SIXTH FRAMEWORK PROGRAMME
PRIORITY 2.3.1.11
e-Health

COCOON (FP6 507126)
Building knowledge driven & dynamically adaptive networked communities within European healthcare systems

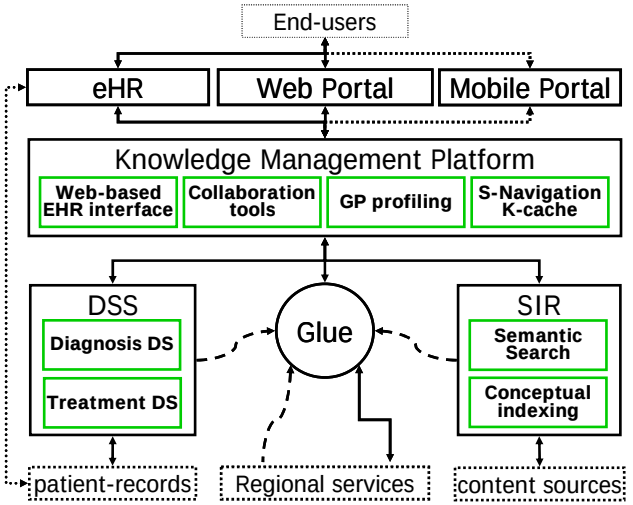
Advanced Interoperability: COCOON glue

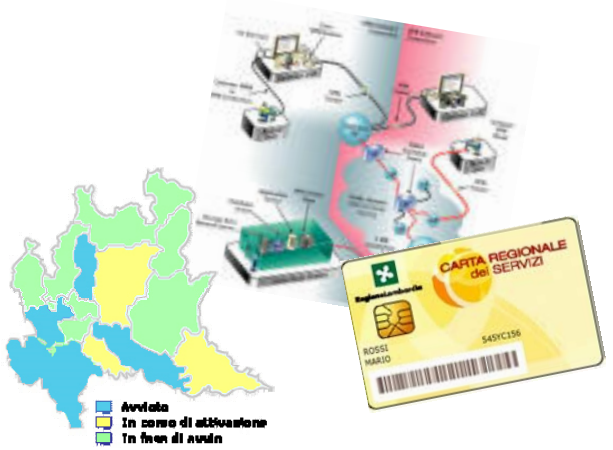
Authors: E. Della Valle, D. Cerizza and S. Ceri

emails: {dellavalle},{cerizza}@cefriel.it and ceri@polimi.it

Advanced Interoperability: COCOON glue
the integration problem in COCOON

- a **seamless integration** of **many complex technologies** is needed in COCOON
- **all the interfaces** must be exposed **as Web Services**
- Moreover COCOON will only add a new set of eHealth services to **a regional environment already populated by thousand of heterogeneous services** (e.g. SISS in Lombardy)



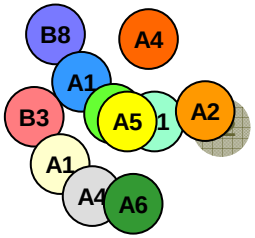


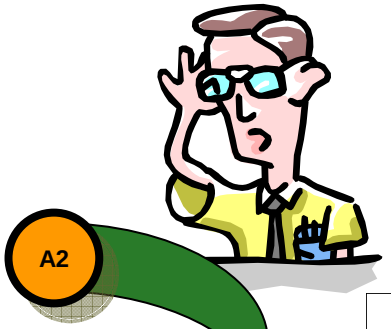
Advanced Interoperability: COCOON glue
a need for cataloguing and discovering services

If you have **few services** and you want to support one **simple implementation strategy**

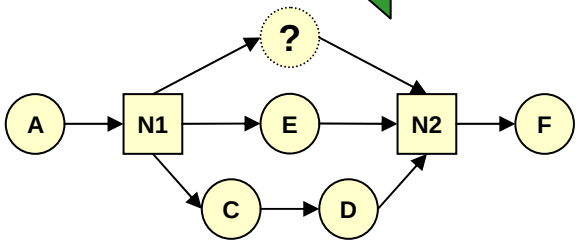
But, if you have **lot of services** and you want to support **multiple complex implementation strategies**

