

# Discovery services in the future generation of mobile networks

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## ABSTRACT

Services discovery mechanism aims to provide a means to publish, find and subscribe services in environments where the services are relatively stable in location. The capabilities of such environments and users are known with limited regard of infrastructure heterogeneity. Therefore, the limited support of interoperability with other service discovery protocols such as infrastructure-less service discovery leads to a critical situation. Particularly, In pervasive environment, where many kind of networks cohabite to form one logical environment for user's view. In this case, there is no cooperation between discovery services, and then every available services in a domain are strictly restrain to its users. This lack of interoperability has already identified by many research communities and they propose some solutions that concretize the interoperability approach of several discovery services. We present in this paper briefly our choice of OSGi broker.

## KEYWORDS

Service discovery, heterogeneity and interoperability.

## 1. INTRODUCTION

Reaching the resources (data, services and applications) in a network is the main goal of the emergence of computer networks. So, several technologies were deployed to ensure the resources delivery to users, example: Service discovery protocols. The service discovery mechanism is an important element, which enables users to search available services, and then invoke them from their descriptions and their characteristics. There are several discovery protocols, which target specifically networks variety: centralized/distributed, wired/wireless, fixed/mobile and with infrastructure/ infrastructure-less [1].

Mobile and wireless technology progressing growth quickly, makes their use essential in many environments. Because wireless networks infrastructure offer communication interfaces performance similar to a wired network. On the other hand, mobile terminals such as Laptops, PDAs, Smart-Phones..., are becoming increasingly popular. Because they have same features to those of a workstation: good time of calculation, enough storage capacity and acceptable content presentation. These clues lead to new wireless interaction environments between servers and clients at home and enterprises. In parallel, other types of networks appear and create more networks mobility in the global environment

(PAN and VAN). This new heterogeneous and dynamic environment presents the networks of future generation. Our goal is to study the services discovery situation in this type of network. In such environment, users moves and communicates with them through several areas in a transparent manner, without realizing administrative borders. These borders could utilize much kind of service discovery protocols. The resulting situation of heterogeneity among discovery protocols makes the discovery process limited between areas which using the same protocol. Therefore, users in one area may not benefit from the services offered by another, because there is no cooperation between existing services discovery. In other words, network resources are not well exploited. This has a task to be developed to better discover services through several areas. Several research communities have proposed solutions in the form of broker intermediation between the protocols to ensure discovery protocols interoperability. They differ in their architecture and their modes of operation.

Our project (developed by e-ugn work-gourp) consists to deploy a mobile-learning plate-forme among heterogeneous environments. In this paper we present our argument to choosing OSGi broker as a best solution.

## 2. DISCOVERY SERVICES

### 2.1 Overview

The service discovery is a process that allows users to discover resources (services, data and devices) of a network corresponding to specific descriptions. This discovery mechanism is particularly essential for networks characterized by mobility and frequent changes of the resources availability. The purpose is to keep users abreast of all these changes about resources availability (new resources, up-date or deletion). Generally, informations about services are changing in a permanent way; the reasons are multiple, e.g. servers location change, publication of new updates, new versions of a service. Therefore, customers don't keep track of these changes. Then it's necessary to deploy mechanisms that allow users (devices or environmental) to automatically discover changes about services instead reconfigure terminals at each access: These are service discovery protocols (SDP). All existing SDPs have the same goal, but they differ in several aspects: Architecture, operating fashion, environment type targeted...in fact, each protocol is developed for a specific architecture:

distributed/centralised, for limited/large environments scope, dependence on technology or not. To better understand the traditional discovery protocols behaviour in heterogeneous environment, the next section will present a brief comparison based on several criteria.

