CityGIM: A Mobile Multimedia IM System for Collaboration of Government Organizations

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Abstract—Mobile Instant Messaging (MIM) service has been the focus of smartphone industry and market. It is widely used in social networking and social media services. For enhancing communication efficiency and collaboration performance of government organizations, MIM software was implemented on cloud computing server cluster and popular smartphone platforms. It provides both Person-to-Person (P2P) and Application-to-Person (A2P) services with support of versatile multimedia message contents. Departments of local government benefit from MIM system deployment for its media richness and system integrability.

I. INTRODUCTION

Instant Messaging (IM) originates as a form of networking technology between computers to offer instantaneous text message transmission between two conversation parties. It is flourishing since Internet started to popularized, e.g., ICQ and MSN are two famous examples. After mobile Internet, smartphone and tablet has blossomed in global consumer electronics market, Mobile Instant Messaging (MIM) is developed on mobile devices to further strengthen the convenience, mobility and positioning capabilities of instant messaging service. With the growing of social networking sites (SNS) like Facebook, Youtube and Twitter, IM and MIM bring the society into a new communication paradigm.

According to forecast from Juniper Research, MIM users will exceed 1.3 billion by 2016, triple in five years [12]. And in mobile messaging market, Application-to-Person (A2P) service will overtake Person-to-Person (P2P) during that year, optimistic about the industry applications of mobile messaging services.

In response to the trend of mobile networking and services being prevalent in the society, Department of Information Technology, Taipei City Government, has designed and deployed a mobile IM system, named CityGIM, for enhancing collaboration performance of the government to properly promote the service level to citizens. CityGIM provides both P2P and A2P messaging services on mobile devices, Android and iOS, and Windows-based personal computer based on data communication infrastructure, supporting various text- and multimedia-type messages including photo, video, map with localization information, and calendar event, to name a few among others.

The rest of the paper is organized as follows: Section II gives an overview of previous MIM work, focusing on consumers’ use. Section III outlines those functionalities adapted from IM to be applied in enterprise environment. Section IV introduces the design and implementation of CityGIM. Section V evaluates CityGIM for application in Taipei City Government. The conclusion is given in the last section.

II. MOBILE INSTANT MESSAGING

In this section, existing mobile IM systems in the consumer market are categorized and characterized, for providing background explanation of CityGIM design as utility used at workplace. In the subsection A, some IM services offered by mobile system manufacturers are introduced; in subsection B, two hot mobile IM app are selected among others to demonstrate its use by consumers; in the last subsection, IM functionality offered by two selected famous SNS sites are briefed. We adapted some ideas of such mobile IM systems for consumer use to be embedded in CityGIM for appropriately promoting collaboration performance.

A. Platform-based

Most major mobile operating system providers offer messaging app as substitute for SMS and MMS, to compete with telecom providers. RIM is the earlier one launching BlackBerry Messenger (BBM) on BlackBerry mobile phones. It supports text, voice, video and photo message content, and be well-known for its encryption capability for the use in business and political circles. BBM was blamed as being used by teenagers during London Riots in 2011 and then people notice its position in civil social networking domain too.

Apple launched in 2011 similar service of iMessenger, built into iOS 5 exclusively supporting i-series devices including iPhone, iPod Touch and iPad. With the prevalence of the devices in the market, Apple strategically shoots for the share of social networking segment. In this way Apple can obtain huge amount of user account data for future social media applications, but all be supported on Apple’s platform only.

B. App-based

Both WhatsApp and Line, attractive cross-platform mobile IM software, are developed by ones with technology
background in Web portal and search engine. They offer versatile message types including text, voice, positioning, etc. Line supports VoIP streaming but WhatsApp supports voice recording file transmission. WhatsApp supports more mobile operating system platforms since it has longer development history. Cross-platform is the main weapon of App-based IM to compete with platform-based. In our design of CityGIM, we support most popular mobile operating systems in Taiwan for higher adoption by different departments. Schrittwieser et al. reported that some App-based IM have account authentication flaws, since they do not own account database like social network sites do [5]. We improved such vulnerabilities by integrating CityGIM with our legacy employee database.