Few services

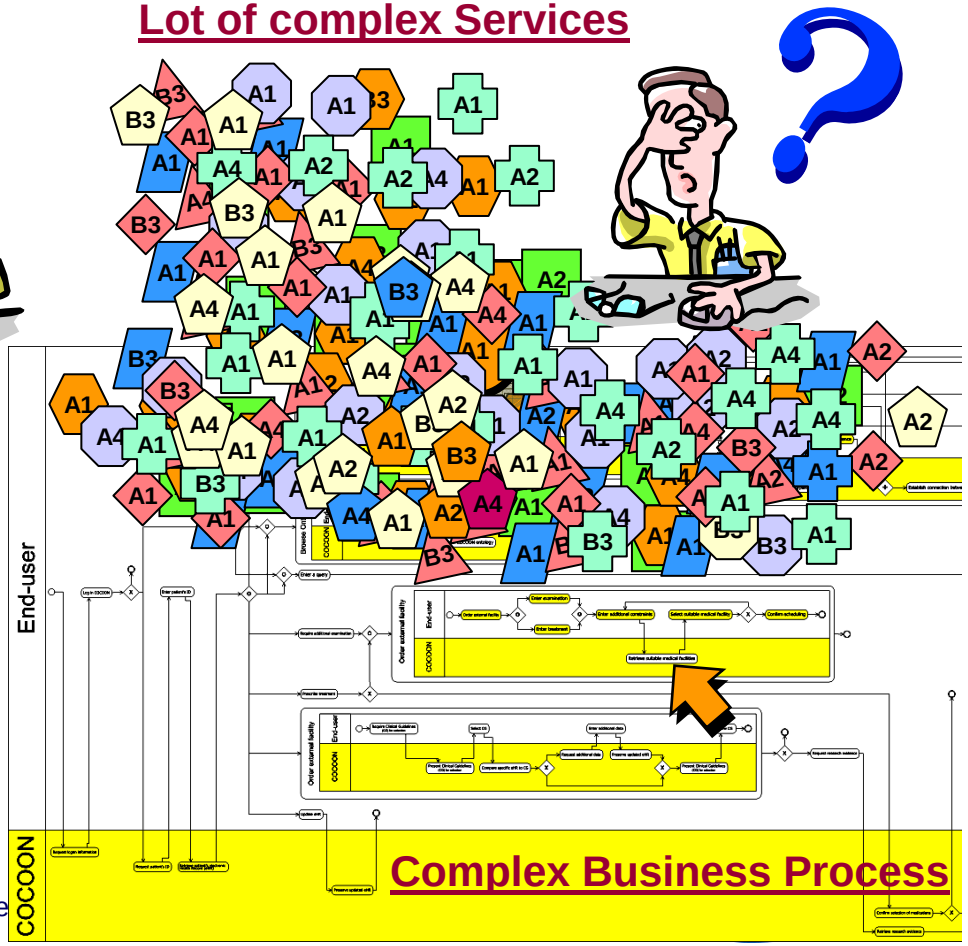




Simple workflow



Lot of complex Services



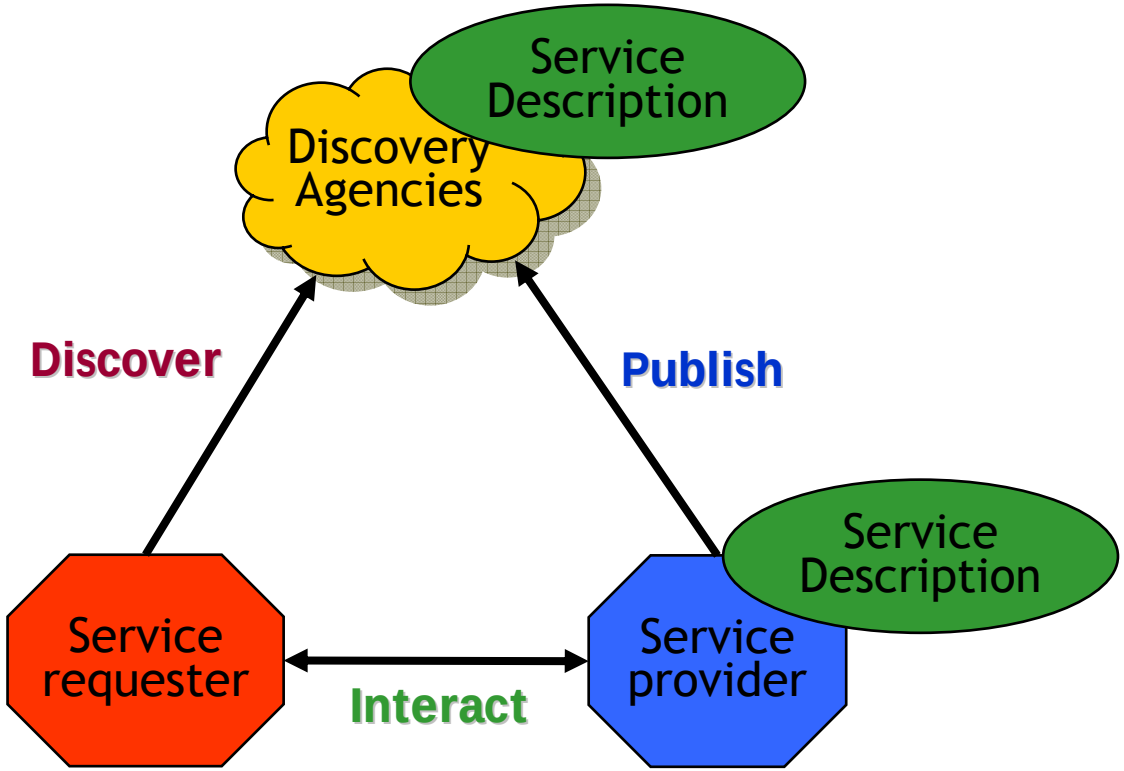
Complex Business Process

1st COCOON revie

Inspired by: J. Cardoso, C. Bussler, A. Sheth1, D. Fensel, **Semantic