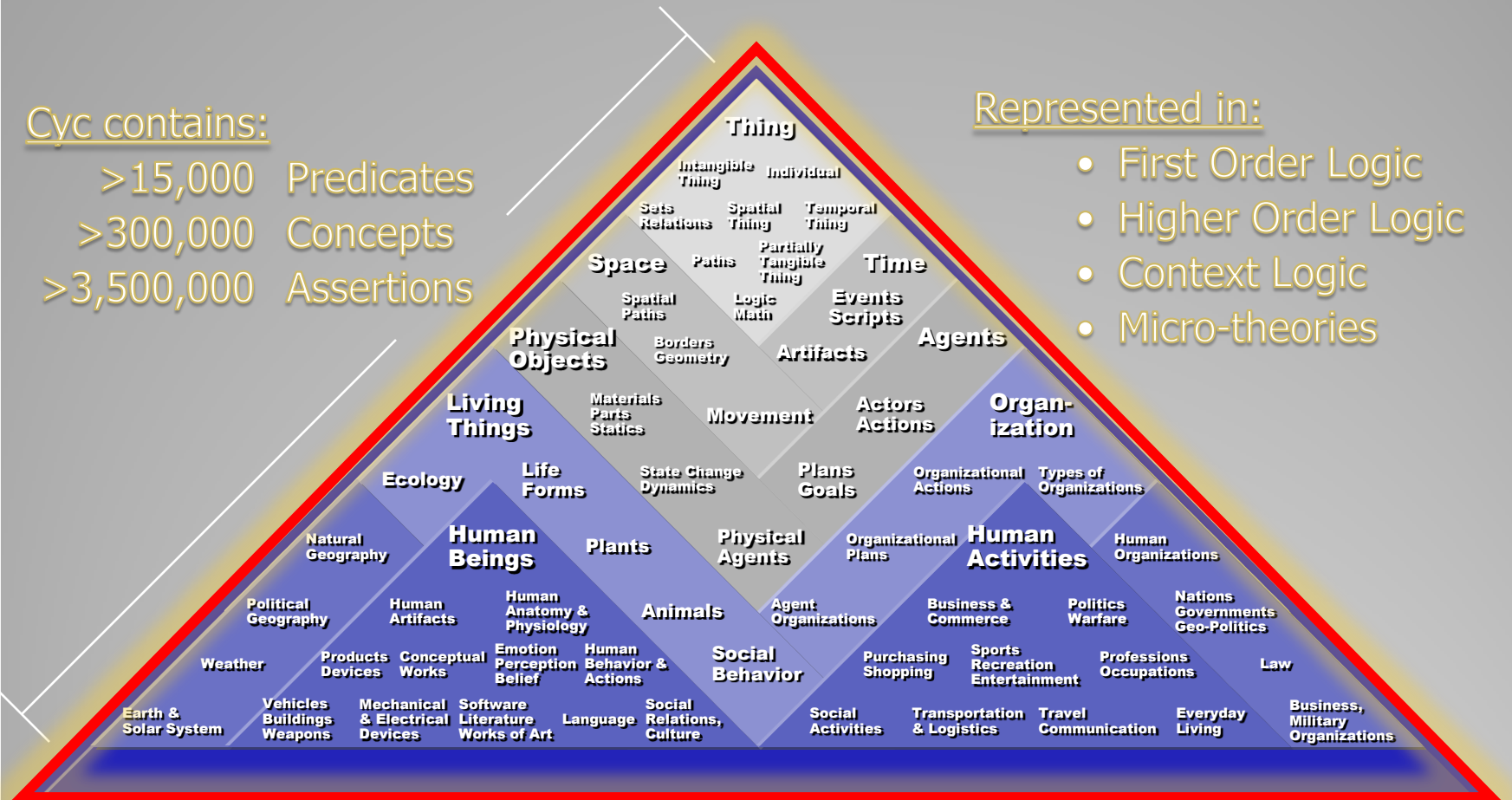


Cyc contains:

>15,000 Predicates  
>300,000 Concepts  
>3,500,000 Assertions

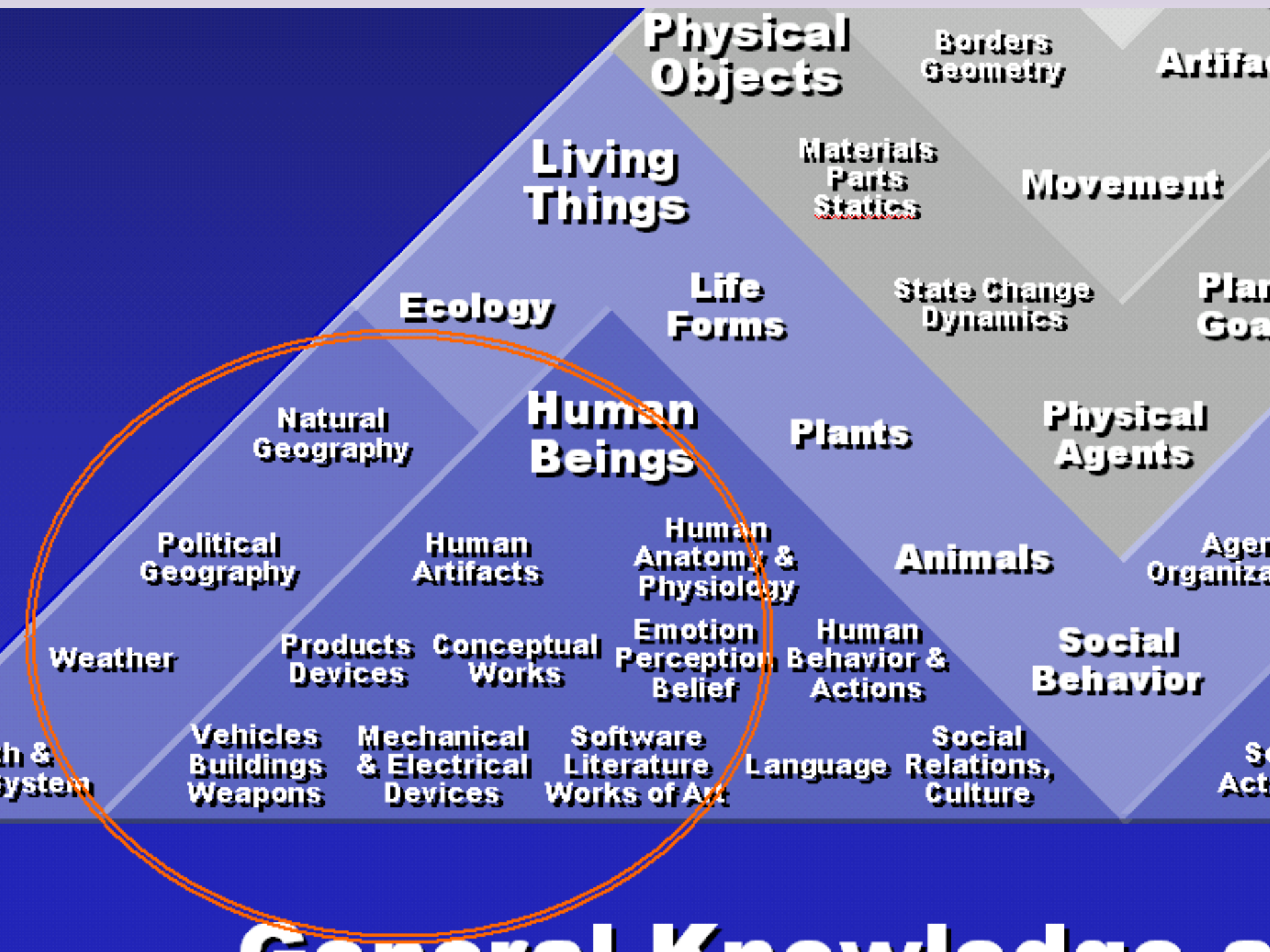
Represented in:

- First Order Logic
- Higher Order Logic
- Context Logic
- Micro-theories

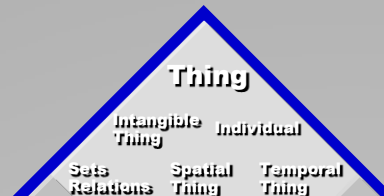


**General Knowledge about Various Domains**

**Specific data, facts, and observations**



# Cyc KB Extended w/ Domain Knowledge



## General Knowledge about Terrorism:

Terrorist groups are capable of directing assassinations:

(implies

(isa ?GROUP TerroristGroup)

(behaviorCapable ?GROUP AssassinatingSomeone directingAgent))

...

## Specific Facts about Al Qaida:

(basedInRegion AlQaida Afghanistan) Al-Qaida is based in Afghanistan.

(hasBeliefSystems AlQaida IslamicFundamentalistBeliefs) Al-Qaida has Islamic fundamentalist beliefs.

(hasLeaders AlQaida OsamaBinLaden) Al-Qaida is led by Osama bin Laden.

Solar System

Buildings  
Weapons

& Electrical  
Devices

Literature  
Works of Art

Language  
Relations,  
Culture

Activities

& Logistics

Communication

Living

Military  
Organizations

## General Knowledge about Terrorism

## Specific data, facts, and observations about terrorist groups and activities

**EVENT  $\supset$  TEMPORAL-THING  $\supset$  PARTIALLY-TANGIBLE-THING**

Upper  
Ontology

$(\forall a, b) a \in \mathbf{EVENT} \wedge b \in \mathbf{EVENT} \Rightarrow$   
 $\mathbf{causes}(a, b) \Rightarrow \mathbf{precedes}(a, b)$

Core  
Theories

Domain-Specific  
Theories

$(\forall m, a) m \in \mathbf{MAMMAL} \wedge a \in \mathbf{ANTHRAX} \Rightarrow$   
 $\mathbf{causes}(\mathbf{exposed-to}(m, a), \mathbf{infected-by}(m, a))$  □

**Very specific information  
(some indirect, via SKSI)**

$(\mathbf{ist} \text{ FtLaudHolyCrossERCCase\#403921}$   
 $\text{ (caused CutaneousAnthrax}$   
 $\text{ (SkinLesions Ahmed\_al-Haznawit))})$

First Order Predicate Calculus: unambiguous; enable mechanical reasoning

**Every American has a president.  
Every American has a mother.**

Higher Order Logic: contexts,  
predicates as variables,  
nested modals, reflection,...

$\exists y. \forall x. \text{Amer}(x) \Rightarrow \text{president}(x, y)$   
 $\forall x. \exists y. \text{Amer}(x) \Rightarrow \text{mother}(x, y)$



## First Order

- (isa ASBFinancialCorp PubliclyHeldCorporation)
- (corporateOfficers ASBFinancialCorp GeraldRJenkins)

## With Context

- In Mt : FinancialTransactionMt  
(relationAllExists performedBy RepurchaseProgram PubliclyHeldCorporation)

## Rule

- In Mt: FinancialTransactionMt  
(forAll ?X (implies  
    (isa ?X RepurchaseProgram)  
    (thereExists ?Y (and (isa ?Y PublicallyHeldCorporation) (performedBy ?X ?Y)))))

## Second Order

- (implies  
    (and (isa ?SET Set-Mathematical) (cardinality ?SET 1) (elementOf ?THING ?SET))  
    (equals ?SET (TheSet ?THING)))

## Modal

- (beliefs Israel (relationInstanceExists possesses Syria ClusterBomb))

## Meta

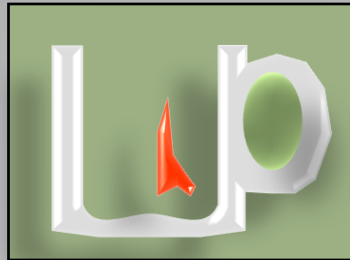
- (opaqueArgument beliefs 2)

Complex logics

- Does part of the inner object stick out of the container?

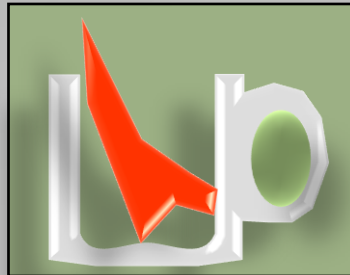
- None of it.

**#\$in-ContCompletely**



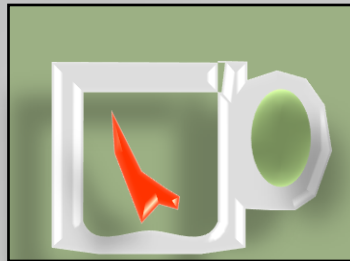
- Yes

**#\$in-ContPartially**



- No

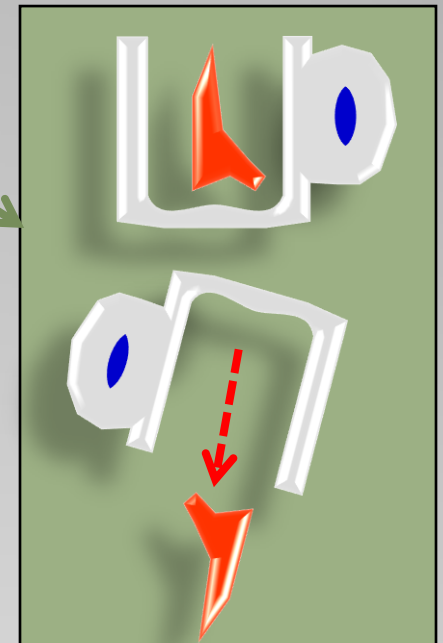
**#\$in-ContClosed**



- If the container were turned around could the contained object fall out?

Yes

**#\$in-ContOpen**



For Inference:

Senses of 'In'

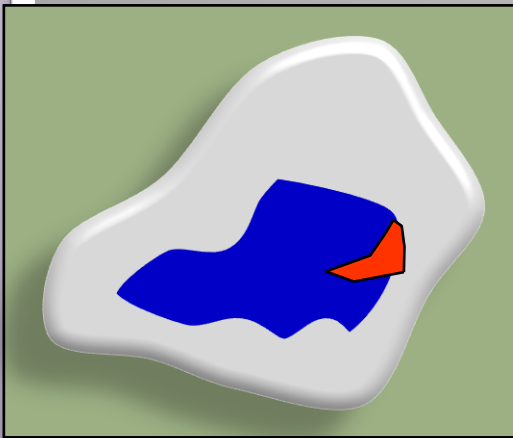




Is it attached to the  
inside of the outer object?

– Yes -- Try

**#\$connectedToInside**

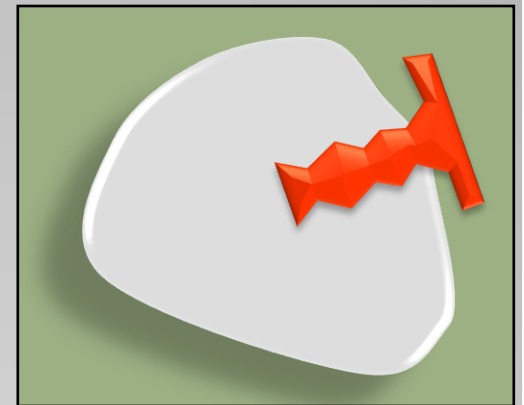
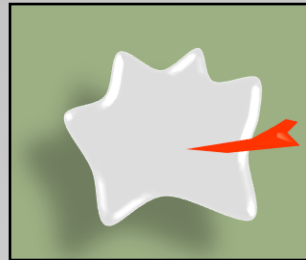


Can it be removed by pulling, if  
enough force is used, without  
damaging either object?

