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An Agent-based Matchmaker

(A case study in biomedical services discovery)

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Outline of the Talk

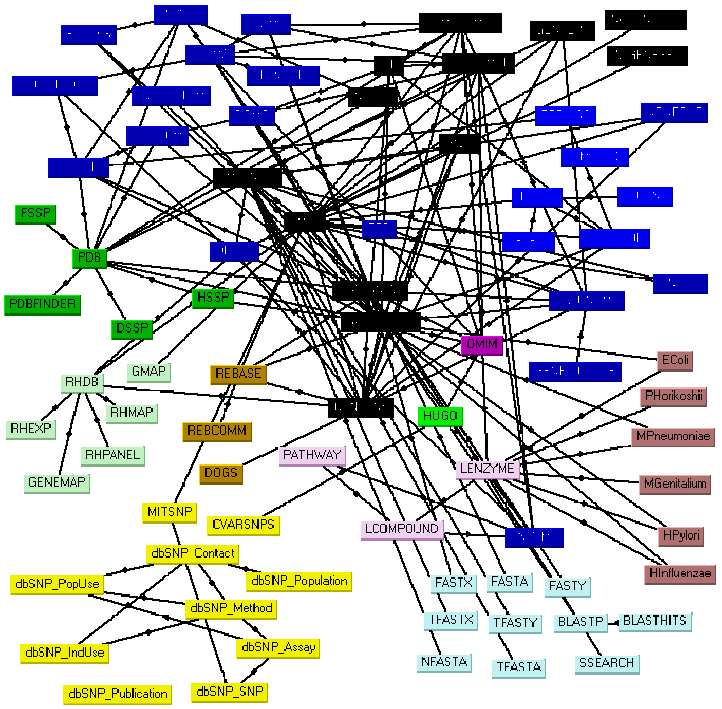
- Introduction
- An agent-based Matchmaker
  - The agent paradigm
  - The reference model
  - The proposed system
  - The protocol
- The quality model
  - The requirements
  - The matching level
  - The matching algoritm
- The QoS matchmaker in the case study
- The future work

The service discovery

*"**Service discovery** is the process of localizing services and resources in the Web that best fit the requests of potential users"*

Why?

- Web features:
  - Interconnect
  - Openness
  - Dynamic
  - Geographycally distributed
  - Heterogeneity



The quality

*"**Quality** can be defined as all the features of an entity like resource, service, tool, that influence its capability to satisfy declared or implicit needs"*

International organization for standardization, Technical Committee ISO/TC 176.
ISO 8402: Quality management and quality assurance.
Vocabulary. 2nd ed. Geneva: International organization for standardization, 1994.

Why?

- Many tools have been presented in the literature to support service discovery.
  - UDDI • Retsina • DiscoveryLink • MyGrid
- None of these suggests the integration of a quality model only some support semantic discovery.

The agent paradigm

*"An **agent** is a computer system capable of flexible autonomaus action, situated in dynamic, open, unpredictable environmed"*

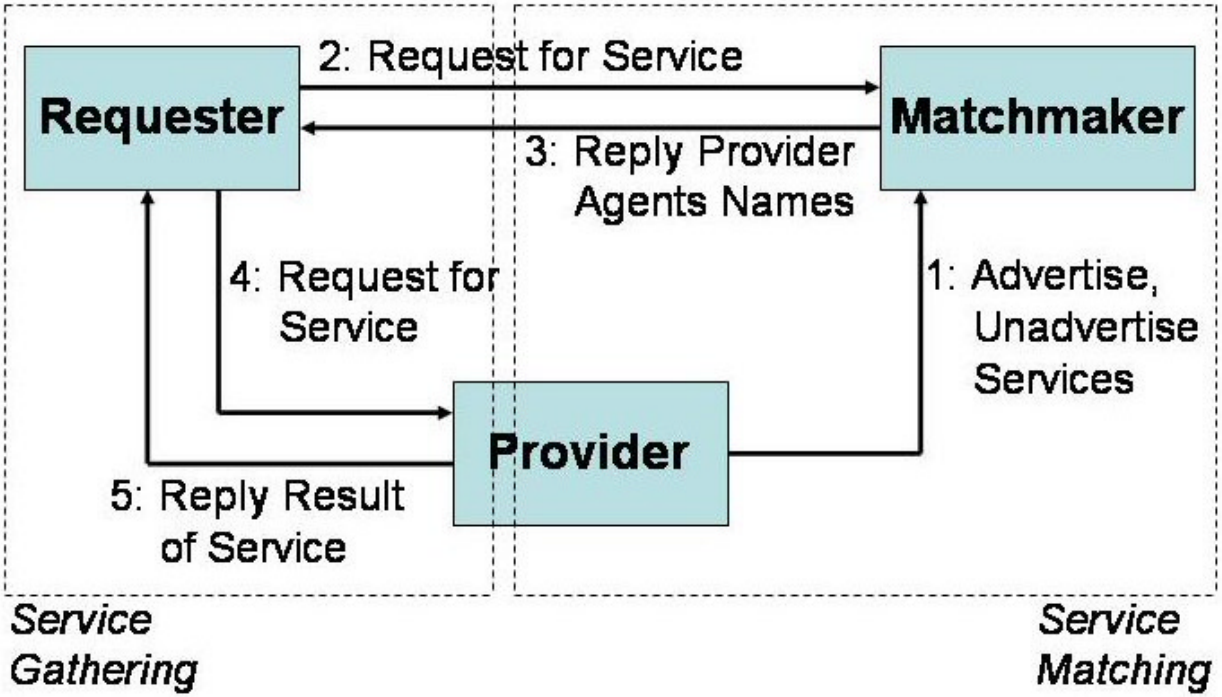
M. Wooldridge. Intelligent Agents, in Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence. G. Weiss, 1999. MIT Press, Cambridge, MA.

