Instant Messaging and Presence Technologies for College Campuses

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Abstract

Instant messaging is an application that enables networked users to send and receive short messages. Presence provides information about users' reachability and willingness to accept/reject a brief chat session. Various proprietary IM and presence (IM&P) solutions are currently on the market, and standards are emerging. There are interoperability problems between the two dominant standards (SIMPLE and XMPP); as a result, this important application is finding difficulty in widespread deployment within college campuses and businesses. We describe a brief history of the development of IM&P technology, discuss the current standardization work being done within IETF, and present an overall architecture of emerging standards. We provide a comparison between the SIP/SIMPLE and Jabber/XMPP standards. We also present data and its analysis from a survey of campus organizations that sheds light into the main issues of deploying, managing and provisioning of IM&P services on college campus.

Instant messaging (IM) is an application that enables short message exchanges between online users. It enables these exchanges in real time independent of locale [1]. This feature of real-time differentiates IM from email systems. IM systems, with the ability of providing presence information, enables a user to know the availability of other users. By using presence information, an IM system enables us to search for a specific user, check the user's status, and send short messages. Popular IM applications include AOL™ Instant Messenger (AIM), ICQ™ ("I Seek You"), MSN™ or WindowsXP™ Messenger, and Yahoo™ Messenger [2].

Instant messaging, by making us able to know the availability of our peers, provides us with improved communication compared to other technologies. We can send an email message at any time and get a reply at the recipient's convenience. But there are times when we may need an instant response from one of a group of users. It takes a while just to find one of the users in that group, who might be available or not. In IM applications, if we have that group of users on our "buddy list," we can tell at a glance if any of them are logged onto the network, and whether they have been active recently.

We are also aware, in this case, whether or not the user is open to communicating at this time. If they are, we can send a quick IM and communicate further. Although IM started as a consumer-grade technology, it was quickly adopted by many businesses that saw its advantages in enabling quick communications and providing presence information [3]. This new phenomenon is now impacting schools and college campuses. However, this emerging phenomenon and its potential value as a campus technology is not well understood. How can higher education and campuses develop strategies and policies to deploy, manage, and support IM programs?

At this time, a large number of IM systems exist in various Internet communities, illustrated in Table 1. Every system, in Table 1, has unique features and separate user communities. After AOL rolled out their service, Yahoo and MSN introduced their own products that enabled users to communicate with AIM servers. However, AOL soon managed to shut them out, and the result for the past several years has been a plurality of competing products that cannot interoperate with each other [3]. Similarly, in standard organizations like the Internet Engineering Task Force (IETF) there have been alternative standards that present a hindrance to interoperability and homogeneity.

The goals of this article are threefold. First, we want to clearly explain how this technology works especially with respect to the emerging standards. There are several Internet-drafts (I-Ds) and requests for comments (RFCs), which is overwhelming for anyone not part of the standards activities. We discuss the state of standardization work done to date within IETF and compare the two alternative protocols. However, it is important to also note that as yet no definitive standard has emerged across the industry. Second, we identify motivations for IM and presence (IM&P[1]) usage, survey the higher education community regarding the use of IM&P, and present preliminary results of the data analysis. Third, we discuss *implications* for using IM&P technology and services based on our preliminary data interpretation. This could be very helpful to information technology (IT) managers as well as researchers who wish to implement IM&P on their campus or create new IM&P systems.

The rest of the article is structured as follows. We start

[1] *This acronym has been adopted from http://www.ietf.org/html.charters/simple-charter.html*

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IM solutions	Characteristics	Vendor examples
Public services	Available to anybody; often free; use a centralized third-party server to relay messages	AOL Instant Messenger™, MSN Messenger™, Yahoo! Messenger™
Private services	IM systems designed for enterprise and corporate use; secure IM, message logging, enterprise-class service, corporate control	AOL Enterprise AIM™, Yahoo Messenger Enterprise™, Microsoft Messenger Connect for Enterprise™, IBM Lotus Sametime™
Collaboration tools	These collaborative systems include presence technology	IBM Lotus Sametime™, Groove Network Inc's Groove Workspace™, Microsoft's Window Server 2003™
Carrier/network services	Convergence products that are now IM&P-enabled	Bantu Inc, Comverse Inc,. DynamicSoft Inc., FaceTime Communications, Invertix Corp., NotePage Inc., PresenceWorks Inc., Vayusphere Inc.
Open source tools	Based on open source XMPP standard	Jabber Inc., Jabber.Org

Table 1. *Instant messaging systems.*

with a brief history followed by a generic model and architecture of IM&P. We also explain the two emerging standards (SIMPLE and XMPP) and compare them. We then discuss motivations of implementing IM&P within campuses. We present results of our initial survey. We discuss implications for practitioners and researchers. Finally, we conclude this article.

Presence and Instant Messaging Services

A Brief History[2]

The early usage of IM&P started with the introduction of the UNIX operating system. Users were able to get the limited presence information and send instant messages using "FINGER" and "TALK" commands respectively in the UNIX environment. The presence information was limited to the last time a user accessed the account and the location. The instant messaging capabilities were limited to plain text messaging. In UNIX systems, users were able to manage the information they wished to share as response to a "FINGER" query. They also had the control over accepting or rejecting a talk request [4].

