Mobiles for Assistant living with images

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***Abstract*— Technology should provide widespread healthcare access in an affordable, decentralized and low cost manner. Smartphones are essential in this evolution.**

This article designs an Apps to take advantage of smartphones to make life easy for elderly people. It is based on smartphones, GSM, 3G and Internet. The application can be adapted to the connections available in each specific smartphone. It can use MMS, email with MIME or cloud computing.

The App uses images and dictation with speech recognition to acquire the data by the users, and have an ergonomic easy to handle interface for elderly people.

***Index Terms*— Cloud Computing, iOS, Android, Xcode, SaaS, TaaS. MMS, SMTP, MIME, Activity, life-cycle.**

***Resumen*— La tecnología debe ayudar a que la atención sanitaria se accesible, descentralizada y de bajo coste. Los teléfonos inteligentes van a ser determinantes en esta evolución.**

Este artículo muestra una Apps que facilita la vida a las personas mayores. Usa un teléfono inteligente, GSM o 3G y su conectividad a Internet. La App se adapta al tipo de conexión disponible. Puede usar MMS, email con MIME o computación en la nube.

La aplicación usa imágenes y dictado con reconocimiento de voz para la adquisición de datos por parte de sus usuarios, y posee una interfaz ergonómica y fácil de usar por la tercera edad.

***Índice de Términos*— Cloud Computing, iOS, Android, Xcode, SaaS, TaaS. MMS, SMTP, MIME, Activity, life-cycle.**

I. Introduction

It is a fact that mobile technologies are allowing to improve the quality in the life of people, mobiles cooperate in order to people can have a better life, allowing them to bound their family and friendship ties at the same time they get closer improving the organization of their social life.

Nevertheless, it is considered that seniors cannot handle new technologies. In the UE , 17€ of its 494 million of the population are over 65 years old and taking into account that the longevity of the population, mainly in women is increasing at the end the number will be higher in the next 10 years.

Besides mobiles have a penetration in market of the half in people older than 65 years old. Basically it is because its use involves not only ergonomic problems but non– recordable values of use that conditions the older user.

This article introduces an Application for assisting elderly people to facilitate the communication between the user and third party / third person who delivers the assistance. The app can be configured to use in new and old mobile networks, using Cloud, email or MMS. The interface is simple and easy-to-used, using speech dictation for caching the consultation and the mobile camera to add a descriptive photo or image to it.

Manuscript received December, 2012.

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II. Design and architecture

In this section we will manage the design and architecture of the application. The propose software allows the users to communicate with the assistance service or any other service or person with a preview setup.

This software delivers communication and assistance using smartphones. A smartphone has the capability to execute third-party applications, allowing programmers to deliver solutions, increasing the value of the phones in the last years.

In addition, tablets are part of the mobile platforms, using the same operating systems and sharing software with their respectively small brothers, the smartphones. The principal difference between a smartphone and a tablet is capability to use phone calls by the first. Nevertheless, tablets can connect to WIFI or to access data through 3G or LTE. Moreover, the solutions design for smartphone can fit the tablet architecture with little code modification.

PCs are out of scope for this solution, but can be consider for an administrator tool, running in a PC-based system to control all the petitions made by the application, either using the cloud communication or MMS or smtp protocol.

A. Mobile Platform Design

According with Gartner [10], the mobile OS market share in the third quarter of 2011 is: 52,5 % for Android, 16,9% for Symbian, 15% for iOS, 11% for RIM and 4,6% for others include Windows. Market share has rapidly changed in the last two years. Android is now the most sold whereas Symbian has a tendency to disappear in the next years. In the other hand RIM market share is decreasing and the iOS´s is increasing. Consequently, we will assume the most important platforms to develop an app are Android and iOS.

Dealing with different platform results on different design options. In one hand there native applications and in the other hand are RIAs.

A Rich Internet Application (RIA) is a Web application that has many of the characteristics of native software,

typically delivered by way of a site-specific browser, via browser plug-in, independent sandboxes, extensive use of JavaScript, or virtual machines. Some characteristics, as browser plug-ins, are not supported for mobile platforms.

