i-mode Streaming PC Contents

Technology Reports

New Streaming Service Using Windows Media Video-compatible Player

NTT DoCoMo has been engaged in development focused on implementing a Windows Media® Video[*1] *-compatible player in a mobile terminal and implementing i-mode streaming service in order to further diversify i-mode service. This new service adopts the high-speed infrastructure of HSDPA and permits the viewing of general PC video content over the Internet via i-mode.*

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1. Introduction

Simulated streaming with i-mode using the i-motion player has already been implemented for viewing video content on conventional mobile terminals. However, since this is a service where i-motion content is stored in cache memory of a sequential player and displayed sequentially as the data is stored, the capacity of a mobile terminal's cache memory limits the maximum amount of content. In June 2005, an i-mode service function was subsequently introduced to permit the viewing of Websites originally designed for viewing on PCs with a full browser in response to the growing demand for richer content relative to improved mobile terminal performance and faster communications speeds supported by High Speed Downlink Packet Access (HSDPA). Within this context, the implementation of a Windows Media Video-compatible player led to a function for viewing streamed video content. The use of streaming requires no storage of data, and permits the display of both video and audio content (such as movies in real time) without having to consider the amount of memory available on the mobile terminal.

The implementation of this player also permits viewing on the mobile terminal of diverse video content available on the Internet to facilitate further proliferation.

This article describes the development of a mobile terminal implementing the Windows Media Video-compatible player and the communication functions provided via i-mode to commercialize a streaming service. It also explains the overview of network technology associated with transmitting large volumes of data over long periods of time, which is a characteristic unique to streaming.

2. Addition of Mobile Terminal Functions

2.1 Implementation of a Windows Media-format Replay Function

The Windows Media Video-compatible player implemented in the FOMA P903iX adds a new function to replay Windows Media video content distributed on the Internet for viewing on PCs and to analyze Windows Media metafiles[*2] (a method of distribution not used with i-motion). In order to enable the replay of previously unplayable parameters (**Table 1**), a Digital Signal Processor (DSP)[*3] handles the considerable processing load associated with video decoding (**Figure 1**).

Fig. 1 shows the function added to the player to analyze metafiles. If a metafile is acquired from the content server, it is passed to the metafile analysis section. After obtaining the information necessary for acquiring and replaying video content, the processing is conducted to acquire the

*1 **Windows Media® Video**: A Microsoft Corporation streaming file format. A method of video compression developed by Microsoft. Accommodates streaming replay and download replay, and enables replay with Windows Media Player, etc. 'Windows Media' is a registered trademark of Microsoft Corporation in the United States and other countries.

*2 **Metafile**: In this article, a file containing the source URL for the distribution of video content, method of distribution, and distribution requirements.

*3 **DSP**: A processor specialized in the processing of audio, video, and other digital signals.

video content from the content server. If the file acquired from the content server contains video content, it is passed to the video-audio separation section which separates and decodes the video and audio data for replay on the LCD display and speakers, respectively.

2.2 Replay on a Windows Media Video-compatible Player Using Metafiles

Figure 2 shows the processing flow for identifying Windows Media content from a full browser, replaying it on the Windows Media Video-compatible player, and then returning to the full browser.

When the link destination is evaluated as possibly being in Windows Media format, the full browser sends this link destination information to the Windows Media Video-compatible player, and the mobile terminal temporarily suspends operation of the full browser application. The Windows Media Video-compatible player uses the link destination previously received to acquire the Windows Media format file, and first evaluates whether it is a Windows Media metafile. If the file is evaluated as being a Windows Media metafile, the system connects to the streaming server storing the file containing the Windows Media video content noted in the metafile, and begins downloading the video content. If the video content of this file is in streaming format, the user is asked to confirm the commencement of replay, and then streaming replay begins with the Windows Media Video-compatible player. Conversely, if the file at the full browser link destination is Windows Media video content rather than a metafile, or if the distribution protocol noted in the metafile is a download protocol, it begins to download the Windows Media video content. The video content is then replayed using the Windows Media Video-compatible player. The download protocol allows the user to specify whether to replay the content while downloading, or after downloading is complete.

