SERVICE DISCOVERY IN E-GOV ENVIRONMENTS[1]

Flavio Corradini, Francesco De Angelis, Alberto Polzonetti, Oliviero Riganelli
Dipartimento di Matematica e Informatica
Università di Camerino
Via Madonna delle Carceri, 9
62032 Camerino, Italy
{flavio.corradini, francesco.deangelis, alberto.polzonetti, oliviero.riganelli}@unicam.it

ABSTRACT

The traditional model of web service architecture is unable to guarantee that web services returned by search are really usable. This depends on the fact that within the traditional model the service registry is a passive element; and it is not able to control the information that it manages. Moreover, the actual model lacks of a description of the web services with suitable Quality of Service parameters. In this paper we present a new architectural model for web services discovery that takes into account both information security and QoS. This is important in the e-Government field to offer suitable services to citizens and firms together with a back office reorganization of Public Administrations.

KEYWORDS

E-government, web service, web service discovery, UDDI, QoS.

1. INTRODUCTION

E-Government relies on the utilization of Information Technologies to improve the efficiency of public service. Systems of Public Administrations need to be properly integrated and services (e-Services) need to be provided to citizens and firms. IT technologies for Public Administrations, moreover, allow manage the *back office* of the central administrations that are not directly related to service customers but it plays a significant role in the whole system. For this type of systems, it is necessary to consider main objectives [Stănescu 2003] including the necessity to possess an underlying information system that supplies both general data and personal data of single individuals. Of course, the system must mantain a high degree of supplied information coherence and a very high degree of trasparency. The service customer can simply refer to services access points to perform him/her task without regarding the back office organization.

The needed e-Government infrastructure can be realized with the use of web services. The web services represent a way to integrate web-based applications through standards like XML, SOAP and WSDL [Freemantle 2004, W3C 2005] by allowing variuos applications to communicate and by limiting interoperability problems. Therefore, we define a Service Oriented Architecture [Hoa 2003]; namely, an architecture in which resources are seen as independent accessibile services in a standardized way.

The web service architecture [W3C 2004] is based on the *publish-find-bind* model (Fig. 1). Three main roles are identified - Service Requestor, Service Provider and Service Registry - as weel as three main operations - Publish, Find and Bind. The basic architecture assumes that a service provider publishes an offered service in the service registry to make it available to interested users. A service requestor (a user) inquires the service registry to find a needed service and, when it is found, the requestor binds the service in order to use it. The service registry manages registration, classification, and discovery of web services. This discovery functionality is defined, by World Wide Web Consortium, as: *"the act of locating a machine-processable description of a Web Service that may have been previously unknown and that meets certain functional criteria"* [W3C 2004b].

Currently, the main used service registry is the Universal Description, Discovery and Integration (UDDI) that, in turn, presents some defects:

[1] Work founded by Halley Informatica, by E-government project "Tecut – Tecnologia Utile" and by Regione Marche.

1. The registry handles information in a passive way. When the access point of a service changes without a suitable updating of the current information in the registry, the following invocations of the service will turn in an unexpected unsuccess. In [Clark 2001] it has been extimated that approximately the 48% of access points through UDDI are not usable because of this problem;
2. The service in the registry contains information and classification too complex to understand and indeed, service requestors are not able to quickly find the needed service;
3. The registry lacks of a semantic support for service description [Lu 2004];

Nevertheless, UDDI is not the only strategy for service discovery. Service discovery represents a "logical role" in this scenario and may be of competence of the service requestor, provider, or other agents.

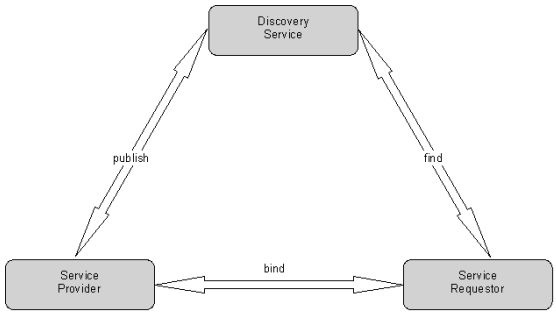

Figure 1: Web service model

UDDI also lacks of a mechanism for handling Quality of (web) Services. These non functional requirements cannot be currently utilized for service discovery, while it could be very useful to add non functional information in the discovery process. The web service QoS can be defined like a set of non functional requirements: scalability, capacity, performance, reliability, availability, …[Shuping 2004] that could be taken into account in the service selection.

