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NAKAMURA et al.

(54) **INFORMATION EXCHANGE METHOD, INFORMATION PROCESSOR, INFORMATION GATHERING SYSTEM, COMMUNICATION METHOD, COMMUNICATION SYSTEM, INTERMEDIARY DEVICE, AND COMMUNICATION DEVICE**

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(52) **U.S. Cl.** **709/203**

(57) **ABSTRACT**

The present invention relates to, for transmitting information by a server from an information gathering device to a terminal device, an information exchange method, an information processor, a communication method, a communication system, an intermediary device, and a communication device. It is directed to provide an information exchange method, an information processor, a communication method, a communication system, an intermediary device, and a communication device with which pieces of streaming video information gathered by a number of information gathering devices can be exchanged efficiently. A feature thereof lies in linking each of the terminal devices to the information gathering device that gathers a given number of pieces of streaming video information that are asked for from its linked terminal device, out of the plurality information gathering devices, directing the information gathering devices to deliver the given number of pieces of streaming video information directly to their linked terminal device, and producing and displaying, by the terminal devices, a predetermined certain screen including a given number of streaming video images that has been delivered.

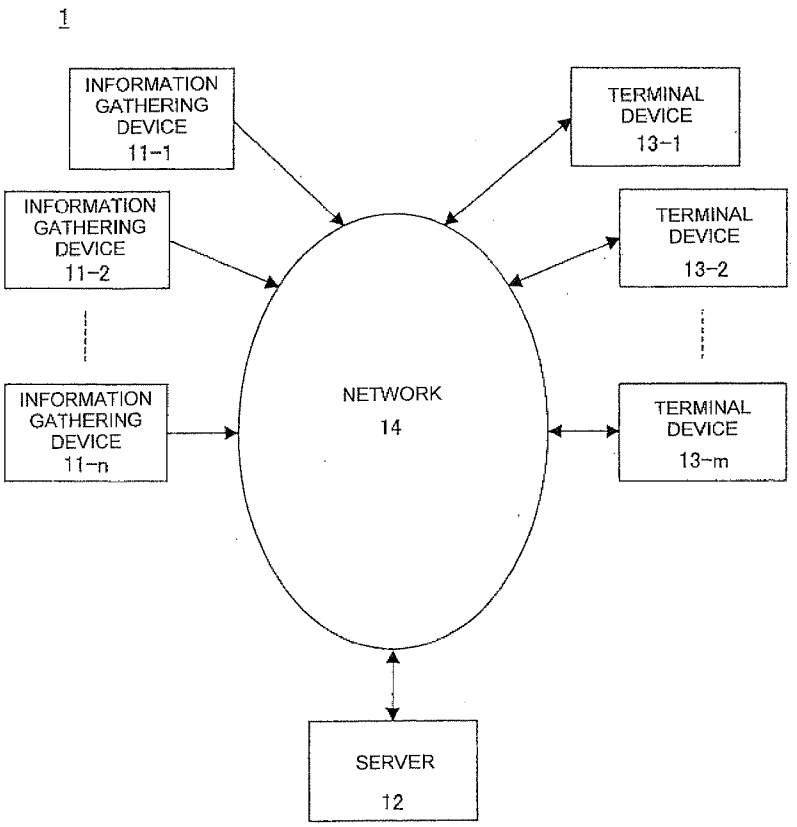


FIG.1

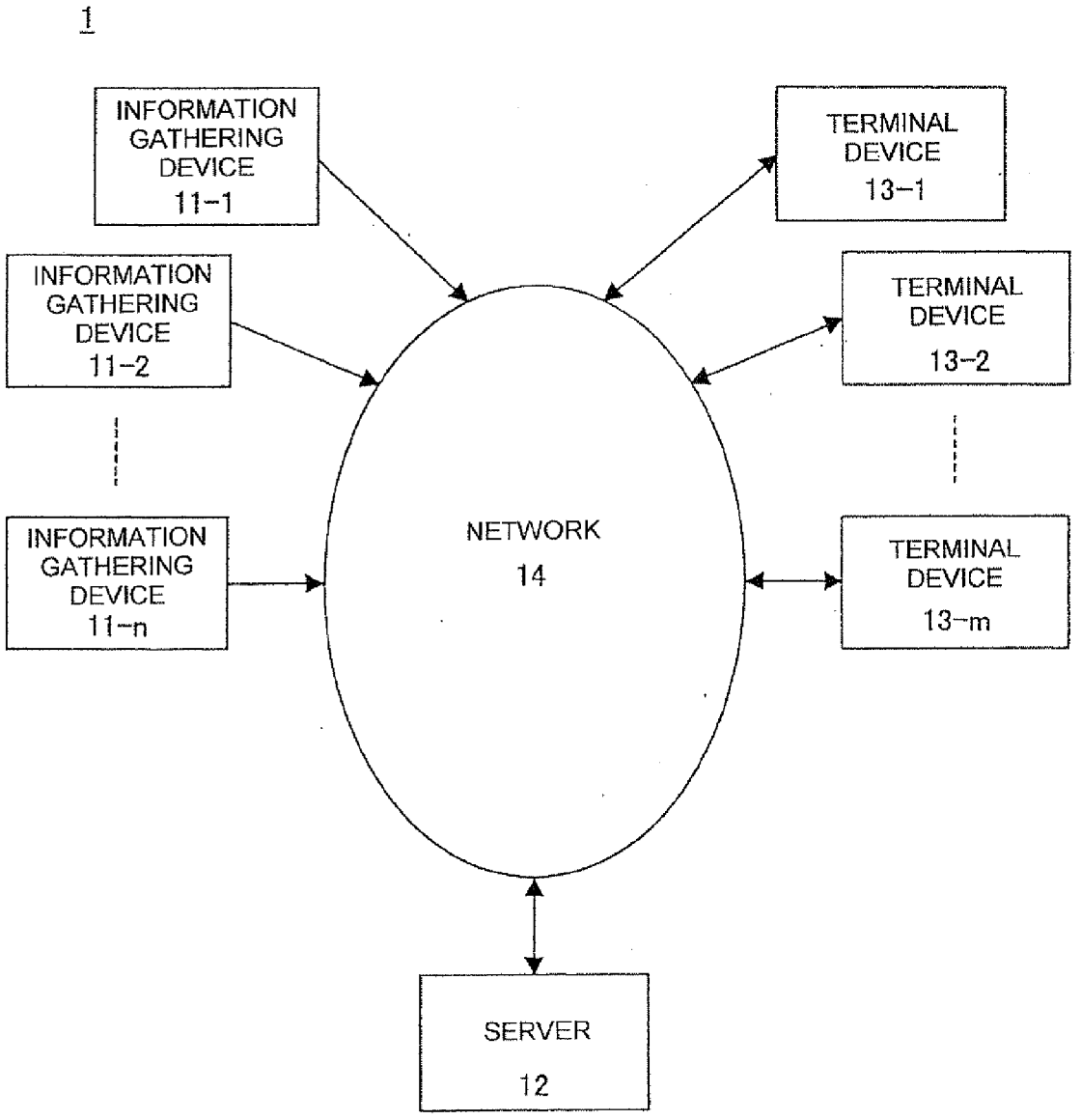

1
INFORMATION GATHERING DEVICE 11-1
INFORMATION GATHERING DEVICE 11-2
INFORMATION GATHERING DEVICE 11-n
NETWORK 14
SERVER 12
TERMINAL DEVICE 13-1
TERMINAL DEVICE 13-2
TERMINAL DEVICE 13-m

