Prototype Web Services and Instant Messaging Integration

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ABSTRACT

With the modern day Web becoming more oriented to providing services for the consumption of software applications through semantic web services and with Instant Messaging technology capable of retrieving data from specific sources, the proposed system, called the Web-IM Bridge, aims to give the IM client access to various data sources from the vast network of readily available web services in the Internet.

The Web-IM Bridge will basically be comprised of two integrated modules - one communicating with the web services called a Web Services Interface and another communicating with the IM Client called the Instant Messaging Interface. The first module will interpret the Web Service Description document of each web service and will relay its content to the second module. After this, the second module will deploy itself as a virtual IM user and, using the information from the Web Service Description documents, allow users to input commands to request data from the web services.

***Keywords*:** Web Services, Instant Messaging

INTRODUCTION

The Internet is growing rapidly in all three dimensions - users, hardware, and software. Internet users are increasing exponentially with the number of world wide users pegged at 1,093,529,692 since January 11, 2007 (Miniwatts Marketing Group, 2007). Meanwhile, CPU processing power and storage capacity are doubling every 18 months (Stewart, 2006). As a result, software applications using Internet technology are becoming more and more sophisticated with every release to the extent that these applications are porting themselves out of the desktop and into the Web as the new computing platform.

Not only is the Web emerging as the new computing platform for software applications, it is also becoming more oriented to providing services for the consumption of software applications themselves and not just individuals (Gudivada, et. al., 2006). The implementation of this vision of the Web is the network of semantic web services. Web services are simply black boxes with an interface with which other software applications can access its services. However, these software applications need to know what this service provides and how to access it. As such, web services also implement the concept of the Semantic Web. Simply put, web services are marked up with machine readable metadata which allow other applications to automatically interpret their services and use it to provide their own services. Figure 1 illustrates the interaction among semantic web services and the applications that use them.

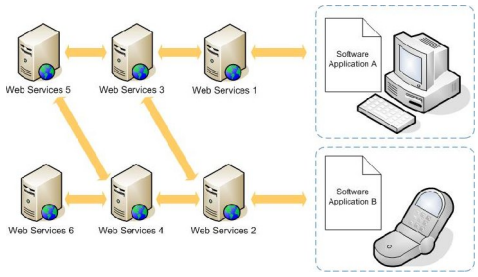

Fig. 1 Semantic Web Services

Instant Messaging (IM) has long been a popular technology since the 1990's. Initially an application primarily used by teenagers for chatting, it is now used as a communication tool in the corporate world and the navy, among others (Cherry, 2002). The success of IM is attributed to its support for presence, real-time communication, and ease of use (Lawton, 2003). IM, however, has evolved to more than just a social tool. With the advent of IM bots, software applications which act as virtual IM users, IM clients can become interfaces for retrieving data (Chan, et. al., 2005).

In concept, data retrieval from IM clients is not far from data consumption from mobile devices. In the Philippines, mobile data services account for around 40% of operator revenues (Duremdes, 2005). Among these data services are Value Added Services (VAS) which allow operators to differentiate themselves and strengthen their relationship with their existing customer base (MobileIn.com, N.D.). Since most modern mobile devices today support the OMA IMPS 2.0 protocol for IM and presence services, the proposed Web-IM Bridge system is potentially accessible from these mobile devices. Furthermore, it can also be accessed through SMS messages. This requires IM servers to be configured to support SMS through an SMPP transport. Subsequently, various web services can leverage the market for mobile VAS.

MATERIALS AND METHODS

2.1 Web Service

Supposing a provider entity, a person or an organization, brainstorms an idea which involves providing resources. To concretize the idea, the provider entity implements a provider agent - a software or hardware which provides those resources by sending and receiving messages. The idea which is concretized by the provider agent is what we call a web service. On the other side, a requester entity, a person or an organization, wishes to obtain those resources from that web service. The requester entity uses a requester agent - a software or hardware which requests those resources by sending and receiving messages to and from the provider agent. So that the requester agent knows how to communicate with the provider agent, the provider entity provides a Web Service Description (WSD) for its web service which specifies messaging format, network location, and other information related to communicating with the provider agent. A Discovery Service bridges the gap between the requester entity and the web service by indexing the WSD and functional description of the web service. The requester entity finds the desired web service through the Discovery Service (W3C, 2004). Figure 2 below illustrates the interaction among components as described above.