In this paper we propose a new web services architecture that is able to handle QoS and to include non functional parameters in the discovery process. The proposed architecture also makes sure an effective usability of web services returned from registry. This prevents for the registy to play a passive role in the architecture.

2. SECURITY AND QUALITY OF SERVICE IN DISCOVERY

Before, it has been spoken about the typical web services architectural model *publish-find-bind.* This model does not hold the quality of service of a Web Service. Currently, the most diffused discovery system is UDDI but it is able to represent only the functional aspects of the service. In [Shuping 2004] it is proposed an architectural model that extends the classic model with the introduction of one new logical role called "QoS Certifier". The provider, beyond describing the functional aspects of supplied service (in order to insert them into a UDDI registry with extended capabilities), must descrive the non functional aspects in order to insert them in the registry after the "QoS Certifier" validation. Now the process of discovery is not only constituited from a single interrogation of the registry but it is necessary filter the results for the desidered QoS. The requestor can search the services by theirs non functional requirements, after that, the requestor can exclude, from obtained services list, all those services that do not satisfy the desidered QoS.

This scenario, however, do not resolve another problem introduced in [Clark 2001] where it is asserted that a greater amount of web services captured from UDDI is not usable since in the registry there are not updated binding information. In according to the above enunciate, the only information to being sure on line with the effective implementation and availability of the service are provided by service provider. In this way, it can be thought to modify the model including the "QoS Certifier" inside the discovery service and adding functionality for verification of founded service.

In the new proposal model the "QoS Certifier" takes the name of "QoS Parameter Registry" and it arranges the functionalities of storage, search, and verification of QoS information about a service. The "traditional" registry containing the functional parameter of web service is named "Functional Parameter Registry". The delineated scenario is represented in (fig. 2) and it refers to one model *publish-find-verify-*

bind. The service provider that supplies the service describes it and publishes it into the discovery service. The discovery service performs a distinction between functional and non functional parameters that describes the service. Functional parameters are managed in the *Functional Parameter Registry* for examples, using UDDI, while QoS parameters are stored in the *QoS Parameter Registry*. The service discovery perform a verification of functional parameters (*verify*) and a verification of QoS (*Certify QoS*) certifing if these are coherent with the information claimed from service provider. When the service requestor performs a search inquiring the discovery service, they can specify in the query both functional and non functional parameters.

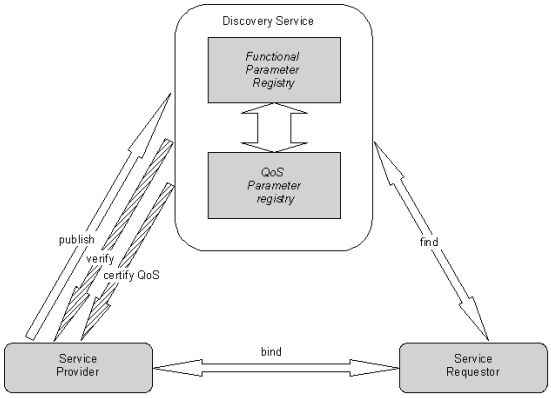

Figure 2: Web service discovery with QoS and security

Therefore, the QoS parameters are considered in the selection process. At this point, the service discovery characterizes potentially useful services for service requestor and checks their availability to the provider. If the information contained in the registry are up to date, the service discovery informs the requestor supplying one list of possible usable services. In the case the discovery service, controlling the service availability, notices some incongruences with the information declaring previously from the provider, the registry perform an update with the new information supplied from the provider. Now, information are supplied to requestor. In this manner information supplied to requestor after a request are surely usable because they are tested directly by service discovery to the service provider. The requestor can now make the binding and starting using the service.

In the Shuping Ran's model there are four actors: the UDDI register, the consumer, the supplier and the QoS Certifier. This change the standard W3C model that consider only three actors: the requestor, the provider and the register that is not only related whit UDDI, but with a generic discovery mechanism. In the Shuping model there is a two step publication phase: first the supplier needs to certificate its QoS claim by the QoS Certifier, and then it is able to insert the description into the registry. In the new proposal model this is a one step phase for the provider. It is the intelligent registry that takes care about QoS claims and functional descriptions. In the previous model also the inquiry phase is a two step phase: the requestor should query the registry using functional parameter then it can use the QoS Certifier for verify the QoS claims and select the appropriate service. The model presented here foresee an inquiry phase than take into account both the functional and non functional parameters in one step because the registry has the responsibility of verify the QoS to service provider.