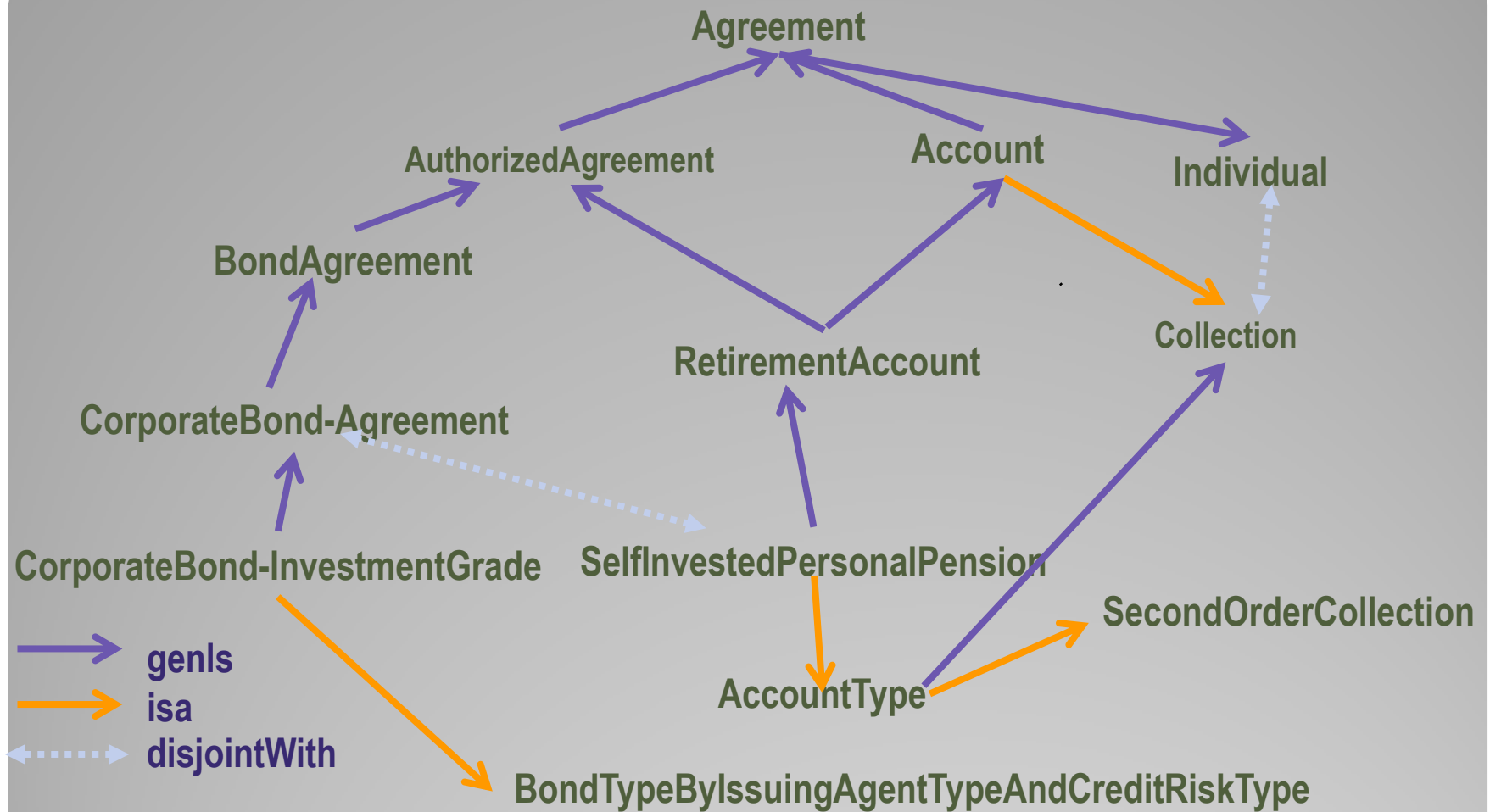
– No -- Try **#\$in-Snugly**  
or **#\$screwedIn**

Does the inner object  
stick into the outer object?

–Yes – Try  
**#\$sticksInto**



Senses of 'In'



Concepts are densely related



Some of these Relations are very General, such as:

**#\$temporallyIntersects**

Such relations are particularly useful when they are known not to hold between a pair of individuals:

**(#\$not (\$temporallyIntersects ?X ?Y))**

That implies all of these:

**(#\$not (\$spouse PERSON-X PERSON-Y))**

**(#\$not (\$consultant AGENT-X AGENT-Y))**

**(#\$not (\$accountHolder ACCOUNT-X AGENT-Y))**

**(#\$not (\$residesInRegion AGENT-X REGION-Y))**

**(#\$not (\$officiator EVENT-X PERSON-Y))**

# Temporal Relations



**Constant: Eat-TheWord**

**isa: EnglishWord**

**Mt: EnglishMt**

**infinitive: “eat”**

**pastTense: “ate”**

**perfect: “eaten”**

**agentive-Sg: “eater”**

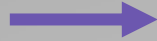
**(subcatFrame Eat-TheWord Verb 0 TransitiveNPCompFrame)**

**(verbSemTrans Eat-TheWord 0 TransitiveNPCompFrame  
 (and (isa :ACTION EatingEvent)  
 (performedBy :ACTION :SUBJECT)  
 (inputsDestroyed :ACTION :OBJECT)))**

**Lexical Entry Example: Eat**



Renaissance Artists



(SubcollectionOfWithRelationToFn  
Artist activeDuringPeriod  
TheRenaissance)

Bronze Age Farmers



(SubcollectionOfWithRelationToFn  
Farmer activeDuringPeriod  
TheBronzeAge)

Kind of TimeInterval

Noun Form: not plural

Kind of Agent-Generic

Noun form



Using representations: Noun Compounds

- **#\$TransportationEvent**
- **#\$ControllingATransportationDevice**
- **#\$TransportWithMotorizedLandVehicle**
- **(#\$SteeringFn #\$RoadVehicle)**
- **#\$TransporterCrashEvent**
- **#\$VehicleAccident**
- **#\$CarAccident**
- **#\$Colliding**
- **#\$IncurringDamage**
- **#\$TippingOver**
- **#\$Navigating**
- **#\$EnteringAVehicle ...**



## **Some Transportation Event Types**

- **#\$performedBy**
- **#\$causes-EventEvent**
- **#\$objectPlaced**
- **#\$objectOfStateChange**
- **#\$outputsCreated**
- **#\$inputsDestroyed**
- **#\$assistingAgent**
- **#\$beneficiary**

- **#\$fromLocation**
- **#\$toLocation**
- **#\$deviceUsed**
- **#\$driverActor**
- **#\$damages**
- **#\$vehicle**
- **#\$providerOfMotiveForce**
- **#\$transportees ...**

Over 400 more.



## Relating Events and Participants

As of Feb (#\$February). 24 (24), Air Force (#\$UnitedStatesAirForce) officials (#\$PublicOfficial  
#\$OrganizationRepresentative) reported (#\$RegisteringAComplaint #\$Reporting) that personnel  
(#\$Employee) in the area (#\$Area 0 #\$FieldOfStudy #\$Region-Underspecified) numbered  
(#\$Counting) close to 8,000 (8000). The 100 (100) aircraft (#\$AirTransportationDevice) based  
(#\$Base-Support #\$MilitaryBase-Grounds #\$BaseOfLandProtrusion #\$NitrogenBase  
#\$ChemicallyBasicSubstance) in Saudi Arabia (#\$SaudiArabia) for patrols (#\$Patrolling) over  
southern Iraq ((#\$SouthernRegionFn #\$Iraq)) has (#\$possesses) seen (#\$VisualPerception  
#\$MeetingSomeone #\$sees) the addition (#\$DoingAddition) of two (2) dozen (12) F-15  
(#\$FighterPlane-F15) and F-16 fighter jets (#\$FighterPlane-F16) to Bahrain (#\$Bahrain-TheIsland  
#\$Bahrain (#\$CityNamedFn Bahrain #\$Bahrain)). The Air Force (#\$UnitedStatesAirForce) has  
(#\$possesses) also authorized (#\$GrantingPermission) the dispatch (#\$SendingSomething) of 12  
(12) F-117 (#\$FighterPlane-F117) stealth (#\$DodgeStealthCar) fighter jets (#\$JetOfFluid  
#\$JetPropelledAircraft) to Kuwait (#\$CityOfKuwaitKuwait (#\$ProperSubcollectionNamedFn-Ternary  
kuwait #\$Individual 34057665-f4ed-11d9-9bea-0002b3a85b0b) #\$Kuwait) three (3) B-1 bombers  
(#\$B-1-Bomber) to Bahrain (#\$Bahrain-TheIsland #\$Bahrain (#\$CityNamedFn Bahrain #\$Bahrain)) and  
14 (14) B-52 (#\$B-52-Bomber) bombers (#\$SubmarineSandwich #\$BomberPlane #\$Bomber) to the  
island (#\$Island) of Diego Garcia. It also has (#\$possesses) diverted (#\$AmusingSomeone  
#\$DivertingSomething) dozens (#\$Dozens-Quant 12) of support (#\$SupportingSomething  
#\$ShowingSupportForSomeone (#\$SubcollectionOfWithRelationFromTypeFn #\$PartiallyTangible  
#\$supportingObject #\$SupportingSomething)) aircraft (#\$AirTransportationDevice) to the region  
(#\$TheRegion) for refueling (#\$Refueling (#\$MakingAvailableFn #\$CombustibleFuelSubstance)),

Specificity has its own problems



# Simplified Concepts Make Things Worse

For my own Part, I swam as Fortune directed me, and was pushed forward by Wind and Tide. I often let my Legs drop, and could feel no Bottom: but when I was almost gone, and able to struggle no longer, I found myself within my Depth; and by this Time the Storm was much abated. The Declivity was so small, that I walked near a Mile before I got to the Shore, which I conjectur'd was about eight a-clock in the Evening. I then advanced forward near half a Mile, but could not discover any sign of Houses or Inhabitants; at least I was in so weak a Condition, that I did not observe them. I was extremely tired, and with that, and the Heat of the Weather, and about half a Pint of Brandy that I drank as I left the Ship, I found myself much inclined to sleep. I lay down on the Grass, which was very short and soft, where I slept sounder than ever I remember to have done in my Life, and, as I reckoned, above Nine Hours; for when I awakened, it was just Day-light.

<http://www.jaffebros.com/lee/gulliver/bk1/chap1-1.html>

I swam, pushed forward by time and current, and when I was almost put to an end, I saw land, and discovered myself in water that was not deep. At about eight o'clock in the nightfall, I got to the edge of the sea and walked for nearly half a mile without seeing any houses. Too tired to go farther, I got down on my back in the grass, which was very short and soft. There I slept soundly till morning.

Put into Basic English by the Basic English Institute  
<http://ogden.basic-english.org/lilliput.html>

850 words: 600 nouns, 150 adjectives,  
100 syntactic operators

## Gulliver's Travels in Basic English

**Travels into Several Remote Nations of the World, in Four Parts. By Lemuel Gulliver, First a Surgeon, and then a Captain of several Ships,** Jonathan Swift, London, Benj. Motte, 1726

**Basic English: A General Introduction with Rules and Grammar.**

Ogden, Charles Kay. Small format, hardcover.  
Publisher: Paul Treber & Co., Ltd. London, 1930.

## CorporateBond-InvestmentGrade



isa: [BondTypeByIssuingAgentType](#)

genls: [CorporateBond-Agreement](#)

Context: Union of all contexts

Predicate: [genls](#)

Index:

Parameters updated at 10:38:14 on 07/24/2007

[Change Hierarchy Browser Settings](#)

... [Agreement](#)

- ... [Authorize \[Agreement\] \(UniversalVocabularyMt\)](#)
- ... [DebtSecurity \[UniversalVocabularyMt\]](#)
- ... [Bond-Agreement \[UniversalVocabularyMt\]](#)

... [AuthorizedAgreement](#)

- ... [TradeableSecurity \[UniversalVocabularyMt\]](#)
- ... [DebtSecurity \[UniversalVocabularyMt\]](#) ... \*see above\*

... [EconomicAgreement](#)

- ... [LoanAgreement \[UniversalVocabularyMt\]](#)
- ... [DebtSecurity \[UniversalVocabularyMt\]](#) ... \*see above\*

... [FinancialAsset](#)

- ... [TradeableSecurity \[UniversalVocabularyMt\]](#)

... [InvestmentVehicle](#)

- ... [TradeableSecurity \[UniversalVocabularyMt\]](#) ... \*see above\*

... [Obligation](#)

- ... [LoanAgreement \[UniversalVocabularyMt\]](#) ... \*see above\*

... [TemporaryUserRightsAgreement](#)

- ... [LoanAgreement \[UniversalVocabularyMt\]](#) ... \*see above\*

... [TradeableSecurity](#)

- ... [UnlistedSecurity \[UniversalVocabularyMt\]](#)
- ... [DebtSecurity \[FinancialTransactionMt\]](#) ... \*see above\*

... [\(MeaningInSystemFn SENSUS-Information1997 "DECOMPOSABLE-OBJECT"\)](#)

- ... [DebtSecurity \[SENSUSMappingMt\]](#) ... \*see above\*

-> [Thing](#)

- ... [\(MeaningInSystemFn SENSUS-Information1997 "DECOMPOSABLE-OBJECT"\)](#)
- ... [CorporateBond-Agreement \[SENSUSMappingMt\]](#)

... [Bond-Agreement](#)

- ... [CorporateBond-Agreement \[UniversalVocabularyMt\]](#)

... [CorporateBond-InvestmentGrade](#)

[\[UniversalVocabularyMt -> \(Bond-Agreement, CorporateBond-Agreement\]](#)

## SelfInvestedPersonalPension



isa: [AccountType](#)

genls: [MoneyPurchasePensionScheme](#), [TaxDeferredAccount](#)

Context: Union of all contexts

Predicate: [genls](#)

Index: 2

Parameters updated at 10:36:12 on 07/24/2007

[Change Hierarchy Browser Settings](#)

... [BusinessRelatedThing](#)

- ... [BusinessRelatedDocumentOrAgreement \[UniversalVocabularyMt\]](#)
- ... [LegalAgreement \[UniversalVocabularyMt\]](#)
- ... [Account \[UniversalVocabularyMt\]](#)
- ... [FinancialAccount \[UniversalVocabularyMt\]](#)
- ... [TaxDeferredAccount \[UniversalVocabularyMt\]](#)

... [InvestmentVehicle](#)

- ... [Obligation \[UniversalVocabularyMt\]](#)
- ... [LegalAgreement \[UniversalVocabularyMt\]](#) ... \*see above\*

... [Policy](#)

- ... [Agreement \[UniversalVocabularyMt\]](#)
- ... [AuthorizedAgreement \[UniversalVocabularyMt\]](#)
- ... [Account \[UniversalVocabularyMt\]](#) ... \*see above\*
- ... [LegalAgreement \[UniversalVocabularyMt\]](#) ... \*see above\*

... [TemporalThing](#)

- ... [BusinessRelatedDocumentOrAgreement \[UniversalVocabularyMt\]](#) ... \*see above\*

... [Account](#)

- ... [PersonalAccount \[UniversalVocabularyMt\]](#)
- ... [RetirementAccount \[UniversalVocabularyMt\]](#)
- ... [MoneyPurchasePensionScheme \[UniversalVocabularyMt\]](#)

... [FinancialAccount](#)

- ... [RetirementAccount \[UniversalVocabularyMt\]](#) ... \*see above\*

... [SelfInvestedPersonalPension](#)

[\[TheMotleyFoolUKCorpusMt -> \(MoneyPurchasePensionScheme,](#)


# Existing Vocab.

Web 3.0 Systems start from Web 2.0-  
style learning.

Acquire ground facts, test rule  
inferences.

**Content Understanding, Review,  
or Entry - CURE**





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## Spectrolab

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**Spectrolab**, headquartered in [Sylmar, California](#), is a subsidiary of [The Boeing Company](#) that manufacturers space [solar cells](#) and panels. It is also a subsidiary of the [Boeing Satellite Development Center](#), which is a unit of [Boeing Integrated Defense Systems](#). It was founded in 1956 by [Alfred E. Mann](#), who has gone on to become a billionaire American [entrepreneur](#) and [philanthropist](#). Spectrolab was acquired by [Hughes Aircraft Company](#) in 1975 and became a subsidiary of Hughes until its sale to Boeing in 2000. The company claims its "NeXt Triple Junction" [high efficiency solar cells](#) have a minimum average efficiency of 29.9%. In 2006 testing at the [National Renewable Energy Laboratory](#) demonstrated an efficiency of 40.7% using [triple-junction solar cells](#) developed by Spectrolab.

### Solar cells [edit]

The company's ultra triple junction solar cells use exotic materials like [germanium](#), [GaInP<sub>2</sub>](#), and [gallium arsenide](#) to achieve their efficiency.<sup>[1][2]</sup>

### References [edit]



# Low Barriers to (knowledge) Entry



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## Solar cells

[edit]

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## References

[edit]


- <sup>↑</sup> "Datasheet: 29.9% NeXt Triple Junction (XTJ) Solar Cells". Spectrolab.
- <sup>↑</sup> <http://www.spectrolab.com/DataSheets/TerCel/tercell.pdf>



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**Spectrolab**, headquartered in [California](#), manufactures [solar cells](#) and panels. It is a subsidiary of [Integrated Defense Systems](#), an American [entrepreneur](#) and a subsidiary of [Hughes](#) until its [acquisition](#). [Spectrolab](#) [cells](#) have a minimum average efficiency of [29.9%](#) demonstrated an efficiency of [29.9%](#).