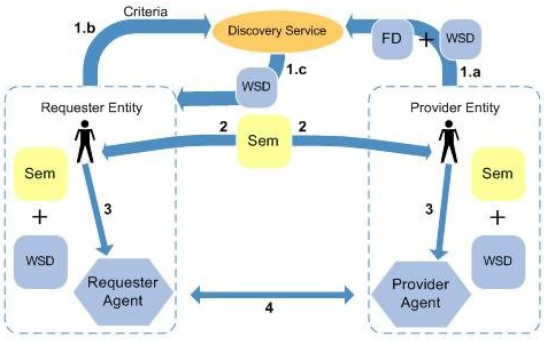

Fig 2 Web Service Operations

2.1.1 HTTP

Hypertext Transfer Protocol (HTTP) is defined as an application-level protocol for distributed, collaborative, and hypermedia information systems. It is layered over a reliable, bi-directional byte stream such as Transmission Control Protocol (TCP). An HTTP interaction is composed of a request message from the client and a response message from the server. A request message is primarily composed of the following: a method, a Universal Resource Identifier (URI), and request header fields. Once the server accomplishes the request, it sends back a response message to the client. A response message is primarily composed of a status code and response header fields. Both request and response messages contain entity header fields and an entity body (Network WG, 1999).

2.1.2 XML

Extensible Markup Language (XML) version 1.0 was standardized by W3C in October 1998. In its third recommendation, XML was defined as a subset of SGML which was to be "served, received, and processed on the Web in the way that is now possible with HTML" (XML Core WG, 2006). XML describes the structure of data within the document by supporting custom tags. Its custom tags improve the searching mechanisms of software applications and its text format is easily transferable over web protocols

such as HTTP. As a consequence, it is a feasible data exchange format for cooperating applications that run over the Internet or on other communication links (Ducket, et. al., 2006). An XML document can be checked if it is well-formed and if it is valid. It is well-formed if it follows the XML 1.0 specification and it is valid if besides that, it follows the constraints of the Document Type Definition (DTD) or schema (Ducket, et. al., 2006) that describes its grammar. This provides parsers within cooperating applications a way to check for data integrity in the XML messages they receive.

2.3 Instant Messaging

Instant Messaging, dubbed as "lag-less e-mail", is an online real-time communication tool between two or more users. Presence refers to the public broadcast of the availability of a certain entity to entertain requests. An entity may be a user, a device, or an application. In its simplest form, it refers to whether an entity is online or offline. Some instant messaging services extend this by providing predefined statuses or fully customizable ones. In a general-purpose IM client, each user owns a buddy list (also known as a roster or a contact list) of subscribers to the user's services such as being able to view that user's presence.

To date, almost all instant messaging services carry their own protocol. Majority of these protocols are proprietary. Interoperability is achieved by means of transports or gateways. A user registers his IM account from a foreign network into the transport. This enables him to exchange messages with users from the other network.

The XMPP/Jabber protocol is an attempt to make current instant messaging services interoperable. The protocol is a foundation for a general purpose instant messaging and presence system based on streaming XML. Most implementations of the protocol are open-source, such as Jive Software's Wildfire Server and its Smack Java Library.

METHODOLOGY

3.1 Architecture

The Web-IM Bridge is comprised of deployed bots and a supplementary client. The supplementary client is designed to interact directly with a single instance of the bot. It provides a graphical user interface and extended functionalities. Figure 3 illustrates the architecture of the Web-IM Bridge.

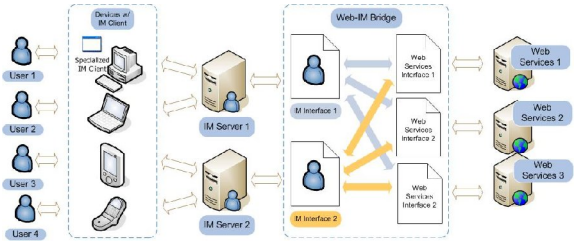

Fig 3 Project Architecture

The Web-IM Bridge is comprised of two modules which are deployed independently. The first module, called the Web Services Interface, stands as the system's Requestor Agent. It is the module which exchanges requests and responses with the actual web services. Ideally, an instance of a Web Services Interface is deployed per group of web services. For instance, there is Yahoo Web Services Interface which utilizes the web services of Yahoo such as Yahoo Search and Yahoo News. Another instance of a Web Services Interface will be assigned for Google and another one for Amazon. The second module, called the Instant Messaging Interface exchanges requests and responses with the actual IM user. This is primarily in charge for converting user commands to machine understandable commands and machine responses to user understandable ones. This is the part of the system directly visible to the users. An instance of the IM Interface stands as the virtual user in the IM network which other users may see online in their contact list and interact with. Ideally, a single instance of the Instant Messaging Interface resides on a single network. For example, one instance is designed to reside within Gtalk's network and another for Jabber.org's network. An instance of an Instant Messaging Interface is designed to communicate with more than one instance of the Web Services Interface. For example, an instance of an Instant Messaging Interface residing in GTalk's network may connect and exchange queries with the the Web Services Interface instances of Yahoo!, Google and Amazon. This makes several web services available to GTalk users. Moreover, an instance of a Web Services Interface is designed to accommodate more than