In this scenario service provider must comunicate to service discovery the information on the exposed service. The data referred to the implementation of service can be expressed by WSDL while to treat other data it would be necessary to define an ad-hoc XML format [Adams 2002, Liang 2003, Tian 2003, Tian 2004,]. In such format there are information related to the description in natural language of the service, a reference to WSDL document and the information related to QoS parameter or a reference to them. In fact, the data that the *QoS Parameter Registry* must be able to handle can be expressed in XML format according to one opportune schema that can be defined. The provider verification must be carried out through the WSIL use, opportunely extended in order to represent the non functional parameters. The control of information to the provider could be preceded from verification on XML document through the use of XML Signature [Simon 2001, W3C 2002]. If the signature of data supplied to the service discovery and the signature of data into the provider registry are coincident then the service implementation is not changed. Otherwise, a new description can be traced through WSIL. Analogous, if the signature regarding the QoS of service is changed is necessary to procede with a new survey of the QoS supplied from provider and the following certification executed from discovery service (*Certify QoS*). The service discovery becomes an element of fundamental

importance in the model. At the service discovery is entrusted the task not only for store information on the services, and their quality, but also the task of verification that the supplied information are effectively usable, therefore useful, for requestor. Discovery service must be able to distinguish the functional information from those that are QoS related so as to deal them differently in phase of publication and in phase of interrogation. This distinction is necessary because information must be verified or certified in a different manner. In interrogation, moreover, can be considerated also parameter of QoS supplying, to this last, an important role, not only for verification of the availability of a determinated service, but also during the process of chosen of the service.

The service requestor carries out one demand to the service discovery like to the traditional model with the difference that now the requestor can also specify non functional requirements. The query format must be revisited for being able to receive this type of information. Once obtained the service information a requestor is able to carry out the bind for the effective use. In the case that the requestor does not specify QoS information in the query, the discovery service would have to answer equally to the query ignoring the QoS of the services. The compatibility with the classic request must be maintained for the requestor that is not interested on QoS claims supplied by provider.

3. SPECIFICATION AND CHARACTERISTIC FOR E-GOV SERVICES

For e-Government they understand the process of informatization of Public Administration. The e-Government allow of dealing documentation and managing administrative procedure with digital systems. With these technologies the e-Government can improve the work of agencies and it can offers to end user (citizen and firms) it is services more expresses, is new services, through web sites of interested Public Administrations. The e-Government, therefore, has the objective of improve the comunication and the efficiency of public service. This domain comprises: on-line informations, document flow with workflow and on-line services for citizen and firms. All that is made by central Public Administrations, regional PA and local PA. The central PA mainly supplies back office functions, while the front office task is made by local instituitions [Medjahed 2003].

From a technological point of view, the adoption of open standards, like for examples those developed by W3C, represent an important choice in order to favor the interoperability between technologically various e-Government platforms. When a citizen has necessity of having to complete an administrative procedure, he addresses PA that tipically executes the task using his back office composed by a multitude of agencies, central administrations and local administrations. The citizen or the firms cannot be informated of every development of single procedure, on the other hand who takes care itself of the development of such procedures for PA often carries out repetitive tasks. Such tasks vary, every so often, with changing of the laws and the norms of the State. In this manner, it is well to divide several tasks in single web services then compose them in an opportune way in order to carry out a complete procedure.

In this way there are two key advantages: the reuse of web services in wide services, that is different administrative procedure, and the possibility for back office to modify itself in short times at the change of administrative iter. It is clearly that for web service composition and coordination it is necessary to hold account of the service QoS that are composed to the aim to guarantee the QoS in the composed service. Moreover, it is necessary to know the availability of a single service before the composition so as to be able to guarantee the composed service availability. Another interesting aspect is the achievable system transparency. Indeed, the user, citizen or firm, addresses to PA through a single access point, the back office executes the whole administrative iter without the customer must necessarily know the development procedure.

4. CONCLUSIONS

This paper is a preliminary work. It is realized in order to comprise how the web service architecture can be extended for including QoS parameters of single web service and in order to add into the model a method that guarantees to the requestor the effective availability of the discovered web service.