C. SNS-based

With the vast member-base and diversified social media services, social network sites hold a good starting point to develop instant messaging services, benefiting back their original business. Facebook is the biggest social network service site, and the subscribers of Google+ grow very fast since 2011 with Google’s popular cloud services and the rapid expansion of Android deployment on smartphone market. Besides more or less similar messaging functions as those of App-based, these SNS providers have their own unique integration strategy to promote user experience, e.g., Google+ make use of Circles to chat with for IM, and Facebook synchronize the messages on both their webpage and IM App. We adapt these ideas to integrate the government organization hierarchies into CityGIM; IT personnel can edit the contact groups according to task characteristics of their own department, and CityGIM automatically deploys the list to smartphones of the users.

III. ENTERPRISE INSTANT MESSAGING

There are off-the-shelf Enterprise IM (EIM) systems for workplace usage, but mostly without enough cross-platform capability for mobile devices to our need. In this section, the main featuring differentiation between consumer IM and enterprise IM is reviewed to appreciate some important requirements of CityGIM systems.

A. Security fulfillment

Security considerations for enterprise environment include account authentication, messaging privacy, and non-repudiation of the conversation. For sign-on process, generally corporate LDAP or Active Directory is integrated with EIM. Some security system providers offer solutions to strengthen existent EIM security. For example, Symantec Enterprise Instant Messenger cloud offers encryption, logging and archiving functionality for using Yahoo!, Windows Live Messenger, and AOL on PC, for satisfying the security and privacy requirements of business IM systems. But as to the use of government departments, the whole process is needed to be setup by our own and no data are allowed to be stored out of the government control, and the risk of the governmental secret leakage is not accepted neither.

B. Collaboration support

Collaboration is the act of working together with other people or organizations to create or achieve something [7]. It is intensively studied in Supply Chain Management (SCM) and Enterprise Resource Planning (ERP) research. Stank et al. propose the model between external collaboration, internal collaboration and logistical service performance, for empirically studying their relationships [8]. IBM Sametime software - enterprise instant messaging, provides versatile collaboration features (Fig. 1) [9] like offline messages and file transfer.

Office Live Communication Server is Microsoft’s total solution for real-time communication supporting voice, video, instant messaging, application sharing, and collaboration [10]. It can integrate Office, SharePoint and Exchange to become an enterprise collaboration platform, mainly on Microsoft infrastructure. CityGIM provides interfacing capabilities and performs customization according to requirements of government departments for collaborating with various legacy application information systems.

C. Knowledge asset protection

Knowledge asset is the intangible know-how owned by organizations which makes impact on the production or service activities. It enables sustained innovation and helps to create unique organizational identity enhancing customer loyalty, which is inimitable by the competitors. Knowledge asset can be categorized into explicit knowledge and tacit knowledge. Explicit knowledge is those written in formal forms such as documents, figures or formulas. Tacit knowledge is the internalized intelligence directing collective actions as default. Such tacit knowledge is often regarded as strategic competence of organizations, needing special protection to maintain the advantage on hand. The dialogues between group members
often contain the implicit and tacit knowledge valuable to the organization decision and operation, if mined meticulously. So CityGIM retains the archives of conversations of the users like most EIM do, for further data mining and latent legislation purpose.

IV. ADAPTATION AND IMPLEMENTATION FOR GOVERNMENT ORGANIZATIONS

The CityGIM App have been developed and deployed in Taipei City Government for two major lines of smartphone platforms, iOS (Apple Computer Inc.) and Android (Google Inc.). Major specifications and characteristics are following.

A. Architecture design

The server software of CityGIM is developed based on Windows Azure cloud platform, which means high reliability, high scalability and high maintainability brought by load balance and failover. For better message transmission performance, memory cache synchronization technique based on Windows Server AppFabric are adopted, speeding up the transactions by storing and processing data in main memory in real time and then written into database later by daemon process when system resources are available. Data copies among hosts of the cluster are synchronized so that the clustering functionality is transparent to clients. Better interactive experiences are gained by such architecture, which is originally used for flexible large-scale Web applications as Cloud Computing technique.

B. Mobile Communication Service

iOS and Android are two major mobile operating systems on smartphone and tablet market. Almost half of U.S. mobile subscribers now own smartphones, with penetration rate still rising in the way. Of these smartphone users, 48% own Android devices, and 32% have an iOS one; market share of both is still expanding [11].