Web Services and Processes**, October 2002

Web Service Discovery

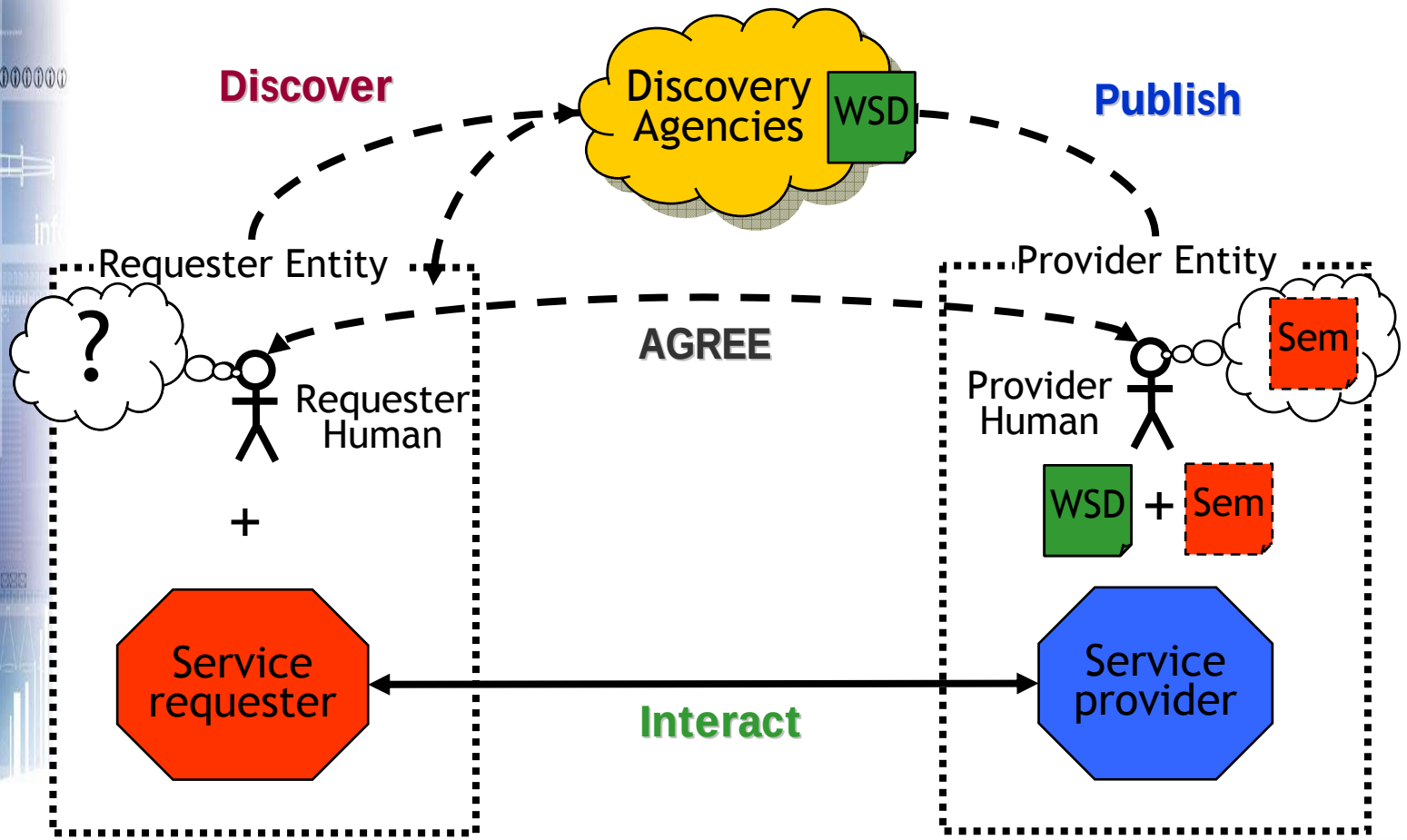
- **Discovery** service is an **essential** component **in the abstract idea of S**ervice **O**riented **A**rchitecture



