Core Technology for Multimedia Messaging

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In recent years, multimedia messaging systems have been receiving great attention and generating high expectations due to the convenience they provide to users. This paper explains the core technologies on which these systems are built, looking separately at fundamental technologies and application technologies, and the respective elements that each of these categories comprise. To illustrate a multimedia messaging system built using the technology described here, we shall examine the CTstage *1) , a product which the author has been involved in developing, and study exactly how core technology is applied and precisely what kinds of services can be achieved as a result.

Fundamental technology

Fundamental technology in this area includes numerous technologies for supporting network environments, such as Internet and Intranet, and technologies for supporting human-machine interfaces, such as PCs and PDAs.

Here, we shall look at the typical technologies in each field.

(1) Multimedia communications protocol 1)

With the publication of the International Telecommunications Union (ITU) recommendation series H on Non-telephone signal transmission lines, and in particular, the ITU-T H.323 standardization recommendations for audio-visual communications systems which allow operation over Quality of Service non-guaranteed LANs (e.g. Internet) and mutual communications between H.320 terminals over N-ISDN, a globally standardized structure has been established for Voice over Internet Protocol (VoIP) and other multimedia messaging services. This structure is already being used for carrier class commercial services.

With H.323, on the other hand, protocols have been very difficult to establish and there has been poor adaptability to expansion, which means attention has been focused on the Session Initiation Protocol (hereinafter, SIP) promoted as a standard by the Internet Engineering Task Force (IETF).

The communications handled by SIP do not stop at voice calls, but also include video communications, text, chat, bi-directional communication games, and even virtual reality. Moreover, since SIP is a text-based protocol designed so that effective use can be made of the existing protocols employed widely in IP networks, it is regarded as the basic protocol for supporting multimedia messaging in the future (see Fig. 1).

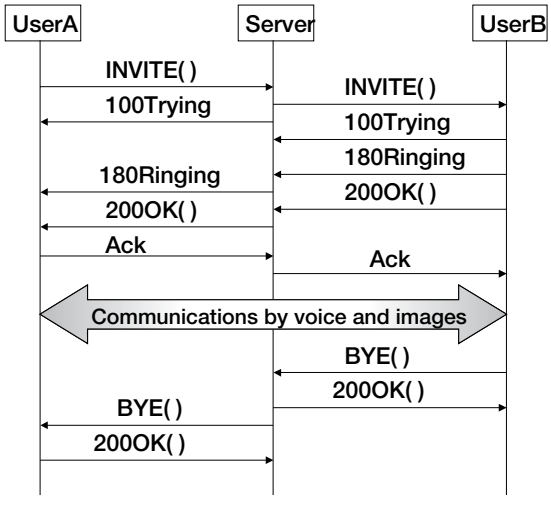

Fig. 1 Example of communications via SIP

(2) Multimedia streaming technology

Multimedia streaming technology includes distributed and parallel video delivery technology, visual communications technology, digital rights management technology, and high-quality picture encoding technology, all of which are discussed in the second half of this special issue. More details about these particular technologies can be found in the respective articles.

(3) Multimedia description languages

One the multimedia description languages used for Web applications is the eXtended Markup Language (XML) recommended by the World Wide Web Consortium (W3C). One of the features of XML is that whilst HyperText Markup Language (HTML), another markup language used widely on the Web, uses procedural descriptions, XML itself is a “generic markup language” which allows the actual markup language to be defined. This makes it easy to achieve multimedia

*1) CTstage and CTstage 4i are registered trademarks of Oki Electric Industry Co., Ltd.

compatibility, and for example, Voice XML extended particularly for voice processing is already used in multimedia messaging (see Fig. 2).

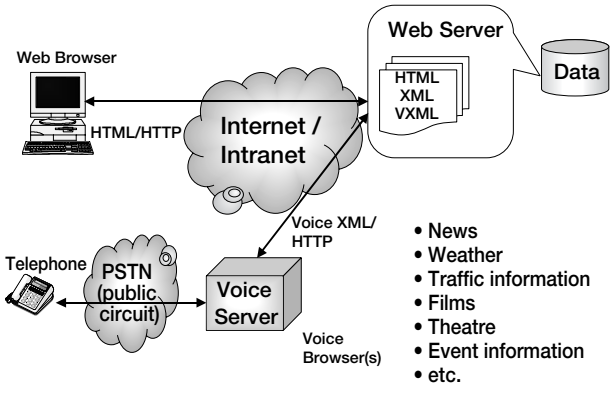

Fig. 2 Application example of Voice XML

(4) Security technology

Security measures are vital in multimedia messaging services, and encryption and authentication are essential core technologies in this field.

(5) Reliability and scalability

In the world of conventional telephone exchanges, reliability has always been treated as a issue of major importance, but in the Internet age, the concept of reliability has shifted towards a "best effort" mentality. This is not to deny the great opportunity for creating state-of-the-art technology and services that can be gained by embracing the Internet.