The importance of the two aspects described here is remarkable because both have an essential role in the web service composition and in personalized selection of web service that is the selection that considers requestor preferences in the discovery process. For the QoS aspect, it will be necessary to establish a QoS

model of reference for e-Government services that holds the QoS general parameters of a web service and that includes a specific part for e-Government services. This model can be adopted for personalized selection [Balke 2003, Yutu 2004] and for web service selection before composition. That is particularly useful for those services that otherwise they would not be distributable from a single point of access. In this way, for the customer, the transparency of the Public Administration's back office is guaranteed.

REFERENCES

Adams, Carlisle and Boeyen, Sharon, 2002. UDDI and WSDL Extensions for Web Services: A Security Framework. *ACM Workshop on XML Security.*

Balke, Wolf-Tilo and Wagner, Matthias, 2003. Towards Personalized Selection of Web Services. *The Twelfth International World Wide Web Conference (WWW 2003)*

Bouguettaya, Athman and Ouzzani, Mourad, 2004. Efficient Access to Web Services. IEEE Computer Society.

Chenliang Sun et al., 2004. Comparison of UDDI Registry Replication Strategies. *Proceedings of the IEEE International Conference on Web Services ICWS'04.*

Clark, M., 2001 UDDI - The Weaher Report. *http://www.webservicesarchitect.com/content/articles/clark04.asp*

Constantinescu, Ion and Faltings, Boi, 2003. Efficient Matchmaking and Directory Services. *Proceedings of the IEEE/WIC International Conference on Web Intelligence WI'03.*

Degwekar, Seema et al., 2004. Constraint Specification and Processing in Web Services Pubblication and Discovery. *Proceedings of the IEEE International Conference on Web Services ICWS'04.*

Freemantle, Paul et al., 2004. Enterprise Services. *COMMUNICATIONS OF THE ACM,* Vol. 45, No. 10, pp. 78-82

Hoa He, 2003. What is Service-Oriented Architecture? *http://webservices.xml.com/pub/a/ws/2003/09/30/soa.html*

Liang, Qianhui et al., 2003. A united Approach to Discover Multimedia Web Services. *Proceedings of the IEEE Fifth International Symposium on Multimedia Software Engineering ISMSE'03.*

Liuming Lu et al., 2004. An Infrastructure for E-government Based on Semantic Web Services. *IEEE International Conference on Services Computing (SCC'04)*

Medjahed, Brahim et al., 2003. Infrastructure for E-Government Web Services. *IEEE Internet Computing.* January-February 2003, pp58-65

Paolucci, M et al., 2002. Semantic matching of web services capabilities. *Proceedings of the 1st International Semantic Web Conference (ISWC)*

Sabucedo, Luis Álvarez and Rifón, Luis Anido, 2005. UDDI Service in eGovernment Environments. *eGOV INTEROP'05 Conference on "Interoperable eGovernment Services"*

Shaohua Liu et al., 2004. Web Service Cooperation Ideology. *Proceedings of the IEEE/WIC/ACM International Conference on Web Intelligence WI'04.*

Shuping Ran, 2004. A Model for Web Services Discovery Whit QoS. *ACM.*

Shuping Ran, 2003. A Framework For Discovering Web Services With Desired Quality of Services Attributes. *International Conference on Web Services (ICWS 2003)*

Simon, Ed et al.,2001. An Introduction to XML Digital Signatures. *http://www.xml.com/pub/a/2001/08/08/xmldsig.html*

Stănescu, Emil, 2003. A Web Services Based Architecture for Improvement of the transparency and Decision-making in Public Administration. *RoEduNet International Conference 2003.* Iasi, Romania.

Tian, M et al., 2003. A Concept for QoS Integration in Web Services. *Fourth International Conference on Web Information Systems Engineering Workshops (WISEW'03)*

Tian, M et al., 2004. Efficient Selection and Monitoring of QoS-Aware Web services whit the WS-QoS Framework. *Proceedings of the IEEE/WIC/ACM International Conference on Web Intelligence WI'04.*

W3C, 2002. XML-Signature Syntax and Processing. *http://www.w3.org/TR/xmldsig-core/*

W3C, 2004. Web Services Architecture. *http://www.w3.org/TR/ws-arch/*

W3C, 2004. WS Glossary. *http://www.w3.org/TR/2004/NOTE-ws-gloss-20040211/*

W3C, 2005. Web Service Description Language (WSDL). *http://www.w3.org/TR/wsdl*

Yutu Liu et al., 2004. QoS Computation and Policing in Dynamic Web Service Selection. ACM.