Short messaging solutions, including XMPP based instant messaging and text based conferences, between health care providers and general practitioners

Sokol Dhana

One of the most challenging problems in the healthcare domain is providing interoperability among healthcare information systems. In this report I'm trying to introduce to the the use of short messaging solutions, including XMPP based instant messaging and text based conferences, between health care providers and general practitioners.
After hours of searching the internet I recognized that there are few Health Care solutions that have already implemented jabber (XMPP) instant messaging in their systems. Most of the papers I found describe the implementation of XMPP as a good solution for Health Care systems but they don't give a really example of implementing that.

Introduction in Jabber

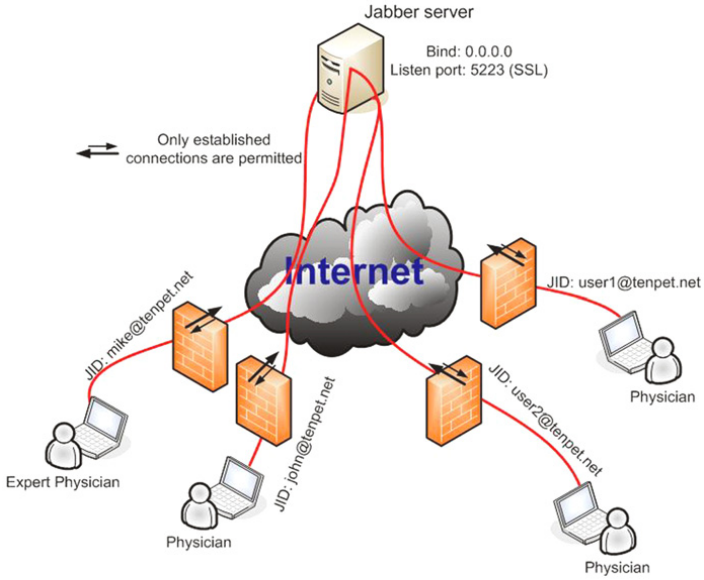
The Jabber protocol and server architecture are developed around the concept of exchanging XML document content between multiple locations.
Jabber is an XML message switch supporting both external clients and internal or external services. Jabber does primarily provide an instant messaging service. However due to simplicity and extensibility of the Jabber protocol, it is very simple to deliver new services built around Jabber. Examples include creation of voice recognition services, connectors to the cellular SMS network, archiving servers, and buddy agents that perform database queries using natural language commands. Recently, Jabber has been utilized on medical application. Jabber's Extensible Instant Messaging advantages come from the following architectural features, to name only few of them:

- *Presence:* Information on each user's availability is a key component of Jabber IM. Presence of the information concerning a contact's willingness to receive information and the state of their system.
- *Open Protocol:* Jabber XMPP (XML-based Messaging and Presence Protocol) is accessible. The completely open protocols enable developers to extend the APIs.
- *XML compliant:* Elaborating messages are delivered as XML fragments. The applicability and portability of the XML to other applications made Jabber an obvious choice for creating IM extensions.
- *Secure Socket Layer:* Open source Jabber server and client support SSL connection, thus Jabber users are able to exchange data without worrying about data security and compromising.

Advantages and Disadvantages Implementing Jabber

One study defines advantages and disadvantages of a medical network based on point-to-point communication and a medical network based on Jabber instant messaging protocol.
Firewalls have heavily been deployed on the Internet, preventing inbound traffic from reaching protected resources.

Most peer-to-peer services, whether in data centres or personal computers, will be in firewall protected environments. In typical hospital firewall configurations, only sessions initiated outbound can be established, as a result to protect the resources inside the firewall. Once an outbound request has been made, an inbound response is then allowed to the same socket and address. This displays a major problem for service accessibility, especially services depending on peer-to-peer connections. Jabber acts as a broker to create logical peer-to-peer connections to a known, fixed entity. This fixed entity is the Jabber server acts as a destination for outbound connections, with the Jabber network providing a central terminating point for establishing two-way connections.
Due to the issues identified above (firewalls, dynamic locations, and discovery requirements) users will not be able to link together in direct peer-to-peer connections. They will rather establish logical peer-to-peer connections, using some central intermediary to direct the traffic, which enables doctors to be reached anywhere on the network.



