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MMSEmail: Delivering Emails to Mobile phone through MMS

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***Abstract*—With the development of mobile communication, there arises the requirement of ubiquitous access to Internet Email service from small screen terminals such as mobile phones and PDAs. This paper proposed a framework, MMSEmail, for delivering Emails to mobile phones through Multimedia Messaging Service (MMS). MMSEmail integrates the functions of Email proxy, content adaptation broker and MMS sender. It not only implements immediate Email delivery by utilizing PUSH mechanism of MMS, but also supports user profile-based content adaptation, spam email filtering and text presentation of Email attachments with special file types as .doc, .rtf and .pdf. Being designed based on the de-facto standards, the framework has great extensibility.**

Keywords-MMS;E-mail; mobile communication; PUSH; POP3

I. INTRODUCTION

By December 2008, the data released by MIIT show that the amount of valid mobile phone numbers had reached 641.2 million, among which 253.9 million used mobile packet data services. According to CNNIC, the amount of Chinese netizens surfing the Internet with mobile phones has reached 73.05 million by July 2008, about 28.9% percent of all netizens. The above two statistics show that mobile phone has become one of the most popular means for accessing Internet services, especially for browsing Web pages and processing Emails. Although capabilities of mobile terminals are on the increase, they are still greatly inferior to desktop computers and have various models that quite distinct from computing capability, resolution and color. Email clients for small-screen terminal have been developed and then deployed in some high-end mobile terminals. However, the deficiency in presenting email contents comparing to normal PC, the incapability of processing Email attachments with special file types as .doc, .rtf and .pdf, and the flooding spam emails together cool the enthusiasm of mobile phone users to process email with the limited bandwidth of mobile communication.

Nowadays, Multimedia Messaging Service (MMS) has captured the attention of wireless developers everywhere, especially in China. It allows delivering multimedia content such as text, image, audio, video and their combinations from phone to phone or from Internet applications to phone and increases satisfaction of mobile subscriber user experience.

This paper exploits characteristics of MMS, presented a framework, MMSEmail, for MMS-enabled email presentation. MMSEmail not only implements immediate email delivering by utilizing PUSH mechanism of MMS, but also supports user profile-based content adaptation and text presentation of Email attachments with special file types as .doc, .rtf and .pdf, thus provides an alternative means to present emails on mobile terminals.

The rest of this paper is structured as follows: Section 2 provides an overview of MMS. Section 3 presents the architecture and characteristics of our MMSEmail. Section 4 goes into more depth on content adaptation and section 5 concludes with a summary.

II. MULTIMEDIA MESSAGING SERVICE

A. Architecture of MM

MMS is developed in accordance with 3GPP standards (3GPP TS 23.140 [1]) and WAP Forum standards (WAP-205, 206 and 209 [2-4]). A reference of MMS architecture and a conclusion of its external interfaces are depicted in Fig. 1.

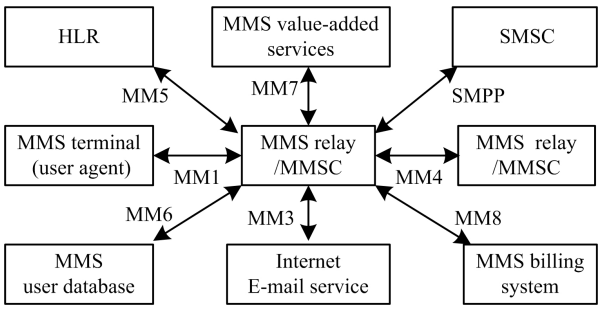

Figure 1. A reference of MMS architecture.

In MMS architecture, the core component is MMS Center (MMSC). The interface between MMSC and other external components can be concluded as follows:

- MM1: the interface between MMS user agent and
- MMSC. It is used for sending and retrieving multi-media messages (including PULL and PUSH) and for notifying message arrival or delivering report.
- MM2: the interface between MMS Relay and MMSC.

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- MM3: the interface between MMSC and external servers (such as e-mail server).
- MM4: the interface between MMSC and other MMS relay servers.
- MM5: the interface between MMSC and HLR.
- MM6: the interface between MMSC and user DB.
- MM7: the interface between MMSC and value-added service (VAS) applications.
- MM8: the interface between MMSC and the billing systems.