Internet relay chat (IRC) was introduced to the online community in 1988 in order to provide real time, conversational capability among users who were connected to a public network anywhere in the world [5]. IRC offered an environment where multiple users can join and leave a chat room at anytime. It also eliminated the basic restriction of being on the same network to chat while still offering the means to initiate a private communication between two users.

ICQ ("I Seek You") beta version was released in November 1996 by Mirabilis. ICQ utilized peer-to-peer communication clients and enabled users to chat simultaneously over the Internet without joining a chat room. By January 1997, ICQ had 27,000 users with a growth rate of 100 percent per week. Meanwhile, America Online's (AOL) Instant Messenger (AIM) increased its subscribers to ten million users. In mid 1998, America Online (AOL) acquired ICQ, which had achieved more than ten million users by that time. Microsoft MSN Messenger and Yahoo Messenger were both released within a year after that acquisition. With the introduction of AIM, ICQ, Yahoo! Messenger, and MSN Messenger IM became a field where large corporations were developing proprietary code, which were not interoperable. In 1998, Jabber project was initiated to build an IM client and server that could interact with the various proprietary systems by using a superset of all of the major consumer IM systems [6]. As with any other open source software (OSS), Jabber was born as a result of a programmer, Jeremy Miller, scratching a personal itch of a programmer.

To overcome the lack of interoperability and other concerns in im, such as security, authentication, scalability and integration with other business applications, IETF formed two working groups focusing on instant messaging and presence at different points in time. Following sections will examine the generic model as well as the standards prescribed by the SIP for IM&P Leveraging Extensions (SIMPLE) and Extensible Messaging and Presence Protocol (XMPP) working groups.

There is another emerging IM&P standard known as the wireless village initiative. Ericsson, Motorola, and Nokia have recognized the need for an industry standard for mobile IM&P services (IMPS). The wireless village service has four components: presence, IM, groups, and shared content. We do not discuss this initiative in detail here but instead point the reader to [7] for further information.

Generic Model for Presence and Instant Messaging

In an effort to develop a standard architecture for IM&P applications, the IETF IM&P Protocol (IMPP) Working Group proposed a generic model for providing a common vocabulary for future work [8]. Figure 1 illustrates the generic model and the proposed entities.

A *presence service* accepts, stores, and distributes *presence information*. It communicates through two distinct clients: *presentities* and *watchers*. Presentities provide presence information to be stored and distributed, whereas watchers receive presence information from the service. Watchers can be *fetchers* or *subscribers*. Fetchers pull the value of presence information for a specific *presentity* from the presence service. If a fetcher is fetching information on a regular basis, it is called a *poller*. Subscribers, on the other hand, subscribe to presentity information on the presence service. The presence service transmits information to the subscriber via *notifications* when a change occurs in the presence information of the subscribed presentity.

Presence information is composed of one or more *presence tuples*. Each presence tuple consists of one mandatory element, *Status*, and two optional elements, Communication Address and Other Presence Markup. The Status field is defined to have at least two states: open and closed. In the former state, IMs will be accepted, and in the latter state they will not. Other possible values for Status may be busy, away,

[2] *Peter Saint Andre of Jabber provided an interesting thread to this on the Internet 2 Working Group Integrated Infrastructure for Instant Messaging (I2IM) mailing list.*

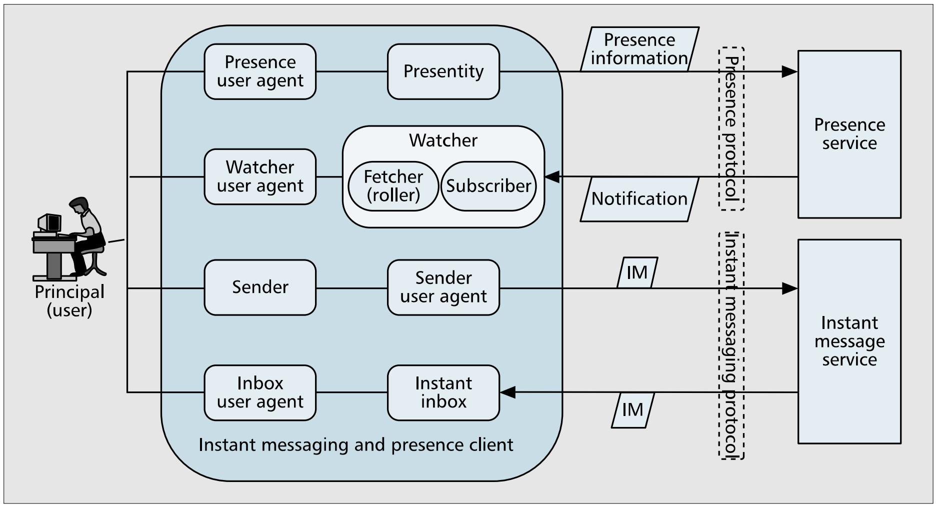


Figure 1. *A generic model for presence and instant messaging.*

do not disturb, and so on (these statuses are further extended in SIMPLE and XMPP). The Communication Address element is composed of Communication Means and Contact Address fields, enabling a user to utilize various types of communication means. The presence information adheres to a standard prescribed by IETF, "Presence Information Data Format (PIDF)" [9].

The IM service is responsible for accepting and delivering IMs to other entities (Fig. 1). It communicates through two distinct clients, *senders* and *instant inboxes*. The sender is responsible for sending IMs to the IM service, which is responsible for delivering them to the instant inbox with the corresponding instant inbox address.