FIG.2

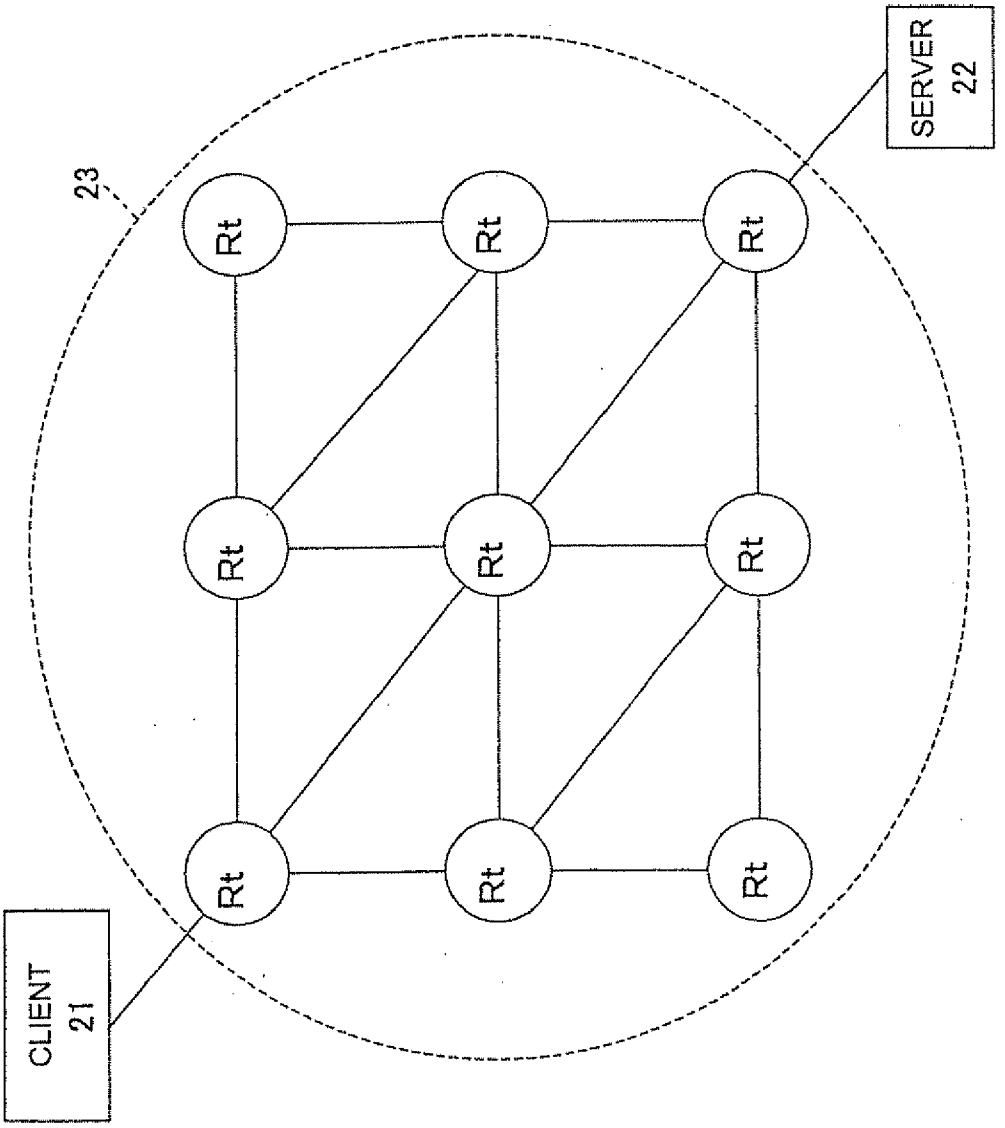


FIG.3

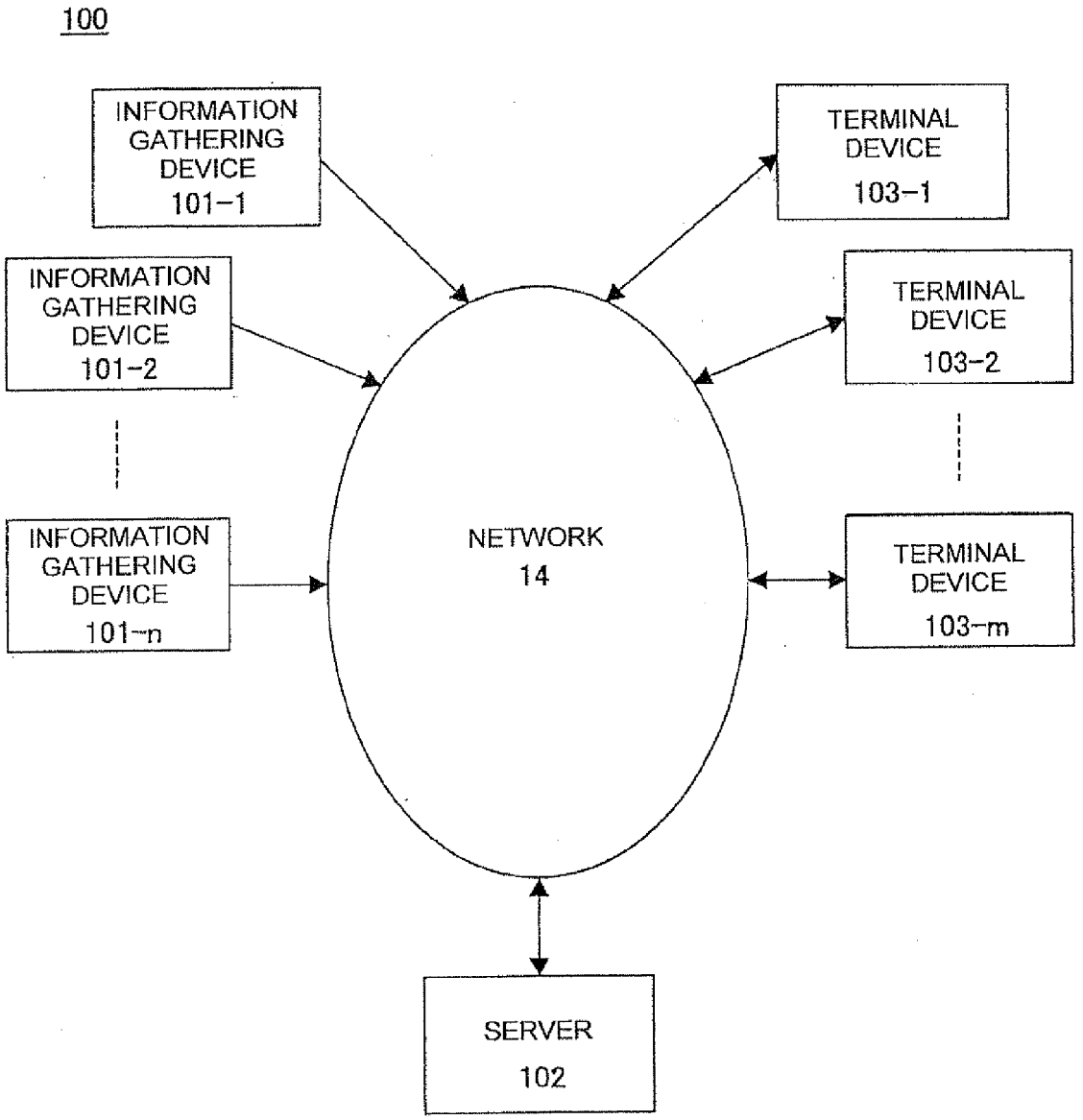

100
INFORMATION GATHERING DEVICE 101-1
INFORMATION GATHERING DEVICE 101-2
INFORMATION GATHERING DEVICE 101-n
NETWORK 14
TERMINAL DEVICE 103-1
TERMINAL DEVICE 103-2
TERMINAL DEVICE 103-m
SERVER 102

FIG.4

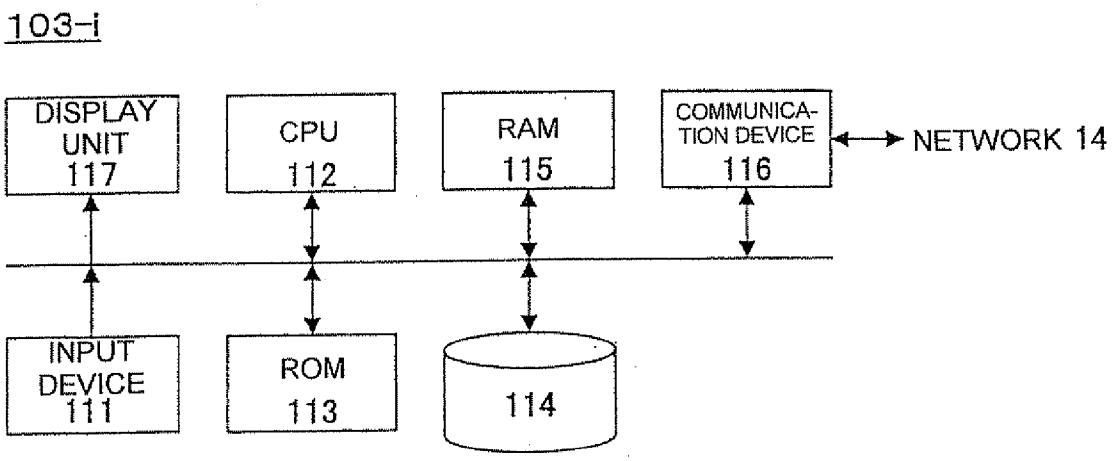

103-i
DISPLAY UNIT 117
CPU 112
RAM 115
COMMUNICATION DEVICE 116
NETWORK 14
INPUT DEVICE 111
ROM 113
114

FIG.5

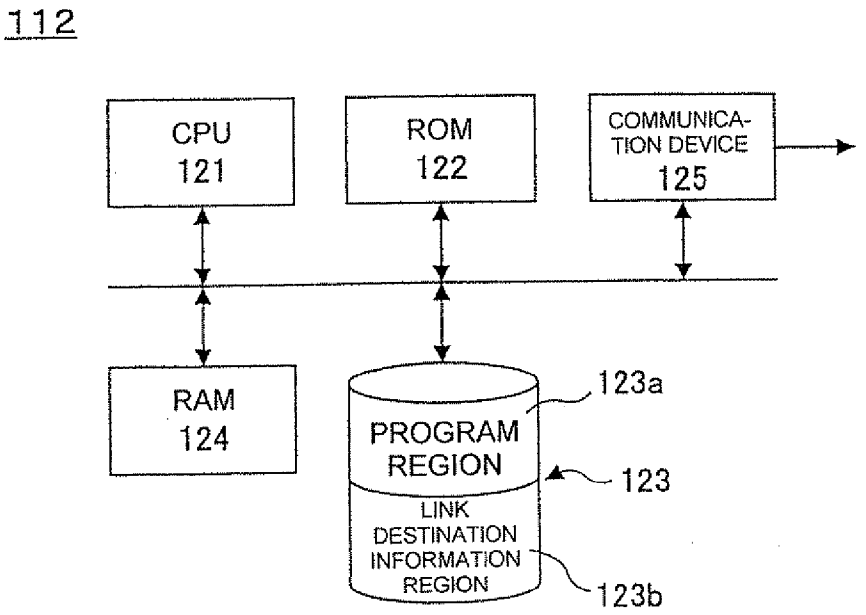

112
CPU 121
ROM 122
COMMUNICATION DEVICE 125
RAM 124
PROGRAM REGION
123a
123
LINK DESTINATION INFORMATION REGION
123b

FIG.6

SELECTION CHANNEL	LINK DESTINATION ADDRESS
S 1	A 1
S 2	A 2
:	:
S k	A k

FIG.7

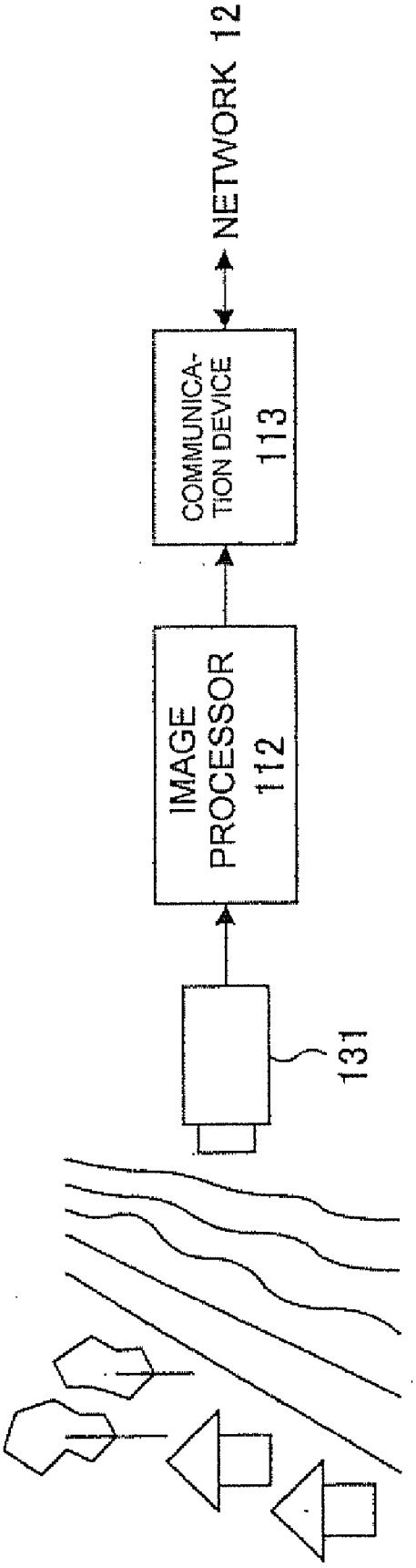

NETWORK 12
COMMUNICA-TION DEVICE 113
IMAGE PROCESSOR 112
131

FIG.8

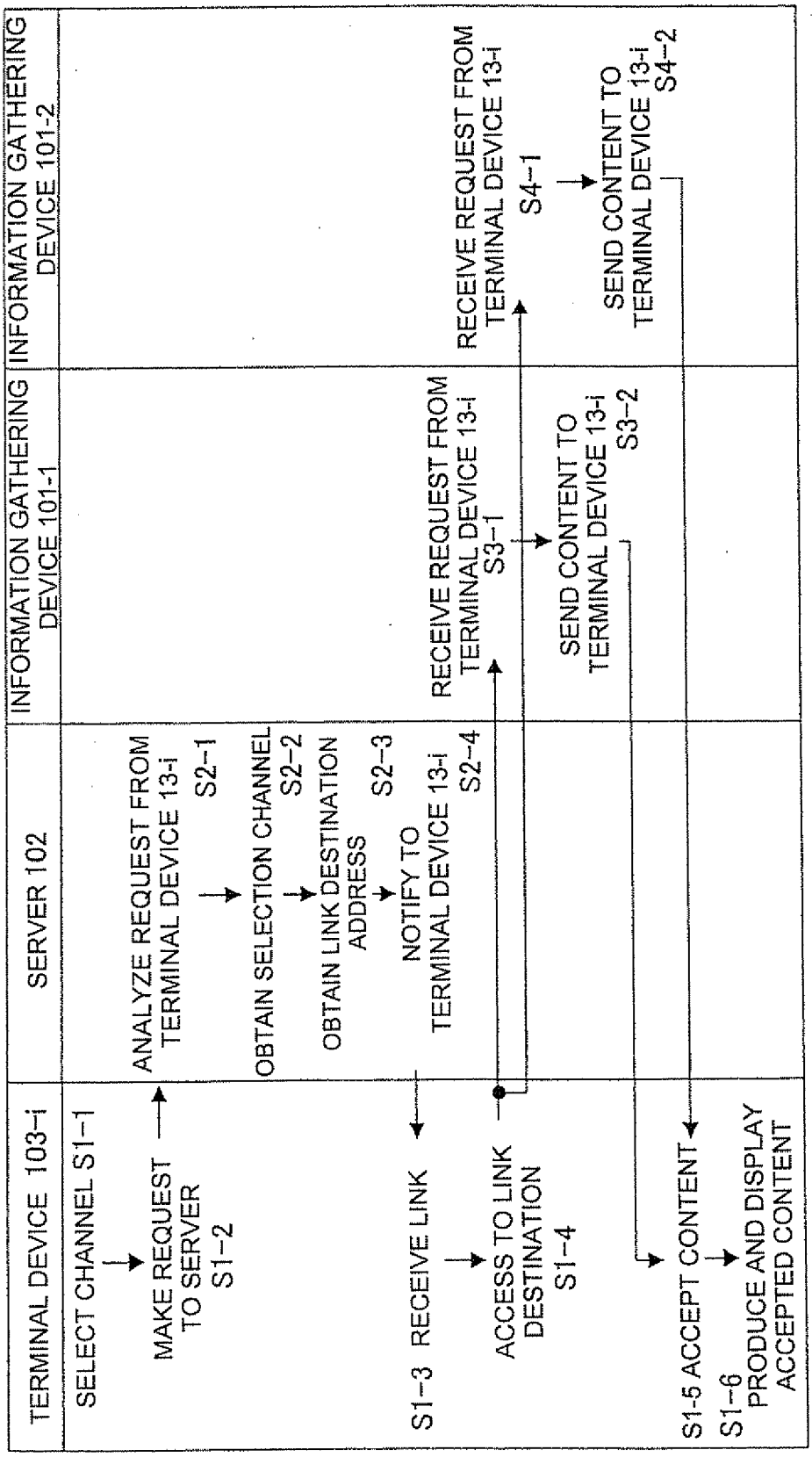

TERMINAL DEVICE 103-i
SERVER 102
INFORMATION GATHERING DEVICE 101-1
INFORMATION GATHERING DEVICE 101-2
SELECT CHANNEL S1-1
MAKE REQUEST TO SERVER S1-2
ANALYZE REQUEST FROM TERMINAL DEVICE 13-i S2-1
OBTAIN SELECTION CHANNEL S2-2
OBTAIN LINK DESTINATION ADDRESS S2-3
NOTIFY TO TERMINAL DEVICE 13-i S2-4
RECEIVE REQUEST FROM TERMINAL DEVICE 13-i S3-1
RECEIVE REQUEST FROM TERMINAL DEVICE 13-i S4-1
S1-3 RECEIVE LINK
ACCESS TO LINK DESTINATION S1-4
SEND CONTENT TO TERMINAL DEVICE 13-i S3-2
SEND CONTENT TO TERMINAL DEVICE 13-i S4-2
S1-5 ACCEPT CONTENT
S1-6 PRODUCE AND DISPLAY ACCEPTED CONTENT