one instance of an Instant Messaging Interface. This eliminates the need to deploy multiple instances of the Web Services Interface for every Instant Messaging Interface instance that will use the web services that Web Services Interface stands for. Already usable, the two modules together serve as a lightweight bridge connecting Web Services and Instant Messaging. By logging in to an IM network where an instance of Instant Messaging Interface is active, and by chatting with that instance, the user may already be able to use the various web services.

3.1.1 Web Services Interface

The Web Services interface accomplishes three specific tasks. First, it acquires a Web Service Description (WSD) for each of the web services it will support through a web address in its input settings. The WSD comes in an XML format adhering to WADL specifications. This is parsed and stored as object instances and fields. The stored object instances and fields are then used to form a simplified WSD. The Instant Messenger requests for this simplified WSD from first module through a GET request with the parameter get having a value of simplified WSD. Second, it receives POST requests with the parameter service having the value of the name of the desired service, while other parameters are mapped to the actual parameters needed to execute the web service. Third, it relays the result from the web service, in XML format, to the requesting Instant Messaging Interface.

3.1.2 Instant Messaging Interface

The Instant Messaging Interface has three specific roles. First, it connects to one or more instances of the Web Services Interface instances based on settings provided. It then requests a simplified WSD from each of these Web Services Interface instances and parses them accordingly. Web services, or simply Services, belonging from a single Web Services Interface are classified into one Service Library. The Instant Messaging Interface stores this into what is called a Service Directory.

The Instant Messaging Interface maintains a session for each participating client. Through this session, a client may send commands requesting for a particular service. The Instant Messaging Interface parses this command, searches for the particular Service requested in the Service Directory, and forms a Query. This Query is processed by the Instant Messaging Interface's Query Processor. The Query Processor maintains a schedule for processing the Query instances. Once a Query is processed, a result is returned to the client's session, which is then passed on to the actual client in the form of an Instant Message. Moreover, the Instant Messaging Interface supports other commands as well, such as a request for libraries and services available.

3.2 Use Case

The user must be able to contact the bot of the Web-IM Bridge prior to any service requests. This means that the user must be able to log on to the IM network to which an instance of the IM interface is assigned. Upon a successful log-on, the user may then engage in a conversation with the virtual user. At this point, the client may request a list of services. The virtual user replies with a list of web services available categorized into libraries. In order to use a service, the user enters a command with a predefined syntax, indicating the service library and service to be used, along with the input parameters. The syntax table may be found in the appendix section. Figure 4 shows the Use Case Diagram for this.

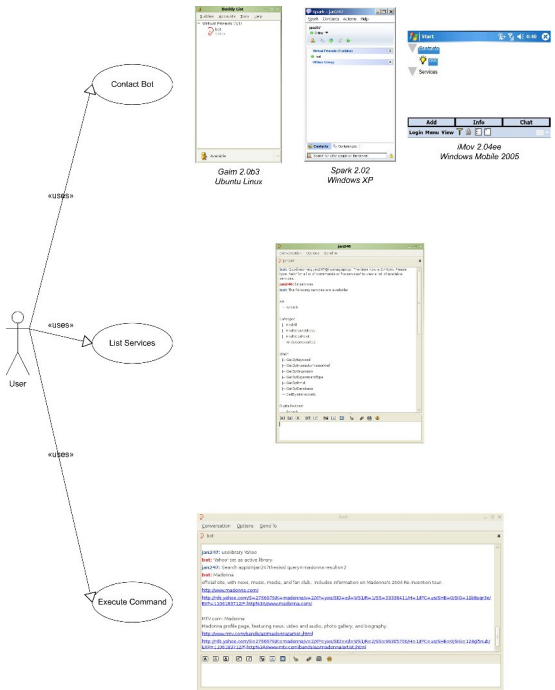

Figure 4 Use Case

RESULTS AND DISCUSSION

The final implementation of the Web-IM Bridge makes various web services available to Instant

Messaging users. Listed at Table 1 are the commands available to the user.