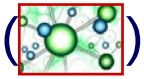
source: http://www.w3.org/TR/2002/WD-ws-arch-20021114/

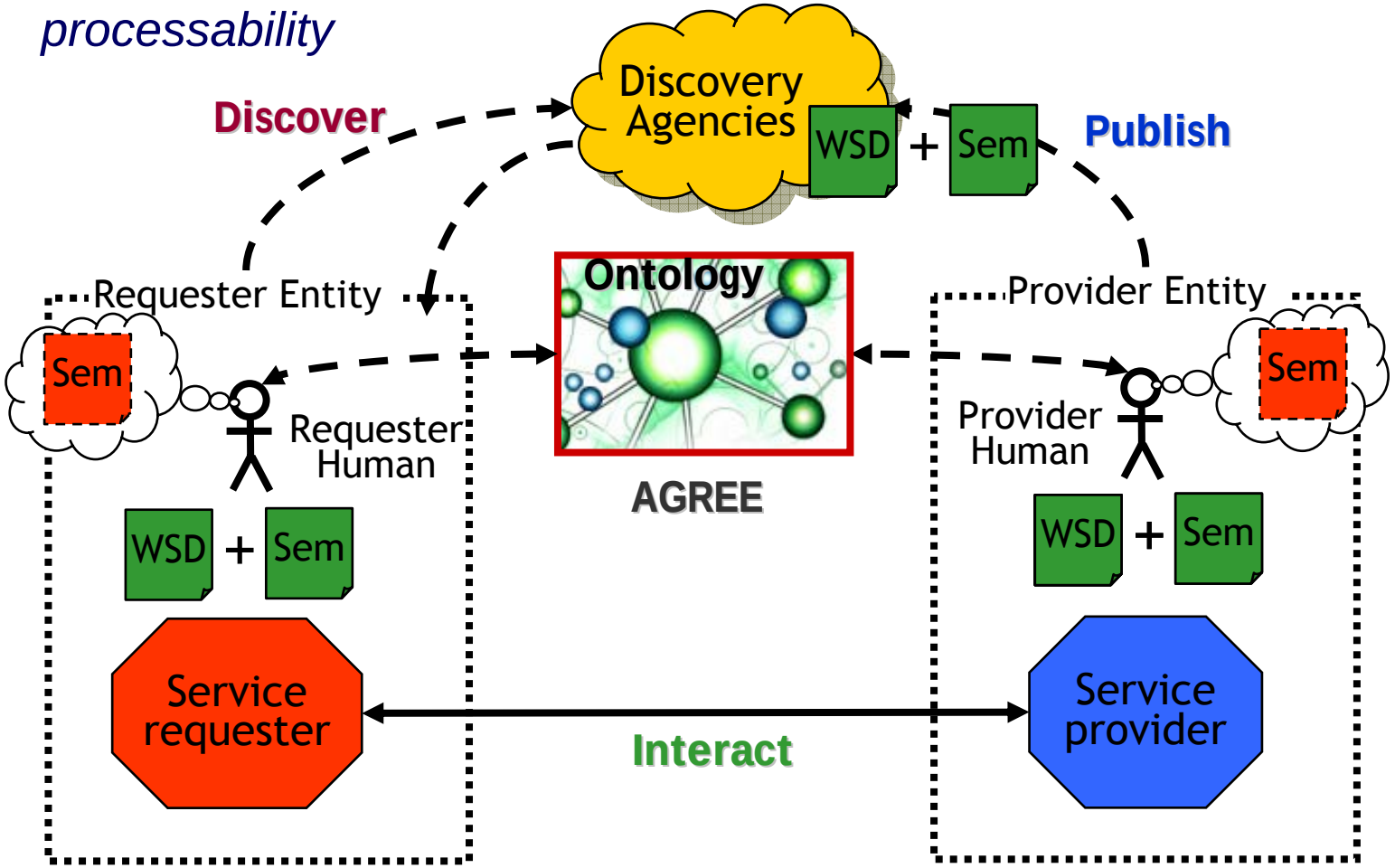
Advanced Interoperability: COCOON glue
Human processable semantics and discovery