FIG.9

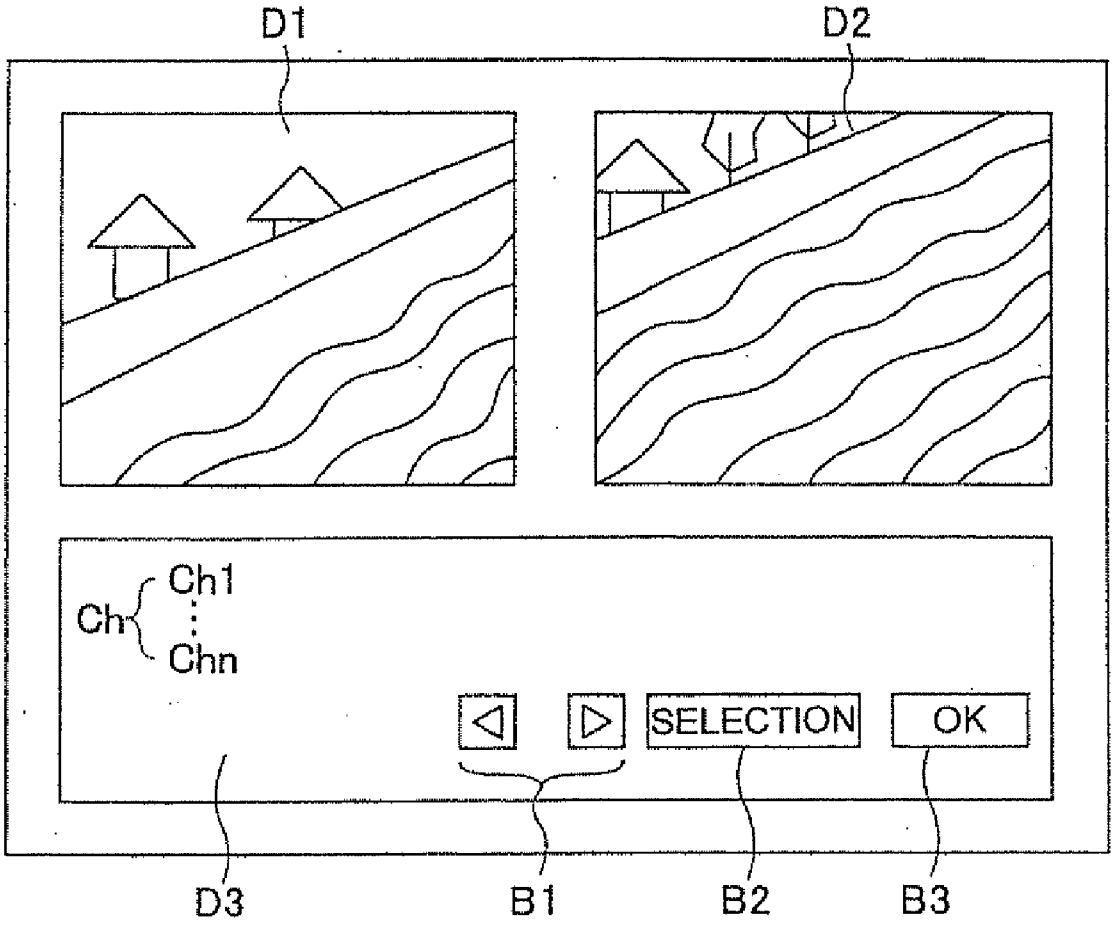


FIG.10

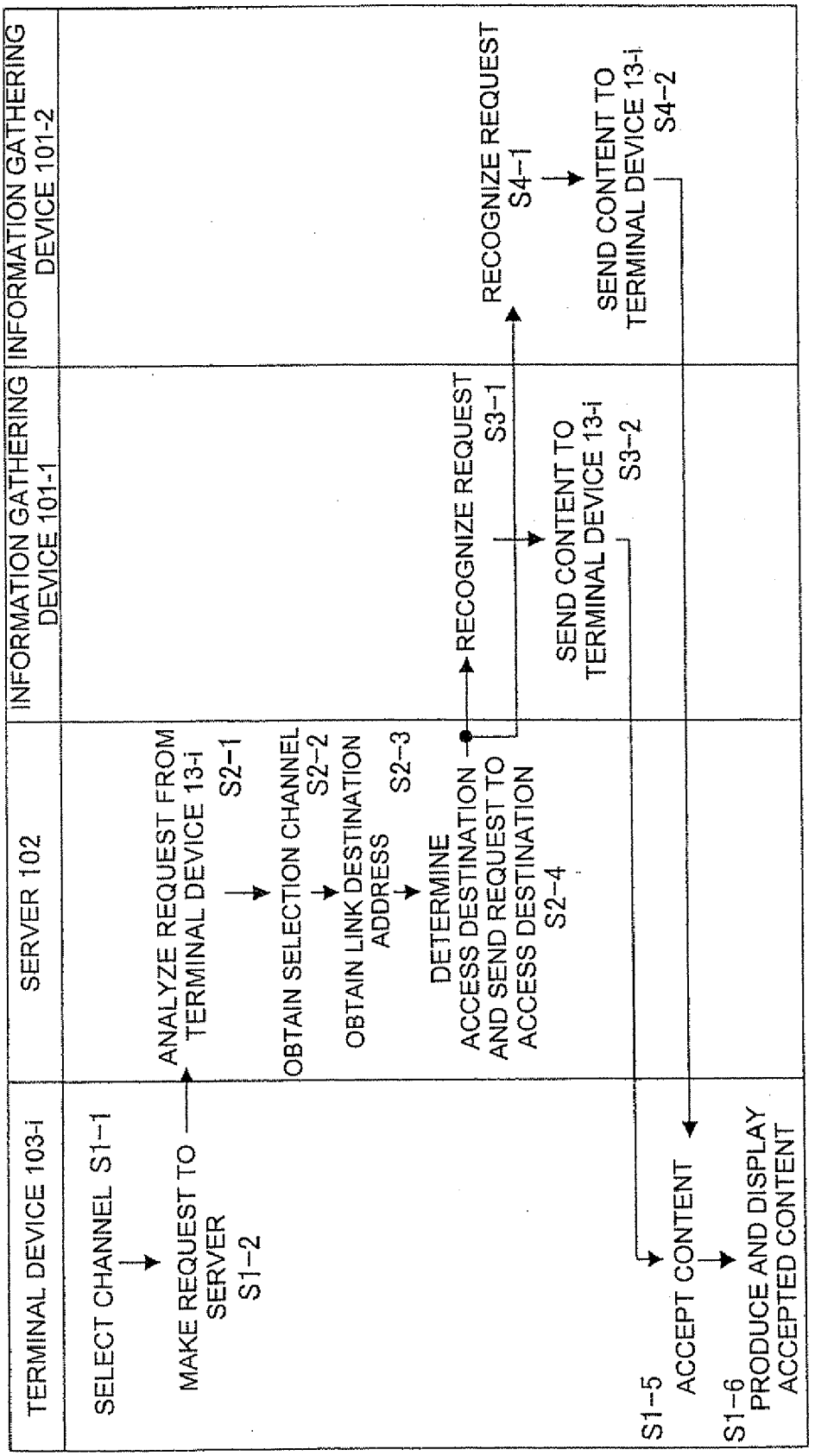

TERMINAL DEVICE 103-i
SERVER 102
INFORMATION GATHERING DEVICE 101-1
INFORMATION GATHERING DEVICE 101-2
SELECT CHANNEL S1-1
MAKE REQUEST TO SERVER S1-2
ANALYZE REQUEST FROM TERMINAL DEVICE 13-i S2-1
OBTAIN SELECTION CHANNEL S2-2
OBTAIN LINK DESTINATION ADDRESS S2-3
DETERMINE ACCESS DESTINATION AND SEND REQUEST TO ACCESS DESTINATION S2-4
RECOGNIZE REQUEST S3-1
SEND CONTENT TO TERMINAL DEVICE 13-i S3-2
RECOGNIZE REQUEST S4-1
SEND CONTENT TO TERMINAL DEVICE 13-i S4-2
S1-5 ACCEPT CONTENT
S1-6 PRODUCE AND DISPLAY ACCEPTED CONTENT

FIG.11

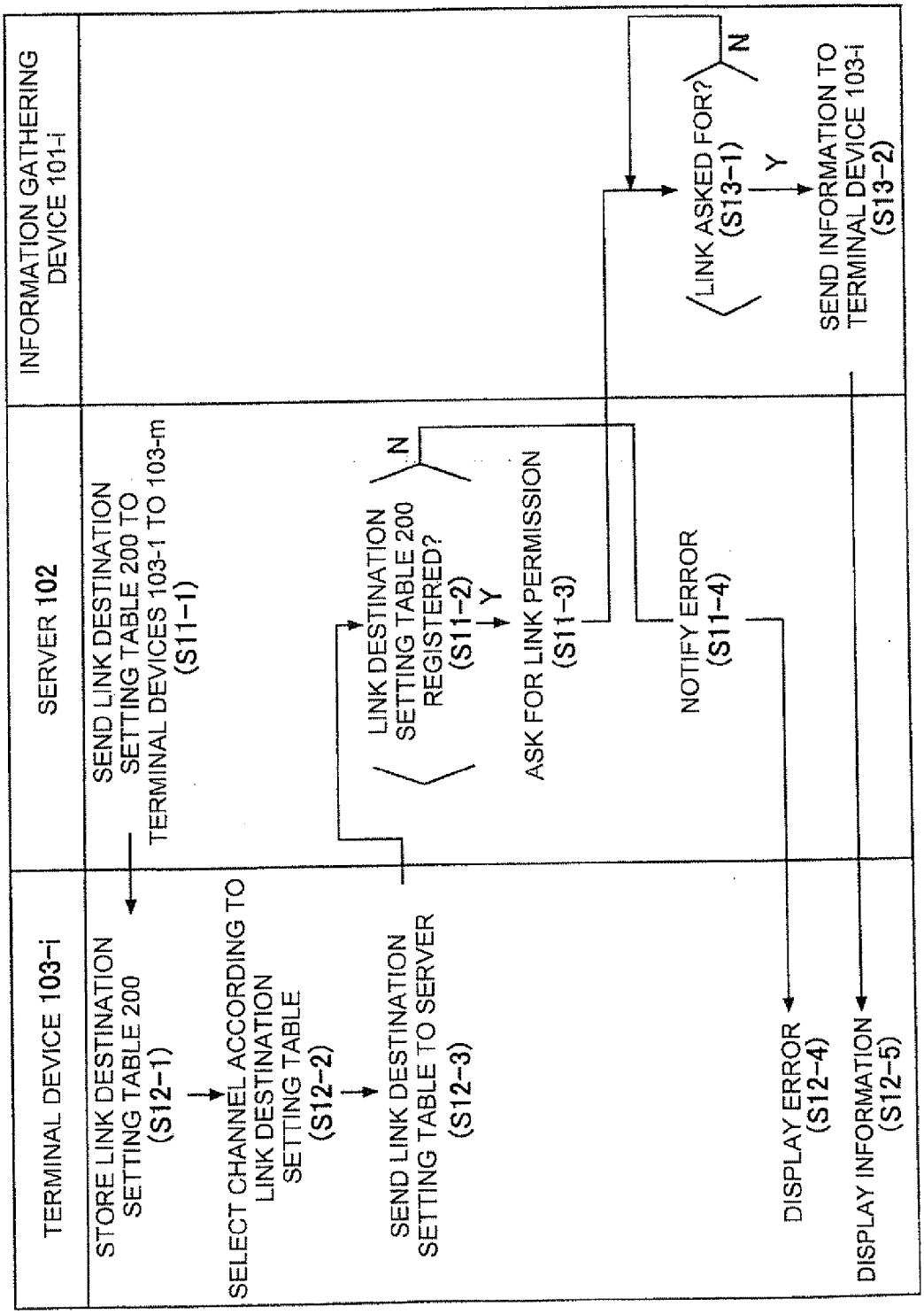

TERMINAL DEVICE 103-i
SERVER 102
INFORMATION GATHERING DEVICE 101-i
STORE LINK DESTINATION SETTING TABLE 200 (S12-1)
SEND LINK DESTINATION SETTING TABLE 200 TO TERMINAL DEVICES 103-1 TO 103-m (S11-1)
SELECT CHANNEL ACCORDING TO LINK DESTINATION SETTING TABLE (S12-2)
SEND LINK DESTINATION SETTING TABLE TO SERVER (S12-3)
LINK DESTINATION SETTING TABLE 200 REGISTERED? (S11-2)
N
Y
ASK FOR LINK PERMISSION (S11-3)
NOTIFY ERROR (S11-4)
LINK ASKED FOR? (S13-1)
N
Y
SEND INFORMATION TO TERMINAL DEVICE 103-i (S13-2)
DISPLAY ERROR (S12-4)
DISPLAY INFORMATION (S12-5)