Command	Description
?	Displays Generic Help
? [command]	Specific Help Command
list libraries	Lists Available Libraries
list services	Lists Available Services for the current Library
list services [library]	Lists Available Services for the specified Library
list inputs [library]:[service]	Lists Parameters for a given web service. If library name is not specified, the current library is used.
[library]:[service] [parameter name 1]=[parameter value 1] [parameter name 2]=[parameter value 2] …	Perform selected service. If library is omitted, current library is used. If parameter name is omitted, the next parameter name in the input list is used.
Lib [library]	Sets the current library

Table 1 User Commands via IM Interface

Of the commands listed at Table 1, the first six commands are used to guide the user on which web services available, along with instructions on how to use them. The seventh command is the actual request command, while the eighth is a convenience command.

The test was conducted on a single server, running Apache HTTP Server and Apache Tomcat, two interfaces, and an IM network. The server runs on an Intel Core Duo 1.83Ghz processor with 1024Mb RAM under Ubuntu Linux 6.10. The server connects to the internet through an 802.11b connection. The Web Service Description documents were located on the Apache HTTP Server 2.0.55 running on the server. The Web Services Interface was tested on an Apache Tomcat 5.5.20 with Java 5 Update 9. The Instant Messaging network is managed by the server's Jive Software Wildfire 3.1.1. Wildfire was installed with a transport plug-in set to be able to connect to Yahoo!, AOL, IRC and MSN networks. The Instant Messaging Interface made use of the Jive Software Smack 2.1.1 library under Java 5 Update 9 as well.

The servers and the client were connected by a wired LAN to a single switch. The client ran under Windows XP Professional. The Instant Messaging application used was Jive Software Spark 2.0.7. Multiple web services were made available to the user. These are listed in Table 2.

Library	Service	Description
Yahoo	webSearch	Searches the web for a specified term using the Yahoo Search Engine.
Amazon	itemSearch	Searches the Amazon database for a particular item.
Inq7	headlines	An RSS feed displaying the latest news headlines from INQ7.
30Boxes	getAllInfo	Gets all calendar events from 30Boxes.
30Boxes	eventSearch	Searches calendar events from 30Boxes.
30Boxes	eventGet	Gets calendar events from 30Boxes.
30Boxes	eventAdd	Adds a new event to 30Boxes.
Esvbible	passageQuery	Searches the Bible for a particular chapter or passage.

Table 2 Initial Web Services Supported

CONCLUSION

With the proposed Web-IM Bridge, readily available web services can be accessed through different devices by Instant Messaging such as PCs, laptops, Pocket PCs, cellular phones to name a few. The proposed Specialized Client, compatible with the Web-IM Bridge, can potentially aid blind users to access web services as well, by using its dictation feature. Furthermore, Mobile Value Added Services providers can utilize the Web-IM Bridge to create and provide new services by reusing and combining resources from web services.

4.1 Further Work

The implementation in the project aims to demonstrate only a portion of the possibilities in using a Web-IM bridge. Improvements listed below aims to enhance the current system and add new features.

4.1.1 SOAP and WSDL support

The current system uses a protocol called REST for exchanging XML-based messages over a computer network. Another popular protocol which other web services such as Google use is SOAP. Supporting this would widen the array of supported web services. Moreover, the current system uses WADL as its standard for WSD. The current standard for WSD is the WSDL (Web Service Description Language) and is almost always readily available for most web services. WSDL is more complex than WADL and is usually used for SOAP services. However, support for the SOAP protocol and WSDL will make the system even much easier to adapt to new web services.

4.1.2 New Transports

One of the primary purposes of XMPP/Jabber is multiple Instant Messaging protocol service. By installing or creating new transports, the system that uses this protocol may extend its scope to other IM networks. An SMPP transport allows mobile phone users to exchange IM messages simply through SMS. This eliminates the need of having to install an IM client for the phone.

4.1.3 Manager Interface

The addition of a Manager Interface for the Web Services Interface and another for Instant Messaging interface will greatly aid in the administration of the system. The Manager Interfaces aims to give the administrator an portal, either through command-line, web, or both to change the settings of the interface involved either prior deployment or during runtime.

4.1.4 Voice over Internet Protocol Interface

The system comprises of two individual interfaces: the Web Service Interface and the Instant Messaging Interface. Adding another one, a VoIP interface will open web services to telephone users as well. The VoIP interface is to work side by side with the Instant Messaging interface through which the users accesses the system. Both the VoIP interface and Instant Messaging interface will communicate with one or more instances of the Web Service Interface. In both options, voice recognition would be necessary. Such system will be fully interactive without key or visual input.

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