User created content with MMS

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Abstract

In this paper the architecture of a mobile network messaging system where Multimedia Messages (MMS) can be sent to a web page or application for creation of content by users is investigated. The currently specified architecture of MMS is evaluated and it is shown that the IP data based nature of the service makes it ideal for user created content services. The billing and charging issues for MMS are discussed. It is argued that MMS should be viewed and possibly priced differently by mobile network operators. Different possibilities for user created content are discussed and the different ways of realizing them are evaluated keeping in mind the role of the mobile network operator. It is concluded that a new perspective on MMS could increase its usage.

Contents

1 Introduction

Multimedia Messaging (MMS) has been touted as the next commercial success in mobile services (see for example [7]). However, so far it has not become clear how MMS will be used. The obvious use is for simple messaging between two end users, a service often described as a natural progression from SMS. The goal that MMS will enjoy the same popularity as SMS, but with richer, multimedia content, has not yet been realized. The reality is that MMS is in technical terms, and possibly in usage terms as well, very different from SMS.

The possibilities of sending messages not directly to another MMS user agent, but rather to some intermediate, possibly publicly available repository of messages could become very popular. The role of external message services and Value Added Services (VAS), provided by parties other than the mobile network operator is worth to investigating. Content from such a public repository can be viewed on another mobile terminal or on a more traditional Internet terminal. The focus here will be on the latter.

It can be argued that mobile operators should consider the possibility that MMS development could follow a different path than that taken by SMS. The future of MMS might not be in simple messaging, hence the technical requirements for other uses provide new challenges.

When the mobile operator is no longer the only provider of content and MMS services, the possibilities for profit and interesting content can be increased by competition. Different companies can compete to provide MMS related services and create content - but content can also, importantly, be created by MMS end users. The possibilities of user created content are great, as many websites have proved. The combination of multimedia messages and the concept of user created content may prove to be powerful. Some scenarios for user created content with MMS will be introduced together with the technical considerations for implementing them.

2 MMS architecture overview

MMS was designed primarily as a person-to-person service for multimedia messages. MMS is standardized by the 3G Partnership project and the Open Mobile Alliance. (see [1], [2] , [3] and [4]). It is essentially a store and forward messaging system, similar in general design to SMS. The user submits a message to a message center, where it is stored and sent to another user when possible. The details, however, are quite different from SMS.

The main components of the MMS architecture are shown in Figure 2-1.

2.1 Network entities

The MMS Relay/Server can be viewed as a single physical component in the architecture, even though it consists of two separate logical network entities - the MMS Proxy-Relay and the MMS Server.

The MMS Proxy-Relay transcodes and delivers messages. It is responsible for transferring messages between different messaging systems. It performs address resolution, routing, collects charging information, performs content adaption and converts message formats if necessary. The MMS Server is a message store. Since MMS is a store and forward messaging system, the MMS Server will be where messages are kept while awaiting the right conditions for delivery or transfer. The MMS Server often has a web interface for retrieval of messages. Neither 3GPP nor the WAP Forum specify an interface between the MMS Proxy-Relay and the MMS Server. For this reason different business models can result in different partitioning or combinations of these two. Together they are sometimes called the MMSC.

The MMS User Agent, or MMS Client in the OMA specifications, is the component that interacts with the user. It should provide means for viewing, creating and sending multimedia messages. Typically, this will be a mobile telephone.