FIG.12

200

CHANNEL	GENRE CODE	URL
ch1	0	http://www.aaa.jp/
ch2	0	http://www.bbb.jp/
ch3	0	http://www.ccc.jp/
ch4	1	http://www.ddd.jp/
⋮	⋮	⋮
chN	1	http://www.xxx.jp/

FIG.13

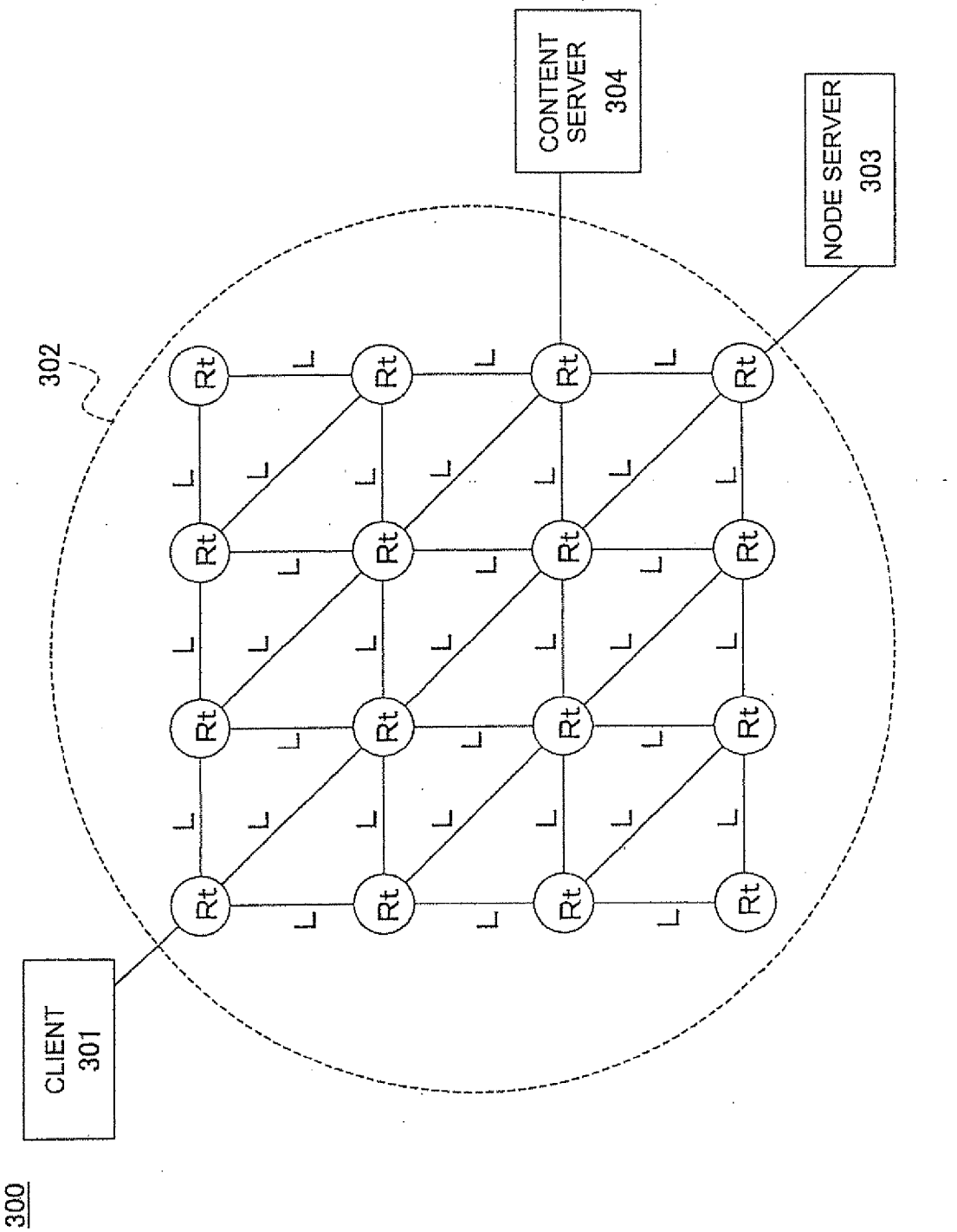


FIG.14

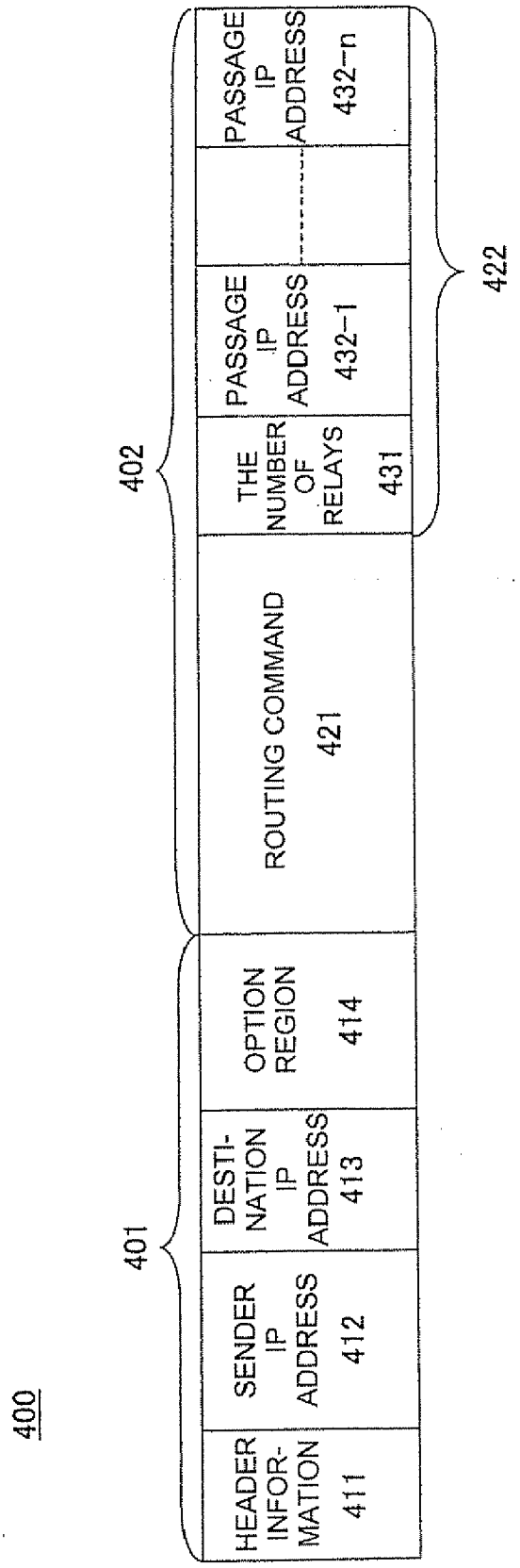

400
401
402
422
HEADER INFOR-MATION 411
SENDER IP ADDRESS 412
DESTI-NATION IP ADDRESS 413
OPTION REGION 414
ROUTING COMMAND 421
THE NUMBER OF RELAYS 431
PASSAGE IP ADDRESS 432-1
PASSAGE IP ADDRESS 432-n

FIG.15

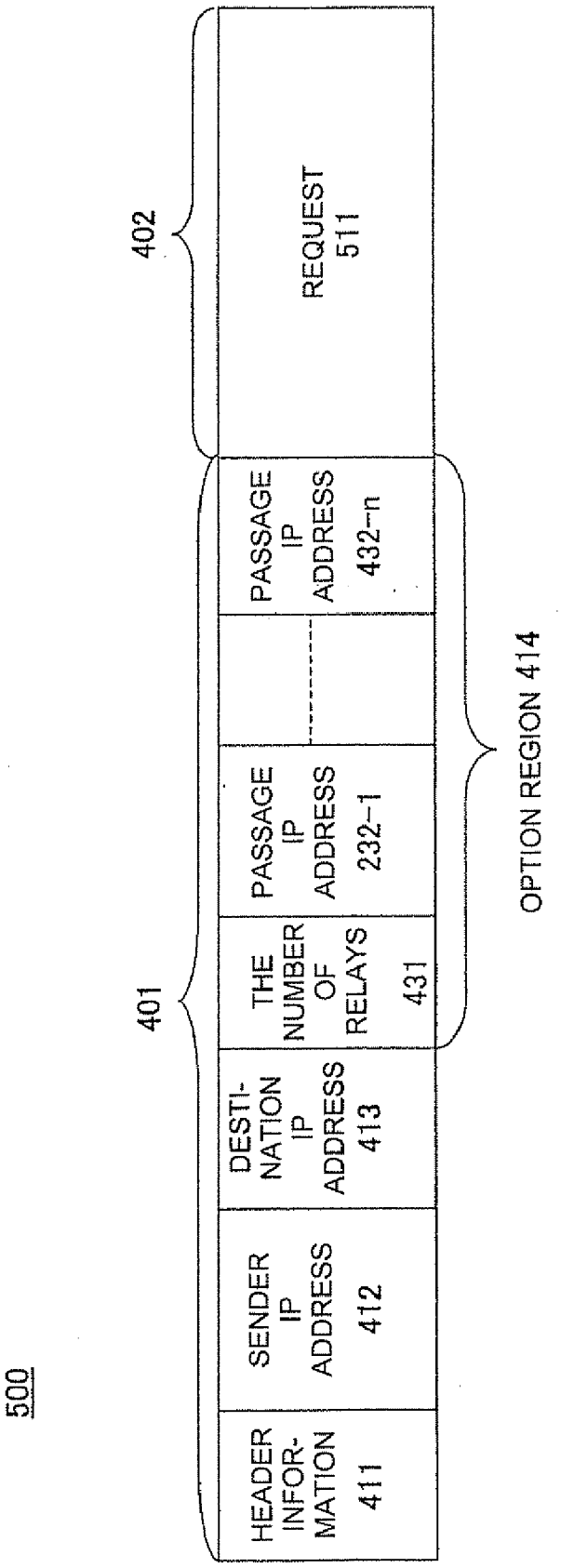

500
401
402
HEADER INFOR-MATION 411
SENDER IP ADDRESS 412
DESTI-NATION IP ADDRESS 413
THE NUMBER OF RELAYS 431
PASSAGE IP ADDRESS 232-1
PASSAGE IP ADDRESS 432-n
REQUEST 511
OPTION REGION 414