Understanding SIMPLE and XMPP Open Standards

Within IETF, IMPP was the first working group formed to define protocols and data formats so that disparate applications can interoperate across the Internet. In addition, there were various standards that provided alternative solutions for IM&P — SIMPLE, Presence and Instant Messaging (PRIM), and Application Exchange (APEX). Working groups for these alternative standards follow different principles for implementing IM&P services. SIMPLE builds on the SIP infrastructures, APEX implements the service as store-and forward or email, and PRIM builds protocols over TCP. XMPP came to the IETF quite late (July 2002). The main reason for creating an XMPP WG was that it was open source and had a big community of developers. Due to commonality of platform (XML), APEX can be considered as a first incarnation of XMPP in some sense. Subsequent content in this section examines the standards prescribed by the SIMPLE and XMPP working groups.

Baseline SIP [10] provides mechanisms for session-oriented communication but not for presence and IMs. The SIMPLE working group (henceforth referred to as SIMPLE) has been chartered to provide extensions for SIP that can be used for implementing IM&P services. The standards prescribed by SIMPLE use SIP as a signaling protocol and describe the usage of SIP for subscription and notifications for presence. It supports various models for IM&P applications [3, 11] and

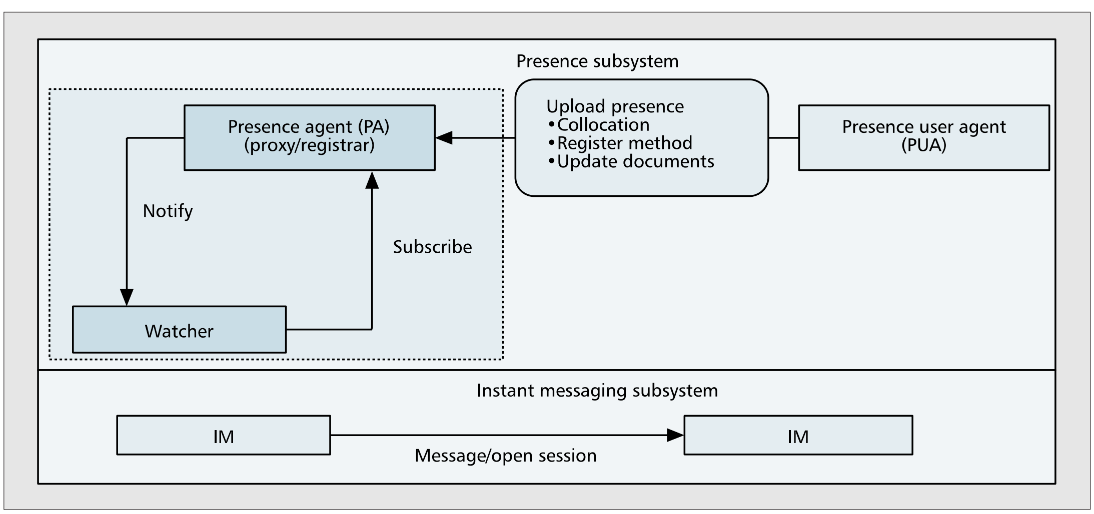


Figure 2. *SIMPLE components.*

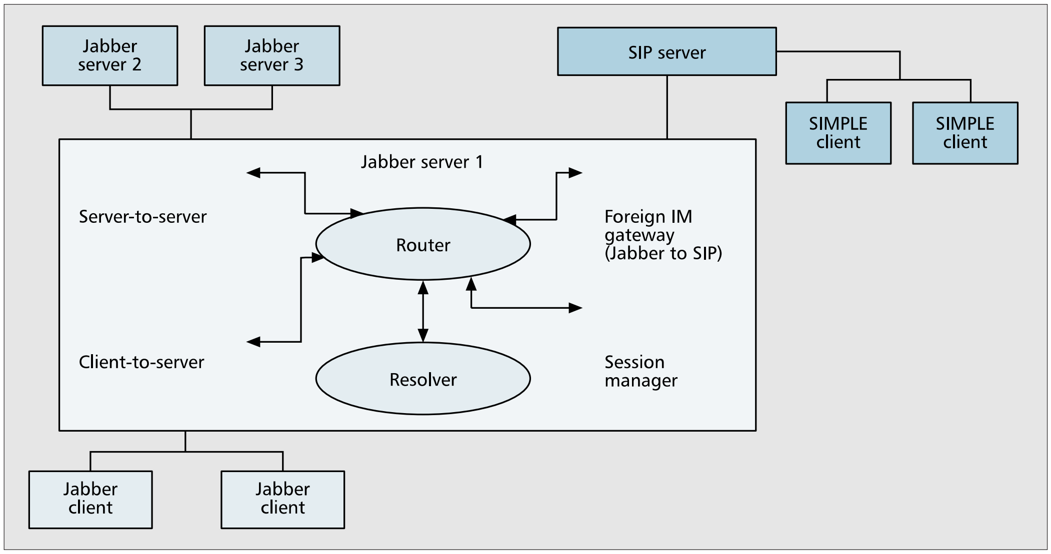


Figure 3. *Jabber architecture.*

adheres to standards such as Common Profile for Instant Messaging (CPIM) [12], Common Profile for Presence (CPP) [13], and PIDF [9]. By introducing SIP extensions, MESSAGE, SUBSCRIBE, and NOTIFY methods [11], SIP can deliver presence information and IMs. Interaction of different components for SIMPLE is illustrated in Fig. 2.

