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A Comparative Study of SOAP Vs REST Web Services Provisioning Techniques for Mobile Host

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Abstract

Web services are moving towards mobile wireless world as a new emerging technology for mobile applications communication. Now mobile devices can operate as web service providers due to the advancement in mobile device capabilities and it has also become possible due to improvement in web service development technologies and wireless communication techniques. Today's most important need is to provide uninterrupted, lightweight, continuous web services to resource constrained mobile device in wireless environment. This paper presents a detailed comparison between two frameworks used for providing web services through SOAP and REST and also discusses the problems and challenges in these two frameworks. With the help of comparison we can decide which frame work is most suitable for wireless environment and fulfills the current needs of accessing lightweight mobile web services continuously from resource constrained mobile device.

Keywords Mobile Web Services, SOAP, REST, RESTful

1. Introduction

Today is an era of Internet. There are various methods for interaction between user and Internet which is web application through web services. Web services are based on the concept of service-oriented architecture (SOA). SOA is the evolution of distributed computing, which enables software components, which includes application functions, objects and process from different systems, to be exposed as a services. Service Oriented Architecture (SOA) (Matthew *et al.* 2005) is a widely applied standard, reference model for service oriented computing and most useful for realization of Web Services. According to the Gartner research (June 15, 2001), "Web services are loosely coupled software components delivered over Internet standard technologies." In short, Web services are self-describing and modular business applications that expose the business logic as services over the Internet through programmable interface and where IP can be used finding way to subscribes and invoke those services.

As per literature survey, mobile device can be used in four different ways for web services. These types are based on role of mobile device used as consumer, provider or broker. Based on role of mobile device, these types are 1. Mobile as a web service consumer. 2. Mobile to Mobile or Peer-to-Peer web services. 3. Mobile device as web service provider and 4. Mobile Device as web service broker in P2P web services. In first case Mobile as web service consumer – mobile acts as web service client and request web services from SOAP or REST framework. In second case Mobile to Mobile or P2P – mobile is a part of Ad hoc network and each node in ad hoc network act as client or server or both. In third case Mobile device as Web Service Provider – mobile act as web server and provides web services to any type of client. In fourth case Mobile as web service broker – mobile device act as a locating web services that are stored in other mobile in P2P network.

To meet the demands of the cellular domain and to maximize the benefits of the fast developing web services domain and standards, the scope of the mobile device as web service providers is being observed. Also nowadays use of web services on mobile devices become increasingly relevant because of development in processing capabilities of the mobile devices. Also with advances in mobile communication technologies and wireless securities, now it has become possible to host Web Services (WS) on mobile devices. Web services have a broad range of service client, however mobile device have a large number of users which is always expanding. Therefore, it is possible to use mobile device as web service provider. The paradigm shift to mobile phones from the role of web service consumer

to the web service provider is a step towards practical realization of various computing paradigms such as pervasive computing, ubiquitous computing, ambient computing and context-aware computing.

Mobile web services provisioning framework allows deploying, publishing, discovering and executing of web services in wireless environment using standard protocols. Mobile web service provisioning can be classified based on architecture as SOA (Service Oriented Architecture and ROA (Resource Oriented Architecture). SOA based web provisioning uses SOAP (Simple object access Protocol) based web service framework and ROA based web provisioning uses REST (REpresentational State Transfer) web service frame work.

The paper is organized as follows: section 2 illustrates state of art for providing web services from mobile device and addresses main issues and challenges of provisioning of web services which also includes comparison of the two different mobile host frameworks (SOAP and REST). Section 3 explores main blocks that are used for building web services for mobile host. Section 4 summarizes the paper and discusses the future directions.

2. State of Art

The SOA and ROA, both are architectural design patterns and the corresponding distributed programming paradigms. Both provide a conceptual methodology and development tools for creating distributed web services architectures. ROA and SOA were named as resources and services.