FIG.16

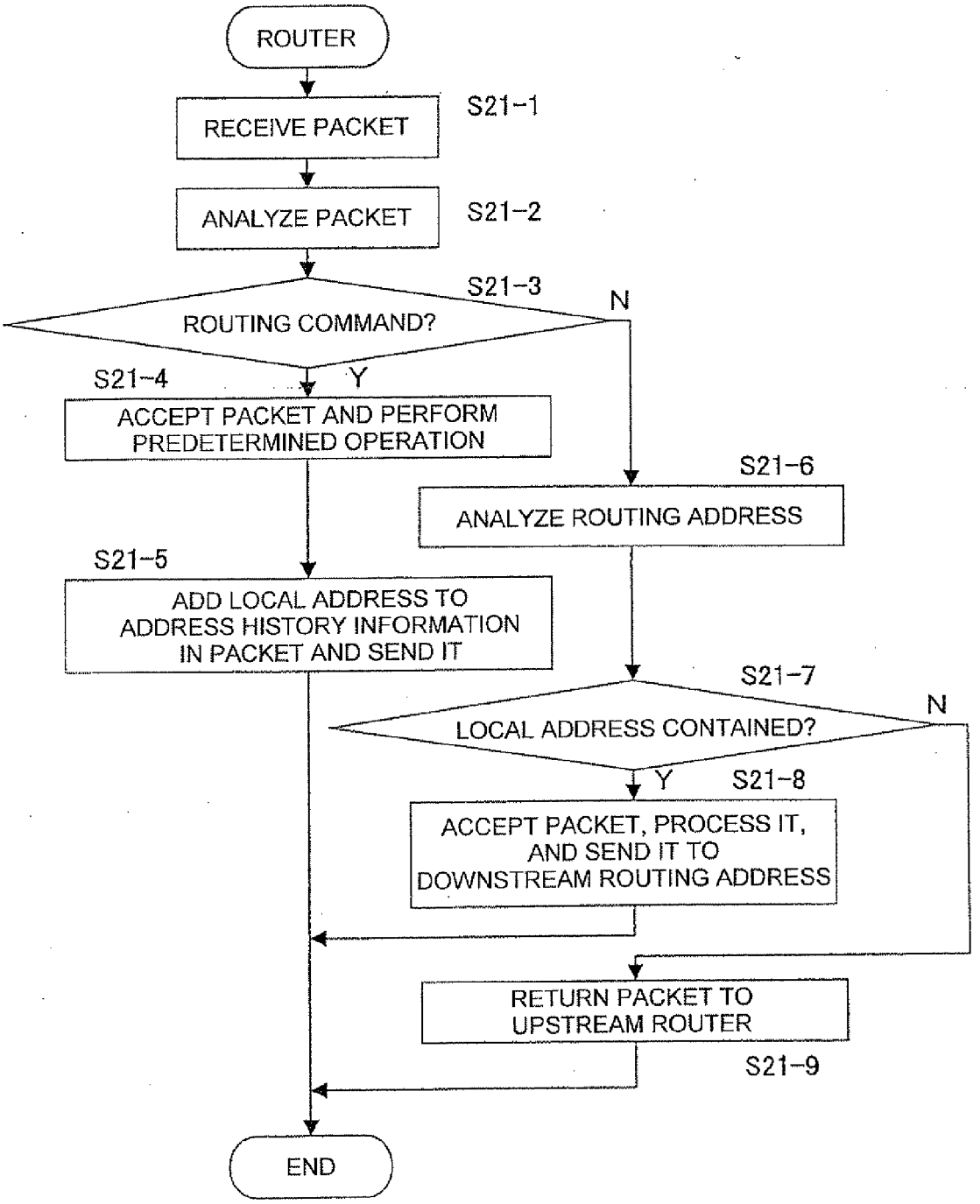

ROUTER
RECEIVE PACKET
S21-1
ANALYZE PACKET
S21-2
S21-3
ROUTING COMMAND?
N
Y
S21-4
ACCEPT PACKET AND PERFORM PREDETERMINED OPERATION
S21-6
ANALYZE ROUTING ADDRESS
S21-5
ADD LOCAL ADDRESS TO ADDRESS HISTORY INFORMATION IN PACKET AND SEND IT
S21-7
LOCAL ADDRESS CONTAINED?
N
Y
S21-8
ACCEPT PACKET, PROCESS IT, AND SEND IT TO DOWNSTREAM ROUTING ADDRESS
RETURN PACKET TO UPSTREAM ROUTER
S21-9
END

FIG.17

600

ROUTE NAME	IP ADDRESS		
R1	A11	...	A1m
:	:	:	:
Rn	An1	...	Anm

FIG.18

700

ROUTE	TIME PERIOD	RATE	RESPONSE TIME
R1	T11~T12	S1	Tres1
:	:	:	:
Rn	Tn1~Tn2	Sn	Tresn

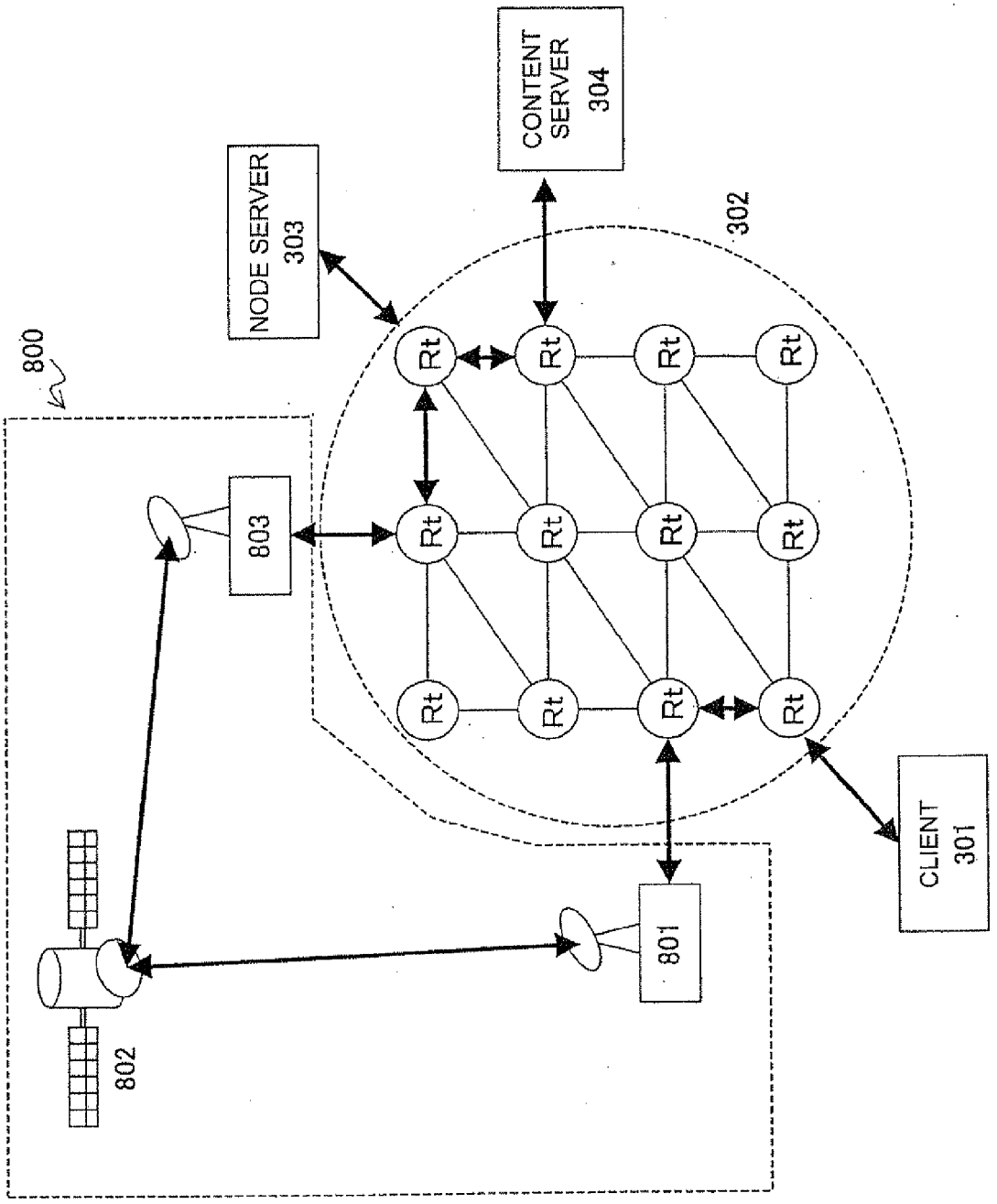

800
NODE SERVER
303
CONTENT
SERVER
304
302
Rt
803
801
802
CLIENT
301

FIG.19

FIG.20

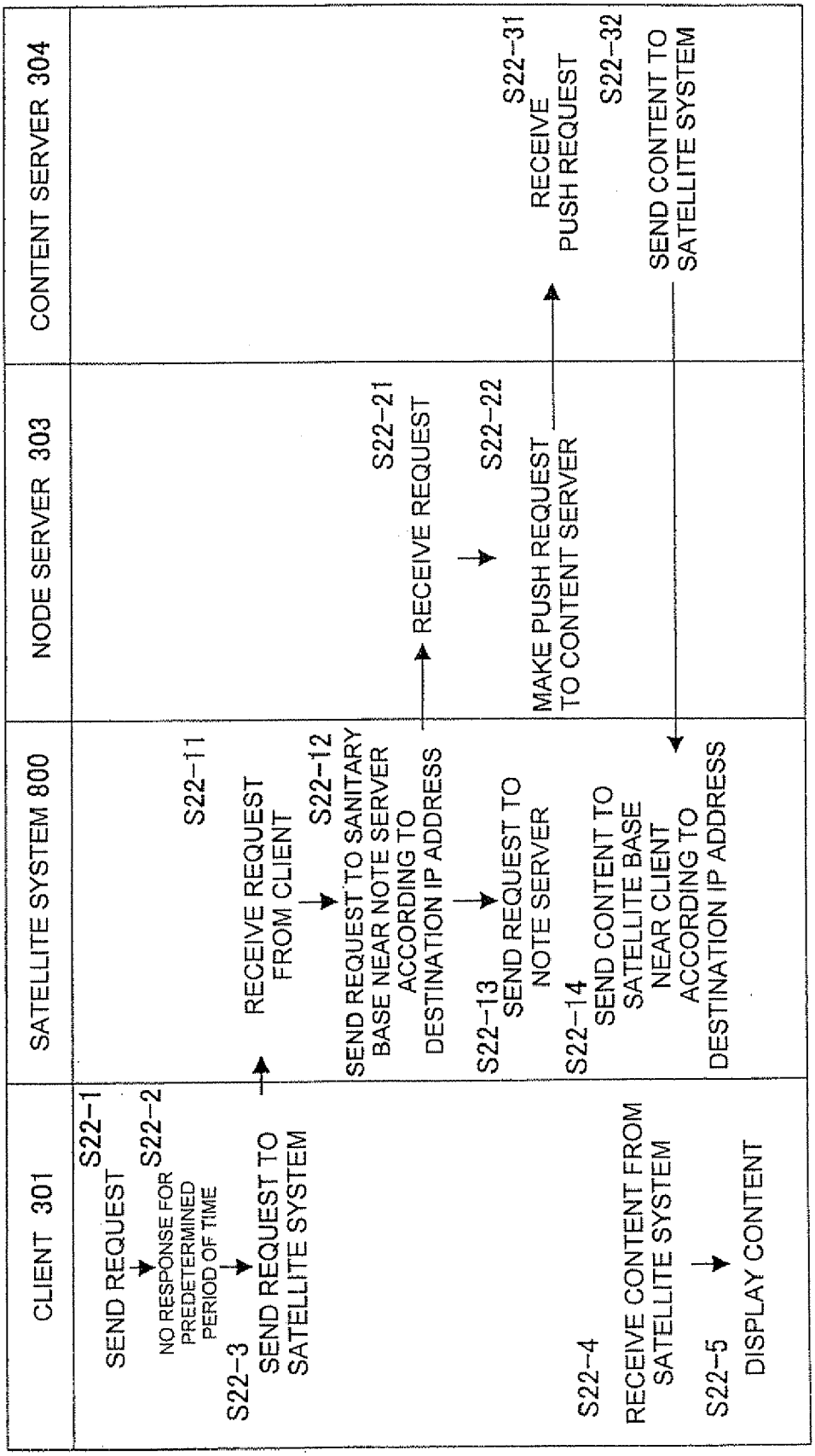

CLIENT 301
SATELLITE SYSTEM 800
NODE SERVER 303
CONTENT SERVER 304
S22-1
SEND REQUEST
S22-2
NO RESPONSE FOR PREDETERMINED PERIOD OF TIME
S22-3
SEND REQUEST TO SATELLITE SYSTEM
S22-11
RECEIVE REQUEST FROM CLIENT
S22-12
SEND REQUEST TO SANITARY BASE NEAR NOTE SERVER ACCORDING TO DESTINATION IP ADDRESS
S22-21
RECEIVE REQUEST
S22-22
MAKE PUSH REQUEST TO CONTENT SERVER
S22-31
RECEIVE PUSH REQUEST
S22-32
SEND CONTENT TO SATELLITE SYSTEM
S22-13
SEND REQUEST TO NOTE SERVER
S22-14
SEND CONTENT TO SATELLITE BASE NEAR CLIENT ACCORDING TO DESTINATION IP ADDRESS
S22-4
RECEIVE CONTENT FROM SATELLITE SYSTEM
S22-5
DISPLAY CONTENT