The central advantage of RIAs is that the design of apps does not depend on the platform chosen (ANDROID, iOS, Windows Phone, Symbian). Some build releases will work in the same browser for different OSs. The adaptability of the code is higher even for dissimilar browsers. [9]

At the end of 2011 there were a great number of announcements that demonstrated a decline in demand for RIA architectures. Adobe announced that Flash would no longer be produced for mobile [7] (refocusing its efforts on HTML5). YouTube, little by little, are focusing con HTML5 rather than continue with Flash. It is questioned its continued or steady relevance even on the desktop and described it as "the beginning of the end" [8]. Rumours state that Microsoft is to abandon Silverlight after version 5 is released. The combination of these announcements had some proclaiming it "the end of the line for browser plugins" [23].

In this context we will assume the future for RIAs is going to be focus on HTML5. One of the main advantages using HTML5 is the useless of browser plugins, making RIAs as a possibility for mobile platforms. However, using RIAs or Web apps bring two difficulties:

- Internet Connection Needed: RIAs are delivered by Internet. The assistance app could work without Internet, using mobile networks such as GSM or 3G if the communication is via MMS (Multimedia Messaging Service).
- The screen and interface of mobiles are different. A smaller screen must show only the essential information, whereas a quite big screen (PC) can show almost every feature of the application. Moreover the interface of mobiles based on iOS or Android are different in the way of using **multitouch interface** for a better app performance.

To solve these two problems, we have to approach a different solution. In the world of mobile OS, native apps are the most used tool to deliver mobile content and services.

The data download requirements is lowered because the native app is installed in the mobile. The app connects to the mobile network to send information via Internet or MMS, whereas in a Web application needs to access data and the app itself.

In the other hand the platform tools for developing apps allow better interface-handling, fitting the essential information in the screen and using the multitouch event for controlling the app behaviour.

This assistance living app uses both ANDROID and iOS. These two platforms use different tools and programming languages to design apps, but the bases are the same. Forward we will deal with the app design.

B. Delivering the app

Delivering an app for both iOS and Android is simply. The AppStore in iOS and Android Market in Android are the tools and the only way to deliver apps in these mobile platforms. The procedure to publicize, sell, and distribute the apps are similar in both platforms and only there is little work for the designers.

Designers needs a developer account and to pay a fee. After the developer uploads the app and waits for approval. Once the approval is guarantee, the app is distributed.

Nevertheless, ANDROID apps can be delivered without the store. Designers have the obligation to test and not infringed the terms of Google.

III. MATERIAL AND METHODS

In this section we explain how to put into practice a design and architecture of an app into iOS and ANDROID, together with the structure and computing program workflow.

The proposed software allows assistance living using iOS (Apple´s mobile Operating System) devices, ANDROID (Google´s mobile Operating System) and mobile network to manage the communication. In both platforms, images are taken with the smartphone camera and data is input by voice recognition (Dragon ™ [11]).

A. iOS Integrated Development Environment

The IDE (Integrated Development Environment) taken is Xcode, which contains all the tools to design for iOS. The app is compatible with iPhone, iPod and iPad. Xcode supports Objective C, C and C++ languages among others. To use the powerful tools inside Cocoa Touch provided by Apple is necessary to use the object oriented language Objective C.

For iOS devices, the interface is controlled by the API (Application Programming Interface) Cocoa Touch. Specifically this API is an extension Cocoa API for MAC OS (Macintosh Operation System) that allows gesture recognition and animation.

The Core Data is a system utility and part of Cocoa API that allows data organized by the relational entity-attribute model to be serialized into XML (Extensible Markup Language), binary, or SQLite (Lite version of Structured Query Language) stores, which storage format is defined by the designer. The data can be manipulated using higher level objects representing entities and their relationships. Core Data interfaces directly with SQLite, insulating the developer from the underlying SQL.

B. ANDROID Integrated Development Environment

The IDE (Integrated Development Environment) taken is the multi-language software Eclipse, which is a multi-language environment comprising a base workspace and an extensible plug-in system for customizing the environment. It is written mostly in Java. It can be used to develop applications in Java and, by means of various plug-ins, other programming languages including Java, C, C++, COBOL, Fortran, etc. There is a plug-in for ANDROID development, which adapt the programming interface adding tools and the API (Application Programming Interface) for all versions of ANDROID. To use the powerful tools inside API is necessary to use Java.