The same situation applies to Taiwan also. Android and iOS platforms dominate the smartphone market, and Windows Phone to be observed. App of CityGIM has been implemented on these two popular mobile operating system platforms as shown in Fig. 2 and 3 for boosting the adoption.

C. Security Design

CityGIM is designed for processing of government affairs, so information security is a vital part for successful adoption of the system to the organizations. For proper authentication of the users to receive and access official messages, CityGIM asks for personal identification and performs the confirmation according to information stored in the legacy city government employee database before the registration of App in the system. CityGIM memorize the mapping of the specific user to the registered App instance, and App authentication is designed based on shared secret key protocol with SSL technique for secured key distribution. The adopted SSL CA (TWCA [13]) is commonly used by financial institutions for mobile banking and mobile stock trading systems in Taiwan, so that all popular mobile operating systems including Android and iOS are supported. CityGIM servers are authenticated by TWCA, so that users are protected from phishing attack, information eavesdropping, and the like.

Contact list and grouping are other important functions of CityGIM to be used at workplace of the City Government. Dedicated IT personnel is supported with consolidated information of CityGIM account database and the legacy city government employee database, for editing contact groups of their own department to satisfy time-varying task requirements. The edited grouping will be deployed to CityGIM App of relevant users so that manual efforts of contact maintenance by general users are eliminated, enhancing the willingness to use...
the system and promoting the communication efficiency during the work.

D. Messaging service for information systems

A2P is the major design objective of CityGIM. With the reduction of headcount and the increase of service projects, mobile office utility is imminently required. For example 1999 service of Taipei City, like 911 service of New York City, has ruled the time limit for processing service requests from citizens. When an order is placed to the 1999 helpdesk system, CityGIM automatically notifies the employee on his/her mobile device with the dispatched task for earlier startup of the work to serve citizens. Electronic official documentation system is another example with the processing-time-limit rules. To help avoid delay of workflow tasks, CityGIM issues notification messages to smartphones of the users, who may spend more time for fieldwork and less time at the office, at every important stage of the workflow.

For building the security infrastructure of mobile information systems, we are doing code refactoring of CityGIM to abstract the authentication functions for Apps as Service Access Points. Mobile application information systems can use these functions for secured information access, and the onetime token mechanism is employed for application systems to authenticate if the transactions are requested from the CityGIM App, and obtain the needed workflow data as well as user profile through CityGIM.

V. EVALUATION AND DISCUSSION

In this section, applications of CityGIM are discussed with various departments of Taipei City Government for enhancing collaboration performance of their organization tasks.

Taipei City Police Department mainly uses police radio system with dedicated voice channel for two-way communication and dialogue when the policemen and policewomen are on duty in the city region. Only voice conversation can be utilized by traditional radio system. With existing mobile and wireless network infrastructure, consumer smartphone and tablet of low cost and CityGIM App software, they can share text messages, video, photo and mobile locations on rendered maps for their tasks and improve the decision making instantaneousness. With the security design of CityGIM, all messaging contents are authenticated and encrypted during transmission on air; it conforms to the security policies of police department, like those of the radio channel dedication. The multimedia processing capabilities of CityGIM enhance the ability of police department to deal with various emergency situations.

The Labor Standards Inspection Office of Taipei City Government investigates the occupational accidents immediately when happened. In the past, the investigators perform the survey work in the field and process the paper work back to the office. It takes a lot of manual effort for investigation because the relevant information is not always available in real time. With CityGIM, they acquire instantaneous support from the colleagues at the office when working in the accident site, and the following task-dispatching is realized faster by the system. The total efficacy of occupational accident investigation is improved and the labor welfare is better protected. That is the organizational vision of Labor Standards Inspection Office.

VI. CONCLUSION AND FUTURE WORK

A mobile multimedia instant messaging system was implemented as a mobile smartphone application. It helps enhance communication efficiency and collaboration performance securely for government tasks. The information accessibility in the fields during work is improved. And Taipei City Government lines with the society pacing by the deployment of CityGIM.

In the future, we will continue to work with various agencies for the reengineering of the operation and the decision making processes to serve citizens of the city. CityGIM will integrate with more legacy information systems during the transition to Mobile Government epoch and the impact of mobile instant messaging system deployment to organizational agility will be studied by continuous case and field studies.

REFERENCES