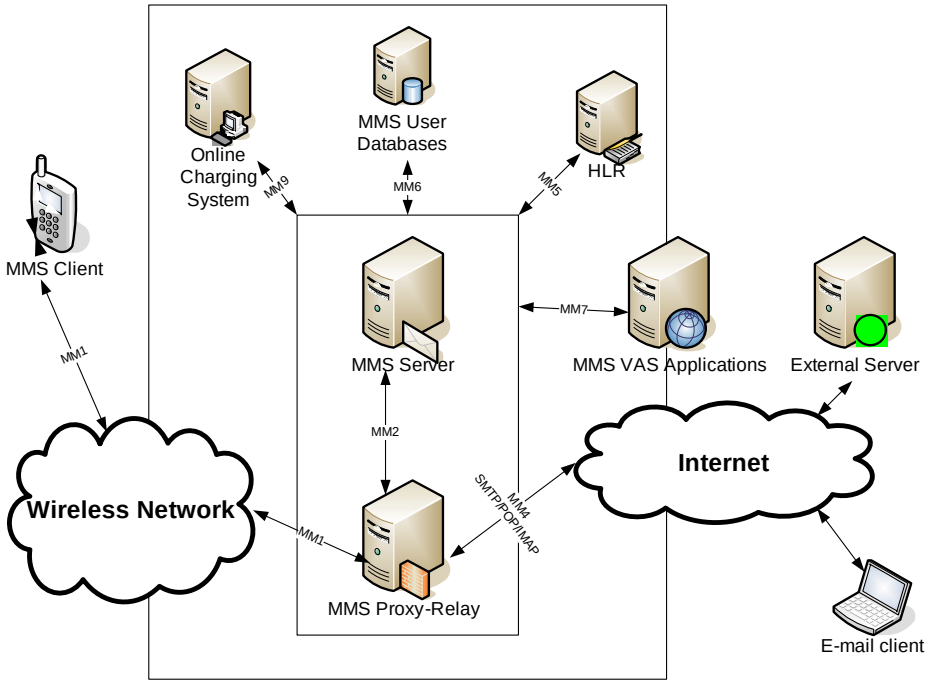

Figure 2-1: MMS Architecture

The MMS User Database contains user descriptions and profiles, containing information about subscriptions and configurations. The Home Location Register (HLR) is another database, containing information about subscribers.

The online charging system is responsible for checking whether a subscriber is allowed to use a certain network resource. This is especially important in pre-paid services where it is used to determine whether or not a subscriber has enough credit to complete the MMS transaction.

The MMS Value Added Services (VAS) applications part of the MMS architecture is important in the context of user created content. A VAS is defined as a service that can provide the operator with additional income and the customer with an extra service without harming the profits from the basic service. In the context of MMS a VAS could be ringtones, pictures, or videos sent via MMS, or possibly some of the services described in Section 4. A VAS application can generate Call Data Records (CDRs) when receiving a MMS from the Proxy-Relay, these CDRs are sent to the online charging system.

2.2 Interfaces

A few of the interfaces in Figure 2-1 are important for sending messages from the user agent.

The interface for submitting messages from the user agent to the network is called MM1. The message submission is done through the wireless network, usually using an IP based bearer such as GPRS and going through a Gateway GPRS Support Node (GGSN).

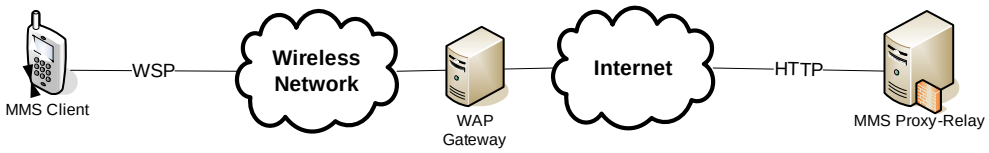

Figure 2-2: MM1 in WAP 1.x

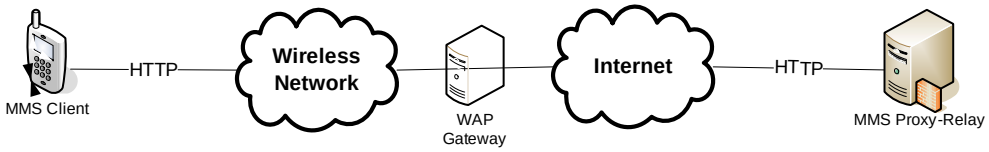

Figure 2-3: MM1 in WAP 2.0

MM1 is the interface between the MMS User Agent and the MMS Proxy-Relay. MM1 is essentially the submission of a HTTP POST message. The message can start off as a WSP POST in a WAP 1.x architecture (Figure 2-2). If WSP is used, a WAP Gateway translates the WSP message to a HTTP message. In a WAP 2.0 architecture (Figure 2-3) HTTP is used from the beginning, but a WAP Gateway may still be present for push or other services. Messages are sent over MM1 in the MMS application format, as described in [2].

The MM4 interface provides the link with connectivity to the outside Internet. MM4 makes use of the different Internet mail protocols, IMAP, POP3 and SMTP, and messages are therefore sent in MIME encoding and compatible with any email client.

The MM7 interface is the link between the MMS Relay/Server and a VAS Application. MM7 uses HTTP as transport and supports the Simple Object Access Protocol ([6]).