The use of the Java language needs a Java Virtual Machine. This results in a diminution of the efficiency of the processor due to the necessity to use a Java Interpreter for the mobile ARM processor. Therefore, an ANDROID app needs more resources to go as fluid as the same app running in an iOS device.

For ANDROID, each version of the Operating System needs a specific API level. The version distribution is show

in Figure 1. Jelly Bean is the most powerful version, whereas Gingerbread is the most used. Ice Cream Sandwich is the second in term of used. [15]

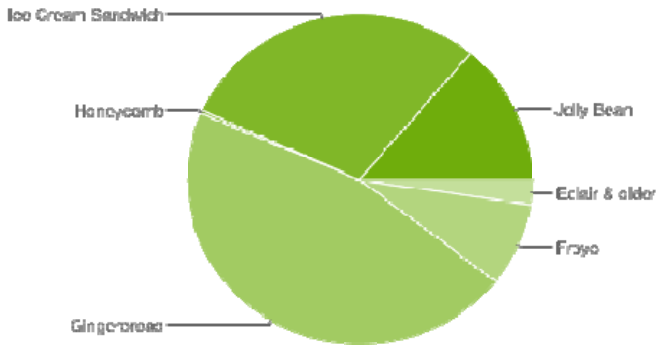

Figure 1: ANDROID versions distribution

In the Table 1 the API version are related to the SO versions. Designing an app for one version could be not compatible for another version because the API references are different. The more difference between API levels, the more methods and functions needed for adaptability. For an app, it is common goal to support Gingerbread or higher, because the app will be compatible with almost 90% of ANDROID devices. [15]

Version	Codename	API	Distribution
1.6	Donut	4	0.2%
2.1	Eclair	7	2.2%
2.2	Froyo	8	8.1%
2.3 - 2.3.2	Gingerbread	9	0.2%
2.3.3 - 2.3.7		10	45.4%
3.1	Honeycomb	12	0.3%
3.2		13	1.0%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	29.0%
4.1	Jelly Bean	16	12.2%
4.2		17	1.4%

Table 1: ANDROID versions and API levels

C. iOS Application Architecture

The app architecture is based on Model-Controller-View (M-C-V) architectural pattern.

The Figure 2 summarizes the behaviour of the M-C-V for the application. The **Model module** manages the data, controlling the information using the Cocoa´s Core Data system utility. The **Controller** handles different **View** modules using classes and methods defined in the Cocoa´s Application Kit (UIKit). The specifics UIKit classes are: UIViewController for the controllers and UIView for the views. The Controller has full access to the Model module to retrieve and storage data for the app [14].

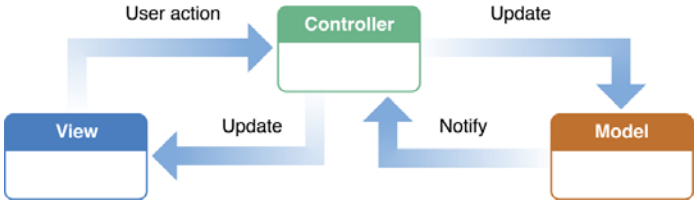

Figure 2: iOS Architectural Pattern

One characteristic of Objective C with Cocoa API is the communication between classes using protocols instead of Inheritance as is shown in Figure 3.

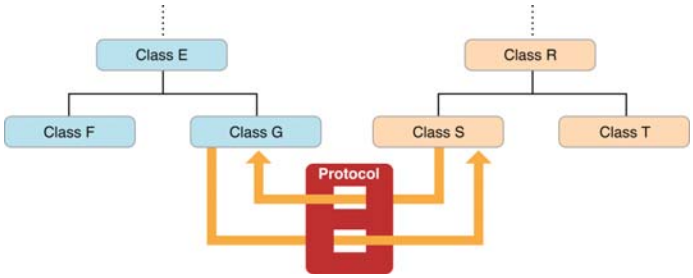

Figure 3: iOS Protocols

A protocol is a declaration of a programmatic interface whose methods any class can implement. An instance of a class associated with the protocol calls the methods of the protocol and obtains values returned by the class formally adopting and implementing the protocol.

D. ANDROID Application Architecture

The Android operating system is a multi-user Linux system in which each application is a different user.