A presence user agent (PUA) provides presence information for a presentity. There can be multiple PUAs for a presentity, using many devices [14]. A presence agent (PA) responds to SUBSCRIBE requests received and generates notifications for presence state of a presentity. Watchers, as explained before, are parties interested in knowing presence information of other presentities. Each of these SIMPLE components registers with the SIMPLE provider to send and receive messages. According to Fig. 2, the PUA uploads the presence information to the PA. Presence information can be exchanged in three ways [14]: collocating PA with PUA, using the REGISTER method of SIP, or updating documents for presence. When users add contacts to their list, they subscribe to these contacts' presence information. In this case, a watcher sends a SUBSCRIBE request to a PA. Once the subscription has been made, any change to the contact's presence information is conveyed to the user who added the contact. This is done by transferring a NOTIFY message using SIP from PA to watcher [15]. A user can send a MESSAGE to a user in the contact list once he/she finds him/her online. In SIMPLE, the network packet with message Hello! sent from Alice@foobar.com to Bob@foobar.com is represented in Box 1.

The network packet was captured on the source machine — here, for example, on Alice's machine using Ethereal Network Protocol Analyzer available at http://www.ethereal.com. The packet is not an exact illustration of all the details. It just gives an overview of how the information is stored and transferred on the network.

However, there is no facility for offline messaging in SIP. Since SIP UAs exchange IMs directly without the help of a SIP server, SIMPLE could provide scalability for IM services. However, it is difficult to monitor the message exchanges and apply security policies to protect the transmission of confidential information.

Prior to IETF's initiation of solving issues such as interoperability, Jabber came into existence [16]. Jabber technology is an IM system focused on privacy, security, ease of use, access from anywhere using any device, and Web-based services. It uses XML, a universal format for structured documents and data on the Web. Jabber, through its architecture (Fig. 3), uses a distributed network utilizing many interconnected servers. Jabber technologies offer several key advantages such as open standards, decentralized architecture, a secured infrastructure, and extensibility of application, flexibility, and diverse services.

XMPP, a core protocol for Jabber IM&P technology, is an XML-based protocol for exchanging IM&P information in real time. Most XMPP-based IM&P applications are implemented via a client-server architecture that requires a client to establish a session on a server in order to engage in the expected IM&P activities [17]. The architecture, presented in Fig. 3, depicts three different components in a cohesive network of IM&P: Jabber servers, Jabber clients, and non-Jabber servers. Furthermore, the illustration details an internal working of a Jabber server labeled Jabber server 1. The router is the central component in a Jabber server. All the components communicate with the router to resolve the paths to be adopted for exchange of XML streams.

A Jabber infrastructure includes three entities: Jabber clients, Jabber servers, and a gateway that translates between Jabber and other protocols, like SIP, used on a non-Jabber messaging network. Clients connect to a server over TCP and use XMPP that contains XML *streams* to access services offered by a server. A Jabber server, apart from storing clients' information and their contact list, routes XML streams between authorized clients, servers, and other entities [17]. In Jabber architecture, features such as streams, stream authentication, and encryption provide building blocks for many types of near-real-time applications [17]. XML streams, between two entities (clients or servers), involve creating a persistent connection for exchanging XML data elements or XML *stanzas*. An XML stanza, as defined in [17], is an unambiguous unit of structured information that has a start (e.g., <conversation>) and an end (e.g., <conversation/>). There are three predefined XML stanzas in XMPP: message, used for exchanging instant messages between clients through one or more servers; presence, used for notifying clients about the status of a client; and iq (Info/Query), used for request-response interaction between entities. All of these stanzas

Frame — Time of packet arrival, total size in bytes (446 bytes).			
Ethernet (14 bytes) — MAC addresses of the Destination and Source	**Internet Protocol (20 bytes)** — Version of IP, type of protocol	**User Datagram Protocol (8 bytes)** — Source port, destination port, checksum	**Session Initiation Protocol (404 bytes)** — Request-Line: MESSAGE sip:10.1.1.2:5060; transport=udp SIP/2.0 Message Header: From: <sip: Alice@foobar.com> To: <sip: Bob@foobar.com> Content-Type: text/plain; charset=UTF-8 Message Body: Line-based text data: text/plain Hello! (If this message is prefixed with "emoticon" of smile it will be represented as - ":-) Hello" and the total number of bytes will increase by 3.)

■ Box 1.

Frame — Time of packet arrival, total size in bytes (311 bytes).			
Ethernet (14 bytes) — MAC addresses of the destination and source	**Internet Protocol (20 bytes)** — Version of IP, type of protocol	**Transmission Control Protocol (20 bytes)** — Source port, destination port, window size, checksum	**Jabber XML Messaging (257 bytes)** — <message type='chat' to= 'bob@foobar.com'><x xmlns='jabber:x:event'> <composing/></x><body> Hello!</body><html xmlns='http://jabber.org/protocol/xhtml-im'><body xmlns='http://www.w3.org/ 1999/xhtml'>Hello!</body> </html></message> (If this message is prefixed with "emoticon" of smile it will be represented as - ":-) Hello" and the total number of bytes will increase by 3.)

■ Box 2.

share a set of common attributes: to, from, id, type, and xml:lang. Accordingly, network packet containing message "Hello!" from Alice@foobar.com to Bob@foobar.com will be as shown in Box 2.