The concept of provisioning web services from mobile device was first introduced in (Guido Gehlen & Linh Pham 2005) by presenting a SOAP server works as middleware for a mobile web service provisioning. The feasibility of mobile web services is proved along with performance analysis of the mobile hosts in (Srirama et al. 2006). After that, this group started comprehensive research activity on same area. It uses SOAP as a messaging framework for web services realization of SOA. SOAP is not made for resource constrained mobile devices but it is for fixed network. The SOAP messages has heavy payload. In contrast, the REST messaging framework has lightweight payload which is suitable for mobile as well as cellular network. REST identifies the service resources by single URL only. Many Mobile web applications have been built over the last decade using SOAP-based web services. But SOAP based web services was made for traditional network or fixed network. These web services are heavy in nature and mobile is a resource constrained device.

Most of implemented web services frameworks are based on SOAP in client server environment discussed in (Berger *et al.* 2003; Luqun 2008; Aijaz *et al.* 2008) and mobile web services was hosted in Peer to Peer network discussed in (Asif *et al.* 2008; Hassa 2009). According to (Guido & Linh 2005) had developed the mobile host for heterogeneous environment. The concept of REST based web services for mobile devices is introduced in (Fahad *et al.* 2009) and comparison with SOAP architecture of HTTP payload is discussed in (Fahad *et al.* 2009; Hatem *et al.* 2010). Both REST and SOAP frameworks are used for hosting web services on mobile. However, each has its own advantages and disadvantages. The comparison of two frameworks discussed in table 1.

Table 1. Comparison of SOAP and REST based Web Services

SOAP	REST
It is well known old traditional Technology.	It is new technology as compared to SOAP
Within the enterprise and in B2B scenarios, SOAP is still very attractive.	This is not to say that REST is not enterprise ready. In fact, there are known successful RESTful implementations in mission critical applications such as banking.
In SOAP, Client-Server interaction is Tightly coupled.	In REST, Client-Server interaction is loosely coupled.
In case of implementation, SOAP overtakes REST as there are established development kits in case of SOAP.	But REST developers would argue that it's got interface flexibility.

Changing services in SOAP web provisioning often means a complicated code change on the client side.	Changing services in REST web provisioning not requires any change in client side code.
SOAP has heavy payload as compared to REST.	REST is definitely lightweight as it is meant for lightweight data transfer over a most commonly known interface, - the URI
It requires binary attachment parsing.	It supports all data types directly.
SOAP is not a wireless infrastructure friendly.	REST is a wireless infrastructure friendly.
SOAP web services always return XML data.	While REST web services provide flexibility in regards to the type of data returned.
It consumes more bandwidth because a SOAP response could require more than 10 times as many bytes as compared to REST.	It consumes less bandwidth because it's response is lightweight.
SOAP request uses POST and require a complex XML request to be created which makes response-caching difficult.	Restful APIs can be consumed using simple GET requests, intermediate proxy servers / reverse-proxies can cache their response very easily.
SOAP uses HTTP based APIs refer to APIs that are exposed as one or more HTTP URIs and typical responses are in XML / JSON. Response schemas are custom per object	REST on the other hand adds an element of using standrdized URIs, and also giving importance to the HTTP verb used (i.e. GET / POST / PUT etc)
Language, platform, and transport agnostic.	Language and platform agnostic
Designed to handle distributed computing environments.	Assumes a point-to-point communication model—not for distributed computing environment where message may go through one or more intermediaries
Harder to develop, requires tools.	Much simpler to develop web services than SOAP
False assumption: SOAP is more secure. SOAP use WS-Security. WS-Security was created because the SOAP specification was transport-independent and no assumptions could be made about the security available on the transport layer.	REST assumes that the transport will be HTTP (or HTTPS) and the security mechanisms that are built-in to the protocol will be available
Is the prevailing standard for web services, and hence has better support from other standards (WSDL, WS) and tooling from vendors.	Lack of standards support for security, policy, reliable messaging, etc., so services that have more sophisticated requirements are harder to develop.