By default, the system assigns each application a unique Linux user ID (the ID is used only by the system and is unknown to the application). The system sets permissions for all the files in an application so that only the user ID assigned to that application can access them.

Each process has its own virtual machine (VM), so an application's code runs in isolation from other applications.

By default, every application runs in its own Linux process. Android starts the process when any of the application's components need to be executed, then shuts down the process when it's no longer needed or when the system must recover memory for other applications.

The architecture of application is based mainly in Activities and Services. An activity represents a single screen with a user interface, whereas a service is a component that runs in the background to perform long-running operations or to perform work for remote processes.

An application usually consists of multiple activities, which one activity is considered the main activity, the first activity the app creates during the launch process.

In the figure 4 we can see the life cycle of an activity. There are four different states: When an activity is launched, when in closed or killed, stopped in the background or shut down and the normal state, when is running. The transitions between states are controlled by different methods or functions.

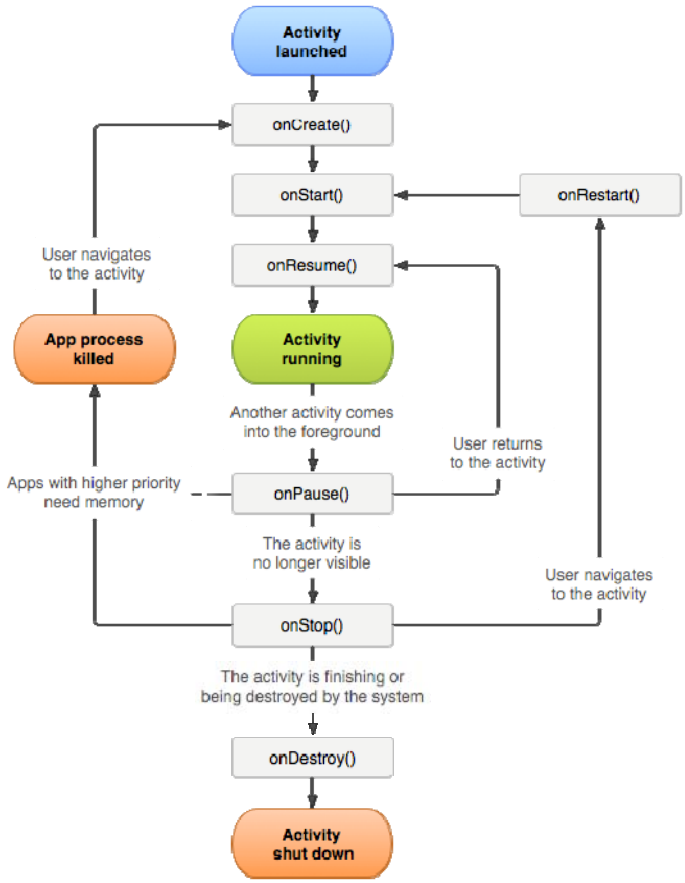

Figure 4: ANDROID Activity life cycle

E. Assistance through MMS

Multimedia Messaging Service, or MMS, is a standard way to send messages that include multimedia content to and from mobile phones. It extends the core SMS (Short Message Service) capability that allowed exchange of text messages only up to 160 characters in length.

The standard is developed by the Open Mobile Alliance (OMA), although during development it was part of the 3GPP (3rd Generation Partnership Project) and WAP (Wireless Application Protocol) groups.

MMS messages are delivered in a completely different way from SMS. The first step is for the sending device to encode the multimedia content in a method similar to sending a MIME e-mail (MIME content formats are defined in the MMS Message Encapsulation specification).

In contrast to next two methods (via email and cloud) MMS does not utilize one's data plan to distribute multimedia content. In other words, this is the solution for mobiles without Internet plan or connection.

The standard allows VGA images for sending, but in the advanced mode it can deliver High Definition images. [16] [17]

F. Assistance through MIME

Multipurpose Internet Mail Extensions (MIME) is an Internet standard that extends the format of email to support:

- Text in character sets other than ASCII.
- **Non-text attachments**.
- Message bodies with multiple parts.
- Header information in non-ASCII character sets.

Virtually all human-written Internet email and a fairly large proportion of automated email are transmitted via SMTP (Simple Mail Transfer Protocol, which is an Internet standard for electronic mail (e-mail) transmission across Internet Protocol (IP) networks) in MIME format. Internet email is so closely associated with the SMTP and MIME standards that it is sometimes called SMTP/MIME email.