### Solar cells

The company's ultra triple junction cells achieve their efficiency.<sup>[1][2]</sup>

### References

- <sup>1</sup> ["Datasheet: 29.9% NeXt Triple Junction \(XTJ\) Solar Cells"](#). Spectrolab.
- <sup>2</sup> <http://www.spectrolab.com/DataSheets/TerCel/tercell.pdf>

**Spectrolab**

About Basic Info

What type of thing is this?

**Additional Names**

Spectrolab

[Click to add another name](#)

Focus on  [Go](#)

[The Boeing Company](#) that manufactures space development Center, which is a unit of [Boeing](#), who has gone on to become a billionaire and by [Hughes Aircraft Company](#) in 1975 and became aims its "NeXt Triple Junction" high efficiency solar at the [National Renewable Energy Laboratory](#) developed by Spectrolab.

[germanium](#), [GaInP<sub>2</sub>](#), and [gallium arsenide](#) to




# Low Barriers to (knowledge) Entry



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### Solar cells

The company's ultra triple junction cells achieve their efficiency.<sup>[1][2]</sup>

### References

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**Spectrolab**

About Basic Info

manufacturing company

**Additional Names**

Spectrolab

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[The Boeing Company](#) that manufactures space development Center, which is a unit of [Boeing](#), who has gone on to become a billionaire and by [Hughes Aircraft Company](#) in 1975 and became its "NeXt Triple Junction" high efficiency solar at the [National Renewable Energy Laboratory](#) developed by Spectrolab.

[germanium](#), [GaInP<sub>2</sub>](#), and [gallium arsenide](#) to



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## Solar cells

The company's ultra triple junction achieve their efficiency.<sup>[1][2]</sup>

## References

1. <sup>^</sup> ["Datasheet: 29.9% NeXt Triple Junction \(XTJ\) Solar Cells"](#)  . Spectrolab.
2. <sup>^</sup> <http://www.spectrolab.com/DataSheets/TerCel/tercell.pdf>  




Spectrolab

About Basic Info

Looking for manufacturing company

**Additional Names**

 Spectrolab

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[edit]


[edit]



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### Solar cells

The company's ultra triple junction solar cells achieve their [efficiency](#).<sup>[1][2]</sup>

### References

- <sup>1</sup> "Datasheet: 29.9% NeXT Triple Junction (XTJ) Solar Cells". Spectrolab.
- <sup>2</sup> <http://www.spectrolab.com/DataSheets/TerCel/tercell.pdf>

**Spectrolab**

About Basic Info Advanced Info

manufacturing company (producer)

**Additional Names**

Spectrolab

Focus on  **Go**



# Low Barriers to (knowledge) Entry



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**Spectrolab**, headquartered in [solar cells](#) and [panels](#). It is a [Integrated Defense Systems](#) American [entrepreneur](#) and a subsidiary of [Hughes](#) until its [cells](#) have a minimum average demonstrated an efficiency of

The company's ultra triple jump  
achieve their efficiency. [1][2]

## References

1. ^ "Datasheet: 29.9% NeXt Triple Junction (XTJ) Solar Cells". Spectrolab.
2. ^ <http://www.spectrolab.com/DataSheets/TerCel/tercell.pdf>

The screenshot shows a window titled "Spectrolab" with three tabs: "About", "Basic Info", and "Advanced Info". The "Advanced Info" tab is selected. The main area contains a list of knowledge statements, each with a highlighted placeholder for a concept name:

- person* is Spectrolab's CEO.
- person* is the COO of Spectrolab.
- person* is the CFO of Spectrolab.
- intelligent agent* founded Spectrolab.
- intelligent agent* is a leader of Spectrolab.
- generic agent* is a member of Spectrolab.
- Spectrolab is headed by *person*.
- generic agent* and Spectrolab are competitors.
- Spectrolab founded *organization*.
- Spectrolab is a member of *organization*.
- Spectrolab has *thing* as an institutional focus.
- is the URL for Spectrolab's

At the bottom of the window, there is a "Focus on" label, a text input field, and a "Go" button. A vertical scrollbar is on the right side of the main content area.



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**Spectrolab**, headquartered in [California](#), manufactures [solar cells](#) and panels. It is a subsidiary of [Integrated Defense Systems](#), an American [entrepreneur](#) and a subsidiary of Hughes until 2007. Spectrolab's [solar cells](#) have a minimum efficiency of 29.9% and demonstrated an efficiency of 33.9%.

## Solar cells

The company's ultra triple junction solar cells achieve their efficiency.<sup>[1][2]</sup>

## References

- <sup>↑</sup> "Datasheet: 29.9% Next Triple Junction (XTJ) Solar Cells". Spectrolab.
- <sup>↑</sup> <http://www.spectrolab.com/DataSheets/TerCel/tercell.pdf>

**Spectrolab**

About Basic Info **Advanced Info**

[person](#) is Spectrolab's CEO.

[person](#) is the COO of Spectrolab.

[person](#) is the CFO of Spectrolab.

[person](#) is a leader of Spectrolab.

[person](#) is a member of Spectrolab.

[person](#) and Spectrolab are competitors.

Spectrolab founded [organization](#).

Spectrolab is a member of [organization](#).

Spectrolab has [thing](#) as an institutional focus.

Focus on  Go

**Not Understood**

None of the meanings for "Alfred E. Mann" make sense in this sentence.

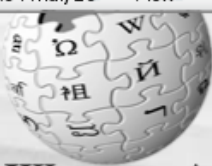
Would you like to define it?



# Low Barriers to (knowledge) Entry

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**Alfred E. Mann** (aka the Alfred E. Mann)

About Basic Info

The Alfred E. Mann is a:

  [intelligent agent](#)





















**Additional Names**

  [the Alfred E. Mann](#)

[\[edit\]](#)

[\[edit\]](#)

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1. ["Datasheet: 29.9% NeXt Triple Junction \(XTJ\) Solar Cells"](#)                       <



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**Alfred E. Mann** (aka the Alfred E. Mann)

About Basic Info

The Alfred E. Mann is a:

- [intelligent agent](#)
- [man \(help program\)](#)
- [controlling event \(physical event\)](#)
- [man \(male person\)](#)

What type of thing is this?

**Additional Names**

- [the Alfred E. Mann](#)
- [Al Mann](#)

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References



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**Alfred E. Mann** (aka the Alfred E. Mann)

About Basic Info Advanced Info

The Alfred E. Mann is a:

- [intelligent agent](#)
- [man \(male person\)](#)
- [billionaire \(human\)](#)
- [philanthropist \(person\)](#)

What type of thing is this?

**Additional Names**

- [the Alfred E. Mann](#)
- [Al Mann](#)

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## Alfred E. Mann

(aka the Alfred E. Mann)



About Basic Info **Advanced Info**

The Alfred E. Mann is a shareholder in [legal corporation](#).

[generic agent](#) employs the Alfred E. Mann.

The Alfred E. Mann's e-mail address is .

One phone number of the Alfred E. Mann is .

 The Alfred E. Mann was born on [1925 \(year\)](#) .

The Alfred E. Mann's occupation is [person](#).

The Alfred E. Mann employs [person](#).

The Alfred E. Mann's sex is [thing](#).

Focus on  [Go](#)

References



# Low Barriers to (knowledge) Entry



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# Low Barriers to (knowledge) Entry

## Entirely declarative

- Can be added by anyone/any project
- Most added automatically
- Can be concluded to or queried over
- Will support any truth verification mechanism

```
(goalCategoryForAgent Cyc
  (thereExists ?TV
    (knows Cyc
      (sentenceTruth
        (conditionAffectsOrgType
          CreutzfeldtJakobDisease
          HomoSapiens) ?TV)))
  (GoalOfVerifyingKBContentAboutTopicFn
    ScienceAndNature-Topic))
```

Cyc would like to know whether it's true that:

 Mad Cow disease affects people.

# Knowledge Acquisition Goals



## Query

“What are symptoms of Whooping Cough?”



(symptomOfAilment WhoopingCough ?SYMP )

NL Generation

## Partial English sentences

“A symptom of whooping cough is \_\_\_\_”

“Whooping cough can cause \_\_\_\_”

“A symptom of Pertussis Bordetella is \_\_\_\_”

“Symptoms (such as \_\_\_\_\_) of whooping cough”



## Even Lower Barriers



# Learning Facts by Search





Looking for something that matches the argument constraints on the predicate...

"... symptoms of pertussis such as fever and a dry cough ..."

Parse back into existing CycL concepts

(symptomOfAilment WhoopingCough Fever)

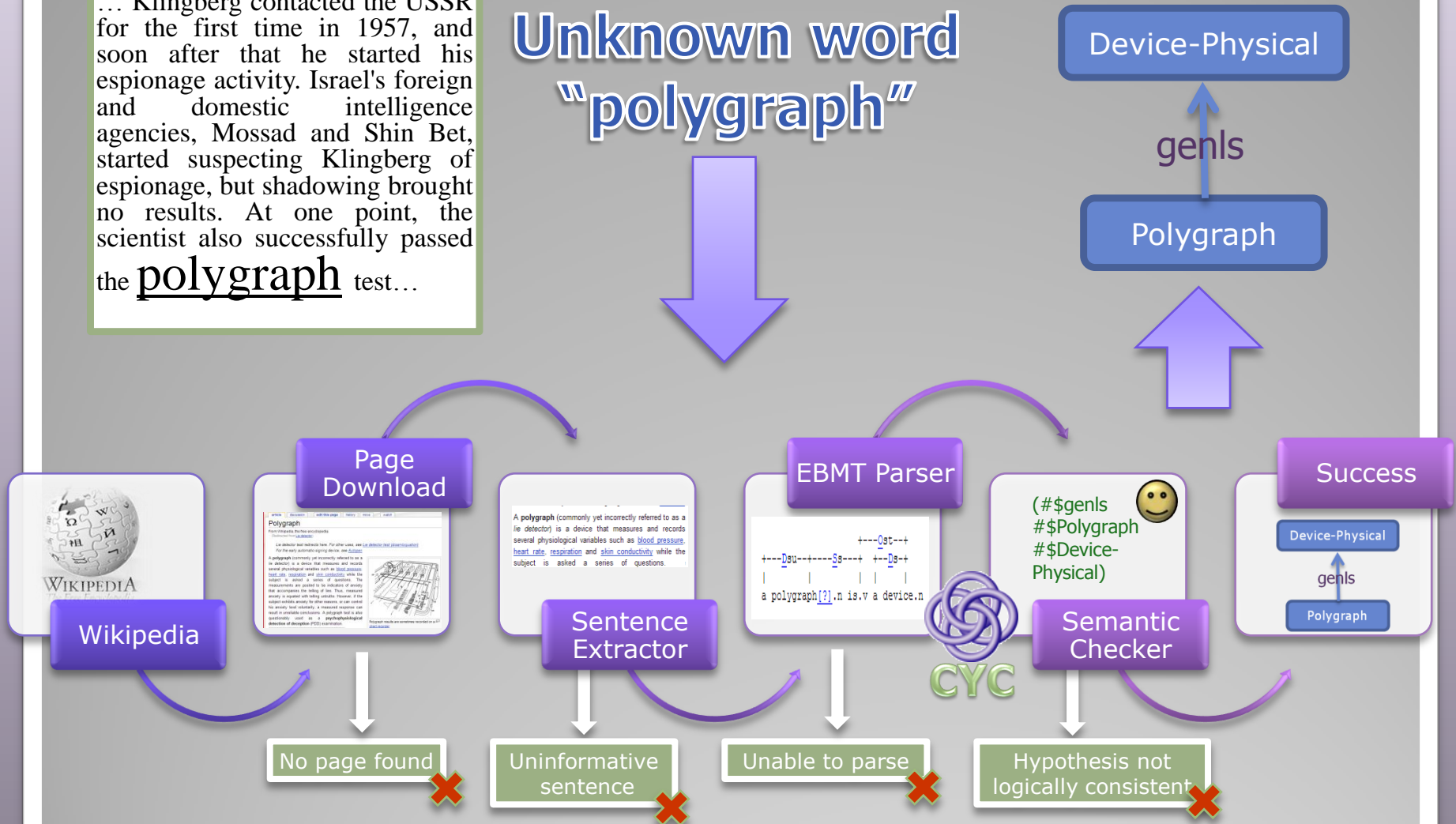
(symptomOfAilment WhoopingCough Coughing-AilmentCondition)

# Parsing Results



... Klingberg contacted the USSR for the first time in 1957, and soon after that he started his espionage activity. Israel's foreign and domestic intelligence agencies, Mossad and Shin Bet, started suspecting Klingberg of espionage, but shadowing brought no results. At one point, the scientist also successfully passed the polygraph test...

# Unknown word "polygraph"



# Machine Reading: Term learning

Example: "common sense"  
"The heart pumps blood to the lungs."

Cyc Knows: The heart is a kind of pump.  
Cyc Knows: Every pump can pump fluid.

**Mt :** AllContentModelsCollectorMt

**HL Formula :**

((TypeCapableFn behaviorCapable) Heart PumpingFluid providerOfMotiveForce)

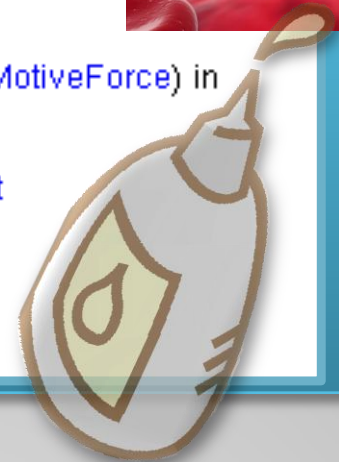
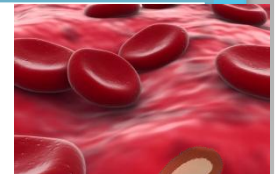
**Justification :**

● (typePrimaryFunction-AgnosticIntentional Pump-Generic PumpingFluid providerOfMotiveForce) in ObjectPhysicalCharacteristicsMt

**:GENLPREDS** (genIPreds typePrimaryFunction-AgnosticIntentional  
(TypeCapableFn behaviorCapable)) in AllContentModelsCollectorMt

● (transitiveViaArgInverse  
(TypeCapableFn behaviorCapable) gens 1) in BaseKB

**:GENLS** (gens Heart Pump-Generic) in AllContentModelsCollectorMt



**Machine Reading: Background KB**

# Train

```
-----Xp-----
+-----Wd-----+          +-----MVp-----+
|               +-----A-----+          |               +-----Jp-----+-----Mp-----+          |
|               +---G---+---G---+---Ss---+---Os---+---Mp---+          +---Dmcn---+          +N Sa+          +---Js---+
|               |               |               |               |               |               |               |
LEFT    Royal.a Dutch Shell Plc halted.v output.n of 455,000 barrels.n a day.p in Nigeria .
```

```
(#$and ($isa ($TheFn #$DecreaseEvent)
  ($DecreaseInValueReturnedByFn ($ExportRateOfByFn #$Petroleum-CrudeOil) #$Nigeria))
($doneBy ($TheFn #$DecreaseEvent) #$RoyalDutchShell)
($quantityChangeAmount ($TheFn #$DecreaseEvent) ($BarrelsPerDay 455000)))
```

# Template

```
-----Xp-----
+-----Wd-----+          +-----MVp-----+
|               +-----+-----+          |               +-----Jp-----+          |
|               +---Ss---+---Os---+---Mp---+          +          +---Js---+
|               |               |               |               |               |               |
LEFT    [Agent]                halted.v output.n of          [Quantity]                in [Locn] .
```