FIG.21

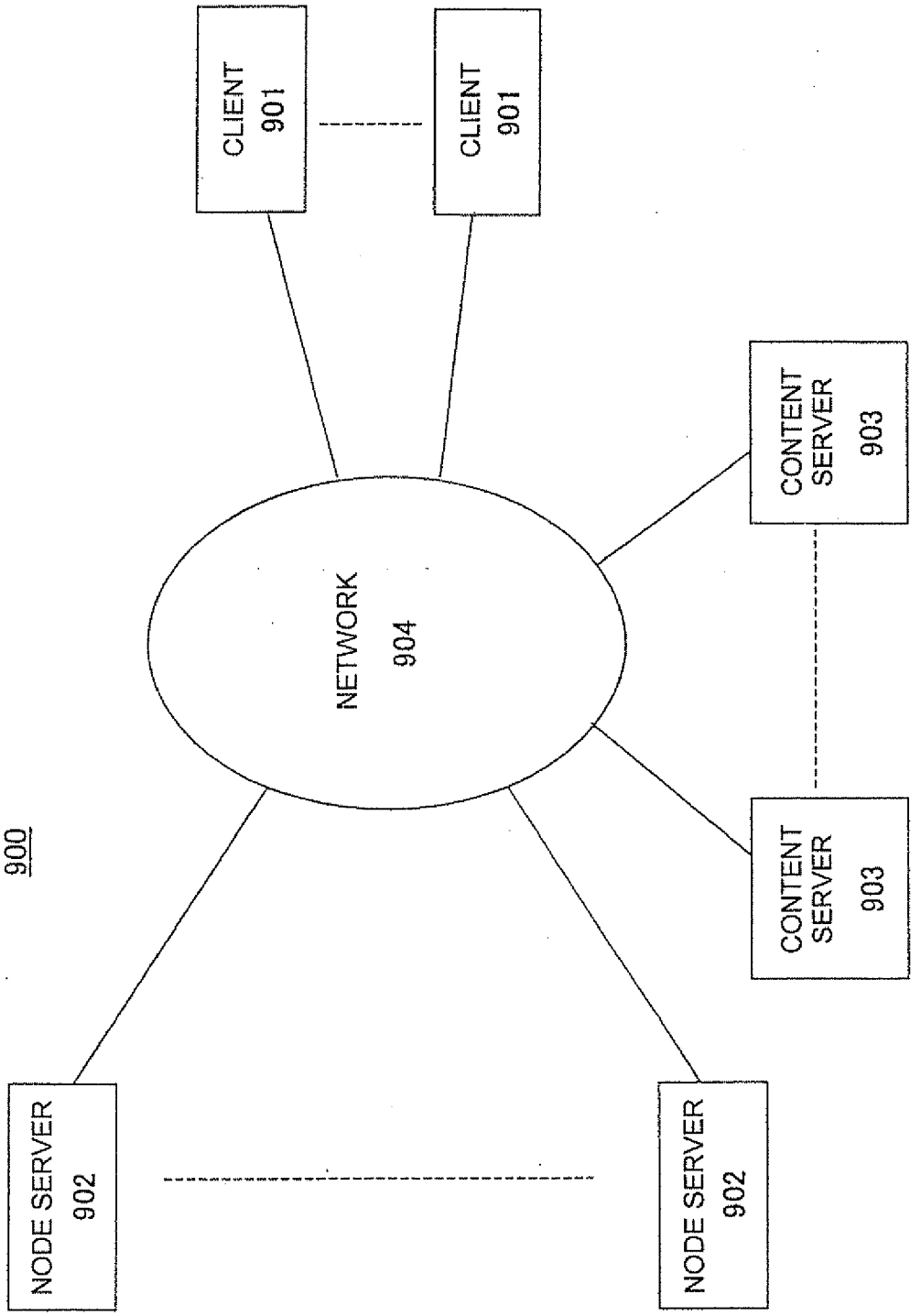

900
CLIENT 901
CLIENT 901
NETWORK 904
CONTENT SERVER 903
CONTENT SERVER 903
NODE SERVER 902
NODE SERVER 902

FIG.22

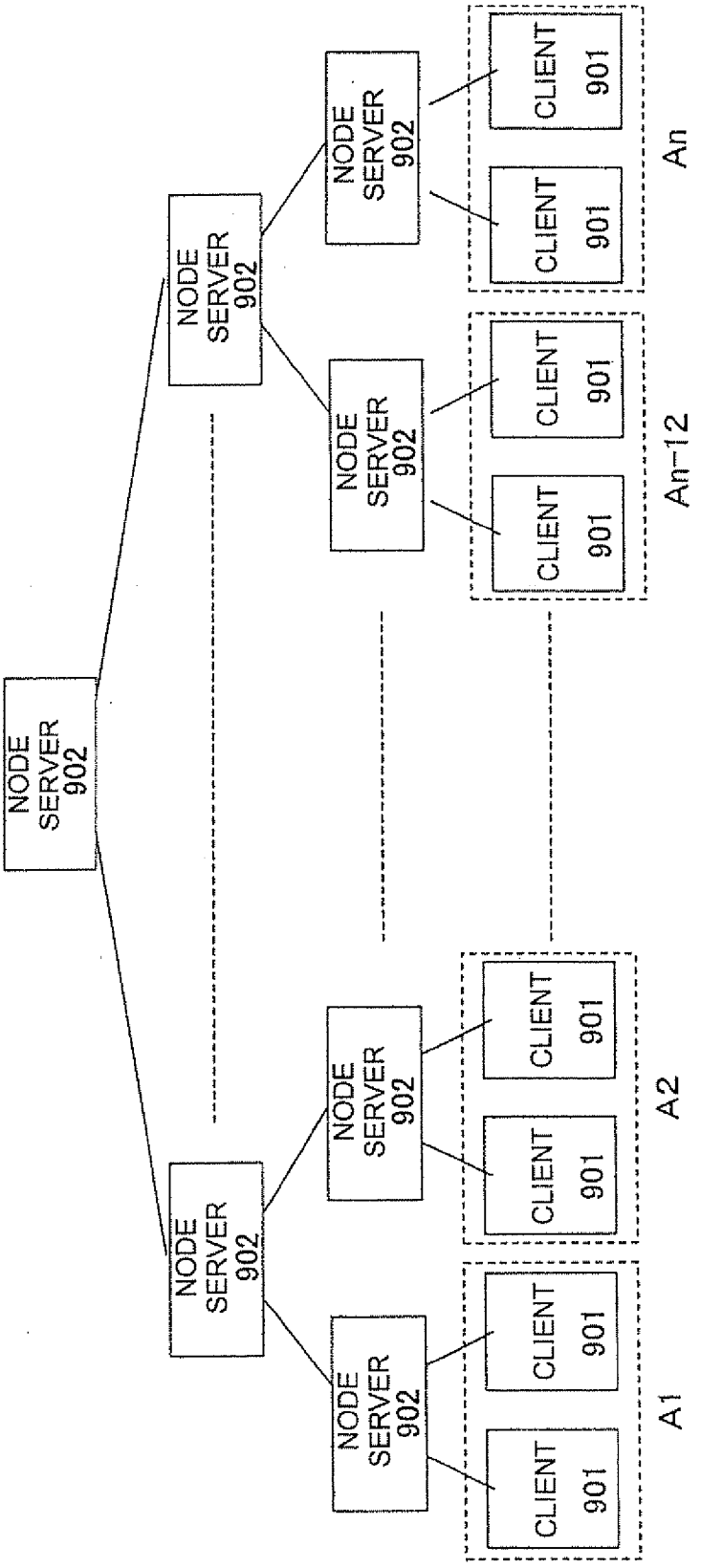

NODE SERVER 902
NODE SERVER 902
NODE SERVER 902
NODE SERVER 902
NODE SERVER 902
NODE SERVER 902
CLIENT 901
CLIENT 901
CLIENT 901
CLIENT 901
CLIENT 901
CLIENT 901
CLIENT 901
CLIENT 901
A1
A2
An-12
An

FIG.23

911

			CONTENT C1	CONTENT C2	CONTENT C3	...
CHANNEL ch1	CONTENT SERVER		URL11	URL12	URL13	...
	CACHE TABLE ADDRESS		adr11	adr12 (INVALID ADDRESS)	adr13	...
	NODE SERVER		false	L2	false	...
CHANNEL ch2	CONTENT SERVER		URL21	URL22	URL23	...
	CACHE TABLE ADDRESS		adr21 (INVALID ADDRESS)	adr22	adr23	...
	NODE SERVER		L21	false	false	...
:	:		:	:	:	/

FIG.24

912

ADDRESS	DIRECTORY NAME	VALIDITY	TIME STAMP
adr1	d1	×	—
:	:	:	:
adr11	d11	○	t11
:	:	:	:

FIG.25

913

RANK	CONTENT	LINK DESTINATION	NUMBER OF RETRIEVALS	TIME	VOLUME
1	C1	L1 (http://www.fff)	h1	T1	10M
2	C2	L2 (http://www.ggg)	h2	T2	20M
3	C3	L3	h3	T3	10M
:	:	:	:	:	:

FIG.26

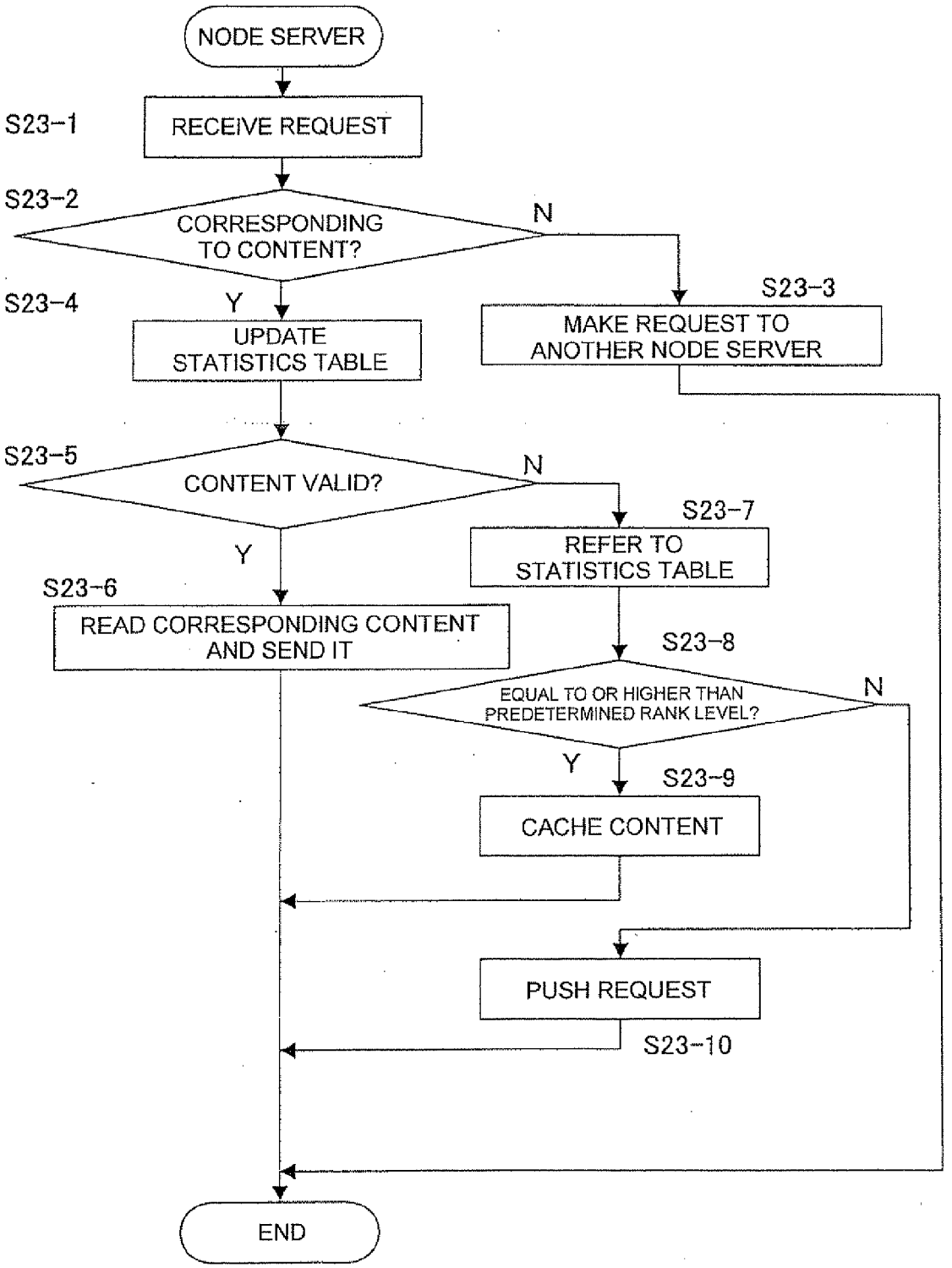
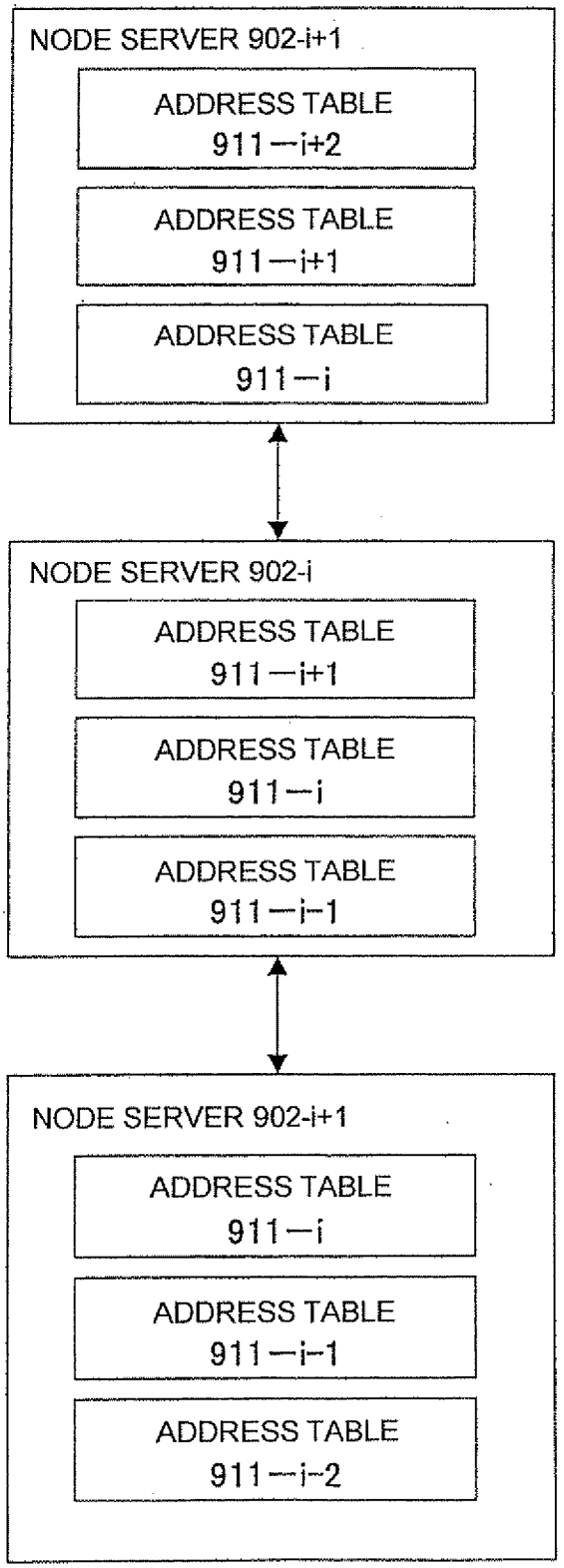

NODE SERVER
S23-1
RECEIVE REQUEST
S23-2
CORRESPONDING TO CONTENT?
N
S23-3
MAKE REQUEST TO ANOTHER NODE SERVER
Y
S23-4
UPDATE STATISTICS TABLE
S23-5
CONTENT VALID?
N
S23-7
REFER TO STATISTICS TABLE
Y
S23-6
READ CORRESPONDING CONTENT AND SEND IT
S23-8
EQUAL TO OR HIGHER THAN PREDETERMINED RANK LEVEL?
N
Y
S23-9
CACHE CONTENT
PUSH REQUEST
S23-10
END

FIG.27


NODE SERVER 902-i+1
ADDRESS TABLE 911—i+2
ADDRESS TABLE 911—i+1
ADDRESS TABLE 911—i
NODE SERVER 902-i
ADDRESS TABLE 911—i+1
ADDRESS TABLE 911—i
ADDRESS TABLE 911—i-1
NODE SERVER 902-i+1
ADDRESS TABLE 911—i
ADDRESS TABLE 911—i-1
ADDRESS TABLE 911—i-2

INFORMATION EXCHANGE METHOD, INFORMATION PROCESSOR, INFORMATION GATHERING SYSTEM, COMMUNICATION METHOD, COMMUNICATION SYSTEM, INTERMEDIARY DEVICE, AND COMMUNICATION DEVICE

TECHNICAL FIELD

[0001] The present invention relates to an information exchange method, an information processor, an information gathering system, a communication method, a communication system, an intermediary device, and a communication device, and more particularly, for transmitting information by a server from an information gathering device to a terminal device, to an information exchange method, and an information processor, an information gathering system, a communication method, a communication system, an intermediary device, and a communication device.

BACKGROUND ART

[0002] FIG. **1** is a diagram showing a system configuration of a conventional information exchange system.

[0003] Conventional information exchange system **1** is configured in such a manner that information gathering devices **11-1** to **11-*n***, a server **12**, and terminal devices **13-1** to **13-*m*** are allowed to communicate with each other through a network **14**.

[0004] The information gathering devices **11-1** to **11-*n*** may be, for example, video cameras that take pictures of their surroundings to collect pieces of live streaming video image information. It should be noted that the information gathering devices **11-1** to **11-*n*** may be those that provide pieces of streaming video information in real time.

[0005] The n pieces of real-time and/or live streaming video image information gathered by the information gathering devices **11-1** to **11-*n*** are supplied to the server **12** through the network **14**. The server **12** distributes and delivers these pieces of real-time and/or live streaming video image information gathered by the information gathering devices **11-1** to **11-*n*** to the individual terminal devices **13-1** to **13-*m***, in answer to a request from the terminal devices **13-1** to **13-*m***.

[0006] It should be noted that the conventional information gathering systems of the type described are designed for cases where the number of pieces of the streaming video image information to be exchanged is more overwhelming than the number of users, so the server **12** is required to have a high processing capacity.

[0007] To this end, the conventional information exchange methods of the type described collect the pieces of streaming video information gathered by the information gathering devices **11-1** to **11-*n*** on the server **12** before distributing and delivering them to the terminal devices **13-1** to **13-*m*** in answer to their requests. Therefore, problems lie in that it causes huge processing loads on the server **12**.

[0008] In addition, the server **12** is accessed by all terminal devices **13-1** to **13-*m*** that ask for the pieces of streaming video information gathered by the information gathering devices **11-1** to **11-*n***. Problems lie in that increase in the number of the terminal devices **13-1** to **13-*m*** gradually reduces the communication rate and, in some cases, may cause missing frames from the streaming video information.

[0009] FIG. **2** is a diagram for explaining the operation of a conventional content exchange system.

[0010] A content exchange system **20** is configured in such a manner that a client **21** and a server **22** are allowed to communicate with each other through a network **23**. Upon a request from the client **21** to the server **22**, the server **22** provides the client **21** with a content that is asked for by the client **21** through the network **23**.

[0011] In this event, a user should work on his or her client **21** to find a server **22** which includes a content that he or she needs and access that server **22**. In addition, he or she cannot choose a communication route from the client **21** to the server **22**.

[0012] In the network **23**, individual routers Rt can automatically determine the optimum route for communication, and data are transmitted through the communication route selected by these routers Rt.

[0013] As apparent from the above, any clients **21** wanting to obtain necessary content(s) should access a certain server**22** in the conventional content exchange system **20**, and they should find the server **22** which stores the content(s) they want. Therefore, problems lie in that user's operation becomes complicated.

[0014] In addition, in the conventional content exchange system **20**, a communication route is automatically selected by the routers Rt included in the network **23**. The routers Rt determine the optimum path depending on the traffic over their surrounding communication paths. They do not take into account the traffic on the downstream paths. Consequently, the overall communication rate of a selected route could possibly be slow. This means that the entire routing is not taken into account.

[0015] The present invention was made with respect to the above-mentioned issues, and an object thereof is to provide an information exchange method, an information processor, and an information gathering system with which pieces of streaming video information gathered by a number of information gathering devices can be exchanged efficiently.

[0016] In addition, the present invention was made with respect to the above-mentioned issues, and an object thereof is to provide a communication method, a communication system, an intermediary device, and a communication device with which a content that is asked for by a client can be obtained at a high speed.

SUMMARY OF THE INVENTION

[0017] The present invention is featured in linking each of the terminal devices to the information gathering device that gathers a given number of pieces of streaming video information that are asked for from its linked terminal device, out of the plurality information gathering devices, directing the information gathering devices to deliver the given number of pieces of streaming video information directly to their linked terminal device, and producing and displaying, by the terminal devices, a predetermined certain screen including a given number of streaming video images that has been delivered.

[0018] According to the present invention, the streaming video information is supplied to the terminal devices directly from the information gathering device(s) that are selected by a user. The server is not required to handle the streaming video information, so that operations in the server will be reduced. Each terminal device directly accesses a selected information gathering device or devices. Consequently, the

access to the information gathering devices is spread. The capacity of the information gathering devices is not necessary to be increased.

[0019] The present invention is also featured in that the server obtains a link destination address of the respective information gathering devices that gather the given number of streaming video images that are asked for from the terminal devices and notifies the terminal devices of their corresponding link destination addresses, each of the terminal devices being adapted to access the information gathering device specified by the link destination address that is obtained from the server in order to directly obtain a predetermined piece of streaming video information.

[0020] According to the present invention, the server is only required to obtain the link destination address of the respective information gathering devices that gather the given number of streaming video images that are asked for from the terminal devices and notifies the terminal devices of their corresponding link destination addresses. This reduces process loads.

[0021] In addition, the present invention is featured in that the server makes a request to each of the information gathering devices that gather a given number of streaming video images that are asked for from each of the terminal devices, the information gathering devices being directed to supply directly to their linked terminal devices the streaming video information in response to a request from the server.

[0022] According to the present invention, the server makes a request to each of the information gathering devices, and the information gathering devices are directed to supply directly to their linked terminal devices the streaming video information in response to a request from the server. This reduces the number of communication steps performed between the server and the terminal devices. Streaming video information can thus be exchanged at a high speed.

[0023] According to the present invention, the server makes a request to each of the information gathering devices, and the information gathering devices are directed to supply directly to their linked terminal devices the streaming video information in response to a request from the server, thereby the number of communication steps performed between the server and the terminal devices can be reduced and streaming video information can thus be exchanged at a high speed.

[0024] Furthermore, the present invention is featured in that each of the terminal devices accesses its linked information gathering device(s) according to a link destination setting table received by the server.

[0025] According to the present invention, the server sends the link destination setting table to the terminal devices, and each of the terminal devices accesses its linked content server (s) according to the link destination setting table. This prevents access concentration to a certain content server out of the content servers, so that loads on the content servers can be spread.

[0026] In addition, the present invention is featured in comparing the link destination setting table that is previously held therein with the link destination setting table that is sent from the terminal devices upon access to their linked information gathering devices in order to control access by the terminal devices.

[0027] According to the present invention, access control can be ensured by means of performing authorization using the link destination setting table received from the server.

[0028] In addition, the present invention is featured in a communication method for transmitting packets between a client and a server through a plurality of intermediary devices, comprising: performing communications more than once by using a certain command between the client and the server; detecting a communication route of the certain command by means of measuring a communication performance during the communications and adding the addresses of the intermediary devices to the certain command on an add-per-passage basis; and performing communications between the client and the server through the communication route which yields the maximum communication performance with respect to the communication route.

[0029] According to the present invention, communications can be done through the communication route which yields the maximum communication performance. This allows comfortable communication.

[0030] Moreover, the present invention is featured in an intermediary device which intermediates a client and a server, comprising: command detection means for detecting a certain command that is transmitted between the client and the server; route information detection means for detecting route information contained in communication data that are transmitted between the client and the server; and intermediacy control means which is adapted to send the certain command to a network after adding its local address to it when the certain command is detected, the intermediacy control means relaying the communication data when its local address is contained in the route information detected by the route information detection means.

[0031] According to the present invention, each of the intermediary devices add its local address to the certain command, which makes it possible to identify a communication route between a client and the server. In addition, the route information contained in the communication data is recognized by the intermediary device to relay the communication data. This makes it possible to transmit the communication data through the communication route according to the route information.