For the application, there no limitation in the size and definition of the image file.

G. Assistance through Cloud

In this section we will provide a specific approach to cloud computing for a better understanding of how services can improve the application.

The model or the idea of the cloud is to transform a product into a service. Using services, compared with products, permits an abstraction on many things such as the management of hardware systems or the actualizations of the platforms and applications. In addition, this model allows new whole group of opportunities for innovative ideas where companies can specialize to deliver high quality services.

1) Layers

The cloud can be separated in different layers according with its service function. The three main layers are:

1. Application
2. Platform
3. Infrastructure

Cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support. [3]

Cloud platform services, also known as “Platform as a Service (PaaS)”, deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. [4]

Cloud infrastructure services, also known as "Infrastructure as a Service" (IaaS), deliver computer infrastructure – typically a platform virtualization environment – as a service, along with raw (block) storage and networking.

Whether this application is a mixture, or can stand in one of these three services will be discussed latter on.

2) Services for deliver assistance reports

Designing a Smartphone application for assistance living using cloud services call for a previous cloud services market study. It is important to have a big picture about cloud services and how can be implementing in the app.

We have to make a distinction here. As we said in the previous section, we need to storage the app and the assistance reports.

There is a wide offer of cloud servers with many options: Windows or Linux based server OS, backups, firewalls and DNS options. In addition, there are hardware options where you have to choose the number of cores and the size of RAM and storage.

One important feature of cloud server services is their scalability. If you demand more power you can simply acquire it. Other advantage is that all the management is provided, so developers do not need to worry about.

3) Services to load and upload the data cases

This application needs cloud storage and deliver for data. This data includes images and text information. It has to be

a service that delivers data storage and access any time is needed. This service can be considered as IaaS.

There are two possibilities for the way data is loading and uploading from the services:

1. The most simply one is to use the natural formats to store the data. These formats can be PNG or JPG for images and TXT for plain text.
2. The second and more appropriate method is to use a cloud based database service. This is in concordance with the cloud model, because in similar way, it means a level of abstraction. Data relations and structure are managed by the database. Relational database services can be found in the cloud. Seven of the most important ones are Xeround, Microsoft SQL Azure Database, Amazon Web Services, Google AppEngine Data Store, Database.com, ClearDB and CouchOne. [5]

It is important to mention that using those services imply not to worry about the maintenance of the database. The designer only has to connect to the database and use queries to ask for data.

H. Novel features and applications

Sending an image and text through Internet put on the table the question of efficiency and structure of the sending data. Using the standards of JPEG for compression and metadata allows to send in an encapsulate file, with some advantages.

1) Images

The norm ISO/IEC 24800 defines how the metadata for JPEG and JPEG2000 images is inserted inside. This standard allows integrating the metadata field for the JPSearch (search engine) queries. In addition, there is another important tool inside this ISO standard; the possibility to create annotations or tags in regions inside the image only with coordinates. Therefore, the data is encapsulated in the header of the file using XML. The use of this standard is considered an advantage due to the fact that the data cases are standardized.

On the other hand, JPEG2000 guaranties some advantages from JPEG such as superior compression performance, multiple resolution representation and progressive transmission among others. Nevertheless, JPEG2000 is not as much extended as JPEG and special software or hardware is sometimes required.

2) Text data

To avoid the inconveniences to write long sentences in portable devices, a dictation tool with voice recognition is integrated in the application. This dictation tool is developed with Dragon Dictation Mobile SDK [11] (Software Development Kit designed by Nuance Communications Inc.).

This dictation tool can be considered as a Cloud service itself. Every time a dictation is made, all data audio data is sent to a Nuance server to make the conversion into text. The app receives the converted text from the server. This service is classified into the SaaS (Software as a Service).

IV. RESULTS

A daily experience is exported from the elderly people to the devices.

A. Application Interface

The application´s interface is easy-to-use and intuitive, using touchable objects like buttons, labels and a navigation bar. The app supports portrait and landscape orientation both.

B. Capture of the report

The app allows people to catch the data in a simple way. One pushing for taking a self picture, a second pushing to enable the dictation and then speak to the phone. Finally touch send and choose one option (this step is missed with an initial setup).