2.3 Charging and Billing

The charging criteria for MMS are fundamentally different from those traditionally used in telecom ([1]). Traditional charging by measurement of connection time and data volume can still be used at the bearer (GPRS or UMTS) level, but charging will often be based on CDRs created at each stage of the message flow in the MMS protocol. This allows the operator to charge on a per MMS, rather than a per byte basis and allows for a very flexible charging structure, regarded to be a necessity as MMS use grows ([1], [8], [7]). Support for pre-paid and well-defined pricing structures will be key in the future of MMS.

It is the handling by operators of the charging and billing for MMS that determines the direction that the service takes in future. A critical point is that MMS, unlike SMS, does not have a static message size - a camera phone with a high quality camera can generate a picture megabytes in size, while basic camera phones can only take pictures of about 50 KB. Some users will not even have the technical knowledge to distinguish between different size messages and could be surprised when the bill arrives. This makes a clear pricing structure important to give users a feeling of what they will pay for a message. Currently, a few operators distinguish between a small message ($<$ 30 KB) and a larger message, with different prices for the two types. This highlights the fact that MMS, unlike SMS, has more of the properties of services that are currently marketed as ”data” services (for example, WAP over GPRS).

3 Why not person-to-person?

Some of the major reasons for the success of SMS has been its quick delivery and affordability. SMS messages are quick and cheap. Many pre-paid 2G network users see SMS as a way to stay in touch using a mobile phone, without making potentially expensive calls. From the point of view of the network operator, sending an SMS uses little network resources, but the user can still be billed for every transaction. SMS can also be sent over GPRS, but is usually sent in the control channels of the GSM network. Operators want SMS to stay this way, because delivering SMS over GPRS can potentially be a lot cheaper for the user if they are able to bypass operator controlled billing.

To build on the success of SMS, MMS is marketed as a Multimedia version of SMS. For the same reason that operators try to avoid SMS over GPRS, they seem to be opposed to the idea of MMS as merely a way of formatting data over a normal IP connection. Operators seem wary of becoming a ”bit-pipe”.

Certain properties of the MMS architecture (described in section 2), however, make it ideal as a way of submitting multimedia formatted messages of different sizes to the Internet. The main reasons for this is that the bearer (GPRS or UMTS) is normally IP based and that the MMS Proxy-Relay uses the Internet Mail protocols for further transmission of messages.

In Sweden the price per MB for mobile data is usually around 20 SEK for prepaid GSM. The prices of SMS, MMS, and the MMS price per MB for a few GSM network operators are compared in Table 3-1. Clearly, the price per MB for MMS is a lot more than the 20 SEK for WAP data. Normal data over GPRS, using WAP, and the MMS service are not exactly the same thing and a difference in price is partly justified (notification of an incoming MMS is usually sent over SMS, at extra cost to the operator), but the fact remains that submission of an MMS message to the network involves exactly the same resources as a request to a website when browsing with WAP. In a simplified view, MMS is just a packet format for use over HTTP.

Operator	*Country*	*MMS (30 KB)*	*MMS cost per MB*	*SMS*
Vodafone SE	Sweden	2.79 SEK	95.23 SEK	1.10 SEK
Comviq	Sweden	2.75 SEK	93.86 SEK	1.20 SEK
Telia	Sweden	2.90 SEK	98.9 SEK	1.25 SEK
Vodacom SA	South Africa	1.4 SEK	47.8 SEK	0.3 SEK

Table 3-1: Comparing prepaid SMS and MMS prices

If normal users become aware of the view described above, they might demand lower prices for MMS, but this is unlikely to happen if MMS is marketed as a messaging service. Companies or individuals who wish to offer a service based on user created content might see it differently - the MMS architecture is ideal for this kind of service, even better than for person-to-person messages. In the delivery of a MMS to a destination MMS user agent a notification is first sent over WAP Push (usually using SMS) and the message is downloaded to the user agent upon receiving the notification in the WAP Push. On the other hand, if a message is posted to a website it is ready for use on the Internet immediately with submission to the network - it is already using the HTTP protocol of the WWW.

Services for user created content could involve the sending of very large numbers of messages by single users. This kind of service could demand data-volume based charging. The fact that it could be easy for third party service providers to set up their own MMSCs, combined with attractive user created content services could make this type of use for MMS very popular. MMS becomes only a convenient way of organizing multimedia on a portable device before sending.