However, in setting up multimedia messaging services, it is crucial to be able to guarantee the same levels of reliability that are demanded in the telephone and broadcasting sectors.

Furthermore, now that networks have reached a global level, abrupt and explosive access scenarios, of the kind witnessed with Internet ticket sales for 2002 football World Cup, are becoming an everyday occurrence, and the potential for scalability has become a key factor, alongside reliability. Clustering and load balancing are some of the technologies used to resolve these problems.

(6) Other fundamental technologies

In addition to the foregoing, multimedia messaging systems are also built on various other key technologies, such as speech and image recognition, voice synthesis, automatic translation, data compression, and so on.

Application technologies

At the present time, examples of application technologies in this field include those listed below. Future expansion of these application technologies will enable the construction of more convenient and easy-to-use multimedia messaging systems.

(1) Unified messaging system

This system handles multimedia messages, such as voice mail and images, in addition to simple text mails, allowing all types of messages to be processed, managed and used according to a single format, on the basis of fundamental technologies. At the present time, this application is centred on the use of text mail and file attachments, but in the future we may well see the appearance of integrated type unified messages, which are mutually reinforcing (see Fig. 3)

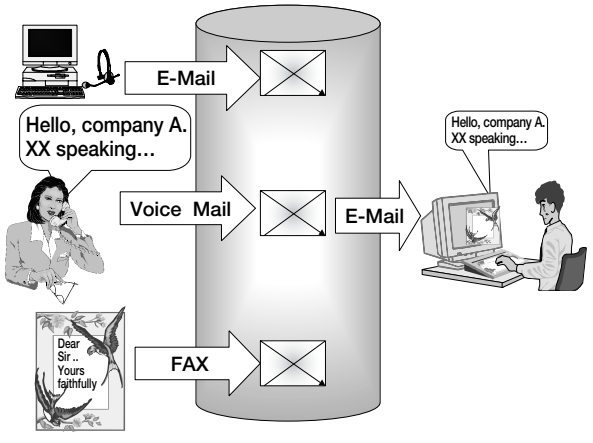

Fig. 3 Application example of Unified Messaging

(2) Contact system

A contact system provides an appropriate response to contact from customers, for instance, in a call centre, allowing customer satisfaction to be improved and client information to be collated. Building a system of this kind involves a transformation from dedicated operators answering calls to an automatic answering system based on a multimedia messaging system using technologies such as option selection by telephone dial tones, speech recognition and voice synthesis.

(3) Ubiquitous systems

Ubiquitous means "omnipresent" [2], and a ubiquitous system is one which allows the user to access the same services obtained in his or her original location, at any time, from any other location. This supports the creation of an environment in which the user can carry out their work in exactly the same way they do in the office, even when they are travelling or working from home.

By extending multimedia messaging to portable terminals and domestic PCs, it is possible to approach a "ubiquitous" environment.

Examples of multimedia messaging systems

For the past several years, Oki has been involved in developing the CTstage as a unified messaging system and contact centre system, by actively incorporating key multimedia messaging system technologies, such as voice recognition and synthesis, and Voice XML.

In particular, the CTstage 4i softswitch model announced in April uses SIP for its own communications control, and provides a fully functioning multimedia messaging system which improves IP compatibility, and incorporates elements, such as security, reliability and scalability.

The type of image system that can be actually constructed around the CTstage, using the core technologies listed in Table 1, is described below.

Table 1 List of core technology used in CTstage 4i

No	Core technology	Role
1	SIP	Control of multimedia communications
2	Voice XML	Automatic answering voice processing
3	Terminal / user authentication	Ensuring security
4	VPN/VLAN technology	Ensuring security
5	Clustering	Ensuring reliability
6	Load balancing	Ensuring reliability and providing scalability
7	Voice recognition	Automatic answering voice processing
8	Speech synthesis	Automatic answering voice processing
9	Voice storage	Voice mail
10	Unified messaging	Integration of multimedia interfaces
11	Contact centre	Various forms of customer contact support, such as call centres, etc.

(1) System configuration

Firstly, the system configuration of a CTstage 4i softswitch model will be described. The system can be divided broadly into the following four sections:

- **Resource management block:**

The "resource management block" uses a database system to manage all of the various data forming the basis for unified messaging and user management. The reliability of this block can be improved by clustering.

- **Communications control block:**

This block provides basic communications control for "Multimedia over IP", using SIP. The communications control block is constructed by a load balancing system, which both improves reliability and ensures scalability.

- **Message processing block:**

As well as performing basic processing for the messaging system, this section supplies the application interface to the public and provides a development environment for the interface, so that user-specific messaging services can be adopted.

- **Gateway block:**

This block realizes gateway functions for connecting to existing telephone networks and other IP networks, as well as communications inside the IP network. The gateway block has a dual configuration in order to ensure access from outside networks.

