

DESCRIPTION

Title of the Invention

CONVERTER AND INFORMATION CONVERSION METHOD

5 Technical Field

[0001] The present invention relates to a converter and an information converting method for converting information between an IP (Internet Protocol) and a non-IP network.

10 Background Art

[0002] In recent years, with the popularization of internet devices, IP multicast communication that realizes multicast communication on the Internet (IP network) has been developed. For example, Patent Document 1 discloses a group
15 communication method that uses IP multicast communication to realize a group communication service such as a video group conference on the TCP (Transmission Control Protocol)/IP.

[0003] Before the IP multicast communication is developed, multicast communication on a non-IP network that does not use
20 the Internet is also popularized.

[0004] Multicast communication is a method of transmitting data a group of some of communication apparatuses connected to the network at once. In the multicast communication, users joining in a group can acquire contents of a session at once
25 without copying packets so as to optimize utilization of a network bandwidth. For this reason, multicast communication is a technique that is most suitable for group communication.

Citation List

Patent Literature

[0005]

5 PTL 1

Japanese Patent Application Laid-Open No. 10-336176

Summary of Invention

Technical Problem

10 [0006] However, a system that connects an IP (wireless) network terminal to a multicast group on a non-IP network or a system that connects a plurality of multicast groups on a non-IP network through the Internet does not have been devised.

[0007] The IP network has a very large maximum
15 communication channel capacity and can transmit a large amount of data at a high speed by compressing information (several Mbps). However, the non-IP network has a maximum communication channel capacity that is considerably smaller than that of the IP network and a low transmission rate (several
20 kbps to tens of kbps).

[0008] Therefore, when the IP network and the non-IP network are simply connected to each other to directly transmit information (IP packet) of the IP network to a multicast group on the non-IP network, a communication bandwidth shortage and a
25 long time delay occur in the non-IP network because a header portion of an IP packet has a large amount of information.

[0009] It is an object of the present invention to provide a

converter and an information converting method that can convert information between an IP network and a non-IP network without changing a terminal on the non-IP network and without a communication bandwidth shortage or a long time delay in the
5 non-ID network.

Solution to Problem

[0010] A converter according to the present invention is a converter that converts information between an IP (Internet
10 Protocol) network and a non-IP network and employs a configuration including a conversion table memory that stores a conversion table showing correspondences between parameters of a header of an IP packet and parameters of a control signal portion of the non-IP network signal, and header forming means
15 forming a control signal portion of the non-IP network signal from the header information of the IP packet.

[0011] An information converting method according to the present invention is an information converting method for converting information between an IP (Internet Protocol)
20 network and a non-IP network, and employs a method including: the communicating party selecting step of selecting a communicating party of the IP packet from header information of an input IP packet; the transmission content selecting step of selecting a transmission content from the header information of
25 the IP packet; the conversion table selecting step of selecting a conversion table corresponding to the communicating party selected by the communicating party selecting section and the

transmission content selected by the content selecting section from a conversion table memory that stores conversion table showing correspondences between parameters of headers of IP packets and parameters of communication signal parts of signals of a non-IP network per communicating party or per communicating group; and the header forming step of forming a control signal portion of the non-IP network signal from the header information of the IP packet with reference to the selected conversion table.

10

Advantageous Effects of Invention

[0012] According to the present invention, a conversion table showing correspondences between parameters of headers of IP packets and parameters of control signal portions of signals of a non-IP network per communicating party or per communicating group is prepared, and, with reference to a selected conversion table, a control signal portion of a non-IP network signal is formed from header information of an IP packet, so that information can be converted between the IP network and the non-IP network without changing a terminal of the non-IP network and without causing a communication bandwidth shortage or a long time delay on the non-IP network.

20

Brief Description of the Drawings

25 [0013]

FIG.1 is a diagram showing a configuration of a system according to one embodiment of the present invention;

FIG.2 is a block diagram showing a configuration of a converter according to an embodiment of the present invention;

FIG.3 is a diagram showing an example of a conversion table stored in a conversion table memory of a converter according to an embodiment of the present invention;

FIG.4 is a diagram showing frame formats of an IP packet and information of a non-IP network input to a converter according to an embodiment of the present invention;

FIG.5 is a diagram showing a frame format of a header of a MAC layer;

FIG.6 is a diagram showing a frame format of a TCP header; and

FIG.7 is a diagram showing a frame format of a UDP header.