Once the video content is replayed and the Windows Media Video-compatible player is terminated, it returns to the full browser screen prior to transition to the Windows Media Video-compatible player, allowing the user to continue viewing Websites for PCs on the full browser.

The Windows Media Video-compati-

Table 1 Windows Media Video-compatible player functions

Codec	Video	WMV9 Main Profile Low Level
		WMV9 Simple Profile
		WMV8
	Audio	WMA2-9
Replay-guaranteed band	Video only	512 kbit/s
	Audio only	192 kbit/s
	Video + Audio	512 + 64 kbit/s
Maximum screen size		320 × 240 pixels
Frame rate upper limit		30 fps
File size upper limit	Streaming	–
	Download	10 Mbyte

WMV: Windows Media Video　WMA: Windows Media Audio　fps: frame per second

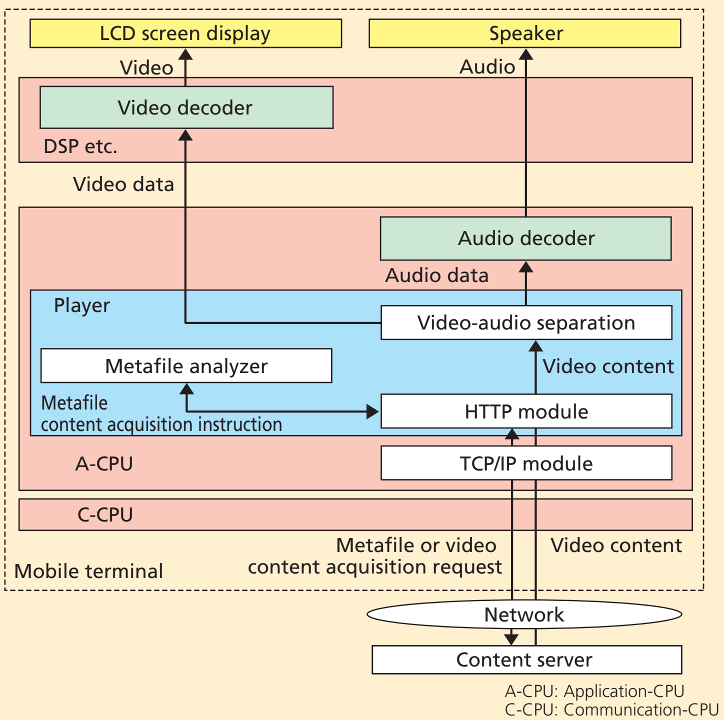

Figure 1 Decoding process

ble player allows the selection of a vertical or horizontal display during replay. When the horizontal display is selected, the entire LCD screen is used for replay at maximum size. Replay from any desired point in the video content may also be specified. This function may be adopted to resume replay from a particular point when the user is interrupted by receiving a call.

3. Network Methods

In current i-mode service, services such as Internet access and e-mail are provided using HTTP. **Figure 3** shows the i-mode network configuration. The Charging and Protocol Conversion Gateway (CPCG)[*4] terminates Wireless-Transmission Control Protocol (W-TCP)[*5][1] with the mobile terminal, and provides a connection to treasure Casket of i-mode service, high Reliability platform for CUStomer (CiRCUS)[*6]. CiRCUS is a proxy device[*7] used for communicating with the Internet.

Sophisticated real-time protocols such as Real-time Transport Protocol (RTP)[*8] are used with general streaming. In many cases, however, communication is only permitted using a specific protocol on Internet connections such as those provided with a firewall. Therefore, RTP streaming may not always be possible. Consequently, general streaming servers support a function to provide streaming using an optimal protocol for the network configuration (including firewalls, etc.). A number of protocols are available, such as RTP and HTTP. Due to concerns about security, i-mode uses HTTP for streaming.