Figure 1: App interface catching the report

Figure 2: App interface presenting the report

V. DISCUSSION

The present solution using the Cloud, MMS or MIME, have been proved easy to handle on everyday life assistance in elderly people.

Our app paradigm approach has been proved extremely good and simple, providing a low cost solution for multiple case or assistance reports.

Novelty of the solution is to integrate in a mobile device image and voice recording transformed into text by means of a dictation tool integrated in the app, together with a very simple and intuitive interface adapted for elderly people.

This software delivers a service in elderly assistance (TaaS) when using the cloud (not with MMS or MIME) and can be considered as SaaS, because it is an application that delivers a service specified in the consultation field.

We have defined above the use of metadata field in the JPEG and JPEG2000 for the integration on data cases. The use of the standards generates an advantage but there some difficulties; the iOS platform is not compatible with JPEG2000. In Android there are some Java Solutions for JPEG2000. In addition using the metadata for JPEG images is not implemented in the iOS platform. Therefore in the application there is a specific XML interpreter to read the JPEG header.

REFERENCES

[1] Schurr, A. "Keep an eye on cloud computing" *Network World*, July 08, 2008, http://www.networkworld.com/newsletters/itlead/2008/070708itlead1.html citing the Gartner report, "Cloud Computing Confusion Leads to Opportunity".

[2] Mell, P. & Grance, T." The NIST Definition of Cloud Computing". *NIST* Special Publication 800-145. NIST

[3] Hamdaqa M., Livogiannis T. and Tahvildari L. "A reference model for developing cloud applications." *Proceedings of the 1st International Conference on Cloud Computing and Services* Science, pages 98-103. (2011)

[4] Schofield, J. "Google angles for business users with 'platform as a service'". *The Guardian*. 2008-04-17 < http://www.guardian.co.uk/technology/2008/apr/17/google.software >

[5] Finley, F. "7 Cloud-Based Database Services" *ReadWriteCloud.com* January 12, 2011. < http://www.readwriteweb.com/cloud/2011/01/7-cloud-based-database-service.php >

[6] "Rich Internet Application Market Share. RIA Market Penetration and Global Usage." *StatOwl.com* < *http://www.statowl.com/custom_ria_market_penetration.php* >

[7] Bonderud, D. "Adobe Flash Player Turfed for Mobile Devices" *infoBoom. November 10, 2011* < *http://www.theinfoboom.com/articles/adobe-flash-player-turfed-for-mobile-devices/* >

[8] Perlow, J. "Without mobile, Adobe Flash is irrelevant" *ZDNet* November 9, 2011 < http://www.zdnet.com/blog/perlow/without-mobile-adobe-flash-is-irrelevant/19247 >

[9] "HTML5 differences from HTML4" *W3C* < *http://www.w3.org/TR/html5-diff/* >

[10] "Gartner Says Sales of Mobile Devices Grew 5.6 Percent in Third Quarter of 2011; Smartphone Sales Increased 42 Percent" *Gartner* < *http://www.gartner.com/it/page.jsp?id=1848514* >

[11] "Nuance Mobile Developer Centre" *Nuance* < http://dragonmobile.nuancemobiledeveloper.com>

[12] Ferrer-Roca O., Figueredo A., Franco K., Cardenas A. *Telemedicine Intelligent Learning. Ontology for Agent Technology"*. Trans. on Adv. Res. Jul 2005, Vol 1, N. 2, 46-54

[13] Enrique Agudo J., Rico M., Sanchez H., Valor M. Registro de aprendizaje movil en Moodle mediante servicios Web. IEEE-RITA vol 6 (3): 95-102, 2011.

[14] iOS Developer Center. Apple Inc. < developer.apple.com/devcenter/ios/index.action>

[15] ANDROID Developers. Google Inc. < http://developer.android.com/index.html>

[16] Coulombe, Stéphane; Guido Grassel (July 2004). "Multimedia Adaptation for the Multimedia Messaging Service". IEEE Communications Magazine 42 (7): 120-126. doi:10.1109/MCOM.2004.1316543.

[17] "Multimedia Messaging Service 1.3". Open Mobile Alliance. Retrieved 14 Jan. 2009.

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