Views of agents

- As a metophor for design of complex, distribuited computational system
- As a source of technology
- As a support for complex real word systems, such as **Biology** and Economy

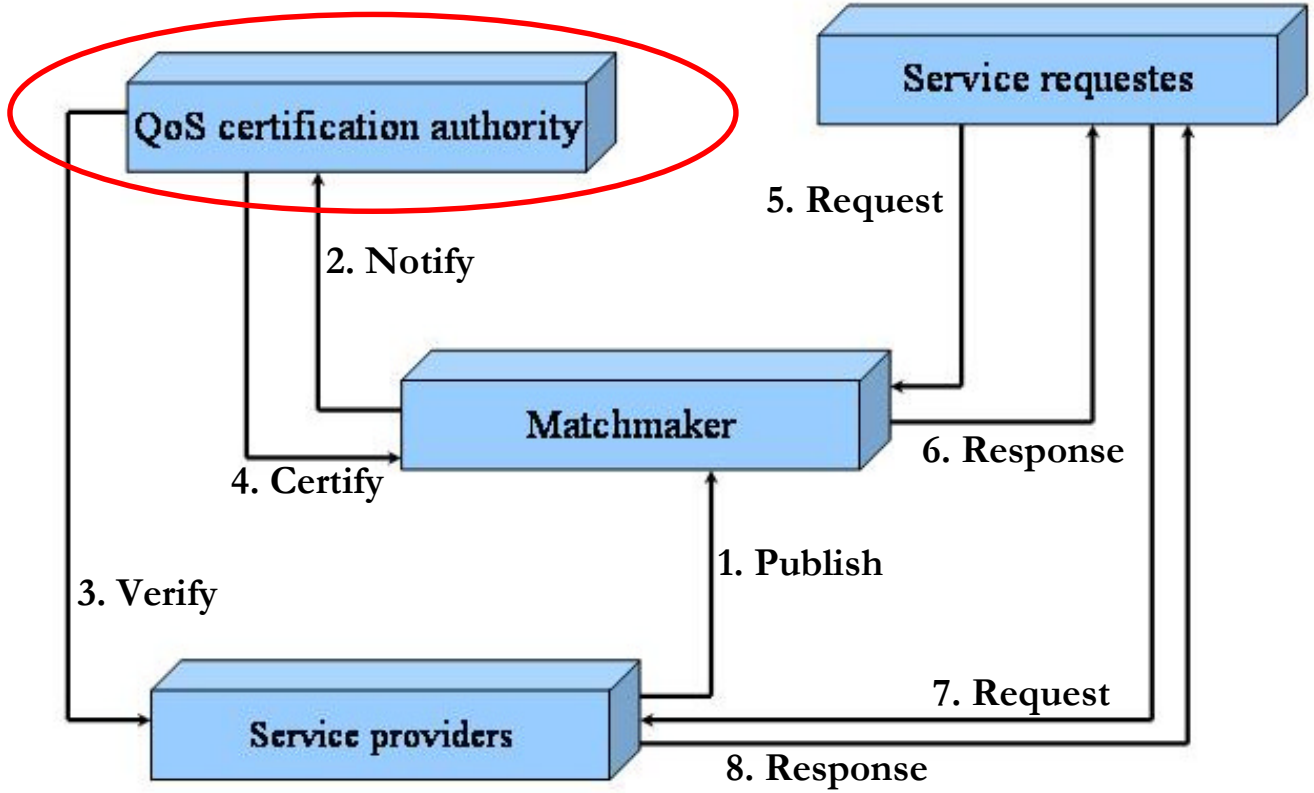
- They reduce the network load
- They overcome network latency
- They encapsulate protocols
- They execute asynchronously and autonomously
- They adapt dynamically
- They are naturally heterogeneous

The reference model



M. Paolucci, K. Sycara, T. Nishimura, and N. Srinivasan. Toward Semantic Web Service Matchmaker . Carnegie Mellon Univerity.