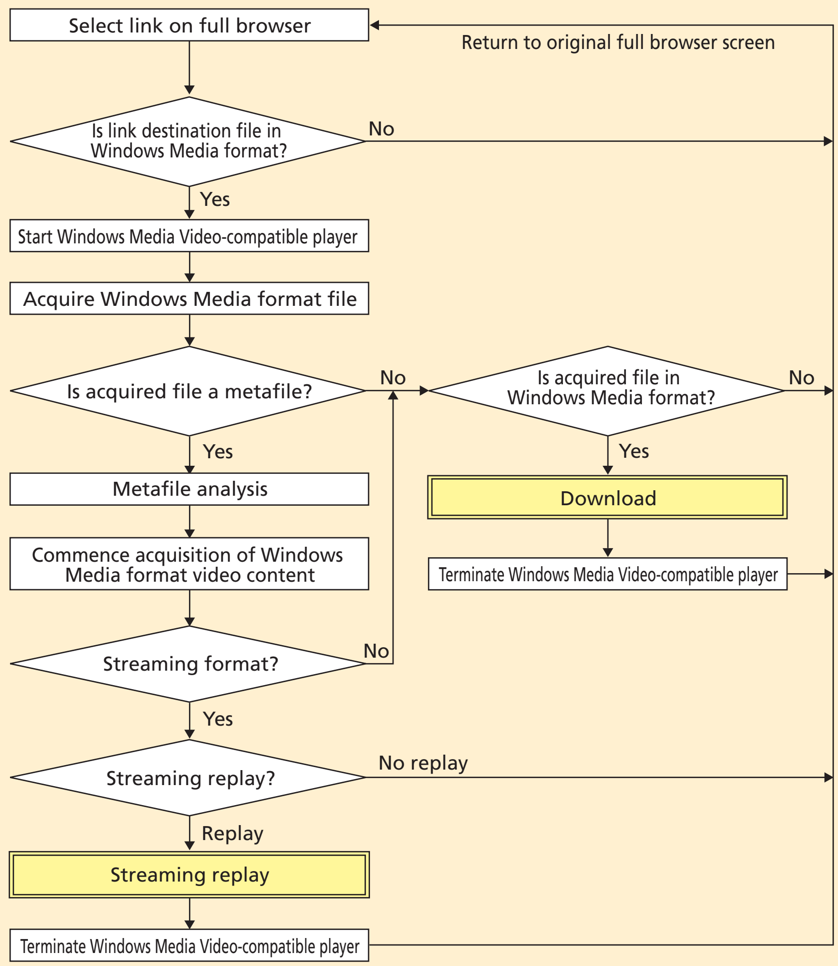

Figure 2 Processing flow for replay with Windows Media Video-compatible player

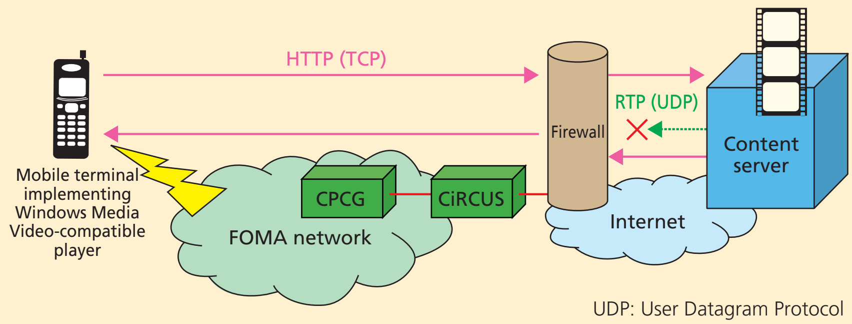

Figure 3 i-mode network configuration

HTTP streaming adopts the HTTP method for streaming and performs encapsulation[*9] of RTP packets with HTTP. In other words, in addition to replaying video content, use of HTTP method also enables to provide such user

*4 **CPCG**: i-mode gateway equipment in the FOMA network.