Description of Embodiments

[0014] An embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0015] (Embodiment 1) 1. 1 System Configuration

FIG.1 is a diagram showing a configuration of a system according to an embodiment of the present invention. The system shown in FIG.1 includes IP network connection terminal 101, IP network terminal 102, IP wireless network terminal 103, non-IP-A (analog) type wireless base terminal 111, non-IP-A wireless terminal 112, non-IP-D (digital) type wireless base terminal 121, and non-IP-D type wireless terminal 122.

[0016] In FIG.1, IP network connection terminal 101, IP

network terminal 102, and IP wireless network terminal 103 configure an IP network. Non-IP-A type wireless base terminal 111 and non-IP-A type wireless terminal 112 configure a non-IP network for analog communication. Non-IP-D type wireless
5 base terminal 121 and non-IP-D type wireless terminal 122 configures a non-IP network for digital communication.

[0017] IP network connection terminal 101 performs cable communication with IP network terminal 102 by the IP. IP network connection terminal 101 makes wireless communication
10 with IP wireless network terminal 103 by the IP. IP network connection terminal 101 can simultaneously communicate with plurality of IP network terminals 102 and plurality of IP wireless network terminals 103 to make it possible to perform multicast communication.

[0018] Non-IP-A type wireless base terminal 111 makes analog wireless communication, typified by a transceiver, with non-IP-A wireless terminal 112 without using the IP. The Non-IP-A type wireless base terminal 111 can simultaneously communicate with
15 plurality of non-IP-A wireless terminals 112 to make it possible to perform multicast communication.
20

[0019] Non-IP-D type wireless base terminal 121 makes digital wireless communication, typified by a cellular phone, with non-IP-D type wireless terminal 122 without using the IP. The non-IP-D type wireless base terminal 121 can simultaneously
25 communicate with plurality of non-IP-D type wireless terminals 122 to make it possible to perform multicast communication.

[0020] Non-IP-A type wireless base terminal 111 and non-IP-D

type wireless base terminal 121 include converter 200 and communicate with IP network connection terminal 101 through converter 200 on the Internet (IP network).

[0021] Converter 200 converts a header part of information (IP packet) of an IP network output from IP network connection terminal 101 into a control signal portion of a non-IP network signal and transmits the non-IP network signal to non-IP network terminal 112 (122). Converter 200 converts the control signal portion of the non-IP network signal output from the non-IP network terminal 112 (122) into a header of an IP packet and transmits the IP packet to IP network connection terminal 101.

[0022] The control signal portion of the non-IP network signal is advance communication information such as DCS (Digital Code Squelch), a selected frequency, a tone signal superposed on an audio signal, or the like in analog communication, and is a header part in digital communication.

[0023] 1. 2 Internal Configuration of Converter

FIG.2 is a block diagram showing a configuration of a converter according to an embodiment of the present invention. Converter 200 shown in FIG.1 mainly includes interface 201, separating section 202, communicating party selecting section 203, transmission content selecting section 204, header forming section 205, conversion table memory 206, synthesizing section 207, transmission permission/impermission determining section 208, interface 209, separating section 210, synthesizing section 211, and transmission timing control section 212.

[0024] Interface 201 receives an information packet

transmitted from IP network connection terminal 101 and transmits the information packet to separating section 202. Interface 201 transmits the IP packet output from transmission timing control section 212 to IP network connection terminal
5 101.

[0025] Separating section 202 separates information of an IP network (IP packet) output from interface 201 into a header part and a data part, transmits the header to communicating party selecting section 203 and transmission content selecting section
10 204 and transmits the data to synthesizing section 207.

[0026] Communicating party selecting section 203 reads an address (MAC address or IP address) of a destination to which a packet is sent from the header of the IP packet output from separating section 202 and confirms whether the address is
15 registered in a conversion table in conversion table memory 206 as an address of a multicast group of a non-IP network to which converter 200 belongs. When the address is registered, communicating party selecting section 203 outputs information representing the address to header forming section 205. On the
20 other hand, when an address is not registered, communicating party selecting section 203 outputs information representing that the address is not registered to header forming section 205 and synthesizing section 207.

[0027] Communicating party selecting section 203 specifies an
25 address of a destination to which an IP packet is sent from the control signal portion of the non-network signal output from separating section 210, and confirms whether the address is

registered in the conversion table in the conversion table memory 206 as an address of a multicast group of a non-IP network to which converter 200 belongs. When the address is registered, communicating party selecting section 203 outputs
5 information representing the address to header forming section 205. On the other hand, when an address is not registered, communicating party selecting section 203 outputs information representing that the address is not registered to header forming section 205 and synthesizing section 211.