The proposed system



QoS *certification authority:*

- The *matchmaker* processes the request within his knowledge base (collection of information on services and *service providers*) and it yields either some information regarding the *service provider* or possibly the result of the
- give a quality level to each registered services taken into consideration.

The proposed quality model

*A **quality model** is a metrics that formalizes the definition of the term "quality" as used during a match*

Components of model:

- describes the quality aspects of the distributed system
- describes the specific quality aspects of the application domain

The features of the quality model

- ***Resource aim*** is the purpose for which the resource has been developed
- ***User target*** is the list of hypothetical users
- ***Reliability*** is the probability of successfully using a resource
- ***Feasibility*** is the measurement of the easiness to access the resource
- ***Usability*** is the measurement of the easiness to use the resource
- ***Originality*** is the degree of correctness of the resource and its information
- ***Privacy*** captures the legal conditions of using the resource
- ***Updating*** is the attendance of the resource updating
- ***Timing*** is the daily time of resource activity
- ***Speedy*** is the measurement of the execution time
- ***Browsing*** is the measurement of the human easiness to find a resource
- ***Popularity*** is the number of active consumers

The matching level

Our system draws a distinction among three matching levels:

- **Exact** match the highest degree of matching.

  The requests are satisfied with a percentage higher than 90%

- **Plug-in** match takes place when a service more general than the requested one is supplied but that can be used instead of the ideal requested service.

  The requests are satisfied with a percentage between 10 and 90%

- **Relaxed** match is the lowest degree of matching.

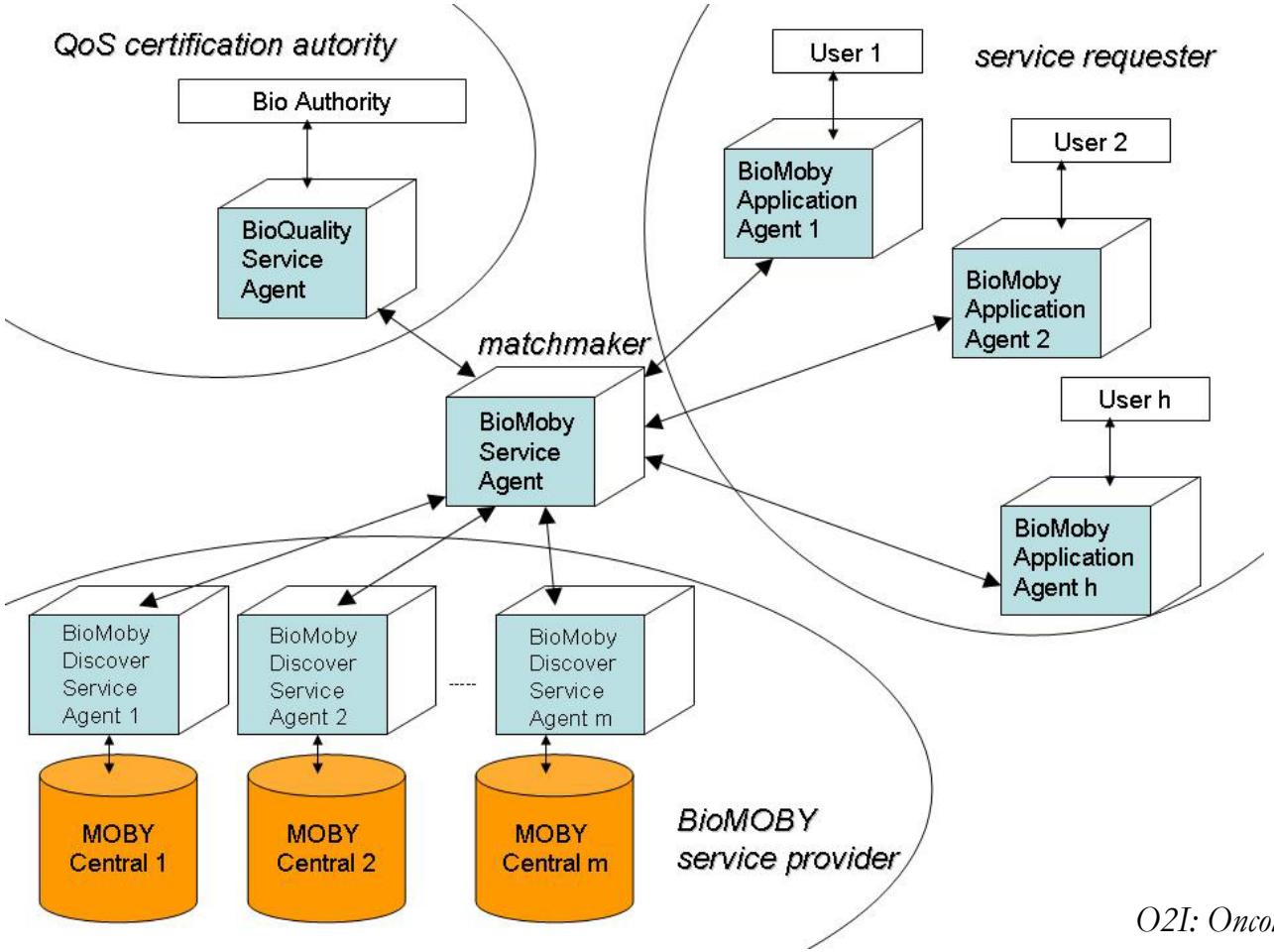
  The requests are satisfied with a percentage lower than 10%