B. *Sending and Receiving an MM*

The following steps provide a general view of transaction flow for delivering a multimedia message (MM) between two mobile phones.

- MM sender invokes a WSP/HTTP POST request to MMSC with the message embedded as the content body.
- MMSC responds to the request, caches the received MM and then informs the receiver that an MM is available. The information conveyed shall include an URI that will be used to actually retrieve the message in a subsequent operation by MM receiver.
- MMS supports message fetch with "immediate retrieval" transaction or "delayed retrieval" transaction. MM receiver initiates the retrieval activity with the specified URI using a WSP/HTTP GET operation. Receiver client can convey its capabilities to MMSC.
- MMSC delivers the specified MM to the receiver.
- The receiver invokes a WSP/HTTP POST operation to confirm having received the MM.
- MMSC sends delivery report to originate sender.

III. MMSEMAIL

A. *Architecture of MMSEmail*

MMSEmail is designed to deliver emails to mobile phone through MMS. It provided an external interface for accepting adaptation request through HTTP registration. The request contains the email address and its username and password, the destination phone number, the preference information and the expired time of request. During the term of valid registration, the registered user profile is stored into Profiles database. An Email proxy will check the database with regular intervals. If a request is activated, the email proxy acts as the email client, connect to the specified Email server and fetch emails, then pass them to the Content Adaptation Broker. The Broker adapts the submitted email according to rules in Profiles database, converts them to SMIL format and returns them to the Email proxy. The Email proxy then starts to send them each with an MMS to the destination phone. MMSEmail implemented an MMS sender with a GPRS modem and third-party MMS SDK. The generated MM can be sent as real MM and factually presented on the screen of the destination phone. The architecture of MMSEmail is shown in Fig. 2.

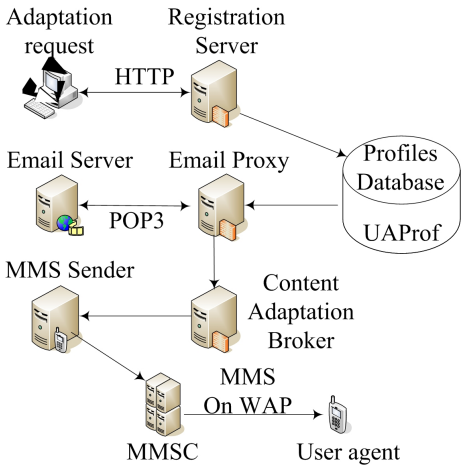

Figure 2. Architecture of MMSEmail.

B. *Personalized Aadaptation Support*

In order to extend MMSEmail's capability of supporting personalized adaptation, MMSEmail considers two ways to acquire CPI (Capability Preference information) of the receptor: by the specialized User-Agent parameter in registration profile or by parsing CC/PP[5] and UAProf [6] with free libraries such as HP's DELI (http://delicon.sourceforge.net/).

W3C's CC/PP (Composite Capability / Preference Profile) and WAP forum's UAProf are compatible standards. CC/PP defines a high-level structured framework for describing and transmitting information about the capabilities of Web clients and the display preferences of Web users using the Resource Description Framework (RDF). UAProf is a variant of CC/PP and have become the industry standard for describing and exchanging CPI of mobile terminals. The UAProf of a mobile terminal is often stored in a profile depository which is generally maintained by its manufacturer and its URL can be conveyed with some headers in request, such as x-wap-profile or Profile. The adapting proxy can retrieve its CPI by parsing the received XML document.

In first phase, we utilize the capability and preference information of the receiving terminal submitted by its user during registration.

C. *Email Proxy*

Most Internet-based email accounts use POP3 (Post Office Protocol v.3). POP3 allows an email client to collect the email on a remote server (POP server). Initially, the server host starts the POP3 service by listening on TCP port 110. When an email client wishes to make use of the service, it establishes a TCP connection with the server host. When the connection is established, the POP3 server sends a greeting. The client and POP3 server then exchange commands and responses (respectively) until the connection is closed or aborted [7].

Our POP3 proxy is an application level proxy for POP3 protocol. It establishes connection, trough remote servers,

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with POP3 clients. The proxy has multiple threads, each checks the email servers in its list in turns and in a time period interval. It reads the login ID, determines which server the account is located on, connects to the server, and logs in. Then, it fetches the new mails back and forwards them to content adaptation broker. After all email messages from an ID is retrieved and forwarded, the connection is closed. Flow control mechanism is considered to fine tune the server's performance and avoid overloading the POP3 proxy. A session is determined to be timeout if the proxy doesn't see any data received from remote email server within 30 seconds. The checking interval can be set from several minutes to several hours. The maximum number of active connections can be configured to limit the number of threads that can be simultaneously opened at a specific moment of time.