The relationship between these blocks is illustrated in Fig. 4.

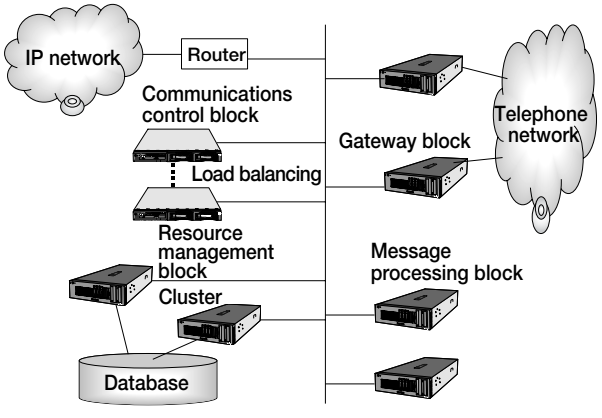

Fig. 4 System configuration

(2) Network location

This section explains how the CTstage 4i system described above is connected to the Internet and Intranets.

In the case of intranet connection, an interface is provided which has two sides – a system maintenance side, and a side for accessing services via the intranet. Maintenance access is used to edit user data and system data, as well as managing the system. On the other hand, access via the intranet involves connecting to the company intranet, via the Internet, and then collecting multimedia messaging information.

On the other hand, connection to the Internet requires conditions which ensure security, such as a firewall or IP-VPN. Connections via the Internet include, for example, access by a company worker from his or her own home, or whilst travelling, access from a HotSpot, and access to content from general customers supplied by the system.

Moreover, the system described in the previous section is constructed in a distributed fashion, more specifically, using distribution of operators (home-based operators and 24-hour answering service, etc.) and distribution of gateways (connection to telephone network from nearest MA) (see Fig. 5).

(3) Examples of application services

When located on a network as described above, the

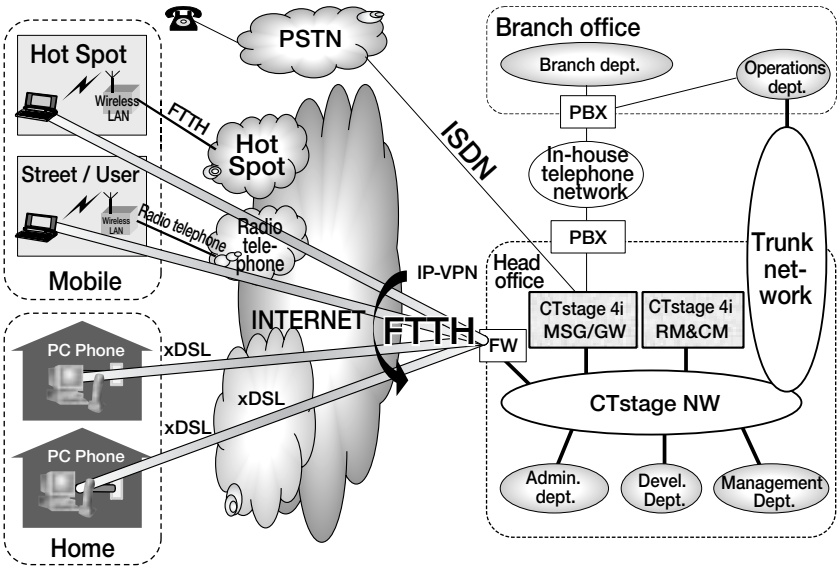

Fig. 5 Example of network configuration

system can provide the following kinds of application services, for in-house use and for customers, respectively.

- **In-house services**

Application examples of in-house services using the Internet and Intranets include not only basic telephone related services, such as individually tailored telephone answering services, automatic call forwarding, and presence display, but also the creation of an environment where a worker can use unified messaging services, just as if he or she was in the office, by accessing the system from a laptop PC or PDA via an external Hot Spot or radio telephone connection.

- **Services for customers**

Application examples of services for customers using the Internet include the ability to supply call centre services and other contact centre services, via a distributed configuration. Furthermore, since these services can be supplied in a multi-tenant style, they can also be used in representative operations which provide an integrated contact centre for a number of different firms.

Conclusion

This paper has introduced the core technologies for multimedia messaging, including fundamental technologies relating to communications protocols, messaging, description languages, security, reliability and scalability, and application technologies using these fundamental technologies, such as unified messaging, contact centres, and ubiquitous systems. We have also looked at a structural example of a network based on CTstage 4i, and discussed its applicability and user convenience.

Multimedia messaging systems are still in the development stage, but as the related infrastructure is consolidated, they are set to make a great impact on our lifestyles as they become increasingly user-friendly in the future. ◆◆

References

1) S. Okubo, M. Kawajima, eds. : Point check method. “H.323/MPEG-4 Manual”, Ver. 1, IE Institute, 2001

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