The matching algorithm

The matching algorithm measures the distance between the quality aspects and the user requirements for a request service.

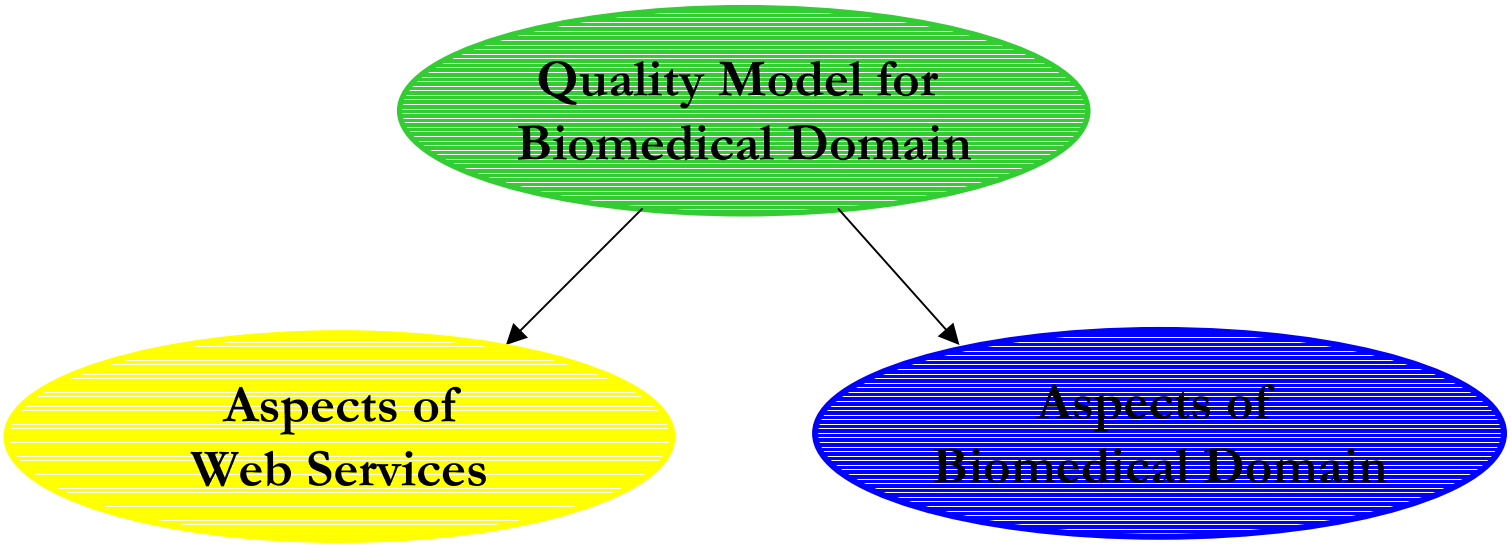
```
match (request){
    recordMatch = empty list
    forall service in mirror do{
            recordMatch.addElement(service, coff)
    }
    return best(recordMatch);
}
```