10 [0028] Transmission content selecting section 204 reads a type (audio communication or data communication) of a transmission content of data from the header of the IP packet output from separating section 202, and outputs information representing the type of the read transmission content to header forming section
15 205.

[0029] Transmission content selecting section 204 reads a type (audio communication or data communication) of a transmission content of data from the control signal portion of the non-network signal output from separating section 210 and
20 outputs information representing the read type of the transmission content to header forming section 205.

[0030] Header forming section 205 selects a conversion table corresponding to information representing an address output from communicating party selecting section 203 and information
25 representing the type of the transmission content output from transmission content selecting section 204 from the conversion tables stored in conversion table memory 206. Header forming

section 205 forms a control signal portion of a non-network signal with reference to the contents of the selected conversion table to output the control signal portion to synthesizing section 207 or forms a header of an IP packet to output the header to synthesizing section 211. Header forming section 205 does not operate at all when header forming section 205 receives information representing that an address is not registered from communicating party selecting section 203.

[0031] Conversion table memory 206 stores a conversion table per communicating party (including groups that make multicast communication) and per transmission content. In the conversion table, parameters of headers of IP packets, parameters of control signal portions of non-network signals, and the correspondence between the parameters of the headers of the IP packets and the parameters of the control signal portions of the non-network signals. Details of the conversion tables stored in conversion table memory 206 and header forming processes in header forming section 205 will be described later.

[0032] Synthesizing 207 divides the data output from separating section 202 into data each having a predetermined length, synthesizes the divided data with a control signal portion output from header forming section 205 to generate an information signal of a non-IP network, and outputs the information signal to transmission permission/impermission determining section 208. When synthesizing section 207 receives information representing that an address is not registered from communicating party selecting section 203,

synthesizing section 207 does not operate at all. Details of a synthesizing process in synthesizing section 207 will be described later.

[0033] Transmission permission/impermission determining
5 section 208 outputs the signal output from synthesizing section 207 to interface 209 within a limited time to comply with the wireless communication standard. On the other hand, when the limited time to comply with the wireless communication standard is over, transmission permission/impermission determining
10 section 208 discards a signal output from synthesizing section 207.

[0034] Interface 209 receives a signal transmitted from non-IP network terminal 112 (122) and outputs the signal to separating section 210. Interface 209 transmits the signal output from
15 transmission permission/impermission determining section 208 to non-IP network terminal 112 (122).

[0035] Separating section 210 separates the non-IP network signal output from interface 209 into a header portion and a data portion, outputs a control signal portion of a non-network signal
20 to a communicating party selecting section 203 and transmission content selecting section 24, and then outputs data to synthesizing section 211.

[0036] Synthesizing section 211 couples the data output from separating section 210 to each other to form data having a
25 predetermined length, synthesizes the coupled data with the header output from header forming section 205 to generate an IP packet, and outputs the IP packet to transmission timing control

section 212. Synthesizing section 211 does not operate at all when synthesizing section 211 receives information representing that an address is not registered from communicating party selecting section 203. Details the synthesizing process in synthesizing section 211 will be described later.

[0037] Transmission timing control section 212 outputs the IP packet output from synthesizing section 211 to interface 201 at a timing to comply with a communication standard.

[0038] 1. 3 Detailed Explanation of Header Forming Process

A conversion table stored in conversion table memory 206 and a header forming process in header forming section 205 will be concretely explained with reference to FIG.3. FIG.3 is a diagram showing an example of a conversion table stored in conversion table memory 206. FIG.3A and FIG.3B show conversion tables between an IP network and a non-IP network, and FIG.3C shows a conversion table between the IP network and non-IP-D type wireless network. FIG.3A and FIG.3B show the tables that are different from each other in only columns of association and conversion. The column of association and conversion in FIG.3A shows a case in which a type of transmission content is data communication, and the column of association and conversion in FIG.3B shows a case in which a type of transmission content is audio communication. The column of association and conversion in FIG.3C shows a case in which a type of transmission content is audio communication.

[0039] When it is confirmed in communicating party selecting section 203 that a MAC address and an IP address of a header of

an IP packet are the same as the MAC address and the IP address in the conversion table in FIG.3A and transmission content selecting section 204 reads that a type of transmission content is data communication, header forming section 205 forms information corresponding to a header for analog communication of the non-IP network according to the conversion table in FIG.3A.

[0040] More specifically, header forming section 205 selects tones corresponding to a MAC address and an IP address to generate a tone signal. The header forming section 205 superposes deemed audio data corresponding to a UDP (User Datagram Protocol) on the Tone signal.