IV. CONTENT ADAPTATION BROKER

Content adaptation is a process to convert the content unsupported by the receptor to the content the receptor understands, while keeps the meaning of source content as far as possible. MMSEmail focuses on two categories of adaptation techniques: structure adaptation which reorganizes the series of object into a SMIL file (currently it had implemented a module to adapt an Email to a SMIL file) and media object adaptation which adapts the format and quality of multimedia objects (currently it had implemented modules of retrieving text from special type file of .doc, .pdf and .rtf).

A. SMIL Convertor

In accordance with "MMS Conformance Document" [8], Synchronized Multimedia Integration Language (SMIL) should be used as the presentation language for MM. Since mobile terminals may not allow us to take full advantage of the presentation capabilities offered by SMIL 2.0 or its simplest profile "SMIL Basic", [8] identifies a very limited subset of SMIL elements (MMS SMIL) for the first phase of MMS.

An MM consists of a "slide show", that is, a succession of one or several pages, each containing at most two regions: one for text and the other contains either an image or a video clip. A simple scheme of the organization of a MM is depicted in Fig. 3.

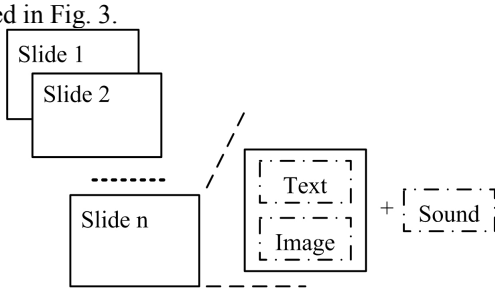

Figure 3. Structure of an MM.

MMSEmail only retrieves the sender, time, receiver and subject from the header of an Email. For decoded text of the body and attachments, MMSEmail fragments the extracted text object into blocks whose length is at most 30KB and parks them into the body part of MMS PDU (Fig. 4). Before factually sent to the destination phone, the newly generated MM can be tentatively presented on a desktop computer, e.g., with SMILSlidePlayer developed by MDS Technology Co. Ltd to verify the adaptation effects.

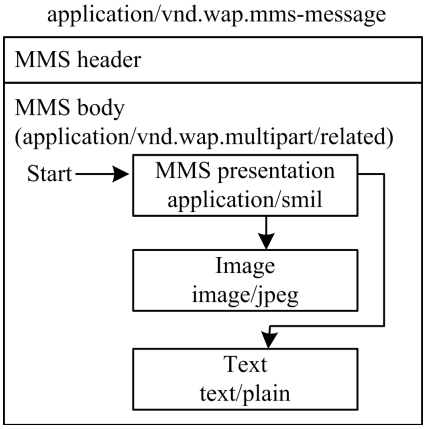

Figure 4. An example of MMS PDU.

B. Media Object Adapter

Some attachment rule is implemented to tell the proxy how to process email attachments. These rules include removing all attached files, removing attachments containing keywords, converting attachments to text, et al.

[8] defines the maximum set of requirements and guidelines for end-to-end interoperability of MMS. It specifies a suite of media types, formats and maximum size belonging to "Core MM Content Domain". There are some differences in media formats and size between 3GPP and 3GPP2 standards. For MM Content Class Text in 3GPP, the maximum length can be 30KB, the character set can be US-ASCII, UTF-8 and UTF-16. For MM Content Class Image Basic, the maximum length can be 30KB, the resolution of image can be 160*120. Still Image can be Baseline JPEG, Bitmap can be GIF87a, GIF89a and WBMP. For MM Content Class Image Rich, the maximum length can be 100KB, the maximum image resolution can be 640*480. For MM Content Class Video Basic, the video format can be H.263 and AMR. The maximum length of Video Rich can even be 300KB.

MMSEmail reserves interfaces for incorporating appropriative tools or APIs freely available on Internet to convert media types or size. The adapted objects are then embedded into a SMIL file. For multimedia playing, SMIL timing and synchronization elements can be taken into consideration, particularly <par>⋯⋯</par> parallel time container.