The matchmaker architecture in O2I



O2I: Oncology over Internet
www.o2i.org

The Quality Model for Biomedical Domain



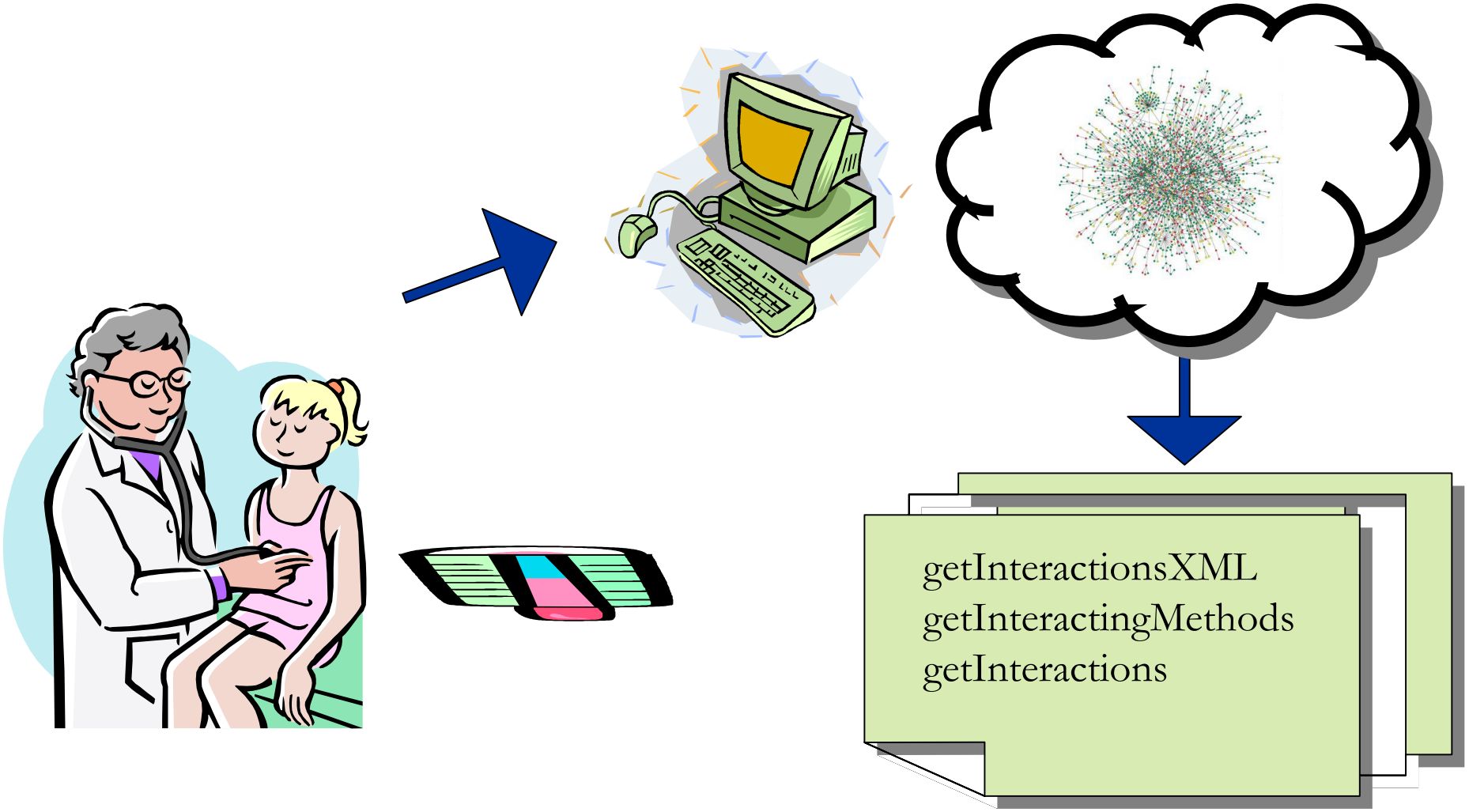
Aspects of Web Services

- Reliability:
  - credentials - assigns a value to the author based on his professional competence
  - certification - allows to find whether the author adheres to certified standards
  - profit - allows to find out whether the supplier of service is profit oriented
- Originality:
  - publicity policy - allow to find whether there are sponsors financing the resource
  - fidelity procedure - allows to monitoring of consumer surveys
- Privacy - makes sure that privacy policies, data security, personal data processing are in accordance with existing laws
- Updating - addresses the time period the resource is updated
- Usability - measures the easiness in using a resource
- Timing - is a measurement of the time period that a service is active
- Speed - is a measurement of the service execution time

Aspects of Biomedical Domain

- **Name** represents the most important parameter because the knowledge of it by the user will cause the search necessarily returning the specified service
- **Description** made of keywords which will be sought inside every individual service stored in the knowledge base
- **Type** has little importance in the model because can only be one of seven kinds
- **Author** simply represents his name and does not carry his credentials with it
- **Input - Output** are fundamental parameters because the user already knows what he has got and what he wants to get

