An Efficient Asynchronous Mobile Web Service Framework

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Motivation:
In Mobile devices, Synchronous web services are not feasible as it makes the user wait while each Web service processes requests and returns results. Asynchronous Web services invocation solves this performance issue and enhances the end user experience by increasing server efficiency. Asynchronous web services are long lived but due to cellular data characteristics, reaching a mobile phone may be problematic using HTTP. Thus this paper proposes sending the SOAP response to the mobile using the SMS protocol.

Assumptions:
Mobile devices can always send and receive SMS (i.e. they have subscribed to the service)
SMS will usually not be delayed or lost.

Notes & Features:
1. Three Processes in web service:
   a. Discovery of available WS which is done through UDDI
   b. Get the web-service description i.e. WSDL
   c. Communication.

2. Challenges: Constrains in terms of processing power, battery life and user interface.

3. Disconnected operation of terminals is the norm, (i.e. internet services keep disconnecting on mobile)

4. This paper proposes to increase efficiency of mobile web services by integrating the telecommunication facility and asynchronous invocation of web services.

5. Since many services cannot support multiple transfer protocols. This paper proposes to use a gateway intermediary to move the SOAP response from the HTTP protocol to the SMS protocol.

6. Asynchronous method for mobile web services is better than synchronous method but its not as simple to implement

7. Asynchronous Patterns: is a basic asynchronous configuration with its own advantages and disadvantages.

8. Fire and Forget Asynchronous Pattern: The client invoke the services and return immediately without ever bother about a response.
   a. Advantage: easy to develop and is loosely coupled.
   b. Disadvantage: no way to verify whether the request has been or not.
9. Polling Asynchronous Pattern: The client application repeatedly asks for the status of an external service that it has invoked.
   a. Client acts only as consumer of the services that the server produces for the client.
   b. This pattern encompasses two WSDL operations:
      i. A request-response to send the request.
      ii. Another request-response to ask for the polling result.
   c. Advantage:
      i. Polling results in retrieval of response within an acceptable time frame which is determined by the time spacing between two polling requests.
      ii. It is not necessary to make any service available at clients premises, since it totally relies on invoking the servers services
   d. Disadvantages:
      i. There is no way for external service to notify the client about its status.
      ii. Polling results in increased traffic over the network, which decreases the processing efficiency of the service since it has to process and respond to status update requests.
      iii. Requires high resource allocation such as more powerful pro-cessors and more network bandwidth.
   e. Not very efficient as:
      i. The client should query the server many times to get the needed information.
      ii. The client gets its answer not when it becomes actually available, but later in the future, when the client itself will actively ask for it.

10. Callback Asynchronous Pattern: is based on the principle of "Don’t call us, we will call you back".
    a. Process:
       i. A client application sends a request and waits for the response without blocking its state.
       ii. The response is sent back to the client when it is available.
    b. Advantages:
       i. Callback results in increased processing efficiency since the service solely performs its tasks and is not bogged down in processing and responding to status updates.
       ii. Less network traffic which in turn requires less amount of resources required.
    c. Disadvantage: Callback may result in delayed retrieval of response at the client end, specially when the service has to inform a lot of clients about the status of the service.

11. SMS Protocols:
    a. Short Message Peer to Peer (SMPP) protocol: is an open industry standard messaging protocol designed to simplify integration of data applications with wireless mobile networks such as GSM, TDMA, CDMA and PDC.

    b. Mobile Message Access Protocol (MMAP): provides a standard XML-based framework for mobile messaging over SOAP and HTTP.

    c. Short Message Application Protocol (SMAP): is a set of abstract XML operations specifically designed for short messaging.
Summary:
The paper proposes a gateway that implements a pattern of subscribe/notify accessible through Web methods. The process is defined as below:

1. The SMS Gateway works as a gateway between the mobile network and an organization intranet.
   a. The application on the user's device creates a web service call.
   b. The web service call is then enveloped as a MAM SOAP message and sent to the Message Centre as an SMS.
   c. The Message Centre received the message and forwards it to the MAM Server.
   d. The MAM server, using private IP connection and MAM protocol sends the SMS to the SMS Gateway

2. The SMS Gateway is based on Web server architecture, exposing its functionality as Web Services and issuing Web Service calls to notify client applications. The SMS Gateway then processes the SMS's SOAP Message, which then makes the Web Service call to the required Client WS.

3. Similarly the response is received from the Client WS by the Application Server, which is then processed by the SMS Gateway which in-turn sends the response back to the user using MAM SOAP SMS.

Thus, The implementation is standalone and provides its own Web server without requiring integration within other Web servers, and using this method, Multiple applications may be made available by a single gateway.

The paper describes two types of scenarios in which mobile web services works:
Scenario 1: There is one fixed node and other mobile device.
A server to mobile communication is done through gateway and server to fixed node communication is done through asynchronous invocation by using best possible pattern in a wired link.

Scenario 2: Two or more mobile node want to access a web service of each other then they communicate through SMS gateway.

Limitations:
The mobile user will have to be subscribed to the SMS service provided by the network service provider thus adding to the cost of service access from the user front.

Conclusion:
In order to increase the performance of mobile devices during the access of Web Services, telecommunication services are used. In Mobile web Application, all Web Services are asynchronously called which increase the speed of calling as compared to synchronous Web Services. Authors used an open wave mobile simulator to simulate the web application. From the simulation result authors were able to find that a combination of asynchronous Web Services and telecommunication service is feasible for mobile devices that also saves the limited battery power and provides greater flexibility.