*5 **W-TCP**: TCP optimized for packet communications on a mobile communications network.

*6 **CiRCUS**: Equipment providing i-mode mail, i-mode menus, and general access to the Internet, and operating as a relay between a core network and the Internet.

*7 **Proxy device**: Relay equipment issuing requests in place of the client, and functioning as both a server and client for connection to the external Internet.

*8 **RTP**: A real-time multimedia transport protocol via IP networks defined by the Internet Engineering Task Force (IETF).

*9 **Encapsulation**: Technology for embedding data in a separate protocol to enable communication on a network that limits usable protocols.

controls as fast-forward, rewind, and pause. To implement this function, the player and network have adopted the HTTP method with HTTP/1.0.

Because HTTP (adopting TCP/IP as a subordinate protocol) guarantees the sending/receiving of data by confirming transmission, the implementation of HTTP streaming allows an accurate understanding of how much streaming data the mobile terminal has received. As with i-mode, streaming consequently adopts a charging system which charges the users for the packets in the streaming session. It is also possible to provide reverse charging where the information provider is charged for the packets.

4. Support for Long-duration Communication and Large Volume Content

4.1 Management of Streaming Communication

Since mobile terminals are subject to limits on memory capacity regarding conventional content, there have only been minimal requirements set relative to large volumes of data and long-duration communication on the network. Given the unlimited volume and duration of real-time movies and other visual content, however, a new concept of managing communications to accommodate different traffic characteristics has become necessary. Currently, a non-communication monitoring function is provided in existing networks to terminate a TCP connection which has not been used for a set period of time and thereby release network resources.