The central Jabber server provides message switching and connectivity, but the perceived relationship by the clients is a direct peer-to-peer connection.
Comparing VPN vs. Jabber communication methods, we can highlight numerous advantages offered by Jabber protocol. First of all, the presence status and directory services offered by Jabber core protocol are a plus. In addition, Jabber is able to be routed over HTTPS protocol by encapsulation of XML messages. One of its disadvantages is the base64 encoding used for binary data transmission. In other words, the data need to transfer over Jabber is 33% more than over a point-to-point binary socket transmission. In base64, triplets of 8-bit octets are encoded as groups of 4 characters, each representing 6 bits of the source 24 bits
In the table, we summarise the advantages and disadvantages of each configuration for data

Table 1

	VPN-based deployment	Jabber-based deployment
Presence and Availability	No	Yes
User mobility	Yes?	Yes
Security through firewalls	Yes	Yes
Binary data overheads	No	Yes
XML compliant and routing	No	Yes
Transportation over HTTPS	No	Yes
Configuration effort	Yes	No
Logical peer-to-peer connection	No	Yes
Point-to-point connection	Yes	Yes
Directory and discovery services	No	Yes

and image transmission of our telemedical application.

The case of PICNIC

PICNIC stands for “Professionals and Citizens Network for Integrated Care”. This EU project is initiated by a group of regional health care providers. They are developing the next generation regional health care networks to support their new ways of providing health and social care. These “new ways” includes an attempt to empower the patient/citizen to take responsibility for his own health and wellbeing. Extensive information provision through an integrated health care network supports these attempts. Furthermore, updated and reliable information is also needed for the health care professionals and administrators to enable an efficient and high quality health service.

In PICNIC, a new middleware Collaboration IT service has been identified and developed. This service allows the end users to perform real-time clinical collaboration, with exchange of text, structured data, voice and images across the limits of a single region. A clinical collaboration is associated with the shared clinical context to provide a record of relevant clinical information and facilitates synchronous as well as asynchronous collaboration. This new IT service builds on the increasing popularity of instance messaging and presence systems that facilitate smooth transition between synchronous and asynchronous interaction.
The main use cases for the Collaboration IT service are shown in the figure

One of the key functions in the Collaboration IT service is the use of Instant Messaging (IM), provided by the Jabber platform. In the collaboration component, jabber provides presence management and real-time routing of structured information.
Extending Jabber to maintain the collaboration context was rather straightforward due to the nature of its communication platform, which consists of multiple components tied together by a central router.

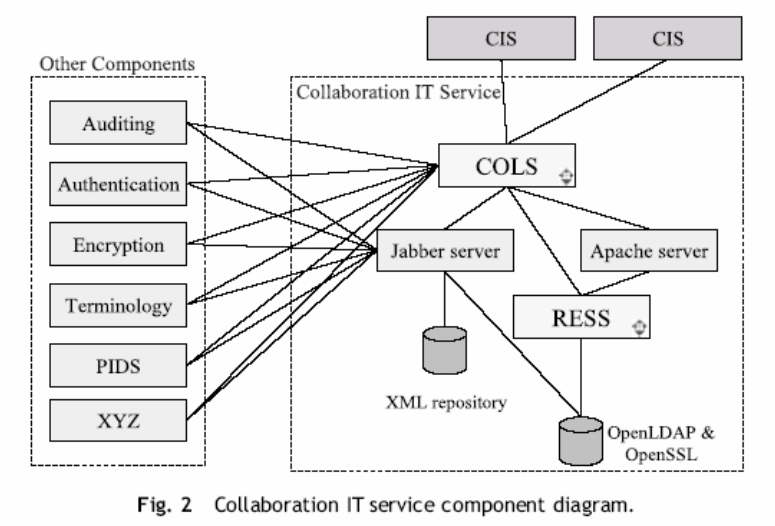


Fig. 2 Collaboration IT service component diagram.

Thus, the collaboration component adds a specialised module to those already supported by Jabber, so as to handle a collaboration specific XML namespace that manages the shared context. The resulting collaboration component bridges the gap between instant messaging systems and groupware applications, since it facilitates launching of groupware tools and maintains the state and shared information that pertains to the specific collaboration.
COLS components are required to establish a collaboration context that enables not only the active sharing of clinically significant information, also receiving feedback, feed through and awareness information from all participating actors.
COLS is designed:

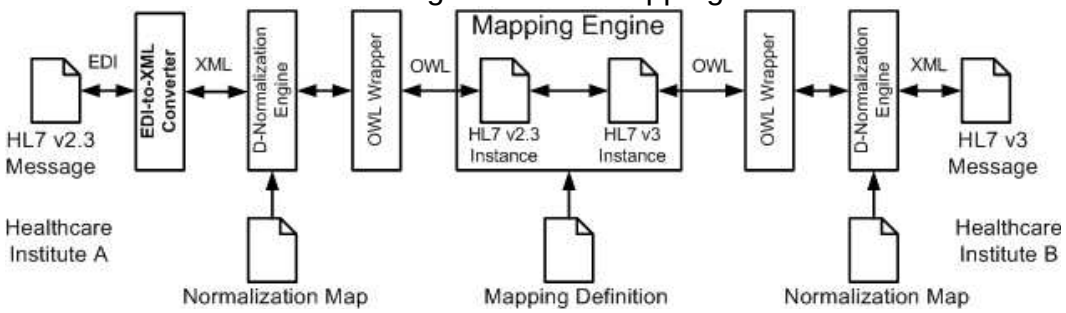
- To support multiple, extensible resource types(e.g. health care professionals, organizations, collaboration contexts, services, devices, pricelists, etc) with respect to their type and way of expression of internal information:
- To support the ability to locate resource information in a distributed environment
- To provide for filtering, such as by resource information in a distributed environment
- To support for site-specific and implementation-specific extensions and customization of profile elements.
- To support the ability to be accessible from any device e.g PCs, mobile devices, and platforms, like HTTP or SOAP.
- To support on-line presence of connected users
- To support exchange of various type of information free text, structured information by use of standards
- To support conferences facilities(chat, video, and sound)
- To support subscription and notification of events in collaboration

Other Instant messaging Implementations

Professors from the Middle East Technical University (METU) Ankara Turkiye published a paper called: Artemis Message Exchange Framework: Semantic Interoperability of Exchanged Messages in the Healthcare Domain. This paper tried to give a solution to the interoperability in the Healthcare Domain.
In this case is proposed the semantic mediation of exchanged messages. Most of the messages exchanged in the healthcare domain are in EDI (Electronic Data

Interchange) or XML format. The paper describes how to transform these messages into OWL (Web Ontology Language) ontology instances. The OWL message instances are then mediated through an ontology mapping tool developed from there, namely, OWLmt.
OWLmt uses OWL-QL engine which enables the mapping tool to reason over the source ontology instances while generating the target ontology instances according to the mapping patterns defined through a GUI.

Message Instance Mapping:



The XML message instances of healthcare institute A are transformed into OWL instances by using the Data Normalization engine. Note that if the message is in EDI (Electronic Data Interchange) format, it is first converted to XML. Then by using the Mapping definitions, OWL source (healthcare institute A) messages instances are transformed into the OWL target (healthcare institute B) message instances. Finally the OWL messages are converted to XML again through the Data Normalization" engine.

The case of the Green Valley virtual community

Green Valley utilizes an instant messaging platform and a web based messaging center for patients. Based on a network of medical contact centers and nurses, Green Valley offers medical messaging support for numerous clients such as health insurance companies, hospitals, physician group practices. Based on the nature of the message and the patient’s preference, Green Valley distributes the message securely to the intended recipient and ensures its appropriate and timely process. Web platforms and instant messaging have helped Green Valley create a distributed community for its employees and clients that support the operation of the virtual community for breast cancer patients. Green Valley processes patient calls in a similar way to the handling of email messages from the members of the virtual community.
The challenges for the sustainability of this virtual community for breast cancer patients are the creation of a virtual environment that will facilitate communication using appropriate interaction channels and addressing breast cancer patients needs., and the establishment of accessibility and authentication structures that enhance the sense of trust among the members of the virtual community.

References

[1] Sachpazidis, R. Rohl, G. Kontaxakis and G. Sakas "**TeleHealth networks: instant messaging and point-to-point communication over the Internet**" September 2005

[2] **Collaboration—a new IT-service in the next generation of regional health care networks.** International Journal of Medical Informatics, Volume 70, Issue 3, Page 205 M. Bruun-Rasmussen

[4] **Collaboration—a new IT-service in the next generation of regional health care networks.** International Journal of Medical Informatics, Volume 70, Issue 3, Page 205 M. Bruun-Rasmussen

[4] **Regional Health Economies And Ict Services: The PICNIC Experience** By Niilo Saranummi

[5] **Intelligent Paradigms for Healthcare Enterprises: Systems Thinking** By Barry G. (EDT) Silverman, Published 2005 Springer

[6] Veli Bicer, Gokce Laleci, Asuman Dogac, Yildiray Kabak: **Artemis message exchange framework: semantic interoperability of exchanged messages in the healthcare domain**. SIGMOD Record 34(3): 71-76 (2005)

[7] www.jabber.org