According to [17], Jabber provides chat, error, groupchat, headline, and normal as types of message for IM, and unavailable, subscribe, subscribed, unsubscribe, unsubscribed, probe, and error as various statuses for presence. For IM a client requests a session with a server, and a server responds by creating that session. After the session has been created, entities exchange messages and presence information using XML stanzas. As mentioned before, a server is responsible for delivering the messages to the recipient's server or the client. A contact list for an entity or a "buddy list," as it is popularly known, is called a *roster*. A contact in the roster item indicates that the user has subscribed to the contact's presence information. There are various types of subscription services described in [17, 18].

SIP/SIMPLE and Jabber/XMPP are very different technologies and are currently in different stages of development. Table 2 compares the characteristics of these two open standards. SIMPLE has more promising features than XMPP since SIMPLE can be connected to other services through SIP. However, there have been fewer deployable IM solutions than in Jabber/XMPP. This might change gradually as collaboration between various industry participants increase, as evident in recent initiatives (http://www.microsoft.com/presspass/press/2004/jul04/0715EnterpriseIMConnectivityPR.asp) between Microsoft™, Yahoo™ and AOL™. XMPP architecture is more stable now and widely deployed through Jabber. However, it has limited capability to connect various devices as compared to SIMPLE.

Motivations for Implementing Instant Messaging System on Campus

IM&P can provide a point of connection for each student on the campus. Most students do not have office space but usually carry a cell phone or laptop computer. Wireless Internet access on campuses is on the rise and students use their laptops to work on projects, assignments and exams. If all students, staff, and faculty are connected to the IM&P service, we can distribute various information including emergency news, campus events, and other important announcements. Students and faculty can engage in real-time discussions that can take learning out of a classroom setting. With voice over IP (VoIP) and IM&P services widely deployed, everybody on campus will be reachable through these new technologies.

IM&P service is more media-rich than traditional applications such as mail, phone, and email. By using IM&P, we can deliver voice, video, and data together to various endpoints. We can integrate the delivered messages with existing systems and infrastructure. For example, we can share presentation files during videoconferencing sessions. We can search for images from our database and transmit them through IM&P services. This feature will save both time and money for campuses.

IM&P also enables online social networking. It can be used to create communities for different purposes. Students can form study groups; faculty can utilize this technology for research collaboration with students and/or other faculty members. Current IM&P services provide functionality that can help users in managing different buddy lists for different projects, and storing, processing, and archiving shared communication as a knowledge repository for later use. IM&P services can improve decision making quality by reducing response time and providing instant decisions. It can be integrated with other middleware services such as calendaring and project management, which can help to improve the entire decision making process. Other interesting applications would include campus security, disaster and emergency control, career services, online community, social clubs, volunteering, distance learning, and cyber classrooms. However, this emerging phenomenon of IM within college campuses is not yet fully understood.