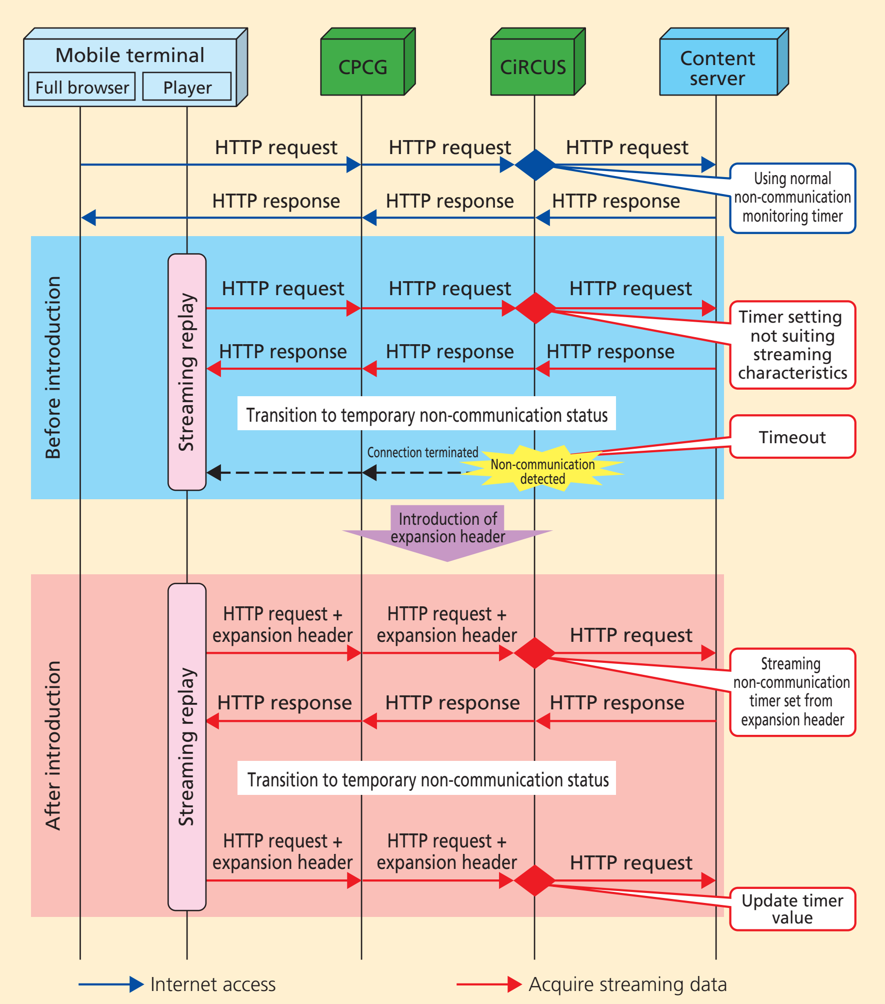

Figure 4 Streaming identification sequence using expansion header

Since streaming may establish multiple TCP connections for each HTTP method, if one TCP connection transitions to a non-communicating status with no user control (such as in pause status), the connection could possibly be terminated at a timeout and streaming is halted.

The non-communication monitoring function was therefore improved. While the current version of the Windows Media Video-compatible player does not handle simultaneous multiple connections, an expansion header for streaming with each method has been defined to facilitate future expansion, and streaming connections are managed (**Figure 4**). This will permit the setting of a non-communication monitoring timer to suit the characteristics of each connection and thereby avoid the termination of unnecessary connections during streaming.

Assuming long-duration communication, the collection of traffic data has been significantly improved. Conventionally, a connection terminated by the mobile terminal or server before completing the transmission of all content was interpreted as abnormal termination, with a log being output. Conversely, with streaming using the Windows Media Video-compatible player, the server or the mobile terminal may terminate the connection even when streaming is completed normally. In some cases, a connection may be established or terminated under user control (such as in pause status) while content is being replayed. With CiRCUS, the termination of such connections is not handled as abnormal streaming termination, but in a manner permitting the collection of traffic data in the same way as for normal termination.

4.2 Large Volume Communications with i-mode

For the streaming of data using mobile terminals on the FOMA network, the content server and mobile terminals are connected through the sending and receiving of control signals between relay nodes. In conjunction with streaming communications, a much greater volume of HTTP data is expected and there are fears that the load will increase regarding the processing of user data (e.g., HTTP relay) .

Control signal processing and user data processing were therefore separated in the CPCG, and a method was introduced to improve processing efficiency in response to the greater volume of user data relay processing. The Call Control Processor (CCP) controlling the signal processing and the Unified proxy Control Processor (UCP) controlling user data are implemented on a blade server[*10] in order to separate the different types of processing. Moreover, general-purpose servers adopt advanced Telecom Computing Architecture (aTCA)[*11]. Thus, UCPs can be added to accommodate the increased user data processing, and load distribution methods can be used in accordance with the UCP processing status to realize more efficient processing.

5. Conclusion

The Windows Media Video-compatible player has been implemented in a mobile terminal to enable the viewing of video content designed for general PCs on the Internet. Implementing this player in the mobile terminal required the development of communications functions to provide content via i-mode, and functions optimized for long-duration and large volume communications (e.g., real-time video) previously not considered for i-mode content.

Ways to expand existing functions and provide users with a streaming service of even higher image quality are now being investigated.

References

[1] K. Yamamoto et al: "Wireless TCP for High-speed Mobile Communications," NTT DoCoMo Technical Journal, Vol.8, No.4, pp.37-40, Mar. 2007.

*10 **Blade server**: A server consisting of multiple circuit boards, each comprising all the elements necessary for a computer. Mounted on a chassis that provides power and LAN functions.

*11 **aTCA**: Industrial standard specifications for carrier-oriented next-generation communication equipment defined by the PCI Industrial Computer Manufacturers Group (PICMG).