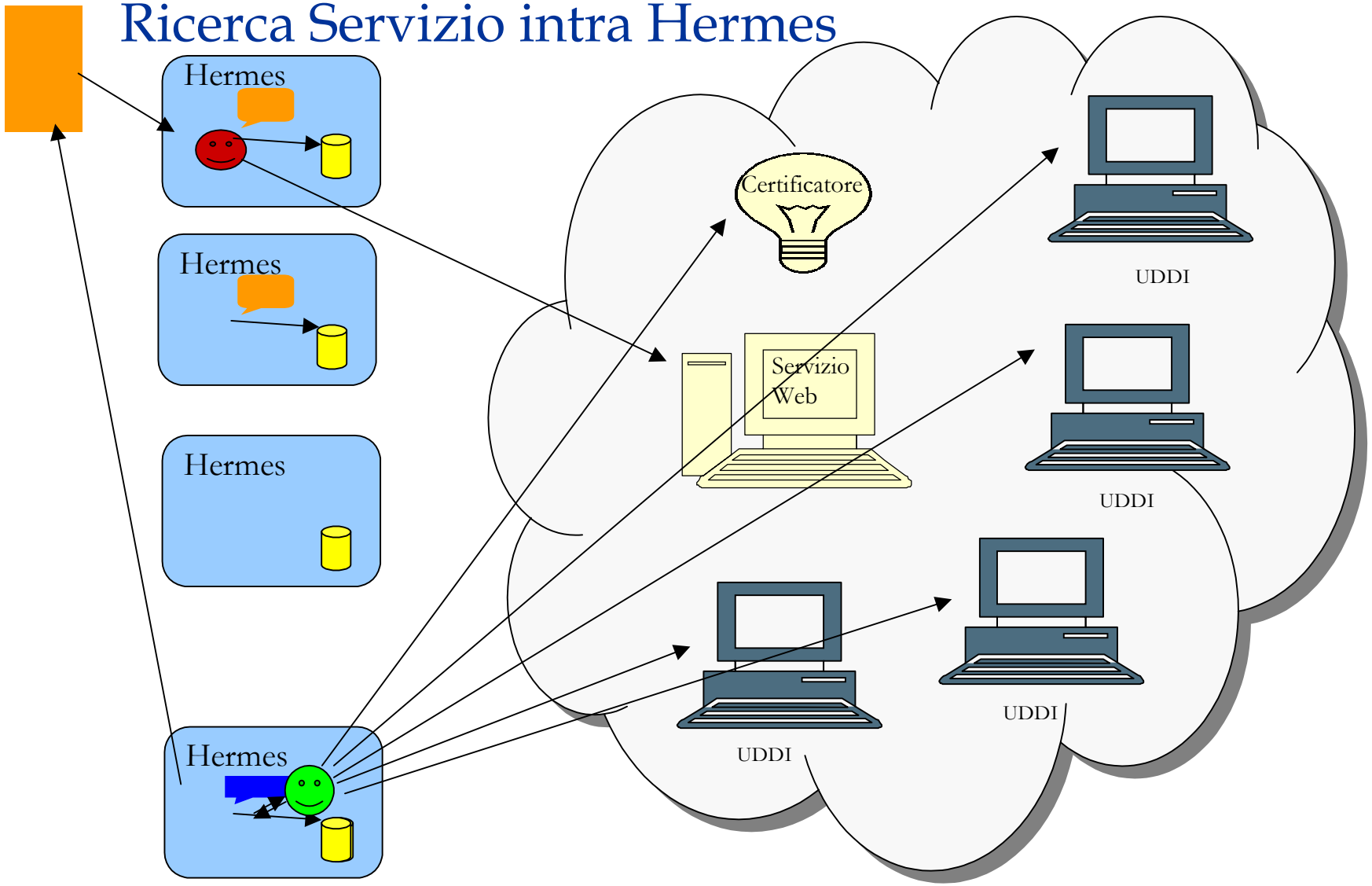
Experimental Results



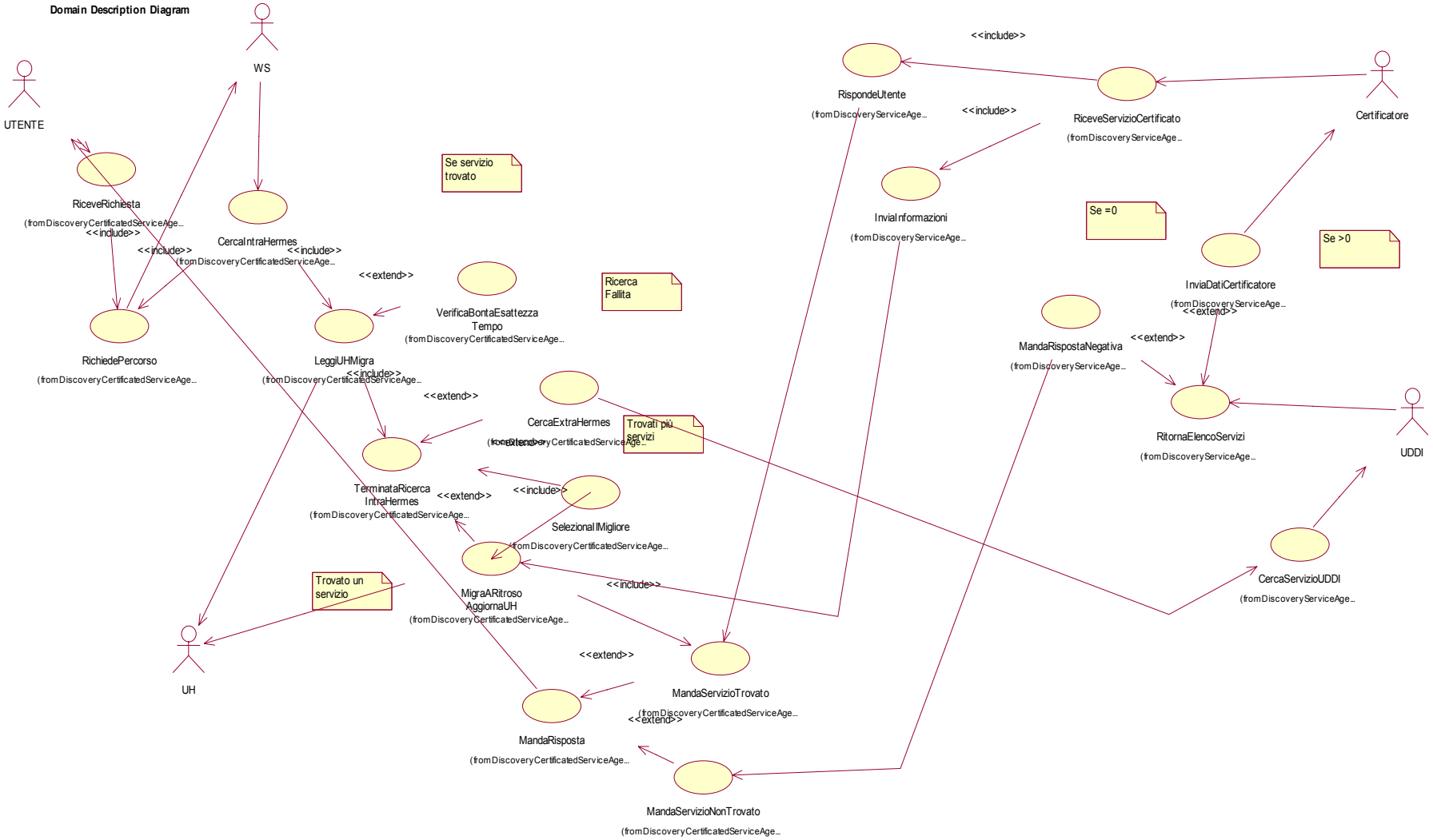
The future work

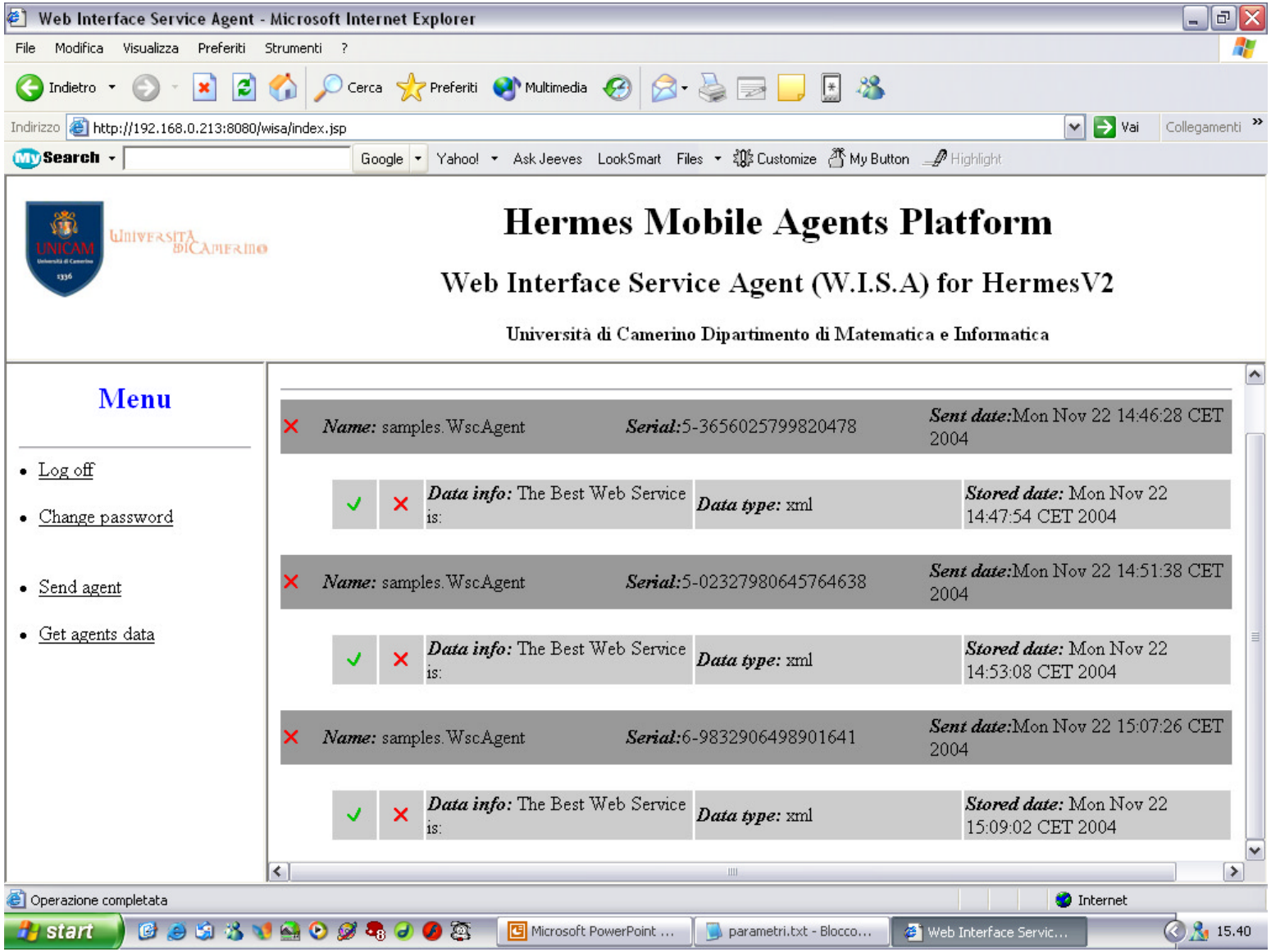
- Customizing requests to target
- Adding use of ontology in order to describe the user requests
- Introduction and quantification of additional certification parameters
- Developing the system in Hermes in order to use mobility to optimize the cost of data transfer and evaluate the possibiltiy to improve the performance of the matchmaker

Ricerca Servizio intra Hermes



Domain Description Diagram




Web Interface Service Agent - Microsoft Internet Explorer