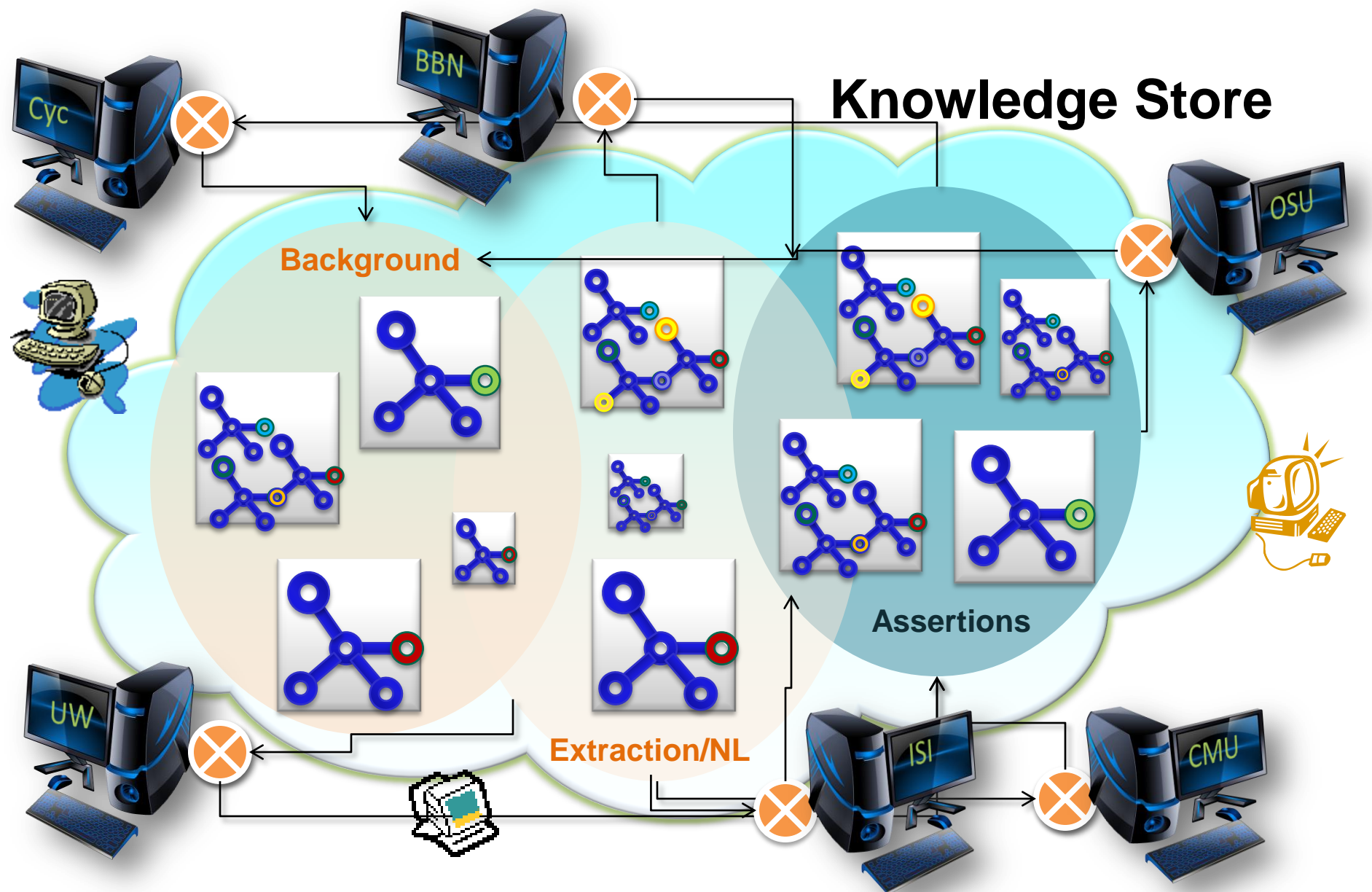
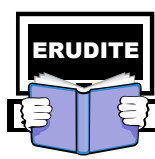
```
(#$and ($isa ($TheFn #$DecreaseEvent)
  ($DecreaseInValueReturnedByFn ($ExportRateOfByFn #$Petroleum-CrudeOil) [Locn]))
($doneBy ($TheFn #$DecreaseEvent) [Agent])
($quantityChangeAmount ($TheFn #$DecreaseEvent) [Quantity]))
```

# Use

Petróleos de Venezuela S.A. halted output of 760 000 barrels a week in Maracaibo.

```
(#$and ($isa ($TheFn #$DecreaseEvent)
  ($DecreaseInValueReturnedByFn ($ExportRateOfByFn #$Petroleum-CrudeOil)
    #$CityOfMaracaiboVenezuela))
($doneBy ($TheFn #$DecreaseEvent) #$PetroleosdeVenezuelaSA
($quantityChangeAmount ($TheFn #$DecreaseEvent) ($BarrelsPerDay 760000)))
```

# Machine Reading: Scaling up scope, detail, understanding



- Scalable application
- Platform scalability (LarKC)
- Is there more than logic
  - and madness like that.

Coming up



# TextPrism

Intelligent Information Dissemination



## **TextPrism:**

- Auto-tagging of text *combined with*
- Rich user models *combined with*
- Business rules *combined with*
- Inference

Allows us to quickly dispatch the right information to the right people

**Personalized Information Feeds**

- Goes beyond pure lexical matches
  - Concepts with multiple lexifications
  - Generalization hierarchy
- Topics of interest are automatically inferred from user profile information
  - Find things the subscriber didn't know – and didn't have to know -- to ask about

**TextPrism: Improved Recall**

- Subscriber:
  - Yankees fan
  - Owns stock in Apple and Verizon
  - Likes the Grateful Dead
- Possible interests:
  - Jerry Garcia, Bob Weir, Phil Lesh, ... (Grateful Dead members)
  - Boston Red Sox (Yankees' rival)
  - George Steinbrenner (Yankees' owner)
  - FCC, Michael J. Copps (Telecom regulatory agency and chair)
  - iPod, iPhone, MacBook, ... (Apple products)
  - Steve Jobs (Apple CEO)
  -

## Improved Recall Examples

- Reduce ambiguities
  - Improve concept identification precision using semantic licensing rules
- Tighten the matching criteria
  - Require the co-occurrence of multiple concepts when selecting matches

**TextPrism: Improved Precision**

- Without considering context, a reference to “Springfield” is highly ambiguous:

I went to (**#\$AttendingSomething**) a **concert** (**#\$CollectionIntersection2Fn** **#\$PublicEvent** **#\$MusicalPerformance**) in **Springfield** (**#\$SpringfieldCollege** (**#\$CityNamedFn** "Springfield" **#\$Colorado-State**) (**#\$CityNamedFn** "Springfield" **#\$Massachusetts-State**) (**#\$CityNamedFn** "Springfield" **#\$Ohio-State**) **#\$CityOfSpringfieldIL** (**#\$CityNamedFn** "Springfield" **#\$Missouri-State**) (**#\$CityNamedFn** "Springfield" **#\$Virginia-State**)).

However, if a state is mentioned, then references to cities in that state are licensed.

(implies  
  (and  
    (isa ?CITY City)  
    (geographicalSubRegionsOfState ?STATE ?CITY))  
  (isLicensedBy ?CITY ?STATE))

## Semantic Licensing Examples



When I arrived (~~#\$ArrivingAtAPlace~~) in Virginia (~~#\$Virginia-State~~), I went to (~~#\$AttendingSomething~~) a concert (~~(#\$CollectionIntersection2Fn #\$PublicEvent #\$MusicalPerformance)~~) in Springfield (~~(#\$CityNamedFn "Springfield" #\$Virginia-State)~~).

However, if a state is mentioned, then references to cities in that state are licensed.

When I arrived (~~#\$ArrivingAtAPlace~~) in Massachusetts (~~#\$Massachusetts-State~~), I went to (~~#\$AttendingSomething~~) a concert (~~(#\$CollectionIntersection2Fn #\$PublicEvent #\$MusicalPerformance)~~) in Springfield (~~(#\$CityNamedFn "Springfield" #\$Massachusetts-State)~~).

## Semantic Licensing Examples

- Subscriber:
  - Investor
- Possible Interests:
  - Paris, Marseille, Lyon, Toulouse , Nice, ...

But not all articles about Lyon are equally interesting to a tourist.

Tourist care about restaurants, hotels, tourist attractions, events, ...

## More Precise Matches

Look for only articles that mention the  
place of interest *and* a type of restaurant

```
(implies
  (and
    (genls ?SPEC RestaurantSpace)
    (interestedInVisiting ?USER ?REGION))
  (conceptSetPotentiallyInterestingToForDomainBecause ?USER
    (TheSet ?REGION ?SPEC) Travel-TripEvent
    (and
      (typeIntendedBehaviorCapable RestaurantSpace
        EatingEvent eventOccursAt)
      (interestedInVisiting ?USER ?REGION))))
```

## More Precise Matches

## The New Russia

Warner LeRoy's doomed incarnation of the Russian Tea Room closed only five short years ago, although in the frantic world of modern-day New York dining, it seems like five decades. As the famous old room sat moldering on 57th Street ...

## Reviewer: MW - foodie

Victor Cafe was a real find in Marseille - amongst the scores of restaurants offering the same dishes, it stands out due to its excellent menu ...

## Ligue 1 - Marseille focused on title, not Gerets

Coach Eric Gerets's departure at the end of the season will not disturb Marseille's quest for a first league title in 17 years when they take on Toulouse in Ligue 1 on Saturday, the players said.

## Bistro Romain

A Quality chain Bistro on the Quais of the Old Port  
4 Quai Rive-Neuve  
Marseille, 13001

This renowned chain Bistro is conveniently located in the Old Port. The menu has a wide selection of dishes at reasonable prices: Beef Bourguignon, sagna, thick sirloin, Duck Breast, ...

## Category: French - Marseille Restaurants

Located in the heart of Marseille, this grill offers a buffet of appetizers and a choice of three main courses.

limited and dishes such

## Austin Spider House Patio Bar & Cafe

Just North of the UT campus in Central Austin, this bohemian hangout is a must for anyone seeking the quintessential Austin experience. ...

# Only Restaurants in Marseille

- Subscriber:
  - Investments in uranium
- Possible Interests:
  - Regions that export uranium and have experiencing civil unrest (e.g., protest marches, civil wars, violent gatherings ...)

```
(implies
  (and
    (isa ?COMMODITY CommodityProduct)
    (hasInvestmentInterestInCommodityType ?USER ?COMMODITY)
    (exports ?REGION ?COMMODITY)
    (genls ?UNREST-TYPE CivilUnrest))
  (conceptSetPotentiallyInterestingToForDomainBecause ?USER
    (TheSet ?REGION ?UNREST-TYPE) Investing
    (and
      (exports ?REGION ?COMMODITY)
      (hasInvestmentInterestInCommodityType ?USER ?COMMODITY))))
```


## More Precise Matches

# Reverence for life aids recovery from heart surgery (Reuters)

Reuters : Having a [deep reverence for life](#) seems [to have influence on](#) health [outcomes after heart bypass](#) surgery [to a study reported today at the American](#) Geriatrics Soc [meeting in](#) Chicago. This [supports the potential influence](#) "spiritual effect" [on](#) patients' recovery.

investing sport **health** travel occupation device




- ?USER may be interested in ?CONCEPT because ?CONCEPT is a symptom of ?AILMENT-TYPE and ?USER has a case of ?AILMENT-TYPE.
- ?USER may be interested in ?CONCEPT because ?CONCEPT is used to treat ?AILMENT-TYPE and ?USER has a case of ?AILMENT-TYPE.
- ?USER may be interested in ?CONCEPT because ?USER has a case of ?AILMENT-TYPE and ?AILMENT-TYPE primarily afflicts the ?CONCEPT.
- ?USER may be interested in ?CONCEPT because ?CONCEPT is the drug of choice for treating a case of ?AILMENT-TYPE and ?USER has a case of ?AILMENT-TYPE.



Larry Lefkowitz

CURE Back

Interest of Larry Lefkowitz

-  Sport
-  Travel-TripEvent
-  AilmentCondition
  - coronary artery
  - coronary artery bypass graft
  - percutaneous intervention
  - beta blocker
  - trinitroglycerine
  - angina
  - vascular stent
  - the Cleveland Clinic main campus
  - Mayo Clinic
  - stress test
  - diagnostic cardiac catheterization
  - intravascular ultrasound
  - coronary angiogram
  - electrocardiogram



0 of 356

Process next Post Auto



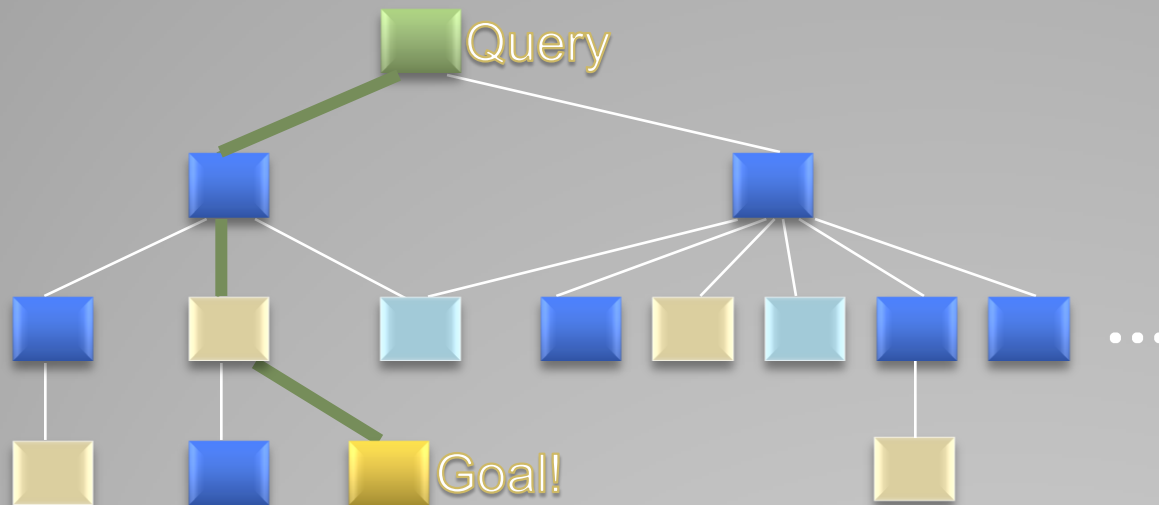


# Scaling Beyond the Web with LarKC

Michael Witbrock, PhD.  
Technical Director, LarKC Project

(perpetrators MurderFn(RHariri) ?X)

Inference is a search through proof space applying a large, extensible array of reasoning modules to perform inference



(advocates RHariri ?WHAT)

**Worker**

- Performs all low-level inference work

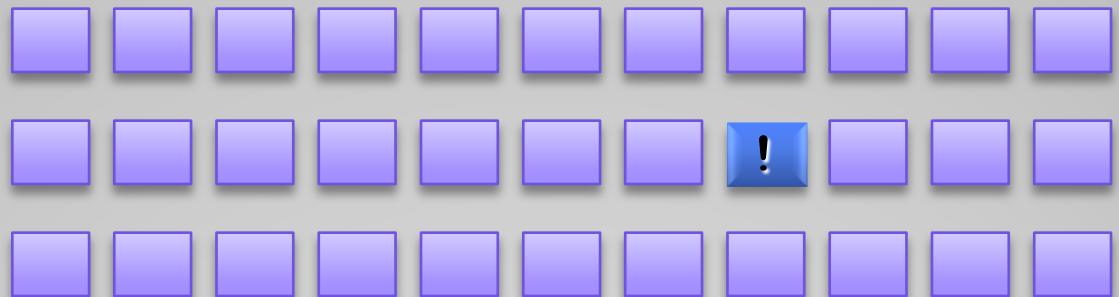
**Tactician (meta)**

- Enforces a strategy
- Decides what work should be done

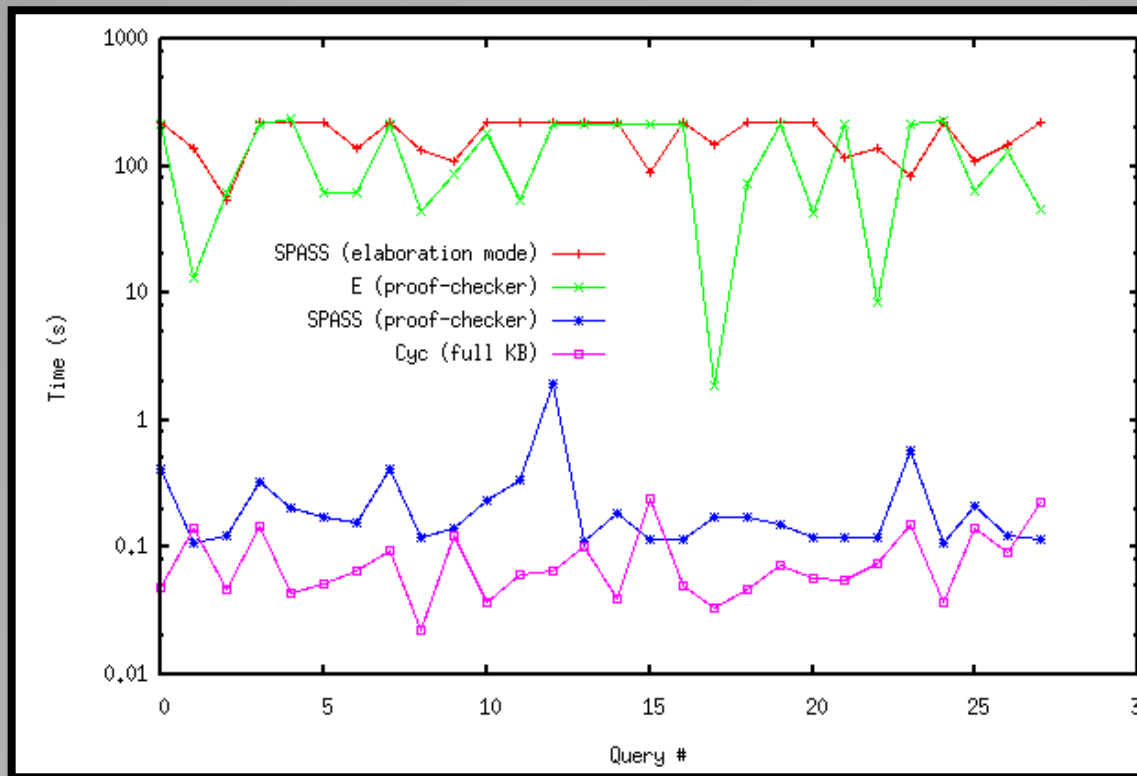
**Strategist (meta-meta)**

- Manages resources
- Decides overall strategy

> 1000 special purpose inference modules



e.g. (disjointWith Doctor-Medical HumanInfant)