- In concrete situation a strong **agreement on semantics is needed**



Machine processable semantics and discovery

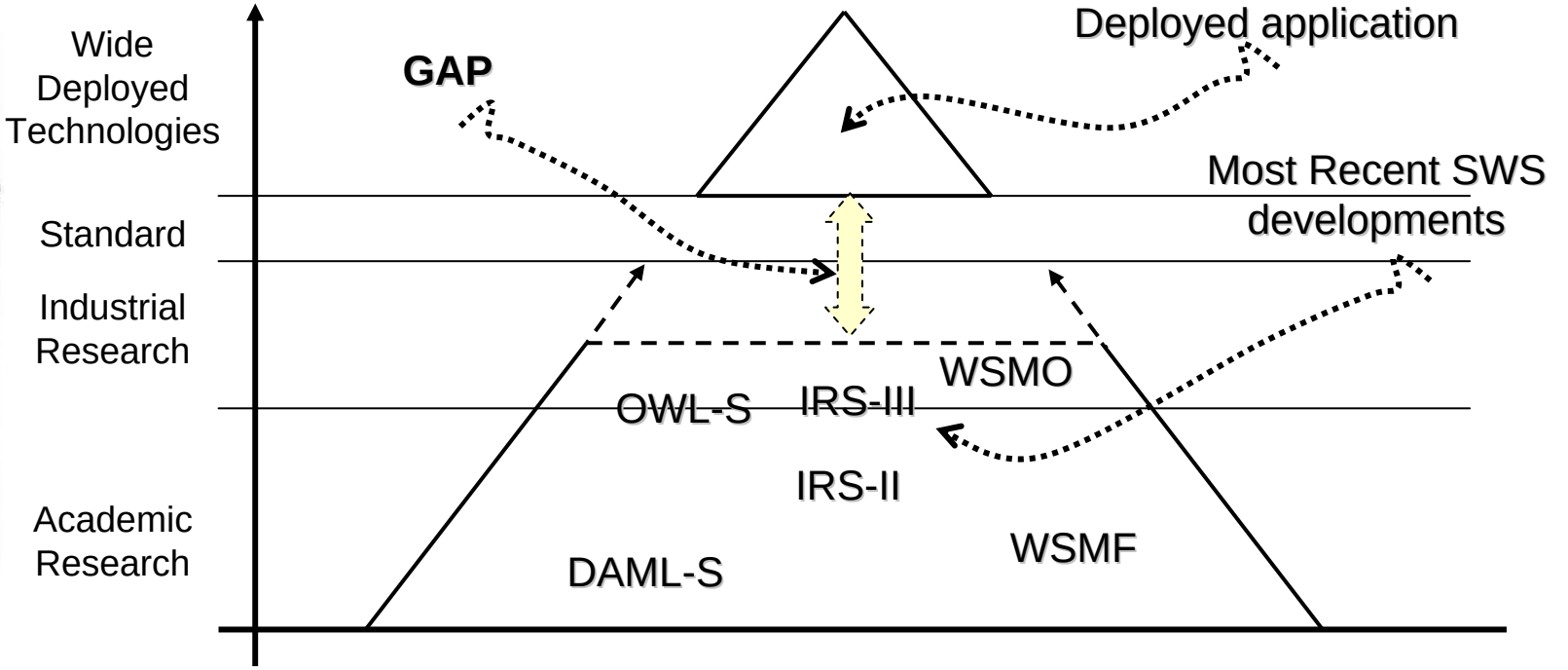
- **Machine processable semantics** is needed for automating discovery.
- **Ontologies** () are **the enabling technology** because they *interweave human understanding* of symbols *with* their *machine processability*



Which approach to Semantic Web Services?

- In addition to a language for ontologies, **semantic interoperability requires a conceptual model and formalization for services**.
- OWL-S and WSMO are the two major initiatives that aim at facilitating the automation of Web service tasks,
  - **OWL-S is an upper service ontology** expressed in OWL.
    - It supplies Web service providers with a core set of markup constructs for describing the properties and capabilities of their Web services in computer-interpretable form.
    - OWL-S has been submitted to W3C in November 2004.
  - **WSMO**, the Web Service Modeling Ontology,
    - describes four different main elements: ontologies that provide the terminology used by other elements, goals that describe aspects related to user desires with respect to the requested functionality, Services descriptions that define various aspects of a Web service, and mediators which bypass interpretability problems.
    - Preperations for the submission to the W3C are currently ongoing and expected to be finished in March 2005.

Which approach to Semantic Web Services?