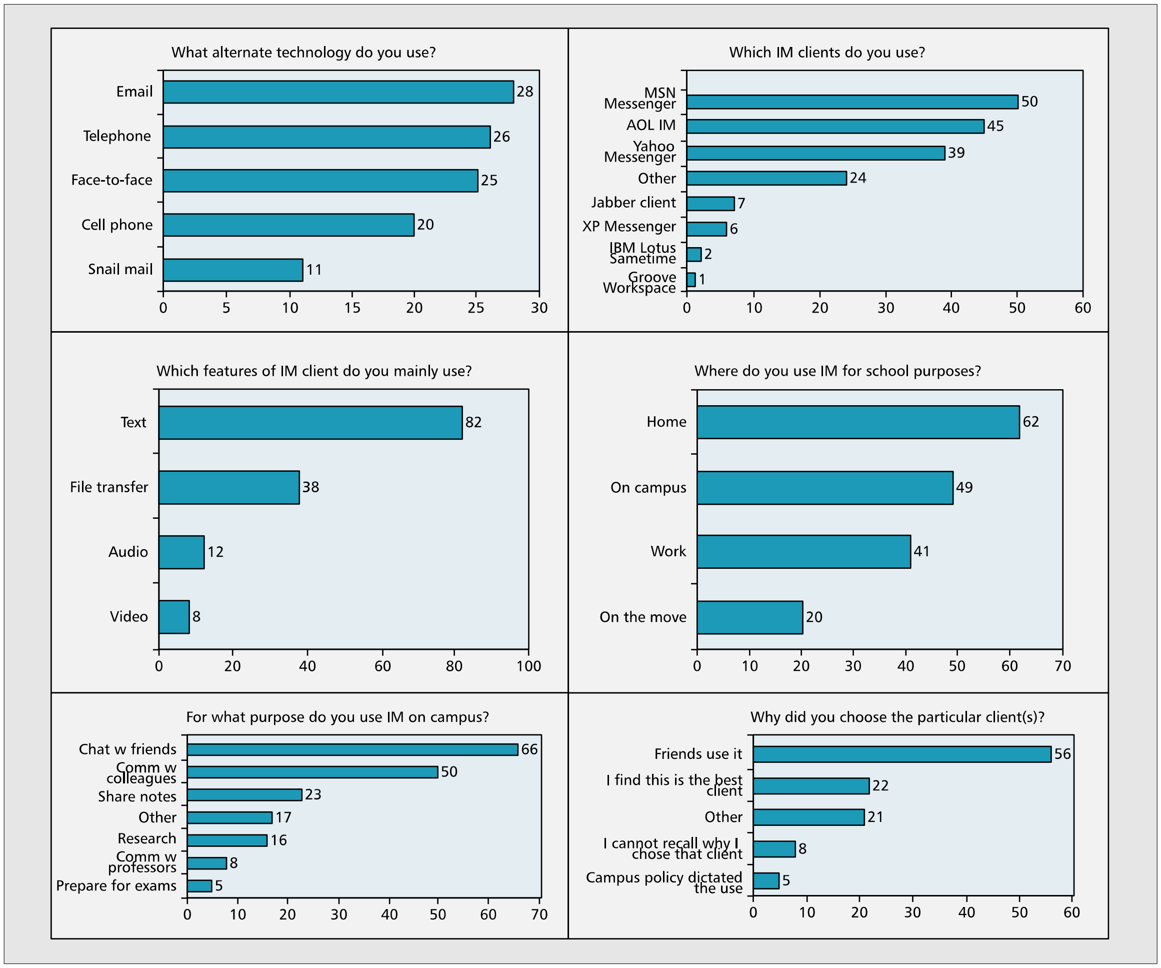
Criteria	SIP/SIMPLE	XMPP
Working Group	SIP/SIMPLE (IETF)	Jabber/XMPP (IETF)
Base technology	Signaling	Data transport (roots in open source community)
Instant messaging method	Peer-to-peer	Client/server
Message format	Text-based negotiable formats for IM, XML for presence attributes	XML
Technical development	Under development	In operation since 1999
Advantage	• Provide converged and unified messaging • Text-based protocol and easy to develop applications • Clients can be integrated with other applications • Smart clients and simple core • Connects seamlessly to SIP and VoIP telephony world • Support of Microsoft (built in function of Windows XP)	• Stable technology • Small message size compare to SIMPLE • Standardized documentation technology (XML) can be combined with other technologies • Transparent message exchange (able to appl security policies)
Disadvantage	• Not matured yet • Complex architecture with various servers • Difficult to apply security policies due to the lack of server capability to check the message contents	• Asynchronously transports of XML content • Need to develop various client devices for XMPP • Server may overload with the presence and instant messaging (implementation dependent)
Media support	Extensible to other media types such as telephony, video	Use XML streaming technology for data exchange, integration to applications and systems
NAT/firewall issues	As a signaling technology, SIP passes IP addresses which are a problem for NATs. Also Firewalls have to allow ports for media passing. These ports tend to be dynamic which is a problem in SIP. (MIDCOM and Interactive Connectivity Establishment [ICE] are emerging solutions.)	The application layer does not need to be analyzed in XMPP. Addressing in XMPP/Jabber is always logical and not physical. XMPP requires the opening of two ports in firewalls (5222 for client-server and 5269 for server-server).
Feature completeness: On/off presence Extended presence Single message Chat sessions Contact lists Group chat	 Yes In progress? Yes In progress Yes In progress	 Yes Yes Yes Yes Yes Yes
Industry lobby	Pledged support from Microsoft, IBM, Sun, 3GPP, Open Mobile Alliance	Investments and support from HP, Intel, Sony, Hitachi, Oracle

■ Table 2. *Comparisons of SIP/SIMPLE and Jabber/XMPP.*

Survey, Data, and Analysis

In an attempt to better understand the higher education community in relation to IM&P, we designed a Web-based survey to gather responses from users. This Web-based survey was conducted from July to September 2004. The sample was made up of students from an undergraduate college and a graduate university, and from two mailing lists with members from around the world who are active in the area of IM&P and VoIP. The questions were segregated into three different groups: overview information relating to the occupation of the respondent and the field in which they are involved, current usage of IM&P, and future use and role of IM&P.

The total number of valid responses received from the sample was 111. Of those, 51.4 percent were students, 5.4 percent were faculty, 23.4 percent were IT staff, and the rest were managers or administrative staff. As illustrated in Table 3, there was a nearly even distribution of full-time students and full-time working individuals. 45.9 percent of the respondents were from universities with more than 5000 students, 28.7 percent from universities with between 1000 and 2500 students. 16.7 percent from universities with less than 1000 students, and 9.3 percent from universities with 2500–5000 students. Most of the respondents (91.6 percent) were from universities with average class size of less than 50 students. Most of the students or faculty belonged to arts and humanities, business



■ Figure 4. *Overview information gathered from respondents.*

management, IT, politics and economics, or science and engineering as a major.

Out of 111 respondents, only 74.8 percent were currently using IM technologies. Among these current IM users, 63.1 percent had three or more years of experience in using IM, 27.4 percent between one and three years, and 9.5 percent less than one year. 76.8 percent of current IM users made use of one to three different IM clients, 15.9 percent used three to six different clients, and only 7.3 percent used more than six clients. Furthermore, referring to Table 3, 84.8 percent of the respondents did not receive an IM account upon registration with the college, indicating lack of IM infrastructure in the colleges. 31.3 percent of the respondents used IM for formal communication. This falls far short of IM usage for informal communication, which was 100 percent. 43.2 percent of the respondents were somehow involved in the IT decision making process.

As illustrated in Fig. 4, users who did not use IM, 28 of the total 111 respondents, used email as their most preferred alternate technology. However, it was not the dominant alternative. Other methods involved using telephones, face-to-face meetings, or cell phones. Among IM clients, MSN Messenger™ was the dominant technology for IM followed by AIM™ and then Yahoo Messenger™. Furthermore, there were certain other messaging technologies indicated by respondents.