The most important web provisioning issues while deploying web services on mobile are web service discovery, device disambiguation and accessing large number of web services from mobile device will create bottleneck and single point of failure. The mobility of devices raises several issues as well, for example, when mobile device is moving from area to another at that time service discovery, networking, trust, and security are the major concerns which are different from those in the domain of large stationary servers. Finally, the constraints on computational power and battery life of mobile devices add another dimension to the challenge faced by this technology. Web Services on mobile devices should also attempt to keep messages as short as possible and clients should tolerate longer round trip times.

3. Framework Architecture

Today's Web Service Frameworks are developed for static servers. These frameworks are heavy in nature. However, these available frameworks are not suitable for resource constraint mobile device. Also these require continuous running environment and also consume large amount of resources and which also lead to heavy discharge of the battery power. So, hosting web services on mobile devices requires lightweight framework, which will allow ease of deployment and thereby providing efficient and continuously executing web services and which in turn will save the battery power.

The SOAP and REST frameworks are used to deploy web services on mobile device. Both frameworks are identical in terms of architecture but they differ, in the context of handling and parsing the request. Both the frameworks have four main core components as shown in figure 1. The uses of these components are as follows:

1. Http Listener: With the help of this block of web service, client can send request or receive response to/from mobile host.
2. Request Handler: The main function of this block is to process incoming request from client and send back response to the client. This block works differently in each framework. In SOAP based framework request handler will remove the incoming HTTP POST request to extract the hidden SOAP envelope then it will dispatch to the parser (kSOAP) module, but in REST based framework request handler will extract the HTTP request directly and send it to the message parser.
3. Parser Module: It is responsible for invoking web services such as name of the service and other required parameters. This invoked information is sent to the web service servlet block. In SOAP based Framework parser desterilizes the SOAP object and maps the data type into service name and other parameters, but in REST, massage parser maps the data type into service name and other parameters.
4. Web Service Servlet: It most important module in mobile web provisioning. It deploys the new web services on mobile host and supports invoking of requested services.

5. Conclusion

In this we have explored the frameworks used for provisioning web services on Mobile phone. This framework is suitable for SOAP as well as REST. From the comparison between SOAP based framework and REST based framework, we conclude that REST based framework is more suitable for handheld, resource constrained mobile device and wireless network also the level of resource consumption is less in REST as compared to SOAP. But SOAP framework is more secure as compared to REST. For reducing the payload size in SOAP we can use different compression techniques. Regarding the future work will design hybrid framework to support various interfaces for mobile hosted web services such as HTTP, Bluetooth, SMS etc on SOAP and REST.

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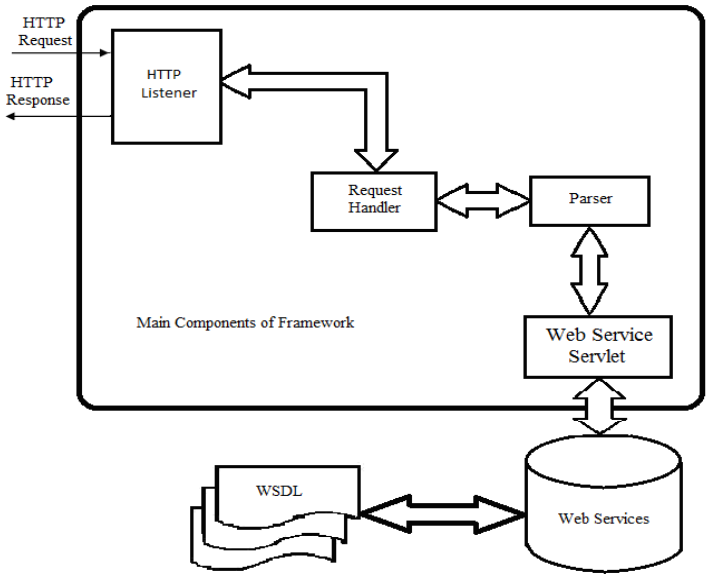

Figure 1. The Main Components of Framework