Services for user created content and the architecture to realize them are described in the next sections.

4 User created content

4.1 Applications

4.1.1 Diaries, web logs and journalism

An increasing number of mobile phones are equipped with cameras, some able to take pictures comparable in resolution to dedicated digital camera devices. Photographs make it possible for users to easily create their own, unique content.

Web logs (”blogs”) are websites that usually publish content in the form of postings by the users. Although the value of the content is sometimes questionable, blogs have been successful on the Internet partly because they separate form from content - enabling users without a lot of computer knowledge to publish a good looking website. Most blogs on the web contain text and picture content.

The idea of sending messages from your phone to your website or blog has become popular as well. This is sometimes called moblogging. Several commercial websites offer moblogging services (Yapeus,

Hiplog and Pholot.net). All of these are completely independent of mobile operators and messages are posted by email. Income is generated with advertising on the content websites.

There are many applications for moblogging, all based on the idea of quickly and easily being able to submit a piece of text or photo to a website and it being immediately available to the public. The fact that many people have their phones with them at all times allows for the capture and quick distribution of images and pieces of news not otherwise available.

Users can keep a diary of their travels or of anything they care to photograph at any time. After posting it via MMS, it is immediately available to anyone who accesses the webpage. The application for journalism are obvious - news can be sent to a news website from anyone at the scene of a news event with an MMS enabled mobile phone. Many news websites (New York Times, BBC) already offer this service.

A photo posting website can also be organized by simple, user assigned categories. Users posting to a certain site can agree on a category name for a certain event and afterwards view the event from the perspective of the different mobile users. Since the receiving application can easily organize the incoming content according to user-specified fields, it is easy for the users to influence how the content will be displayed on the site.

The use of posted messages are not limited to websites. Once the messages are received by an application or server, they can be used in any way. The can be displayed on a video wall during a party or social event, printed, or redistributed in some other ways. At least one Swedish company (Quedro) already offers such a service.

4.1.2 Collaborative projects

The idea of using content submitted by users to create a single collaborative art project has also been implemented on the Internet [13]. With MMS, the same is possible using content created by MMS users. It is closely related to the ideas described in the section above in the sense that incoming user content is manipulated in a way to produce a more valuable community created product, but it is different because in collaborative projects all content is combined into a single (or a few) images or stories.

A good example of this is implemented by [13], where MMS images submitted to the site are combined into a large image that evolves as more content is added. The videos created from snapshots of the growing image create a very interesting narrative and is a new form of content only possible because of the participation of many users.

4.1.3 Business applications

Business content created by users is promising. Companies like Nokia [7], see this as a potentially big market for MMS. Business people roaming around with camera enabled phones can easily submit images or text to central headquarters.

An example of this is a sales agent (eg estate agent) taking photographs of sales objects and sending them directly to an office, or event posting them directly on the sales webpage. On the wired Internet sites like eBay and Amazon also feature a lot of user created content. A mobile version of this, using MMS contributions could be very useful.

4.2 A new perspective

In all of these applications of MMS, the MMS message becomes a way to facilitate the creation of content - the value of the service is in the content created by the users. This represents a major shift from the traditional use where the value of the service lies in the quick communication of a message, usually intended for a single person. The submission of the MMS message is the means to an end and the usage can better be described as ”posting” than ”messaging”. When the value is in the content, customers will come to expect to pay for the content (viewing the website), rather than posting a message.

This again (see sections 2.3 and 3) highlights the difference between SMS as a popular, purely messaging service and MMS that, because of its design, does not have to be restricted to messaging. It is because of its use of the Internet protocols that other uses are easy to realize. How to realize a user created content service is described in the next section.

5 Realizing a User Created Content MMS Service

From a network perspective the only problem for realizing a user created content service is getting the message to the content server. The rest of the service is local processing and organizing of the messages into the content described in section 4.

5.1 Email and SMTP

Since the MMS architecture supports sending messages to email addresses, email is the obvious way to submit messages to a content server. This method is used in many of the services available today.

This method does not require any changes to MMS architecture as provided by the mobile network operator. A mobile user uses the operator's network as the bearer for the MMS to an MMSC owned by the operator. The operator can charge on a per message base and differentiate between MMS and other data services. The content server provider can operate completely independent of the mobile operator and no agreements for VAS provisioning and CDR generation are required.