C. Text Extractor

MMSEmail implements modules for automatically extracting text from email attachments with file types .html, .pdf, .doc and .rtf [9].

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The structure of PDF file contains four parts: header, body, cross-reference table and trailer. The first line of a PDF file is a header identifying the version of the PDF specification to which the file conforms. The PDF document body contains a collection of objects such as fonts, graphics and pages. Cross-reference table is stored at the end of the PDF file and can be used to locate and directly access pages and other important objects within the file. The trailer contains the keyword startxref and the byte offset from the beginning of the file to the beginning of the xref keyword in the last cross-reference section, which enables PDF reading application can quickly find the cross-reference table and certain special objects. By locating the trailer, searching cross-reference table and finding objects within PDF file, MMSEmail repeatedly retrieves text-stream between "stream" and "endstream" sections and decodes them through calling ZLIB library API, all strings between "BT" and "ET" are extracted as text content of the PDF file.

The .doc file parser of MMSEmail fulfills the functions of format analyzing of .doc file header and FIB (File Information Block), recognizing the text-stream, extracting and transcoding the text. For .doc files containing Chinese characters, MMSEmail needs to convert Unicode to GBK code which is the default code of Windows platform.

RTF provides a format for text and graphics interchange that can be used with different OS. An RTF file consists of unformatted text, control words, control symbols and groups. The control words, control symbols (backslash '\'), and braces ({ }) constitute control information. The .rtf file parser evaluates and separates control information from plain text, acts on control information and collects text from the document. All other characters in the file are plain text. A standard RTF file can consist of only 7-bit ASCII characters, all characters above 0x80 must be in the escaped form, \'hh. So for .rtf file with Chinese characters, when MMSEmail encounters raw characters in the leading-byte range of the double-byte character, it regards the next character as the trailing byte of the double-byte character and combines the two characters into one double-byte character.

V. CONCLUSION AND FUTURE WORKS

With the development of mobile communication, there arises the requirement of ubiquitous access to Internet Email service from small screen terminals such as mobile phones and PDAs. In view of the advantages of MMS, we design a framework, MMSEmail, for adapting Email to MMS. MMSEmail is capable of: 1) decoding email attachments and converting .pdf, .doc and .rtf files to text; 2) encapsulating the meta-data retrieved from Email header and text converted from Email body and attachments into MMS SMIL; and 3) validating the presentation effect of the generated MM. Our method provides a new way for immediate Email delivery to mobile communication terminals. As a result of adopting industry standard interfaces, the architecture can be flexibly extended to other MMS-enabled applications.

In future, MMSEmail will implement adaptation algorithms for other media objects and synthesizes them with the extracted text into SMIL, so that the presentation effect of the adapted MMS comports with that of a normal PC-version Email clients.

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REFERENCES

[1] 3GPP. "Multimedia Messaging Service (MMS); Functional description; Stage 2," 3GPP TS 23.140, V6.13.0. Jun, 2006.

[2] WAP Forum. "Wireless Application Protocol Multimedia Messaging Service Architecture Overview Specification," WAP-205-MMSArchOverview-20010425-1.

[3] WAP Forum. "Wireless Application Protocol Multimedia Messaging Service Client Transaction Specification," WAP-206-MMSCTR-20020115-a.

[4] WAP Forum. "Wireless Application Protocol MMS Encapsulation Protocol. 05-Jan-2002," WAP-209-MMSEncapsulation-20020105-a.

[5] W3C. "Composite Capability/Preference Profiles (CC/PP): A user side framework for content negotiation," July 27, 1999.

[6] WAP Forum. "WAG UAProf, Version 20-Oct-2001," WAP-248-UAPROF-20011020-a.

[7] J. Myers, M. Rose. "RFC 1939: Post Office Protocol - Version 3," May 1996.

[8] Open Mobile Alliance. "MMS Conformance Document, Version 1.3," Oct 27, 2005. OMA-TS-MMS-CONF-V1_3- 20051027-C.

[9] Wang Lidong, Qian Liping. "An Alternative Means for Delivering Web Documents to Mobile Phones," Proc. International Conference on Wireless Communications, Networking and Mobile Computing (WICOM 2007), IEEE Press, Sep. 2007, pp. 3093-3096, doi: 10.1109/WICOM.2007.768.

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