Proof checker:  
<100 relevant  
axioms

Elaboration Mode:  
1600 relevant  
axioms

Cyc KB:  
4 million axioms  
relevant & irrelevant

Note: Otter times out

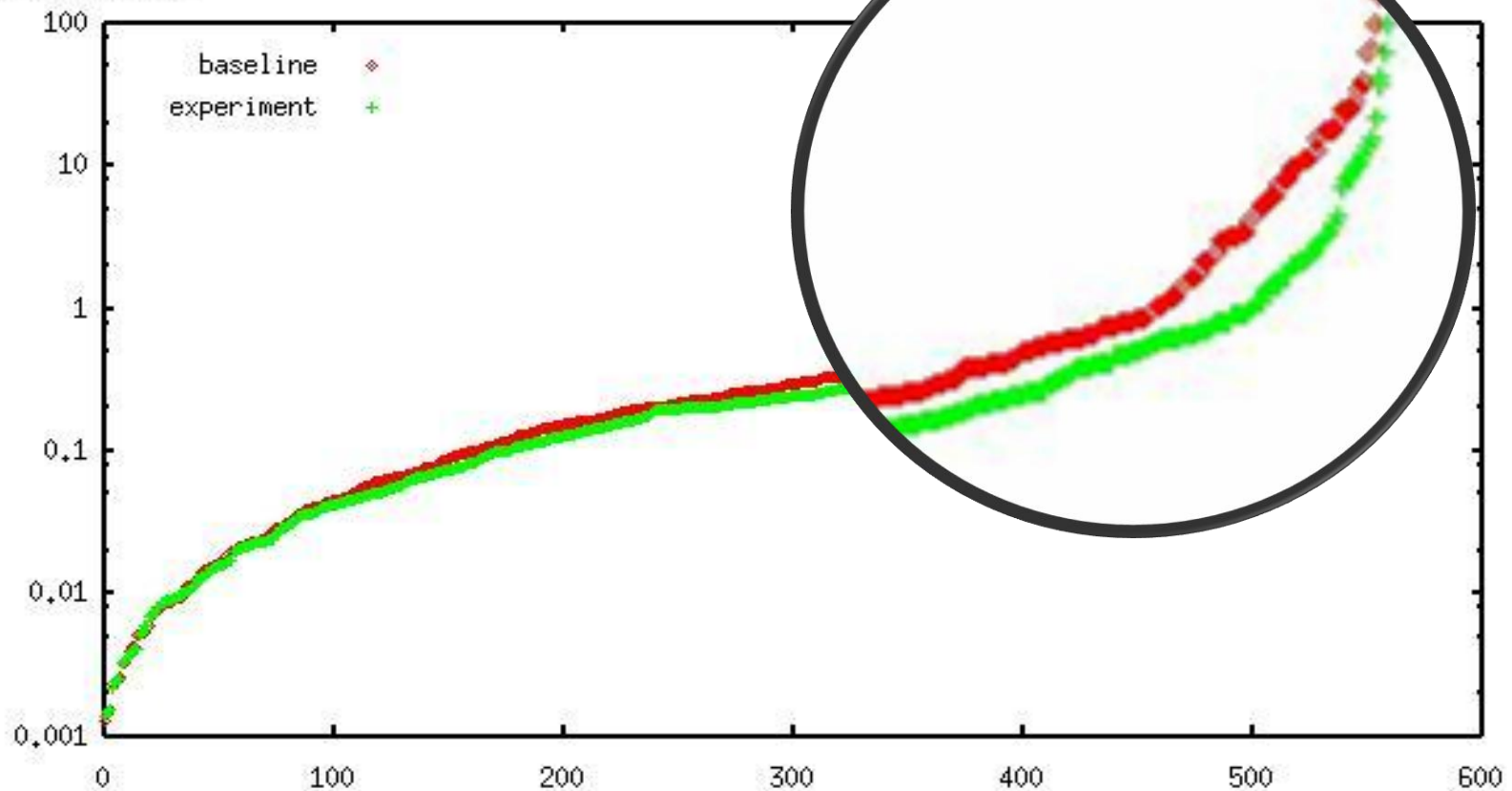
**Performance:**  
**Subtheory: disjointWith**

Experiment : Non-TKB Training Answerable Transformation

Experience-Based Tactician Sorting

Time To First Answer

Time (seconds)



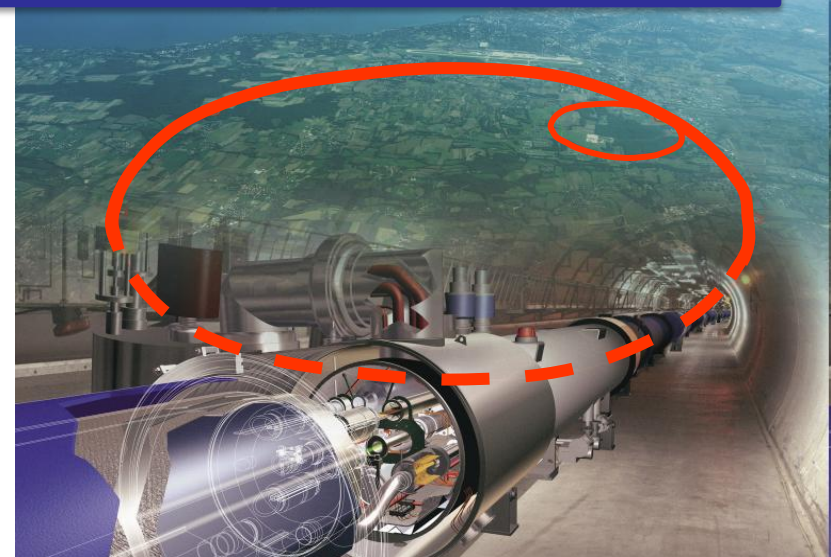
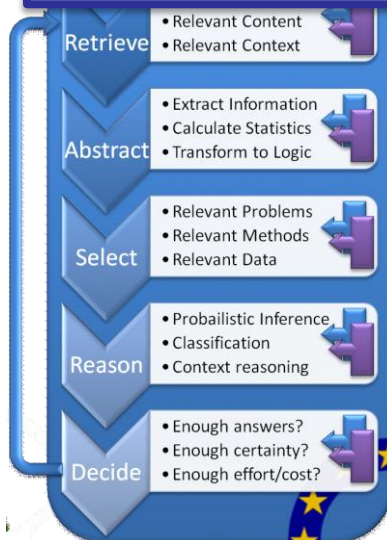
**Inference is Fast & Trainable**

# The Large Knowledge Collider



“LarKC's value is as an **experimental platform**.

LarKC is as an **environment** where people can go to replicate (or extend) their results in an environment where **all the infrastructural heavy lifting has been already taken care of..**”





- Scalable ( $> 10^9$  triples, lazy pipes)
- Reconfigurable (plugins with standard API's)
- Open (Apache license)
- heterogenous (TRANSFORM, wrappers)
- easy to do experiments on (wrap & integrate)
- enable incompleteness (IDENTIFY, SELECT)
- enable distribution (plugin containers)
- anytime behaviour
- web-enabled (remote plugins, remote data)



# Infinite scalability?

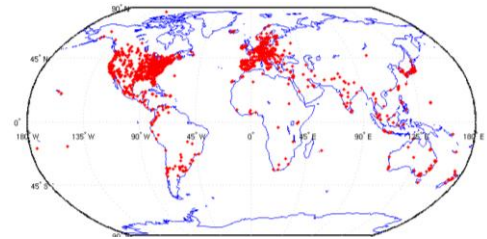
## parallelisation

- cluster and high-performance computing



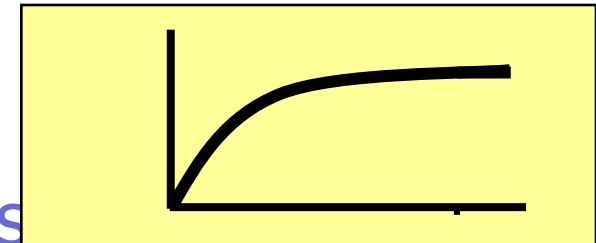
## distribution

- “Thinking@home”,  
“self-computing semantic Web”

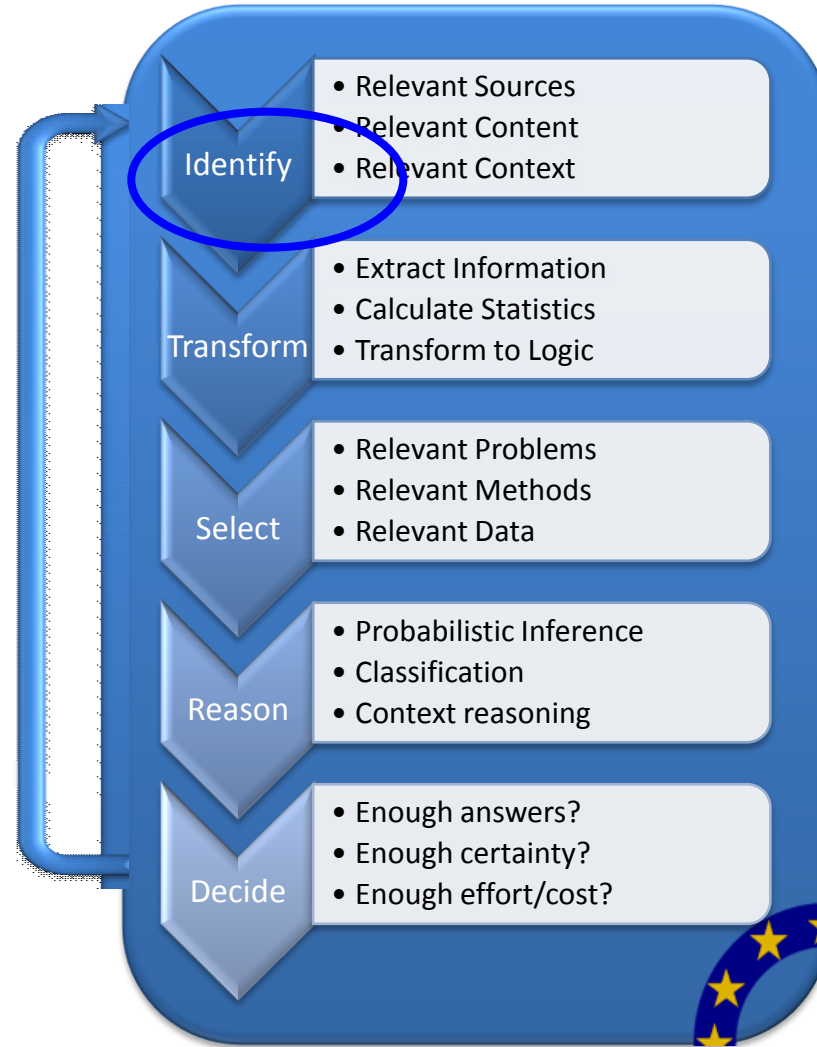


## approximation

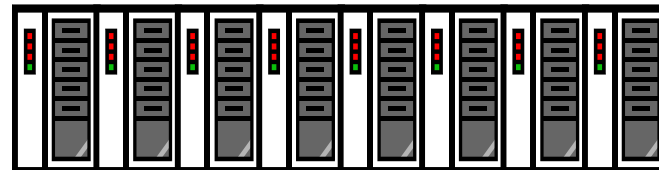
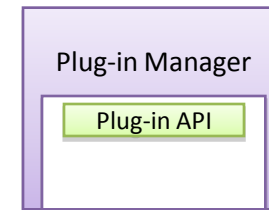
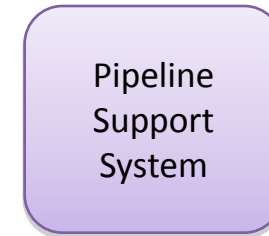
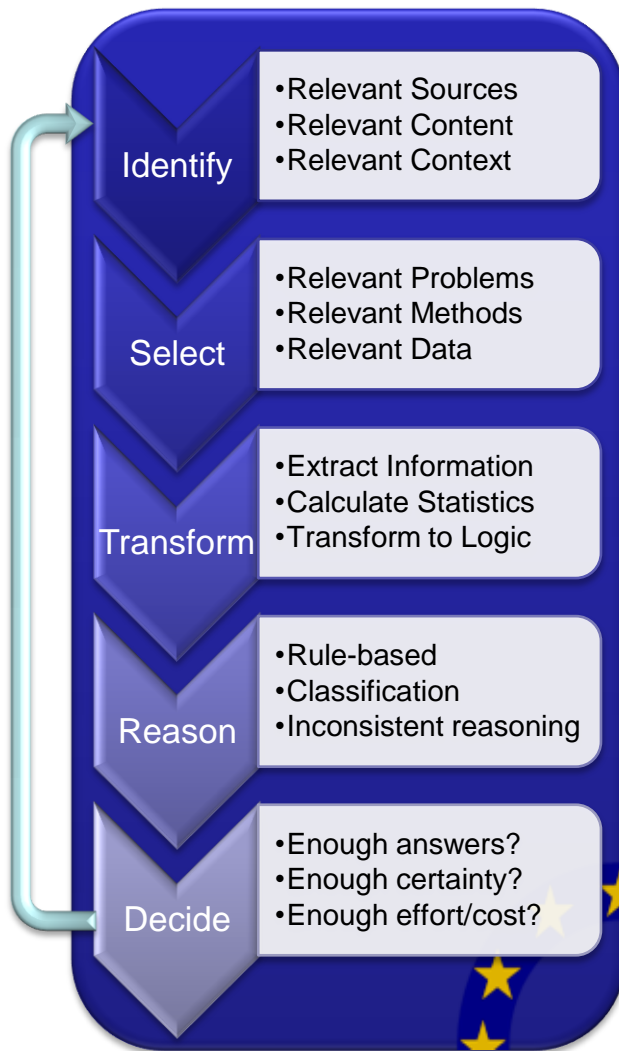
- gets better with more resources
- “almost” is often good enough