## 2.2 Discovery services: Comparative study

Traditional service discovery protocols often use different terminologies to better reflect unique aspects of their design choices. A common terminology and classification mechanism help analyze their advantages and disadvantages and identify areas worthy of additional efforts to respond heterogeneous environment requirements. To predict the behaviour of existing discovery protocols in such environment, it is better to analyze them from behavioural point of view. There are many comparison works, but we adopt that made by Hoffert [2], this study define a taxonomy that categorizes the properties common between discovery services and the properties that differentiate them so that existing discovery services can be compared and contrasted meaningfully. The details of these studies is not included in this document, we will consider just the heterogeneity issue that presents a challenge in the next generation of mobile networks. The following table (Table 1) provides some discovery services and their evaluations with their heterogeneity, negotiation between the entities that use the protocol and the scope of the network on which work.

**Table 1. Classification of discovery services**

	Service Negotiation	Heterogeneity	Network Scope
<b>Jini</b>	No	No	LAN
<b>Jxta</b>	No	No	WAN
<b>SLP</b>	No	No	LAN
<b>Bluetooth-SDP</b>	No	No	LAN
<b>UDDI</b>	No	No	WAN

Each protocol refers to a particular network infrastructure (LAN/WAN), It should also be noted that all discovery protocols do not ensure a service negotiation, and can no longer support the heterogeneity. Certainly, the lack of cooperation between the discovery protocols, poses a major problem in the case of cohabitation of several protocols in one environment. Because the services available in the area, they are restricted. All users outside this area will not benefit from its services.

Heterogeneity limits performances for next generation networks, however, Many works done to support heterogeneous discovery services include the Service Discovery Broker, which provides a gateway that locates services across heterogeneous discovery services and federation of Service Discovery Brokers for scalability. Consequently, discovery mechanism discovery will be executed within one logical area instead of several.

## 3. INTEROPERABILITY BROKERS.

The existing interoperability approaches offer the possibility of communication between different protocols discovery. They are the only solution to the heterogeneity issue and lack of cooperation between these protocols. These solutions have several attributes in which they differ: *background* (the scope it has), *architectural perspective*, *functionality* and *extensibility* [3].

Reflective Middleware for Mobile Computing, ReMMoC, is a reflective, reconfigurable common services middleware. It focuses on abstracting the potential heterogeneity in the discovery and

interaction protocols by making applications independent of protocol-specific APIs, instead tying them to a more generic API provided by ReMMoC [4]. The FuegoCore Service broker is a common service middleware. It focuses on protocol adapters that utilize a gateway-functionality. Its aim is capability to extend client and service reach, transparent functionality to clients and services and minimal need for administration after setup [5]. Open Services Gateway initiative (OSGi) was managed broadcast services to homes and cars and other environments [6]. From service discovery interoperability perspective OSGi originally focused on providing a translation service in a gateway to enable interoperation between home appliances and devices. Actually, with the last version (2006) the specification has mainly been extended to support mobile smart phones in order to enable their direct OSGi-service use. OSGi, from a standardization perspective, requires defining new APIs for new service discovery protocols. The framework can operate also with minimum framework in J2ME capable devices and foundation framework in J2SE-based server-side services.

The presented solutions operate in two modes, transparent or explicit. Transparent: servers and clients are unaware of the interoperability process, in the explicit mode need intervention in user level. The transparent mode is the most desirable of its simplicity, FuegoCore and OSGi adapt this mode. From architectural view, OSGi is the only specification that defines an open and well documented for the services development and deployment. On the other hand, is the only one which provides flexibility in the establishment on either server side or on clients devices (OSGi min), which have limited performance. The extension of OSGi adapting new discovery services requires only the API appropriate for these protocols. However, ReMMoC and FuegoCore request of kernel development, so is very costly in time and skills.

## 4. CONCLUSION

Our choice of OSGi had several reasons, we see that's the appropriate solution to our m-learning platform. We are already in testing phases of the discovery mechanism in heterogeneous environments. The results so far are satisfactory. Our aim is not confined there. Our future works are much more on improving the discovery process in a smart way that takes some environment parameters, user preferences and the privacy and security side.

## 5. REFERENCES

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