Respondents chose text as the most used feature in messaging followed by file transfer. Most of the users utilized IM for exchanging IMs with friends or colleagues; few of them used it for communicating with professors or preparing for exams. Most of the respondents used IM at home, but using IM in an office or on campus did not seem unusual. Respondents used a particular IM application since it was being used by their peers or friends.

Referring to Table 4, among the responses from IT managers, 88.4 percent indicated that their university did not implement any policy for IM usage on campus. 92.7 percent indicated lack of budget for IM infrastructure. Also, more than half indicated that the existing systems should not be integrated with IM services.

Table 5 enumerates the responses received in relation to future use and role of IM&P. Interpretations from these responses follow. Using IM increases efficiency and productivity if it is ubiquitous (i.e., available on the cell phone and used extensively on campus, but not part of every class). However, all kinds of communication need not be through IM. It need not be the primary tool for collaboration activities like research or replace existing technologies such as email. Users like being informed about campus and college or university correspondence through other channels, which could be traditional or innovative. Although IM is appropriate for providing

IT support to users, it appeared unlikely for users to indulge in IM with someone they do not know. IM is exchanged between users who know and trust each other and are not in close proximity, leading to minimal human interaction. Furthermore, IM users are apprehensive about losing control of privacy in their conversation, even to IT administrators or infrastructures such as servers. In addition, IT decision makers, 47 of the 111 respondents, indicated that IM was not a critical application for their campus. If IM were implemented, standardization and interoperability would be an important consideration for them.

Questions	Yes	No
Do you also have a full-time job besides going to school?	44%	55.6%
Was an IM account provided to you during registration?	15.2%	84.8%
Do you use IM for formal communication?	31.3%	68.8%
Do you use IM for informal communication?	100%	0%
Are you in the IT or MIS group or do you have a role in IT decision making?	43.2%	56.8%

Table 3. *Questions for all participants.*

Questions	Yes	No	Undecided
Does your organization have a policy in place regarding IM use on campus?	11.6%	88.4%	N/A
Do you have a budget plan for investing in IM in the next 12 months?	7.7%	92.7%	N/A
Should all your other systems (ERP, student services, alumni systems, etc.) be IM enabled?	7.2%	56.8%	15.3%

Table 4. *Questions for all participants.*

Implications for IT Managers and Researchers

The responses analyzed in the previous section offer a guideline based on which the IT decision makers in college campuses may select the IM&P services to be implemented. Below are the summarized findings from the analyses:

• A large number of respondents are experienced with IM technology. However, they prefer to use IM for informal communication with friends or even in the workplace. They reported that very little formal communication is done through IM. Familiarity with IM at home or work should make it easy to deploy it on campuses. Campus administrators can implement IM systems among users that tend to be peers at the same level of responsibility than in a hierarchical authority.

• A sizeable number of respondents indicated disagreement with storing IM messages on the server. Monitoring of IM messages and who owns these messages will be the subject of heated debates across campuses. IM systems that assure users of the message being delivered to the intended end without any intermediaries will tend to be more successful. At the same time solutions that store information, like buddy lists, locally and scale well will tend to serve users better. Corporations have already proclaimed that employee email belongs to the company and is subject to monitoring. However, academic freedom on college campuses will be a strong driver against storing IM.

• Respondents seem to be aware of the benefits of IM compared to other technologies. Respondents have clearly indicated the need for IM for specific applications such as IT support and where face-to-face communication is not necessary. Administrators need to explore for what type of activities and applications is IM suitable for and gather the resource or investment to make that a reality.

• Even though IM applications are well understood among current IM users, it seems as though IT decision makers in college campuses are not yet including IM&P in their future infrastructure plans. Lack of awareness, budget cuts, and perhaps lack of a clear value proposition may be the reasons. Researchers in the field can explore the reasons further or evaluate solutions that suit certain needs. A brief attempt to evaluate various solutions has been made in Table 6.

• Text is the most widely used feature of IM applications. This is important for vendors who are pushing integrated voice, video, and data services in IM systems. Solution providers can focus on integrating the medium of text with other media. Further research in this area might include devising "intelligent agents" that evaluate the contents of a message and query persistent storage such as a database for results.

• IM applications are ubiquitous in usage. More users would like to use IM&P if an infrastructure existed and services were offered. Campus administrators will not have to train students, faculty, or management in using IM applications. Researchers can focus on behavioral aspects of using IM applications so that further efficiencies can be gained.

• IT managers do not seem enthusiastic about integrating IM in all applications, and most universities do not have any specific policies or budget for IM infrastructure. This is in contrast to the desire to have it. Respondents are unsure about how IM can increase their productivity. However, they indicated that IM did contribute toward completion of tasks quickly. Public policy researchers can take our study as a starting point in shaping up policies for adopting IM&P in communities as well as higher education.