[0041] Header forming section 205 selects FM (Frequency Modulation) as a communication scheme, selects ADPCM (Adaptive Differential Pulse Code Modulation) as an IP-side audio codec, selects real time voice and 8-kHz conversion corresponding to the FM modulation scheme, and selects a band limit as 12.5 kHz to support an FM communication standard. Header forming section 205 designates the selected pieces of information to synthesizing section 207.

[0042] When it is confirmed in communicating party selecting section 203 that a tone of information corresponding to a header for analog communication of a non-IP network is the same as a low-frequency tone of the conversion table in FIG.3A and transmission content selecting section 204 reads that a type of transmission content is data communication, header forming section 205 forms a header of an IP packet according to the

conversion table in FIG.3A.

[0043] More specifically, header forming section 205 selects a MAC address and an IP address corresponding to the tone and selects multicast information matched with the group. A header
5 having the pieces of information is formed.

[0044] Header forming section 205 selects PM as a communication scheme, selects ADPCM as an IP-side audio codec and designates synthesizing section 211 to quantize a received FM demodulating signal by the ADPCM scheme, and
10 designates synthesizing section 211 to form blocks having packet sizes to comply with the communication standard.

[0045] When it is confirmed in communicating party selecting section 203 that a MAC address and an IP address of a header of an IP packet are the same as the MAC address and the IP address
15 in the conversion table in FIG.3B and transmission content selecting section 204 reads that a type of transmission content is audio communication, header forming section 205 forms information corresponding to a header for analog communication of the non-IP network according to the conversion table in
20 FIG.3B.

[0046] When it is confirmed in communicating party selecting section 203 that a MAC address and an IP address of a header of an IP packet are the same as the MAC address and the IP address in the conversion table in FIG.3C and transmission content
25 selecting section 204 reads that a type of transmission content is audio communication, header forming section 205 forms information corresponding to a header for analog communication

of the non-IP network according to the conversion table in FIG.3C.

[0047] 1. 4 Detailed Explanation of Synthesizing Process

Synthesizing processes in synthesizing section 207 and
5 synthesizing section 211 will be concretely explained with
reference to FIG.4. FIG.4 is a diagram showing a frame format
of information of a non-IP network. FIG.4A shows a frame
format of an IP packet, FIG.4B shows a frame format of a
non-IP-A type wireless network, and FIG.4C shows a frame
10 format of a non-IP-D type wireless network.

[0048] As shown in FIG.4A, in a frame of an IP packet, a header
is added before a Payload (data portion). The header is divided
into a header of a physical layer (PHY-I), a header (MAC) of a
MAC layer, a header (IP) of an internet layer, and a header (TCP
15 or UDP) of a transport layer. In the headers of the layers,
control signals to be exchanged between the headers and the
same layers in a transmission destination.

[0049] FIG.5 is a diagram showing a frame format of a header
of a MAC layer. As shown in FIG.5, a control signal of the
20 header of the MAC layer has $56 + 8 + 48 + 48 + 16 + 32 + = 302$
bits.

[0050] FIG.6 is a diagram showing a frame format of a TCP
header, and FIG.7 is a diagram showing a frame format of a UDP
header. The control signal obtained by adding an IP header and
25 a TCP header has 160 bits, and a control signal obtained by
adding an IP header and UDP header has 64 bits.

[0051] In this manner, the IP packet has large header

information. When the IP packet is caused to directly flow in a non-IP network having a small maximum communication channel capacity and a low transmission rate, a communication bandwidth shortage or a long time delay occurs because an overhead caused by header information or the like is large.

[0052] In the embodiment, header forming section 205 forms a control signal portion of a non-network signal, and the control signal portion and the data are synthesized in synthesizing section 207. Synthesizing section 207, as needed, performs data processing (for example, data is converted into general-purpose data and then provided in a form to comply with the standard) to synthesize the control signal portion with the data.

[0053] More specifically, in the non-IP-A type wireless network, as shown in FIG.4B, for example, DCS is added before a sound of, for example, FM or the like, or a Tone signal is superposed. In the non-IP-D type wireless network, as shown in FIG.4B, a header of a physical layer (PHY-D) and a header of a MAC layer (M: 48 bits) are added before the data.

[0054] When a header of an IP packet is formed in header forming section 205, synthesizing section 211, as shown in FIG.4A, synthesizes the header of the IP packet with the data.