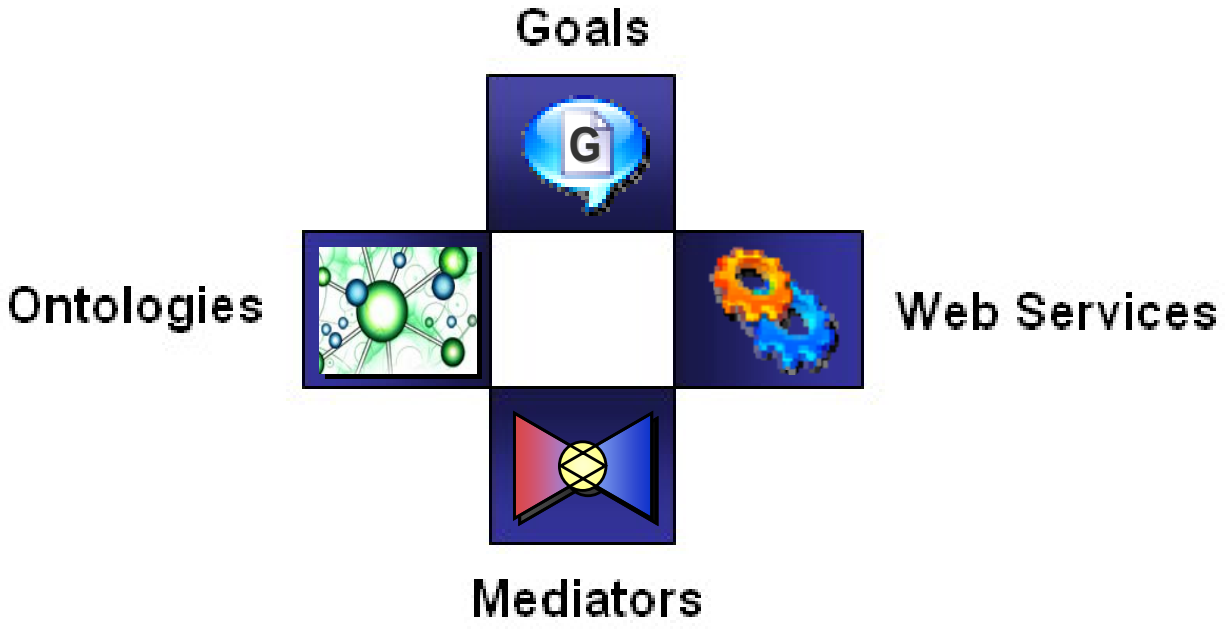


- We choose WSMO because
  - It is a **strong conceptual model** based on a sound separation between ontologies, goals, web services and mediators
  - It is founded on **two clear principles** of strong decoupling and strong mediation

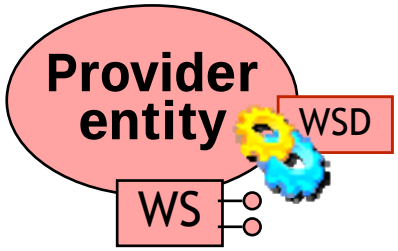
WSMO model

Source: WSMO D2v1.0.

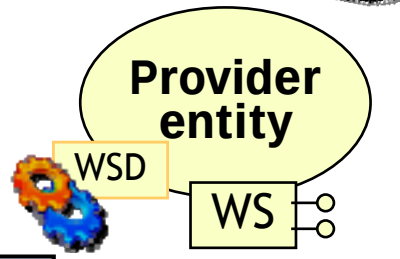
- WSMO consists of four different main elements for describing semantic web services:
  - **ontologies** ( ) that provide the terminology used by other elements
  - **goals** ( ) that define the problems that should be solved by web services
  - **web services** ( ) descriptions that define various aspects of a web service
  - **mediators** ( ) which bypass interpretability problems.