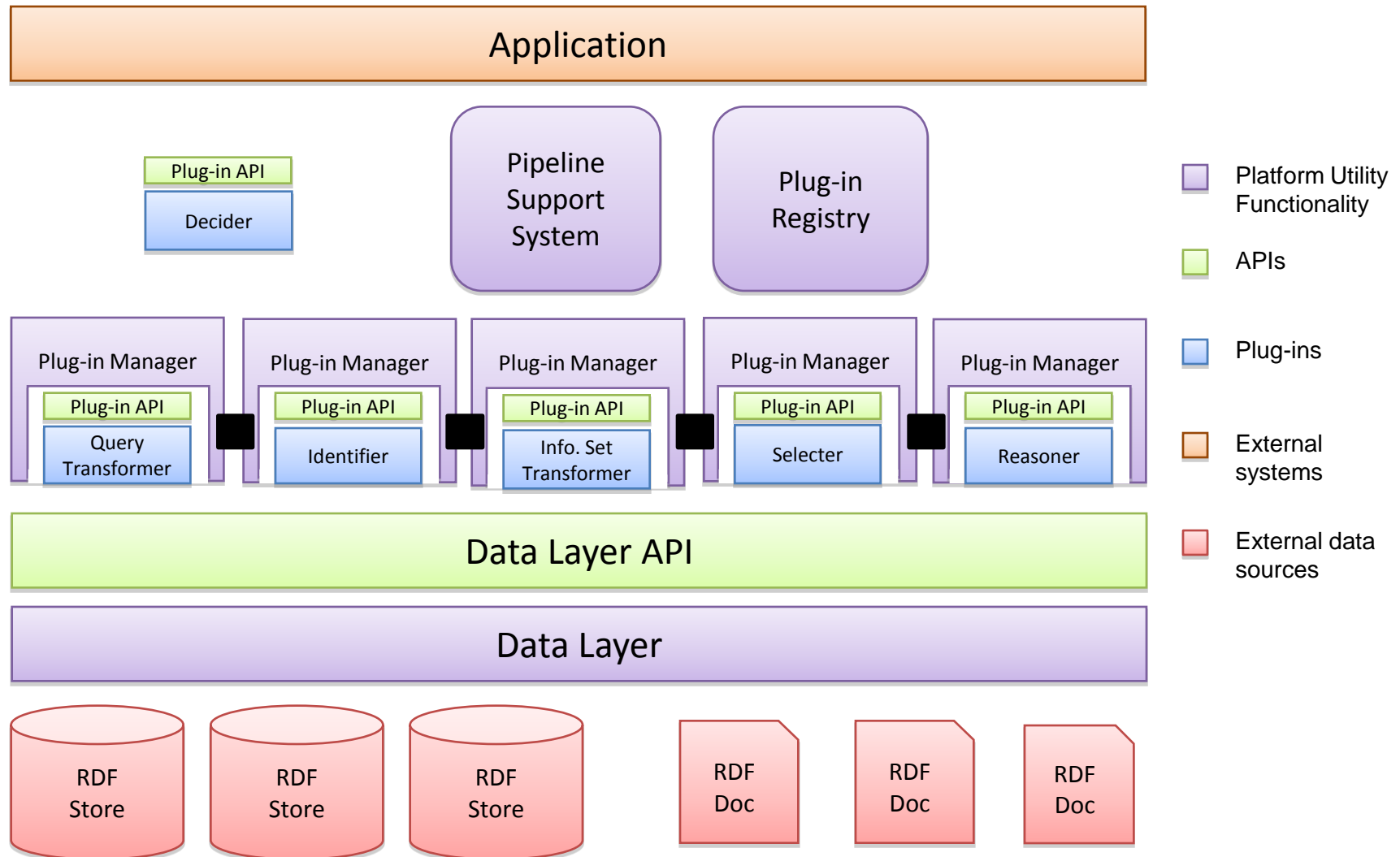
# Basic Operation Types



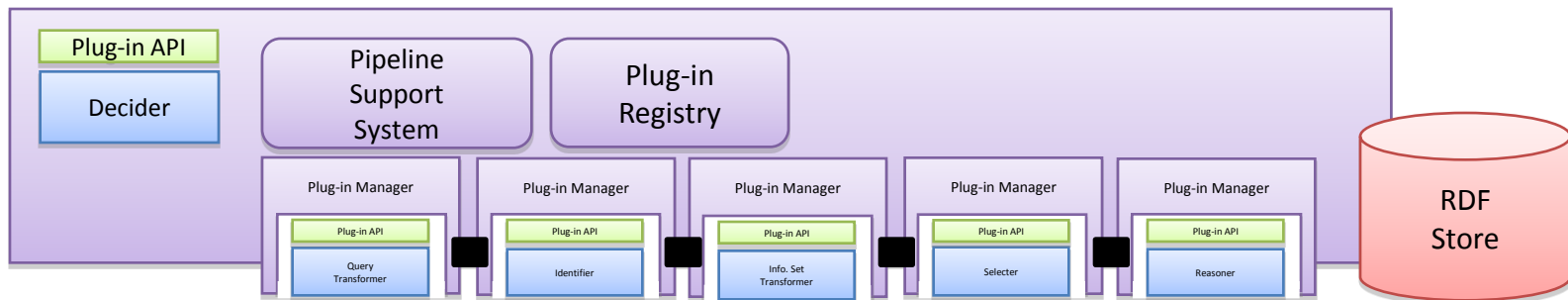
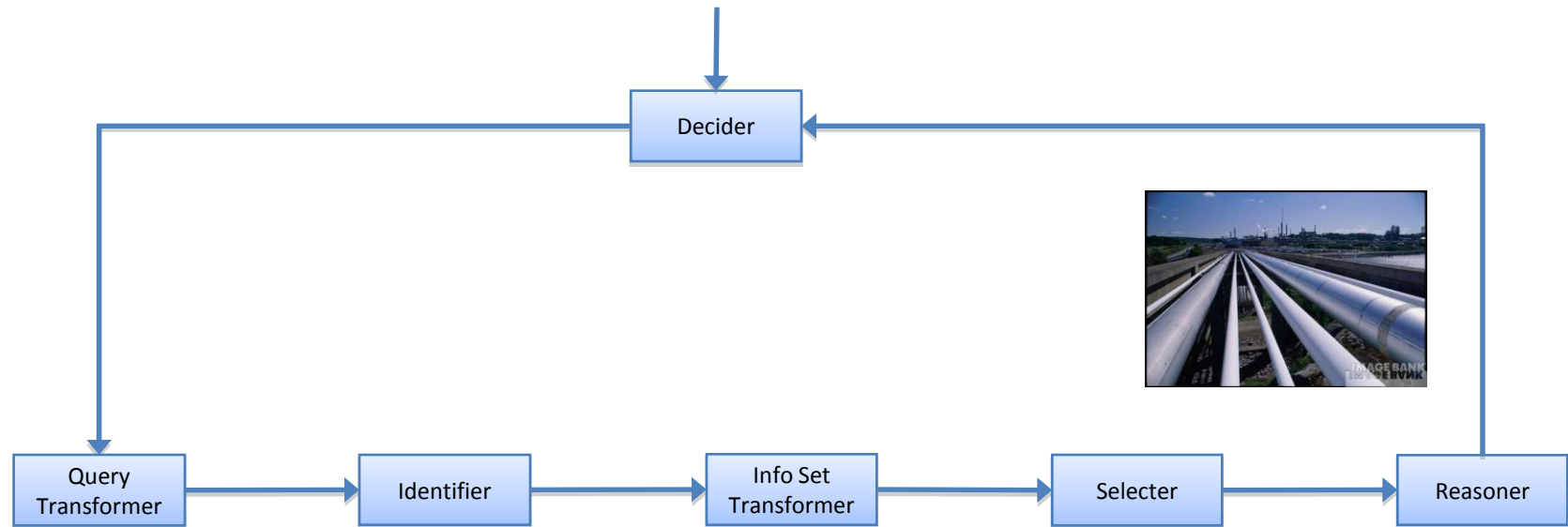
# Realising the Architecture



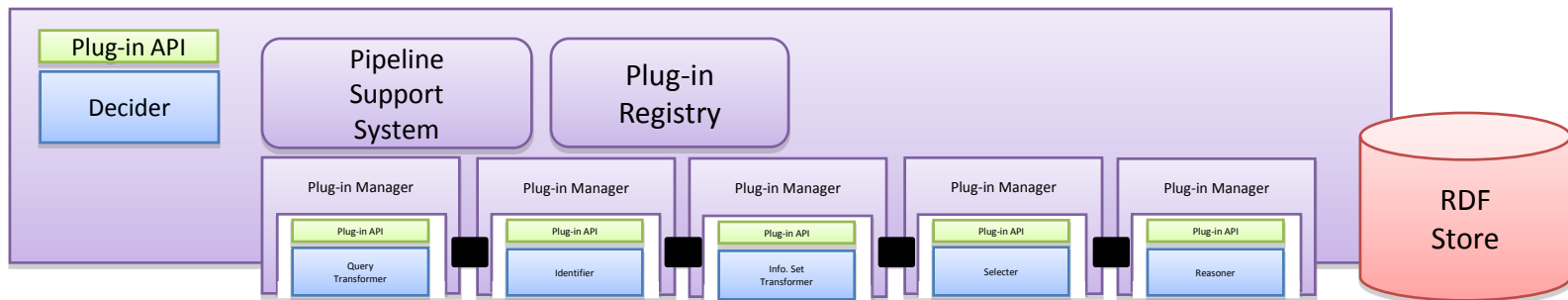
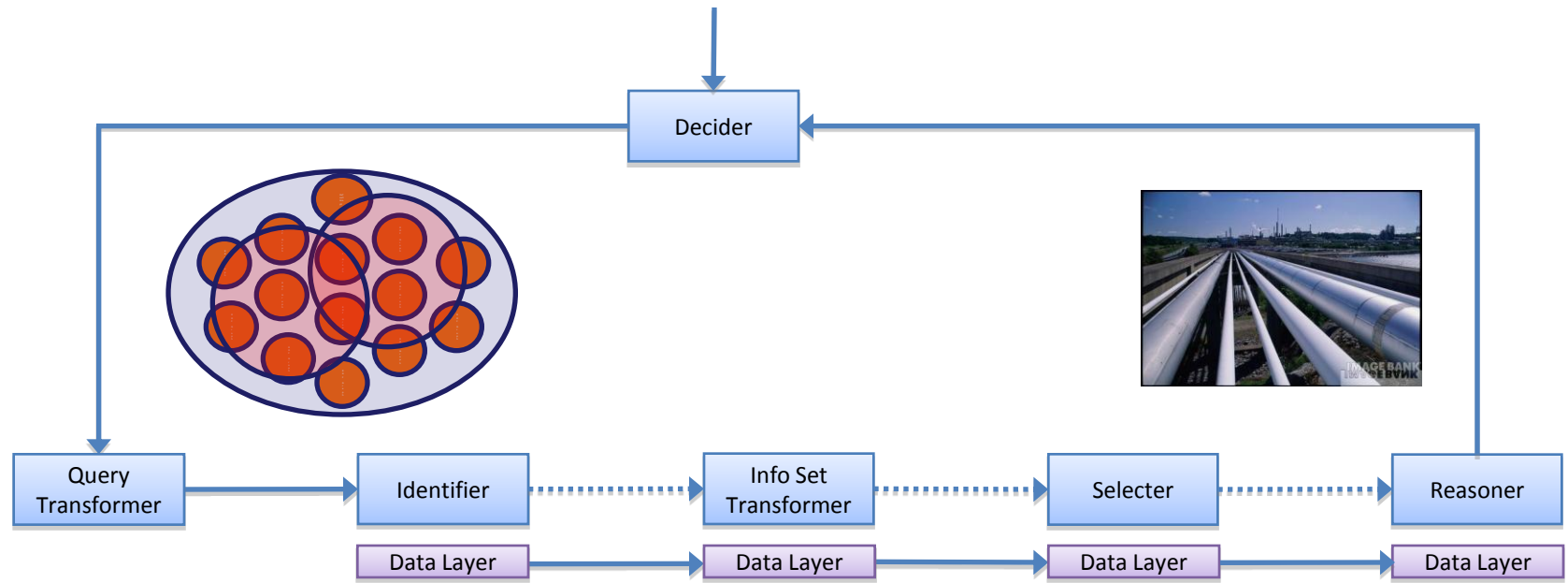
# LarKC Architecture



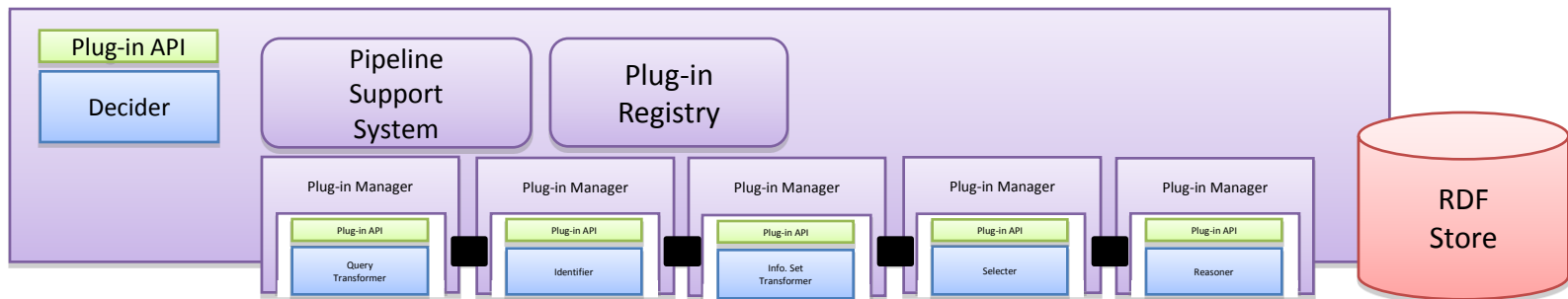
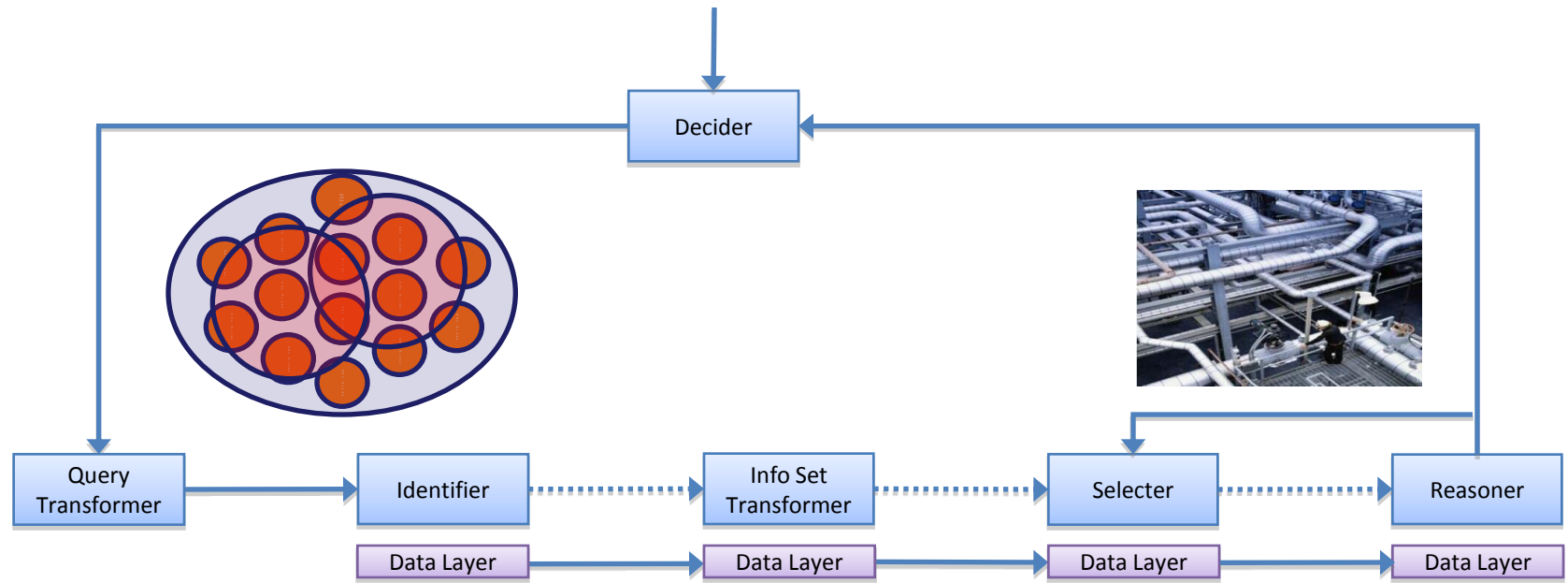
# What does a pipeline look like?