[0055] 1. 5 Effect of Embodiment

In this manner, according to this embodiment, a conversion table showing correspondences between parameters of headers of IP packets and parameters of control signal portions of signals of a non-IP network is provided per

communicating party or communicating group, and, with
reference to a selected conversion table, a control signal portion
of the non-IP network signal is formed from header information
of an IP packet, so that information can be converted between the
5 IP network and the non-IP network without changing a terminal
of the non-IP network and without causing a communication
bandwidth shortage or a long time delay on the non-IP network.
[0056] The disclosure of Japanese Patent Application No.
2009-085642, filed on March 31, 2009, including the
10 specification, drawings, and abstract is incorporated herein by
reference in its entirety.

Industrial Applicability

[0057] The present invention is preferably used in a base
15 station apparatus, a terminal apparatus, a relay station apparatus
used in mobile communication of an OFDM transmission scheme.

Reference Signs List

[0058]

20 101 IP network connection terminal

102 IP network terminal

103 IP wireless network terminal

111 Non-IP-A (analog) type wireless base terminal

112 Non-IP-A type wireless terminal

25 121 Non-IP-D (digital) type wireless base terminal

122 Non-IP-D type wireless terminal

200 Converter

- 201, 209 Interface
- 202, 210 Separating section
- 203 Communicating party selecting section
- 204 Transmission content selecting section
- 5 205 Header forming section
- 206 Conversion table memory
- 207, 211 Synthesizing section
- 208 Transmission permission/impermission determining section
- 212 Transmission timing control section

CLAIMS

Claim 1 A converter that converts information between an Internet protocol network and a non-Internet protocol network, the converter comprising:

5 a conversion table memory that stores a conversion table showing correspondences between parameters of a header of an Internet protocol packet and parameters of a control signal portion of the non-Internet protocol network signal; and

a header forming section that forms the control signal
10 portion of the non-Internet protocol network signal from header information of the Internet protocol packet.

Claim 2 The converter according to claim 1, further comprising:

15 a communicating party selecting section that selects a communicating party of the Internet protocol packet from header information of an input Internet protocol packet; and

a transmission content selecting section that selects a transmission content from the header information of the Internet
20 protocol packet, wherein:

the conversion table memory stores conversion per communicating party and groups that perform communication; and

the header forming section forms a control signal portion
25 of the non-Internet protocol network signal with reference to the communicating party selected by the communicating party selecting section and the transmission content selected by the

transmission content selecting section.

Claim 3 The converter according to claim 2, wherein:

the communicating party selecting section selects a
5 communicating party of the non-Internet protocol network signal
from the control signal portion of the input non-Internet protocol
network signal;

the transmission content selecting section selects a
transmission content from the control signal portion of the
10 non-Internet protocol network signal; and

the header forming section forms a header information of
an Internet protocol packet with reference to a conversion table
corresponding to the communicating party selected by the
communicating party selecting section and the transmission
15 content selected by the transmission content selecting section.

Claim 4 The converter according to claim 2, comprising a
first synthesizing section divides the data of the Internet
protocol packet into data having a predetermined length and
20 synthesizes the divided data with the control signal portion
formed by the header forming section to generate a non-Internet
protocol network signal.

Claim 5 The converter according to claim 4, further
25 comprising a transmission permission/impermission determining
section that outputs the signal output from the first synthesizing
section to the non-Internet protocol network within a limited

time to comply with a wireless communication standard, and discards the signal output from the first synthesizing section when the limited time to comply with the wireless communication standard is over.

5

Claim 6 The converter according to claim 3, further comprising a second synthesizing section that couples the data of the non-Internet protocol network signal into data having a predetermined length and synthesizes the coupled data with the
10 header information formed by the header forming section with each other to generate an Internet protocol packet.

Claim 7 The converter according to claim 6, comprising a transmission timing control section that outputs an Internet
15 protocol packet output from the second synthesizing section to the Internet protocol network at a timing to comply with a communication standard.

Claim 8 An information converting method for converting
20 information between an Internet protocol network and a non-Internet protocol network, comprising:

 a communicating party selecting step of selecting a communicating party of the Internet protocol packet from header information of an input Internet protocol packet;

25 a transmission content selecting step of selecting a transmission content from the header information of the Internet protocol packet;

a conversion table selecting step of selecting a conversion table corresponding to the communicating party selected by the communicating party selecting section and the transmission content selected by the content selecting section from a conversion table memory that stores conversion table showing correspondences between parameters of headers of Internet protocol packets and parameters of communication signal parts of signals of a non-Internet protocol network per communicating party or per communicating group; and

10 a header forming step of forming a control signal portion of the non-Internet protocol network signal from the header information of the Internet protocol packet with reference to the selected conversion table.