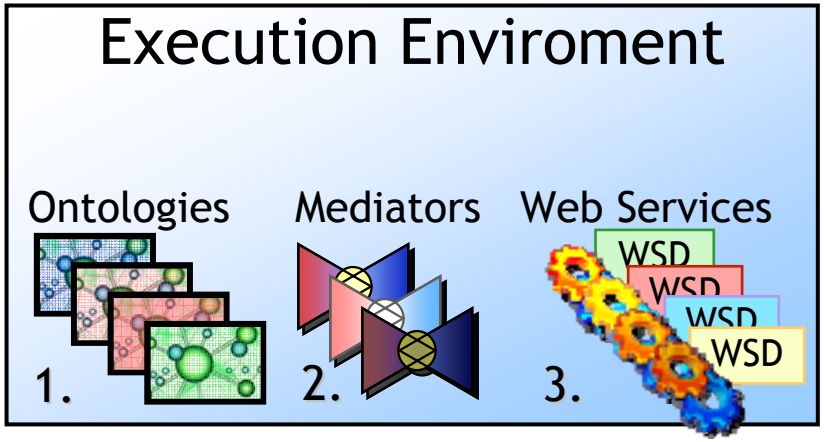


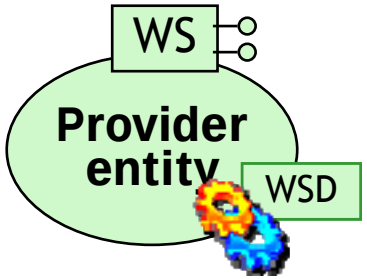
WSMO at work: publishing time



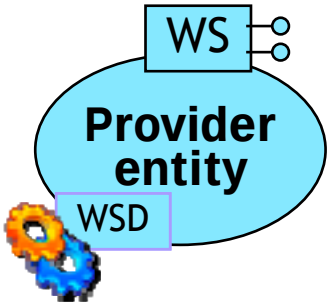
Requester entity



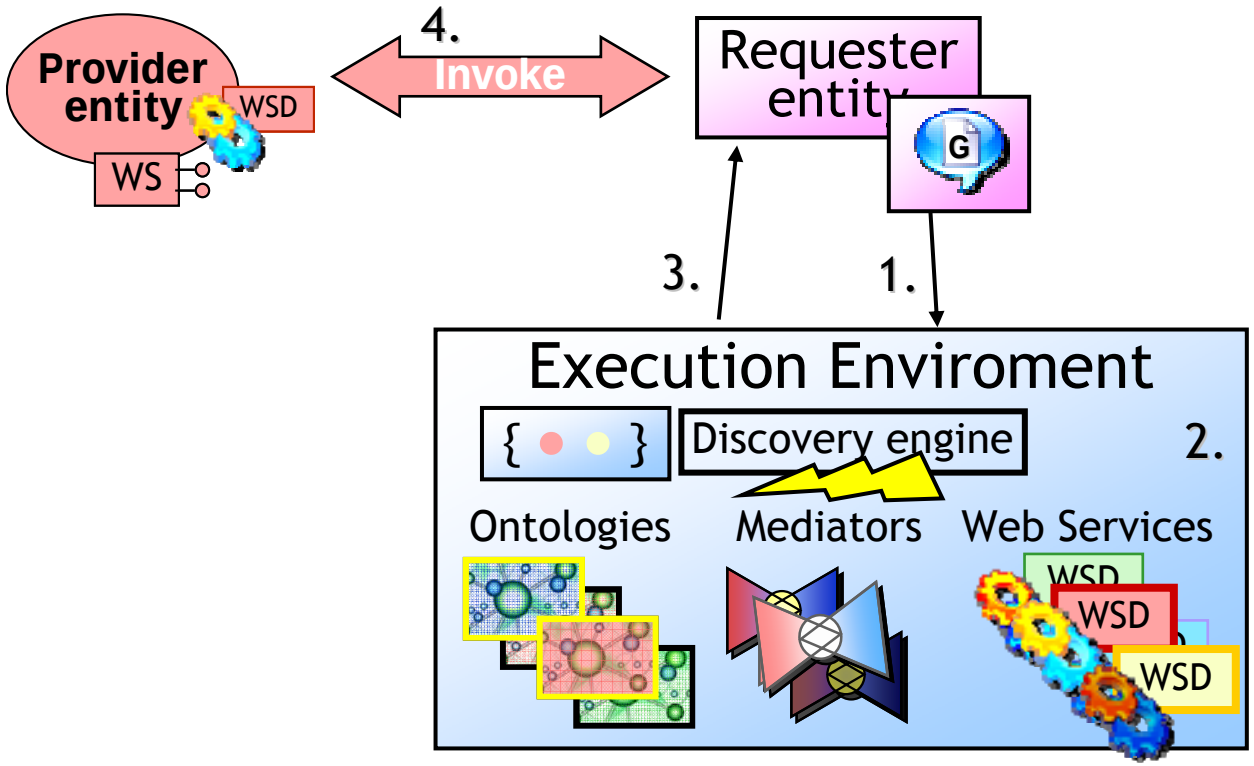


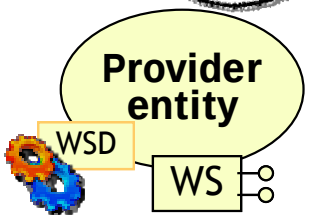


1. **provider** and **requester** entities **agree on** the **ontologies** to use
2. If they can**not** reach an **agreement** on the terms to use (e.g. SNOMED, IDC) **mediators are required**
3. **Each provider** entity formally **describe** its **services** using the agreed ontologies and (if necessary) mediator