This method makes it easy for the content server provider - it only has to receive email messages and organize the MIME content. The mobile network operator only has to provide a general MMS to email service.

5.2 VAS Provider

The location of a VAS in the MMS architecture is shown in Figure 2-1. A VAS provider normally has some sort of agreement with the mobile network operator to pass messages back and forth and to exchange CDRs for customer billing.

A VAS provider can receive an MMS message directly from the MMS Proxy-Relay via HTTP. The Proxy-Relay can immediately forward the message after determining the destination. This can be done by forwarding the incoming HTTP POST to the VAS server.

In this case the VAS provider can receive money through the billing system of the mobile network operator. It is less easy for many user created content providers to set up services of this kind, because an agreement with each specific mobile operator is needed. For the user created content service to receive messages from other operator networks the two mobile network operators need to have an agreement to exchange messages between their Proxy-Relays or the content services has to directly connect to both of them.

5.3 Content server as MMSC

Both of the above solutions maintain the MMS infrastructure as provided by the mobile phone operator. At the time of writing this means that operators charge for MMS at different rates than normal packet data. It also means that the IP connection established to the MMSC for submission of the MMS are charged for and handled differently from the connection for accessing the "Mobile Web".

Since many operators provide Internet access, and MMS (specifically the interface MM1) is based on Internet protocols, it is easy to set up a MMS Proxy-Relay. All a basic Proxy-Relay has to do is receive a normal HTTP POST. In theory anyone wishing to provide a user created content server need only set up a Proxy-Relay and open it up for MMS submissions from the Internet.

Unfortunately, most operators have different GPRS Access Point Nodes (APN) and WAP gateways for MMS and "normal" data and advise users to set up different packet data accounts on their phones for the "different" services. Some operators then block access to MMS Proxy-Relays other than their own. This blocking can be done by examining HTTP data in the Network Address Traversal (NAT) box of the operator network and looking for MMS submissions to block. As argued in Section 3, this approach creates an artificial distinction between MMS Internet data and "other" Internet data.

User Created Content providers can set up a web server to process incoming MMS from HTTP POSTS. The MMS User Agent specifies the content server as the destination for its MMS submissions. If Internet access for MMS is not blocked by the operator, the user pays Internet data-volume rates for the MMS submission, the volume being the amount of traffic required to do a HTTP POST. The operator cannot charge on a per message basis, since the message transaction happens at the content server. With the data volumes being small, this is very cheap for the user.

Since setting up a web server does not require excessive resources the main challenges in setting up a MMS content server is decoding a MMS message and then organizing the messages in a way appropriate for the user created content service. Such a simple MMS Proxy should also return a `MM Submit Response` message (see [4]) to the MMS user agent. A simple MMS content server is described in the next section.

The way settings are organized in mobile phones presents one problem with the approach of having the content server act as a MMSC. A mobile phone is usually configured to use a single "MMS Server". If a user wishes to use a user created content service where the content server acts as MMSC, the "MMS Server" setting will be set to the user's content server of choice. If the content server is a simplified MMSC that can only receive MMS, then person-to-person functionality will be lost.

Fortunately there exists a fully functional open source MMSC [14]. This solution makes it even easier for content providers to set up servers. All aspects of the MMS service are implemented and therefore the problem of not being able to send person-to-person can be solved, while still using the operator only for data transfer.

An advantage of the content server as MMSC is that the low cost and ease with which a simple content server can be set up can increase competition and in turn increase the quality of user created content services.

5.3.1 Simple content server implementation

For purposes of testing and demonstrating the simplicity of creating a user created content server acting as simple MMSC, a basic service has been created [1]. The service is a posting site with dynamic creation of posting categories (called "areas") and organization of messages into these categories according to the "to" address field in the MMS message. A large number of users can easily create content together, based on category names being shared and advertised. An example case could be a group of friends agreeing to post to a certain category while at a party.

The most important part of the site is a PHP script acting as a receive-only MMSC. This script will receive the HTTP POST of a MMS and process it to make it displayable on the website.