Table 6 shows three possible IM&P solution choices and a comparison of their capabilities as measured by a set of criteria. The comparisons, enumerated in the table, are relative to solutions that can be implemented. A college campus could simply ask students and faculty to use freely available public IM clients such as those from AOL, MSN, and Yahoo. A second choice could be purchasing an enterprise IM system from a commercial vendor (e.g., IBM Sametime). The final choice could be to customize an open source IM platform such as jabber.org. Maintenance and deployment costs in *free service/public IM clients*, which are tested solutions, are low compared to other solutions, but there is less flexibility available as there is no administrative control over these implementations, although they scale well and require minimal prior knowledge for working with them. *Licensed enterprise IM systems* offer greater administrative control, but the cost and knowledge required to work with them are high. If a campus decides to tailor an open source IM system for their requirements, deployment cost might not be higher but maintenance cost can rise due to increased expectations among users or short-

Question	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Average/Standard Deviation
The use of IM should be part of every class.	13.8%	25.7%	31.2%	21.1%	8.3%	2.8/1.16
IM should be extensively used on campus.	2.7%	13.6%	38.2%	30.0%	15.5%	3.4/1
IM would make things efficient for me.	5.4%	9.9%	25.2%	38.7%	20.7%	3.6/1.09
Every faculty should use IM.	8.2%	14.5%	38.2%	28.2%	10.9%	3.2/1.08
IM should replace email.	52.3%	34.2%	10.8%	1.8%	0.9%	**1.6/0.82**
IM should be on my cell phone.	4.5%	16.2%	36.0%	35.1%	8.1%	3.3/0.98
Every campus administrator should use IM.	9.1%	21.8%	29.1%	29.1%	10.9%	3.1/1.14
All university/college correspondence should be in IM.	49.5%	27.9%	14.4%	4.5%	3.6%	**1.8/1.06**
IT support should be done via IM.	8.1%	14.4%	36.0%	27.9%	13.5%	3.2/1.11
Campus announcements should be via IM.	32.4%	30.6%	27.9%	7.2%	1.8%	2.2/1.02
IM should be the primary tool for research collaboration.	26.4%	29.1%	33.6%	10.0%	0.9%	2.3/1.00
All IM transactions should be monitored.	51.8%	26.4%	16.4%	5.5%	0	1.8/0.92
All IM transactions should be logged in a server.	30.9%	22.7%	33.6%	11.8%	.9%	2.3/1.06
IM would make me more productive.	6.3%	15.3%	39.6%	26.1%	12.6%	3.2/1.06
IM distracts me from work.	8.1%	22.5%	26.1%	36.9%	6.3%	3.1/1.08
Doing more IM with people leads to less face-to-face contact with them.	5.4%	27.0%	27.0%	34.2%	6.3%	3.1/1.04
I tend to do IM more with people in near proximity.	6.4%	37.6%	38.5%	16.5%	0.9%	2.1/0.86
I tend to do IM more with people who I know.	0	2.8%	15.9%	46.7%	34.6%	**4.1/0.78**
I tend to do IM more with people who I trust.	1.9%	7.5%	25.2%	43.9%	21.5%	**3.8/0.94**
IM takes up a lot of my productive time.	11.3%	34.0%	34.9%	16.0%	3.8%	2.7/1.00
Using IM enables me to accomplish tasks more quickly.	3.8%	10.4%	37.7%	40.6%	7.5%	3.4/0.9

■ Table 5. *Expectations of IM usage (bold font represents extreme distributions).*

comings of the open source solution. However, administrative control is very high; hence, scalability might be high too. There are certain other criteria that cannot be scaled in a general sense, such as interoperability and security. To elaborate, some open source solutions are designed to interoperate between various IM clients, while there are enterprise IM systems that are integrated into workflow systems or application systems and thus interoperate with native applications other than IM systems. Similarly, Jabber offers stream authentication to provide better security, while other customized solutions might not offer any capability for security.

Criteria	Free service/ public IM clients	Licensed enterprise IM systems	Customized open source software
Deployment cost	Low	High	Medium
Maintenance cost	Low	Medium	Medium to high
IT administrative control	Low	High	High
Deployment maturity	High	High	Low to medium
Prior knowledge required	Low	Medium	Medium to high
Scalability	High	High	High

■ Table 6. *Comparison of IM&P solutions.*

Conclusions

As colleges prepare to build a presence-aware infrastructure, several issues have to be carefully planned and thought out. We can classify them into four major categories: standards, vendor support, security/policy, and extensibility/integration with other applications. As we have observed, there are alternative IM&P standards, and many proprietary systems are in use today. Colleges have to consider the appropriate standards and systems for IM&P in terms of the total cost of ownership. The cost of ownership includes the cost of acquisition, installation and configuration, training, administration, migration and upgrades, storage and archival, security, and interoperability [19]. The capability of each standard, especially extensions and interoperability with VoIP and enterprise applications along with vendor support, will be critical. Table 6 shows some guidelines and trade-offs.

As IM&P services become widely deployed on campuses, security concerns have to be addressed. Research issues include identity management, authentication, and authorization to access protected resources and seamless IM usage across federated campus domains.

Peer-to-peer applications such as KaZaa and Napster for file and music sharing have already created enough buzz inside college campuses. IM&P applications are growing rapidly inside enterprises, and campuses are considering them. As these emerging applications become widespread, new issues such as copyright infringement, sexual harassment, and loss of confidential information will arise. However, the value and benefit of this technology far exceeds its current limitations; hence, we envision a presence-aware campus in the near future. Deployments of these systems are still in their infancy. We have provided a brief comparison between the two dominant architectures based on SIP/SIMPLE and Jabber/XMPP. The preliminary data analysis and guideline for managers/practitioners is a first step toward understanding this new IM&P phenomenon and its impact on college campuses.

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