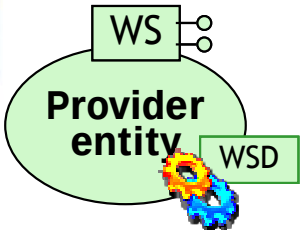


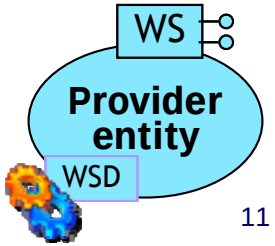
WSMO at work: discovery time





1. **Requester entity** formally describes its **goal** using the agreed ontologies and (if necessary) mediator
2. The **discovery engine** uses the specified ontologies and mediators to **match the goal** against the web service descriptions
3. The execution environment **returns a list** of Web Services
4. The **requester selects** the most appropriate Web Services and **invokes** it

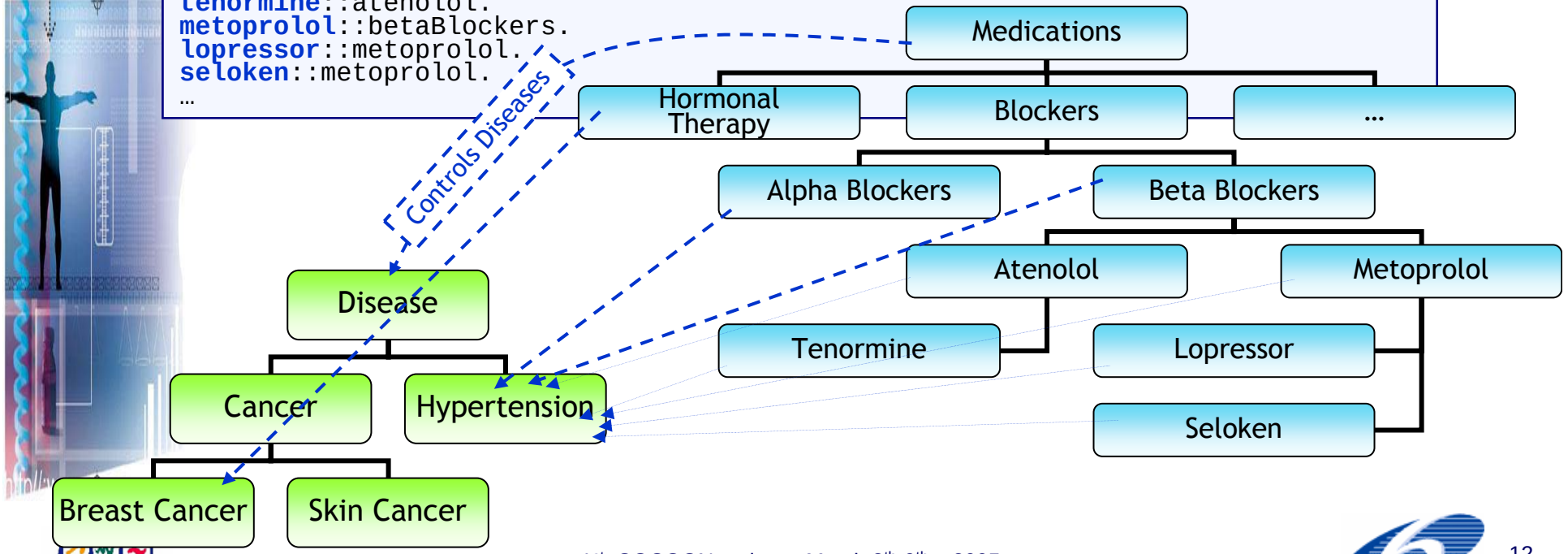




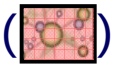
COCOON Ontology

Part of internal F-Logic syntax

```
…
disease[ affects=>>{bodyPart} ].
cancer::disease.
breastCancer::cancer[ affects=>>{breast} ].
hypertension::disease[ affects=>>{artery, heart} ].
…
medication[ controlsDiseases*=>>{disease} ].
hormonalTherapy::medication[ controlsDiseases*=>>{breastCancer} ].
blockers::medication.
alphaBlockers::blockers[ controlsDiseases*=>>{hypertension} ].
betaBlockers::blockers[ controlsDiseases*=>>{hypertension} ].
doxazosin::alphaBlockers.
atenolol::betaBlockers.
tenormine::atenolol.
metoprolol::betaBlockers.
lopressor::metoprolol.
seloken::metoprolol.
…
```



WSMO at work: example of mediator

- Providers and requester entities may disagree on the representation of date-time.
- For example:
  - *A provider entity may prefer to express service availability using a* **Week-based calendar** terminology ()
    - *E.g. the service is available on Monday and Thursday morning and Friday evening*
  - A requester entity may prefer to express user preferences using a **Gregorian-based calendar** terminology ()
    - *E.g. is the service available on March, 8th from 10 to 12*
- *An agreement is not necessary, a mediator can be used to bypass the heterogeneity problem*