The content type of the HTTP POST is identified as `application/vnd.wap.mms-message`. The `HTTP_RAW_DATA` of the HTTP post contains the SMIL encoded MMS message. Before a message can be displayed on a website it must be decoded to extract graphical, text and sound parts. In this implementation the extraction is done by `mmslib.php` [13]. Once the message has been decoded it can be stored on disk in a format convenient for formatting to display on a website. The rest of the website PHP code organizes and displays the messages.

[1] Currently (2005/05/22) available at `http://web.it.kth.se/~loubser/mms/`

Testing the PostAnything simple user content server
To test the experimental user content server make sure you have a GPRS or other packet data connection available on you user agent. In the message settings of your MMS user agent, simply change the MMS server setting to `http://web.it.kth.se/~loubser/mms/`. *Now any MMS sent should be submitted to the website. The area it will be placed in is determined by the destination email address specified when sending the message. The user agent should indicate that the message was successfully sent. This is triggered by receipt of the* `MM Submit Response`.

This implementation is extremely simple and works well, provided the mobile network operators does not block the HTTP POST to the server. It proves that a working user created content service can be cheaply and relatively easily created using open source software and a PHP application.

5.4 Security issues

There are security issues that affect the experimental implementation described above and also user created content services in general.

When using normal operator MMS services and a person-to-person message a user agent receiving a MMS wants to know the originating mobile phone number (MSISDN in GSM). Since submission of messages are done by a simple HTTP POST and the MMS user agent might not even have access to the MSISDN, there is no natural way to include the MSISDN in the MMS. Operators solve this problem by inserting a token into the "from" field of the MMS. This token can be replaced by the MSISDN at the WAP gateway or NAT box for the network. For an operator independent MMSC this has to be solved in a different way. One way is to require users include their number as part of the URL that they submit their messages to.

In a user created content service it can be difficult to control posting to the site. Services using email for submission approach this in a number of different ways. Some have general email address for all users and filter message based on the subject. Others create an email address for each user of the service and the address itself becomes a (weak) secret. Spam can be a problem and it is not difficult to abuse another user's account. If such a service becomes very popular this could be a concern.

Content servers using the MMSC approach face a similar problem, since anyone can send a HTTP POST from the Internet to the user created content server. Messages can also be filtered on fields in the post, but this can provide only very weak security at best. User created content servers who wish to make money from their content would obviously like to limit posting access to their site to paying customers. There is no simple way of solving this problem without changes to MMS. However, the community based nature of user created content make it less likely that abuse would be a major problem. Providers of user created content would also rather protect the content with good security than controlling message submissions.

6 Conclusion

It remains to be seen what the major use of MMS will be. In Sweden alone, during the first half of 2004 960 million SMS messages were sent, with the number of MMS that were sent during the same period only 10.7 million. The MMS volume increased by 2.0 million from the corresponding period a year earlier [15]. If MMS numbers reach the levels SMS are at today, the service could evolve into something very different from a simple way of exchanging messages.

It is possible that the major use of MMS could be related to user created content. It is unlikely that the person-to-person use of MMS will disappear or cease to be important. The nature of the MMS architecture makes it very easy to integrate with the Internet. It is likely that operators will eventually make their Internet access completely open, making it possible for user created content to be posted in

any of the ways possible. This could make operators restructure the charging for MMS to be closer to the prices for data services, but it should be kept in mind that delivery of MMS to another user agent can also involve a SMS for notification of an incoming message. Users will eventually demand prices closer to data prices when more and more operator independent MMSCs become available on the Internet.

User created content can offer a very attractive community based service. The value of the service will be in the content and a commercial service will probably be based on charging for viewing the content. It has been shown that it is very easy to set up a content server and a simple MMSC. This fact can stimulate competition to provide unique and well managed user created content services. Even if mobile network operators only carry the data to external content servers, increased use will eventually profit them as well.

Security can be a concern in systems based on posting Multimedia Messages. When the message is posted over the Internet to an open server on the Internet spam can become a problem.

It is important that most of the applications of user created content mentioned still rely on users having access to both a mobile and a more powerful Internet terminal. In some mobile markets many users do not have the latter. In these markets a slightly different approach to MMS and user created content is needed. It is possible that with handsets improving and available bandwidth increasing user created content will increasingly be created and viewed on mobile terminals.

User created content services and traditional messaging with MMS are likely to coexist in future, while operators will need to adjust to an increasingly inclusive view of the mobile and other parts of the Internet. User created content can be a compelling and valuable mobile service.

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