# What Does a Pipeline Look Like?

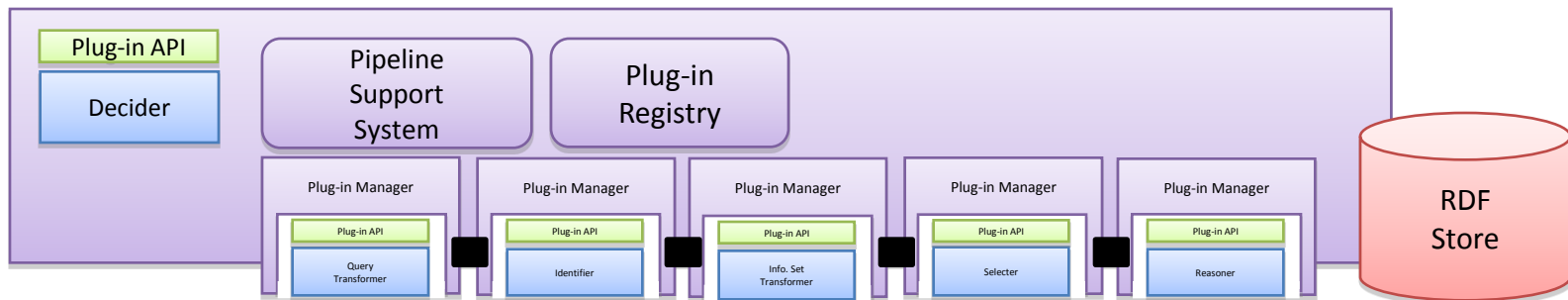
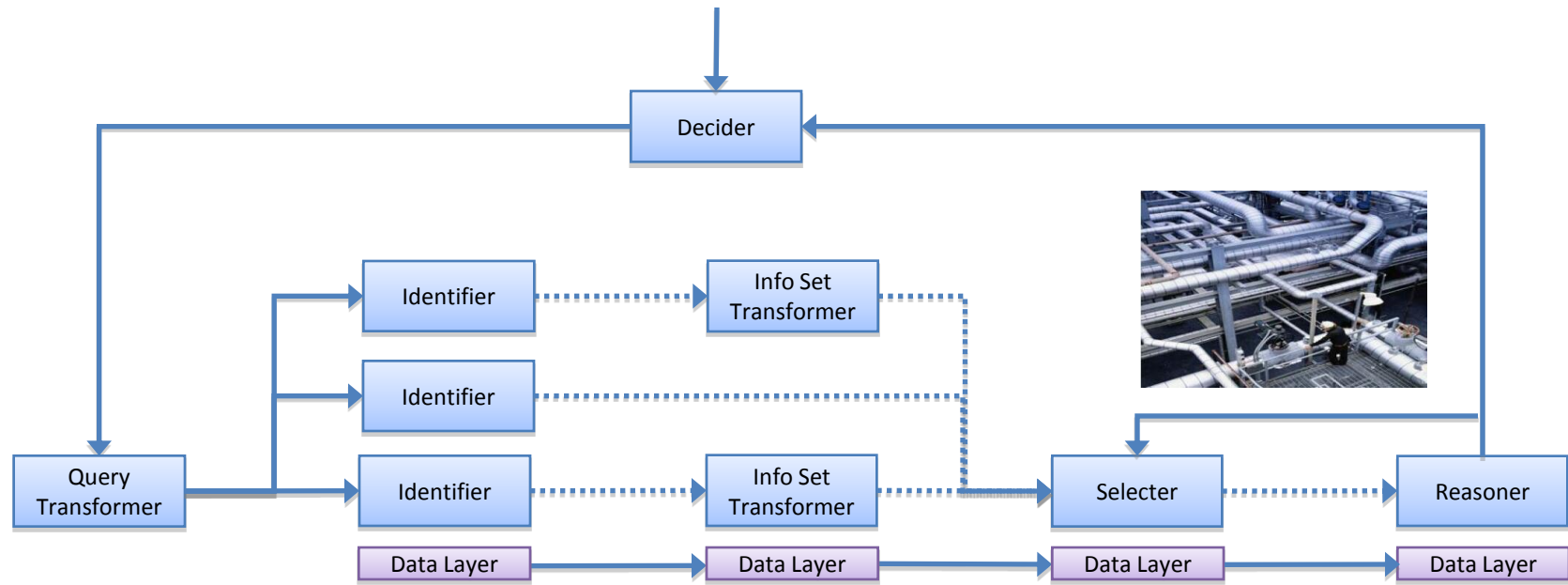


# What Does a Pipeline Look Like?

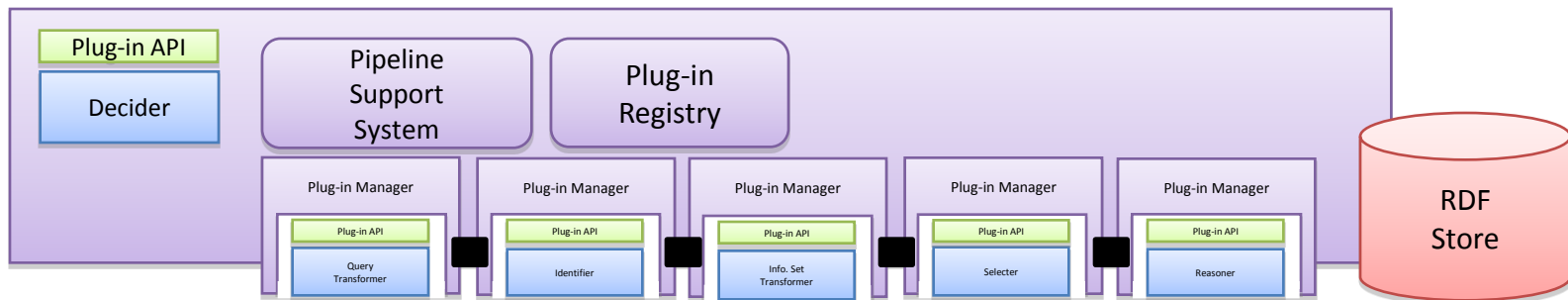
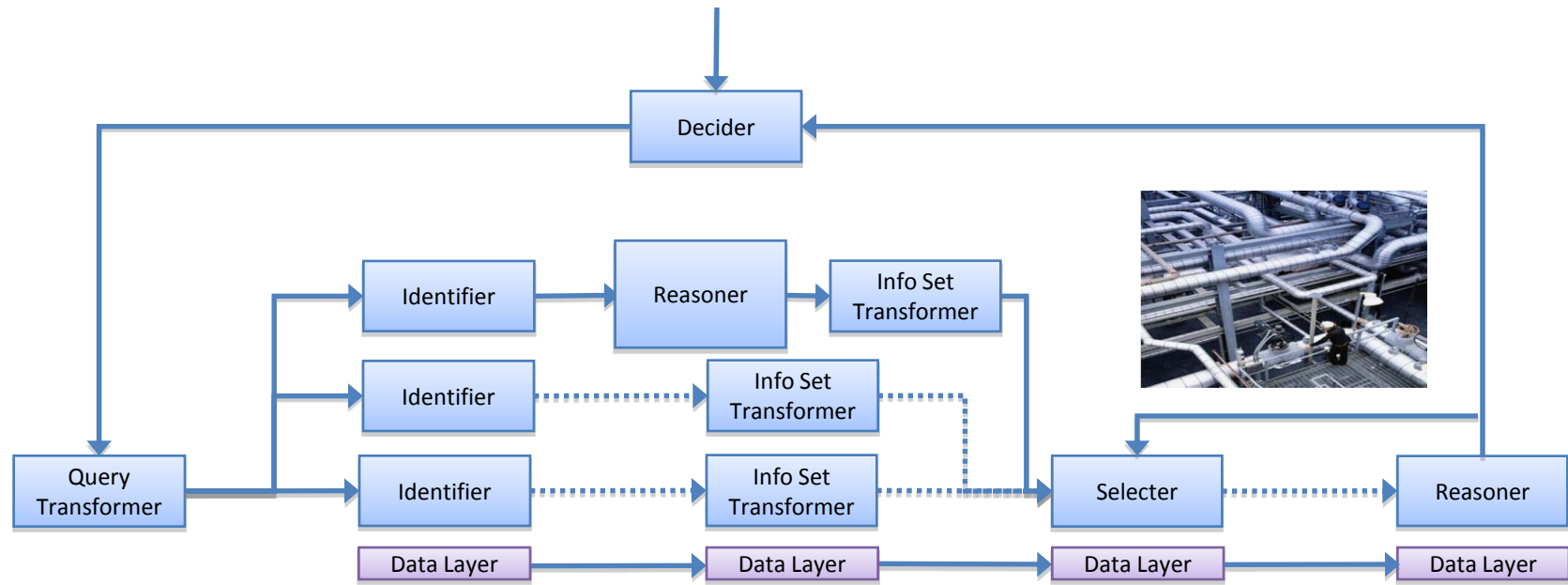




# What Does a Pipeline Look Like?



# What Does a Workflow Look Like?



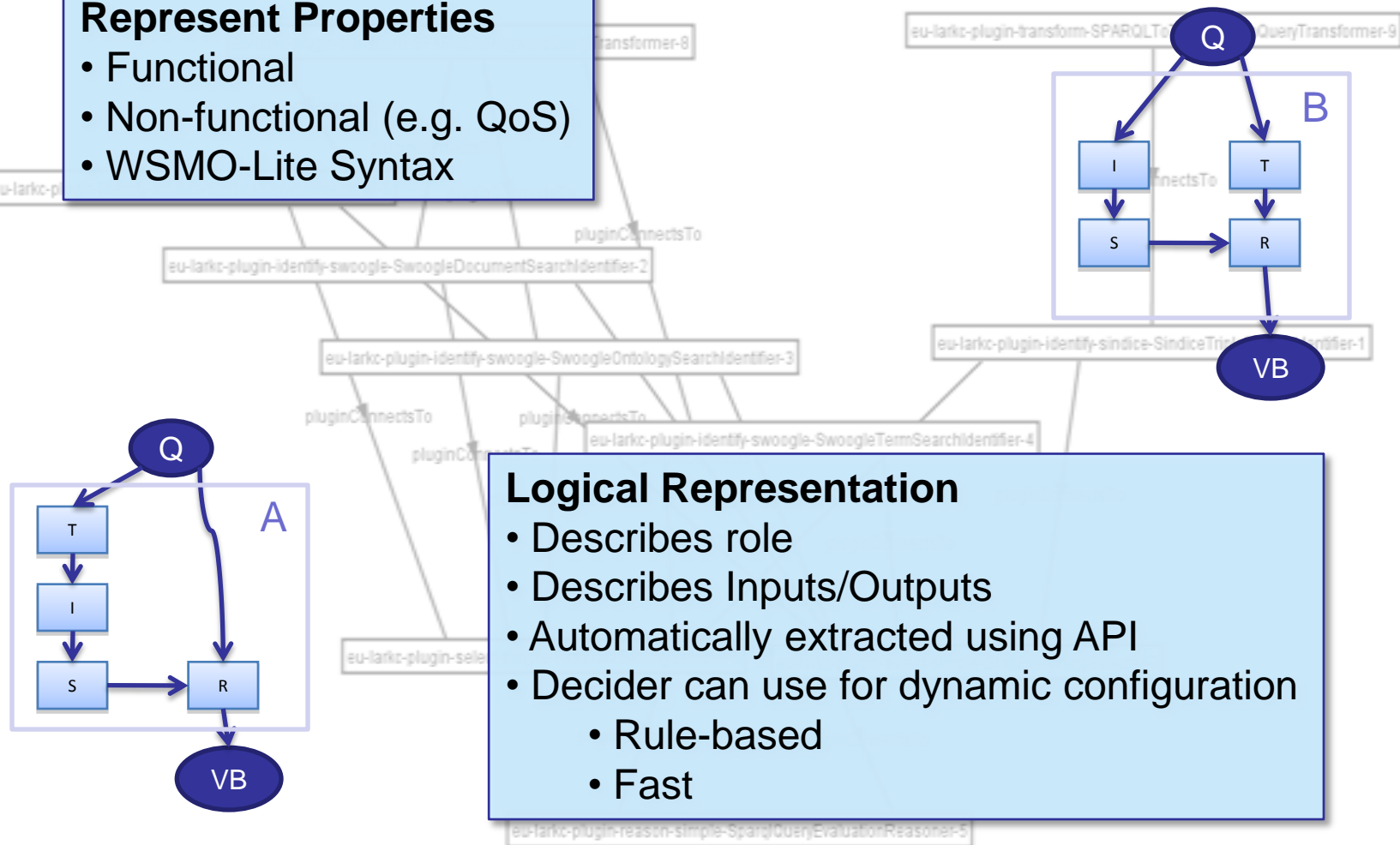
# Decider Using Plug-in Registry to Create Pipeline



D 1.3.1

## Represent Properties

- Functional
- Non-functional (e.g. QoS)
- WSMO-Lite Syntax



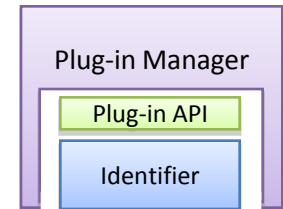
## Logical Representation

- Describes role
- Describes Inputs/Outputs
- Automatically extracted using API
- Decider can use for dynamic configuration
  - Rule-based
  - Fast

# 1. Platform and Plug-in APIs are useable

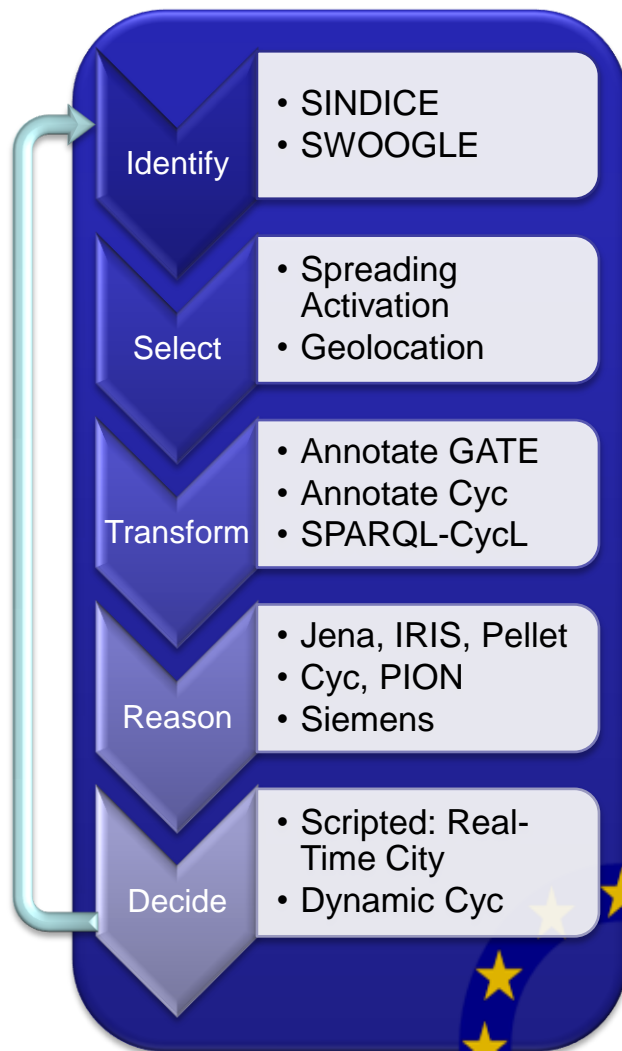


- In the twenties of plug-ins already
- Plug-ins written with little help by platform architects
- Plug-ins run successfully, and perform together
- Plug-in for open-calais text done in <4 hours