File Modifica Visualizza Preferiti Strumenti ?
Indietro Cerca Preferiti Multimedia
Indirizzo http://192.168.0.213:8080/wisa/index.jsp
Vai Collegamenti
Search Google Yahoo! Ask Jeeves LookSmart Files Customize My Button Highlight
Hermes Mobile Agents Platform
Web Interface Service Agent (W.I.S.A) for HermesV2
Università di Camerino Dipartimento di Matematica e Informatica
Menu
Log off
Change password
Send agent
Get agents data
Name: samples.WscAgent Serial:5-3656025799820478 Sent date:Mon Nov 22 14:46:28 CET 2004
Data info: The Best Web Service is: Data type: xml Stored date: Mon Nov 22 14:47:54 CET 2004
Name: samples.WscAgent Serial:5-02327980645764638 Sent date:Mon Nov 22 14:51:38 CET 2004
Data info: The Best Web Service is: Data type: xml Stored date: Mon Nov 22 14:53:08 CET 2004
Name: samples.WscAgent Serial:6-9832906498901641 Sent date:Mon Nov 22 15:07:26 CET 2004
Data info: The Best Web Service is: Data type: xml Stored date: Mon Nov 22 15:09:02 CET 2004
Operazione completata
Internet
start
Microsoft PowerPoint ...
parametri.txt - Blocco...
Web Interface Servic...
15.40

Acknowledgements

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Thank You Very Much for Your Attention!