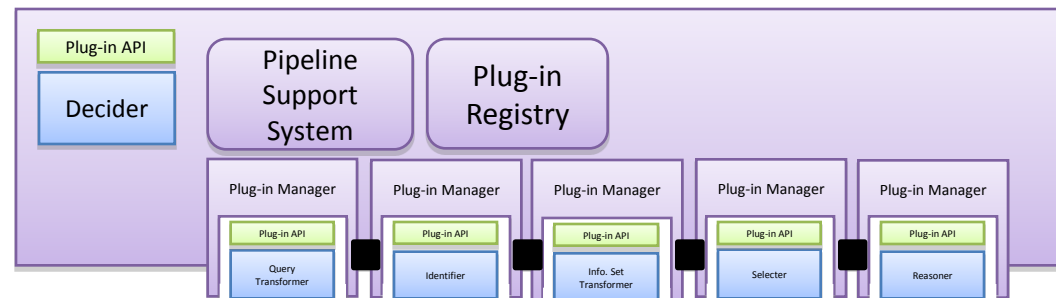


## 2. 25+ very heterogeneous plugins

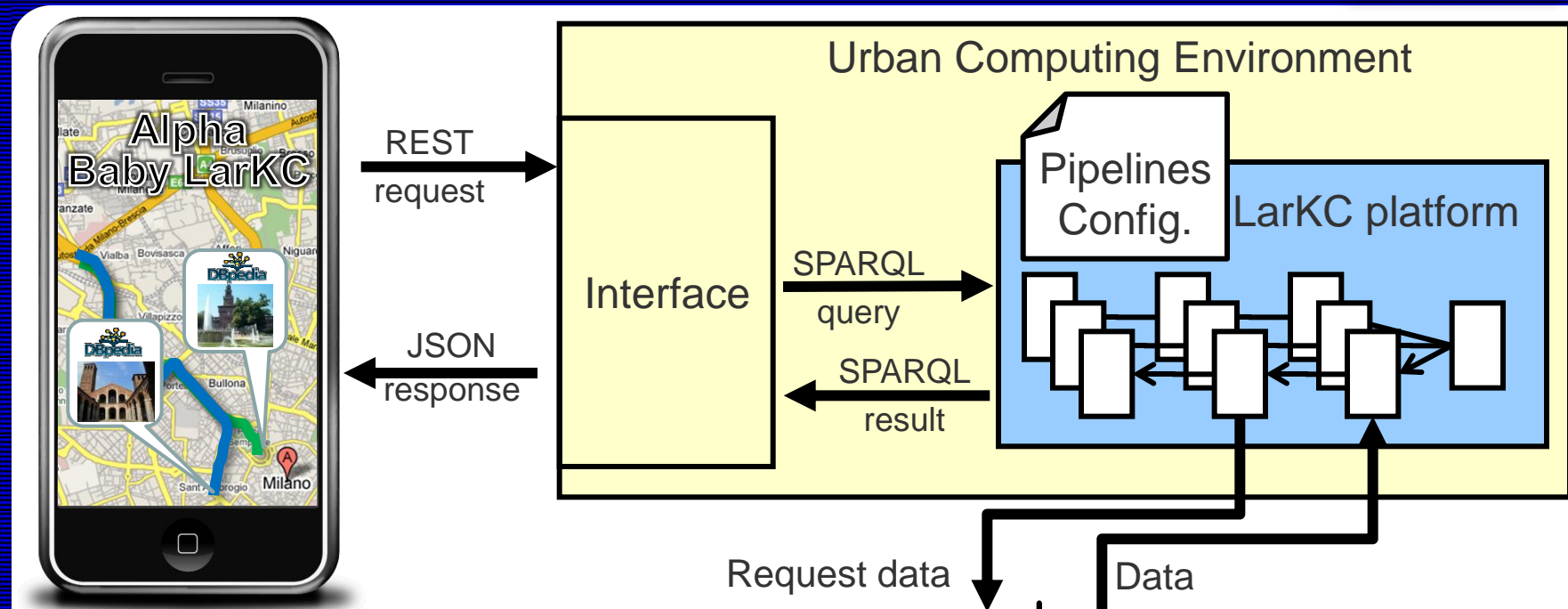
- **existing web-services** (e.g. Sindice, Swoogle)
- **another RDF store** (geo-queries in Allegrograph)
- **a very large (pipeline-based) system** (GATE)
- **existing reasoners** (Jena, Pellet, Cyc, IRIS)
- **XSLT scripts** (XML-2-RDF)
- **spreading activation** (new)
- **RDF-2-weightedRDF** (new)



- Open Apache 2.0 license
- early adopters workshop @ ESWC
  - 20 people attended
  - participants modified plug-ins, modified workflows
- **Standard Open Environment:** Sourceforge/SVN
- You can use it!



# Alpha Urban LarKC High Level Architecture



**PROBLEM:** Which Milano monuments or events or friends can I quickly get to from il Duomo?



Data & Index

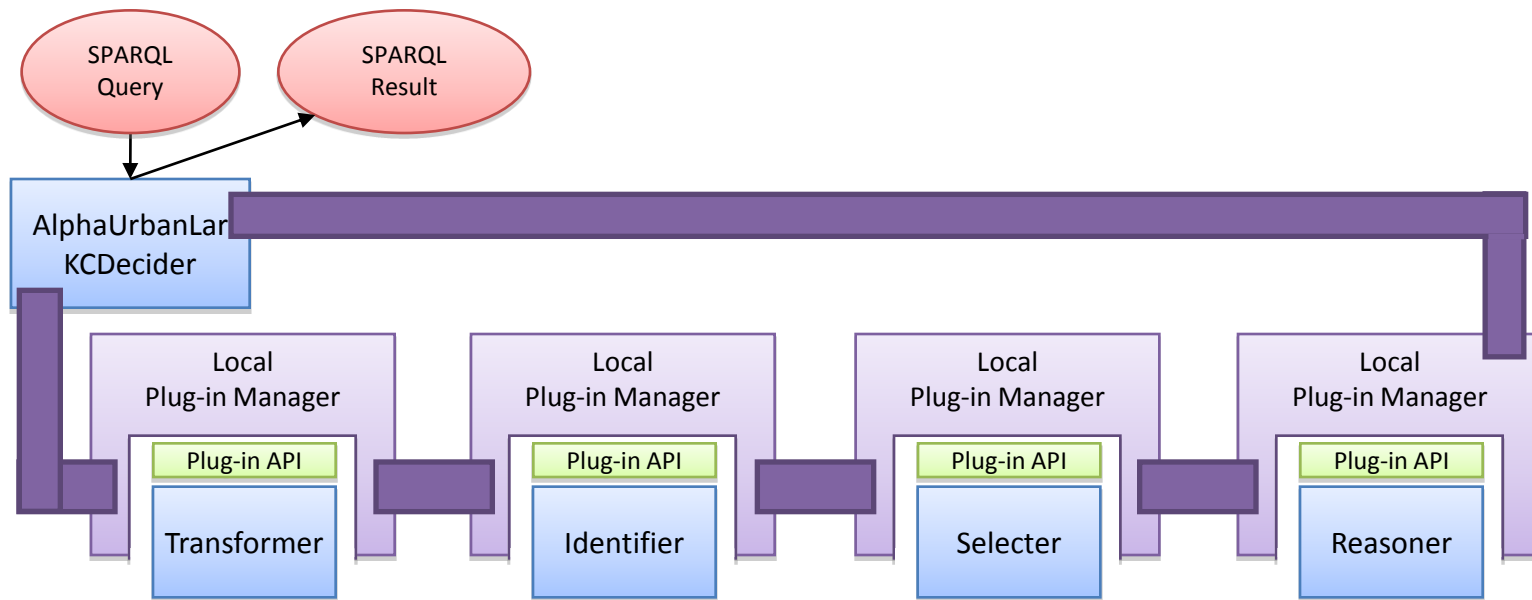
Events

Monuments

Streets

# Destination Selection Pipeline

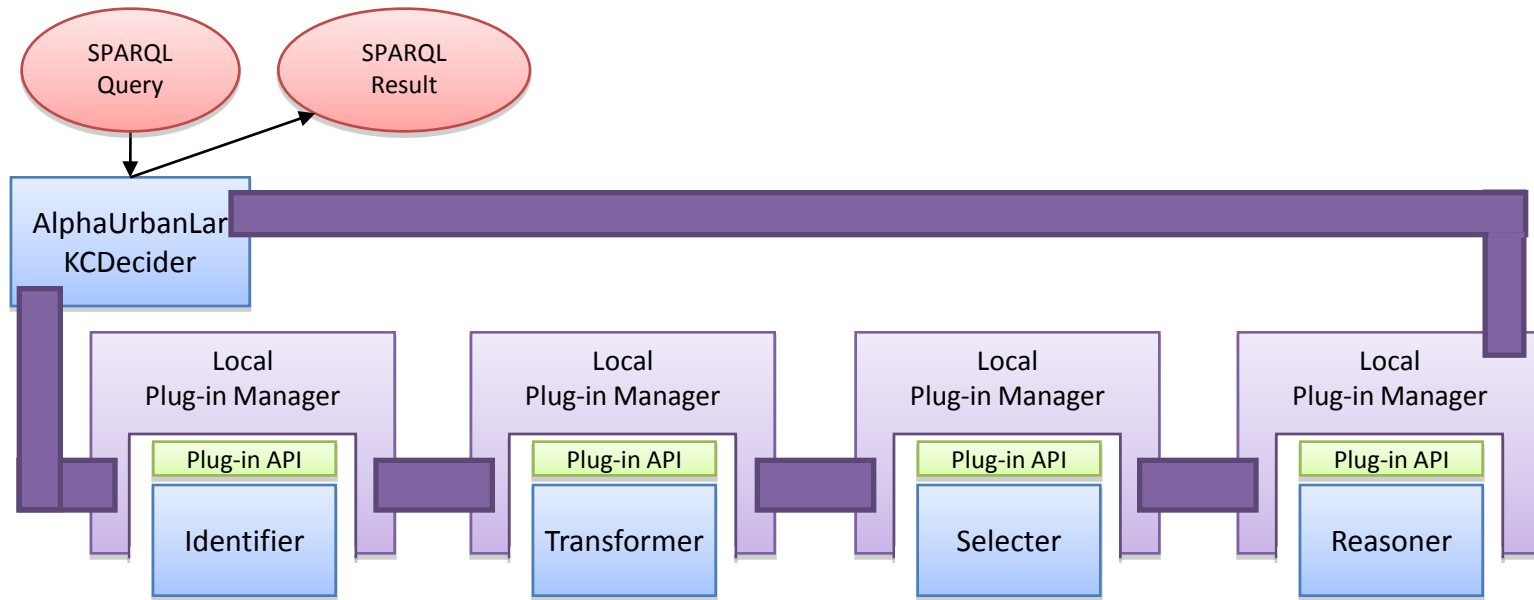
## Urban Monuments



- Decider → `AlphaUrbanLarKCDecider`
- Transformer → `MonumentQueryTransformer`
- Identifier → `SindiceTriplePatternIdentifier`
- Selector → `GrowingDatasetSelector`
- Reasoner → `SimpleSparqlReasoner`

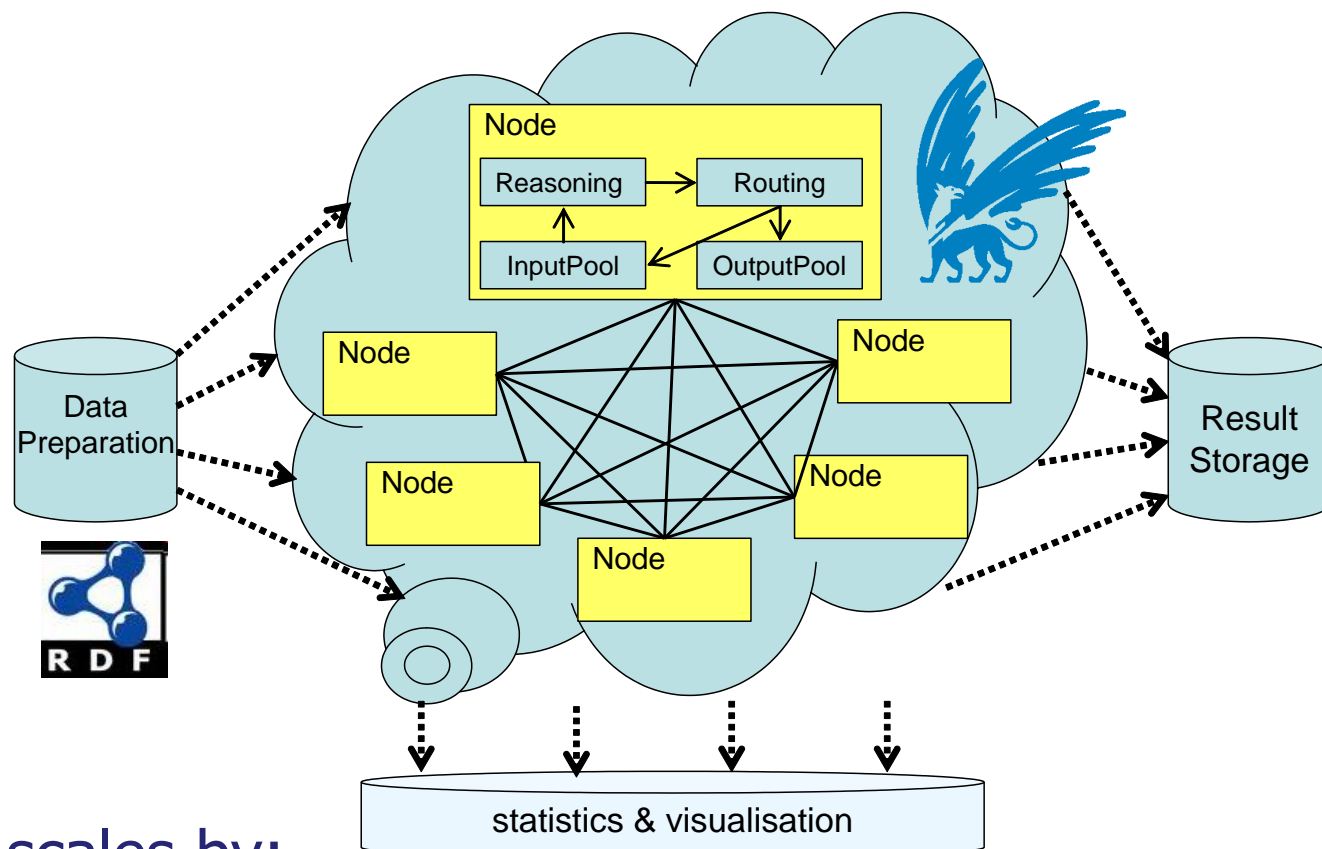


# Destination Selection Pipeline Events



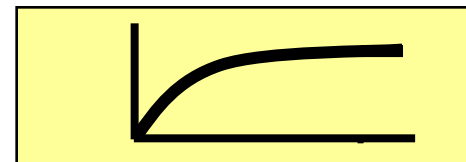
- Decider → AlphaUrbanLarKCDecider
- Identifier → EventfulQueryIdentifier
- Transformer → EventfulResultsTransformer
- Selector → GrowingDatasetSelector
- Reasoner → SimpleSparqlReasoner

# LarKC Experiment: MaRVIN



MaRVIN scales by:

- distribution (over many nodes)
- approximation (sound but incomplete)
- anytime convergence (more complete over time)



# Reinfor

## Acyclic Cyc

Microtheories should not have C

```
(#$thereExists ?OTHER-1
  ($and
    ($isa ?MT #$Microtheory)
    ($genlMt ?MT ?OTHER-1)
    ($genlMt ?OTHER-1 ?MT)
    ($different ?MT ?OTHER-1)
    ($unknownSentence ?MT)
    ($coGenlMts ?MT ?OTHER-1))
```

Handcoded search: 4774 inference steps

Learned search policy: 5 inference steps

- Average improvement: 90%
- Time improvement: 99%

## All In The Family

List terrorists with shared name and group affiliation or alias:

```
(#$thereExists ?WHO1-1
  ($thereExists ?WHO2-1
    ($and
      ($isa ?WHO1-1 #$Terrorist)
      ($isa ?WHO2-1 #$Agent-Generic)
      ($familyName ?WHO1-1 ?FAMILYNAME)
      ($familyName ?WHO2-1 ?FAMILYNAME)
      ($givenNames ?WHO1-1 ?GIVENNAME)
      ($givenNames ?WHO2-1 ?GIVENNAME)
      ($different ?WHO1-1 ?WHO2-1)
      ($extentCardinality
        ($TheSetOf ?ALIAS-1
          ($and
            ($alias ?WHO1-1 ?ALIAS-1)
            ($alias ?WHO2-1 ?ALIAS-1))) ?M)
      ($extentCardinality
        ($TheSetOf ?GROUP-1
          ($and
            ($hasMembers ?GROUP-1 ?WHO1-1)
            ($hasMembers ?GROUP-1 ?WHO2-1))) ?N)
      ($evaluate ?SUM
        ($PlusFn ?M ?N))
      ($greaterThan ?SUM 0))))
```

Handcoded search: 14,678 inference steps

Learned search policy: 11 inference steps

# Other potential plug-ins

- Leverage other larger-scale reasoners
  - (within their domain of applicability)
- General purpose inference :
  - Vampire, DPLL, SAT solvers, LOOM, etc.
- Special purpose inference :
  - symbolic arithmetic => *Mathematica*
  - linear algebra => *Matlab, LAPack*
  - machine learning => *SVM, Neural Networks, Reinforcement learning*
  - planning, linear programming => *iLog, constraint solvers*
  - Humans => *mechanical turk*
  - etc.

# Why would people (like you) want to use LarKC



- Workflow builders:
  - easier to get some application scenario running
- Plug-in builders:
  - easier integration with components by others,
  - wider take-up of your own component by others

[opencyc.org](http://opencyc.org)

[research.cyc.com](http://research.cyc.com)

[game.cyc.com](http://game.cyc.com)

[cyc.com/doc/inCyc](http://cyc.com/doc/inCyc)

[larkC.org](http://larkC.org)

Reaching Web 3.0 is a  
collaborative, world-wide effort.

**Research Cyc Licensees**



Reaching Web 3.0 is a  
collaborative and world-wide  
effort.

For fun, follow Cyc\_ai on  
twitter, or play  
[game.cyc.com](http://game.cyc.com).

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collaborative effort. Try out  
LarKC at  
<http://wiki.larkc.eu/GettingStarted>.

**LarKC First Release**