[0032] The present invention is a communication system for performing communications between a client and a server through a network, comprising: bypassing means which allows communication between the client and the server while bypassing the network.

[0033] The present invention is featured in comprising: measuring means for measuring a communication performance between the client and the server; and communication control means that causes the bypassing means to bypass the network when the communication performance measured by the measuring means is lowered under a certain level.

[0034] According to the present invention, communication can be performed at a high speed by means of bypassing the network using the bypassing means when a communication performance during the communication between a client and the server is not good.

[0035] The present invention is featured in a communication system for performing communications between a client and a server through a network, wherein the server comprises a node server adapted to accept a request from the client; and a content server adapted to send, to the client, a content that is asked for by the client in answer to a request from the node server.

[0036] The present invention is featured in a communication system for performing communications between a client

and a server through a network, wherein the server comprises a content server which provides a content to the client; and a node server adapted to accept a request from the client and to provide the client with link destination information of the content server that stores a content that is asked for by the client; the client being adapted to ask for a content to the content server according to the link destination information from the node server.

[0037] According to the present invention, burdens of operations can be divided among the node server(s) and the content server(s).

[0038] The present invention is featured in that the node server has a hierarchical structure based on the content or its link destination; the node server having a function to backup information about contents managed by node servers at upper and lower levels.

[0039] According to the present invention, by configuring the node servers in a hierarchical structure based on the clients that access thereto. This reduces process loads of the individual node servers.

[0040] The present invention is featured in a communication device for performing communications with a client through a network, the communication device being adapted to provide a content to the client by means of accessing a content server that provides content in answer to a request from the client, comprising: caching means for caching contents in the content server according to the frequency of accesses from the client; the communication device being adapted to send, to the client, a cashed content in answer to a request from the client.

[0041] According to the present invention, the contents in the content server are cached in the node server according to the frequency of accesses from the client. This makes it possible to deliver a content from the node server to the client without passing through the content server. Therefore, it is possible to provide a content to the client at a high speed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] FIG. **1** is a diagram showing a system configuration of a conventional information exchange system;

[0043] FIG. **2** is a diagram showing a system configuration of a conventional content exchange system;

[0044] FIG. **3** is a diagram showing a system configuration according to a first embodiment of the present invention;

[0045] FIG. **4** is a block diagram of a terminal device **103**-*i*;

[0046] FIG. **5** is a block diagram of a server **102**;

[0047] FIG. **6** is a diagram showing a data structure of a link destination information region **123***b*;

[0048] FIG. **7** is a block diagram of an information gathering device **101**-*i*;

[0049] FIG. **8** is a process flowchart according to the first embodiment of the present invention;

[0050] FIG. **9** is a view illustrating a player screen;

[0051] FIG. **10** is a process flowchart of a modified version of the first embodiment of the present invention;

[0052] FIG. **11** is a process flowchart of a second modified version;

[0053] FIG. **12** is a diagram showing a data structure of a link destination setting table;

[0054] FIG. **13** is a diagram showing a system configuration of a content exchange system according to a second embodiment of the present invention;

[0055] FIG. **14** is a diagram showing a data structure of a packet containing a routing command;

[0056] FIG. **15** is a diagram showing a data structure of a packet containing a request from a client **301** to a node server **303**;

[0057] FIG. **16** is a diagram showing a data structure of a packet containing a content from a content server **304** to a client;

[0058] FIG. **17** is a diagram showing a data structure of a route table;

[0059] FIG. **18** is a diagram showing a data structure of a route information table;

[0060] FIG. **19** is a diagram showing a system configuration of a modified version of the second embodiment of the present invention;

[0061] FIG. **20** is a diagram for explaining the operation of the modified version of the second embodiment of the present invention;

[0062] FIG. **21** is a diagram showing a system configuration according to a third embodiment of the present invention;

[0063] FIG. **22** is a diagram illustrating a hierarchical structure of node servers;

[0064] FIG. **23** is a diagram showing a data structure of an address table;

[0065] FIG. **24** is a diagram showing a data structure of a cache table;

[0066] FIG. **25** is a diagram showing a data structure of a statistics table;

[0067] FIG. **26** is a process flowchart that is performed by a node server **902**; and

[0068] FIG. **27** is a configuration diagram of essential parts which is applied to a case where a node server **902** contains address tables **911** at the upper and lower levels of the hierarchical structure.

BEST MODE FOR CARRYING OUT THE INVENTION

First Embodiment

[0069] FIG. **3** is a diagram showing a system configuration according to a first embodiment of the present invention. In this figure, similar components and parts to those illustrated in FIG. **1** are depicted by like reference numerals, and descriptions thereof will be omitted.

[0070] The difference of an information exchange system **100** of this embodiment from the conventional systems lies in operations of information gathering devices **101-1** to **101**-*n*, a server **102**, and terminal devices **103-1** to **103**-*m*.

[0071] In the information exchange system **100** according to this embodiment, when one terminal device **103**-*i* of the terminal devices **103-1** to **103**-*m* asks for a content to the server **102**, the server **102** returns a link destination to the terminal device **103**-*i*. The terminal device **103**-*i* obtains a content directly from the linked information gathering devices **101-1** and **101-2** of the information gathering devices **101-1** to **101**-*n* and displays the content.

[0072] First, a configuration of a predetermined terminal device **103**-*i* of the terminal devices **103-1** to **103**-*m* is described.

[0073] FIG. **4** is a block diagram of the terminal device **103**-*i*.

[0074] The terminal device **103**-*i* is configured having an input device **111**, a CPU **112**, a ROM **113**, a hard disk drive **114**, a RAM **115**, a communication device **116**, and a display unit **117**.

[0075] The input device **111** may be a keyboard or a mouse that is used for command or data input. The CPU **112** performs data processing according to a program stored in the ROM **113** and the hard disk drive **114**. In the ROM **113**, programs such as BIOS and initial setting information are stored. In the hard disk drive **114**, program and data such as a player for displaying a streaming video image from a plurality of information gathering devices **101-1** to **101-*n*** are stored. The RAM **115** is used as a temporary storage area for the CPU **112**.

[0076] The communication device **116** performs communication control with the network **14**. The display unit **117** may be a CRT or an LCD on which contents and so on are displayed.

[0077] Next, a configuration of the server **102** is described.

[0078] FIG. **5** is a block diagram of the server **102**.

[0079] The server **102** is configured having a CPU **121**, a ROM **122**, a hard disk drive **123**, a RAM **124**, and a communication device **125**. The CPU **121** processes the information according to a program stored in the ROM **122** and the hard disk drive **123**. In the ROM **122**, BIOS and various setting values are stored.

[0080] The hard disk drive **123** is configured having a program region **123*a*** and a link destination information region **123*b***. The program region **123*a*** stores a program that is used for finding the link destination information region **123*b***, determining a link destination, and notifying the terminal device **103-*i*** of it, according to a request from the terminal device **103-*i*** as will be described below.

[0081] FIG. **6** is a diagram showing a data structure of the link destination information region **123*b***.

[0082] The link destination information region **123*b*** has a structure in which link destination addresses A**1** to Ak are defined for respective selection channels S**1** to Sk. By designating a selection channel Sk, a corresponding link destination address Ak can be determined.

[0083] The RAM **124** is used as a temporary storage area for the CPU **121**. The communication device **125** performs communication control with the network **14**.

[0084] Next, a configuration of one information gathering device **101-*i*** of the information gathering devices **101-1** to **101-*n*** is described.

[0085] FIG. **7** is a block diagram of the information gathering device **101-*i***.

[0086] The information gathering device **101-*i*** is configured having a video camera unit **131**, an image processor **132**, and a communication device **133**.

[0087] The video camera unit **131** takes streaming video images of its surroundings. The streaming video images taken by the video camera unit **131** are supplied to the image processor **132**. The image processor **132** performs operations, such as compression operations, necessary for the transmission of the streaming video images on the information of the streaming video images taken by the video camera unit **131**. The streaming video image information processed by the image processor **132** is supplied to the communication device **133**. The communication device **133** performs operations to send the streaming video image information to the terminal device **103-*i*** through the network **14** according to a request from the terminal device **103-*i***, as will be described below.

[0088] Next, an operation for a case where a plurality of channels are selected by the terminal device **103-*i*** is described with reference to the drawings.

[0089] FIG. **8** is a process flowchart according to one embodiment of the present invention.

[0090] First, when a player is run on the terminal device **103-*i***, a player screen is displayed.

[0091] FIG. **9** is a view showing a player screen.

[0092] The player screen includes streaming video image display sections D**1** and D**2** and a channel menu display section D**3**.

[0093] For example, in the streaming video image display section D**1**, a streaming video image from one information gathering device of the information gathering devices **101-1** to **101-*n*** is displayed. In addition, in the streaming video image display section D**2**, a streaming video image from one information gathering device of the information gathering devices **101-1** to **101-*n*** is displayed.

[0094] Furthermore, in the channel menu display section D**3**, a channel list Lch, a channel selection button B**1**, a selection button B**2**, and an OK button B**3** are displayed.

[0095] First, a user selects a channel through which he or she wants to receive streaming video images, on the player screen in step S**1-1**. In response to this, the terminal device **103-*i*** sends a request to the server **102** in step S**1-2**. This request includes a selection channel information that is used by the user to fix the desired channel.

[0096] The user refers to a channel list Lch in the channel menu display section D**3**, and uses the channel selection button B**1** to select a desired channel. Then, he or she uses the selection button B**2**. By activation of the selection button B**2**, the channel to be displayed on the streaming video image display section D**1** is selected. The channel to be displayed on the streaming video image display section D**2** is also selected. Next, after the selection of the channels to be displayed on the streaming video image display sections D**1** and D**2**, the user sends a request to the server **102** by using the OK button B**3**.

[0097] After accepting the request including the selection channel information from the terminal device **103-*i*** in step S**2-1**, the server **102** analyzes the accepted request and obtains the selection channel information, in step S**2-2**. Next, the server **102** looks for the link destination information region **123*b*** according to the selection channel information and obtains a link destination address in step S**2-3**. Subsequently, the server **102** notifies the terminal device **103-*i*** of the link destination address, in step S**2-4**.

[0098] After accepting the link destination address for the selected channel from the server **102** in step S**1-3**, the terminal device **103-*i*** asks for a content from a device or devices identified by the accepted link destination address, such as the information gathering devices **101-1** and **101-2**, in step S**1-4**.

[0099] After accepting the request from the terminal device **103-*i*** in step S**3-1**, the information gathering device **101-1** sends the content, that is, the streaming video image information that is taken by the video camera unit **131**, to the terminal device **103-*i***, in step S**3-2**. Likewise, after accepting the request from the terminal device **103-*i*** in step S**4-1**, the information gathering device **101-2** sends the content, that is, the streaming video image information that is taken by the video camera unit **131**, to the terminal device **103-*i***, in step S**4-2**.

[0100] After receiving the contents, i.e., the pieces of streaming video image information, from the information gathering devices **101-1** and **101-2** in step S**1-5**, the terminal device **103-*i*** produces the player screen with the received streaming video images and displays the result, in step S**1-6**.

[0101] With the above-mentioned process, the streaming video images on the selected channels, i.e., the streaming video images collected by the information gathering devices **101-1** and **101-2** are displayed in real time on the terminal device **103-***i*. In this event, the pieces of streaming video image information are directly supplied from the information gathering devices **101-1** and **101-2** to the terminal device **103-***i*. The terminal devices **103-1** to **103-***m* access the server **102** only for the purpose of obtaining a link destination address. This can reduce the process load on the server **102**.

[0102] If, for example, there are a number of information gathering devices **101-1** to **101-***n*, the terminal devices **103-1** to **103-***m* are less likely to flock to one information gathering device and, accordingly, it is expected that the access from the terminal devices **103-1** to **103-***m* is spread across them. The capacity of the information gathering devices is not necessary to be increased.

[0103] In the terminal device **103-***i*, contents from the information gathering devices **101-1** to **101-2**, i.e., the pieces of streaming video image information are combined with a predetermined screen specified by the player and displayed. The resulting representation causes the user of the terminal device **103-***i* to feel as if he or she accesses the server **101-2**. The user is not aware that the streaming video information is directly sent from the information gathering devices **101-1** to **102**.

[0104] In this embodiment, when the terminal device **103-***i* makes a request to the server **102**, the server **102** notifies the terminal device **103-***i* of the link destination address, and the terminal device **103-***i* accesses the information gathering devices **101-1** and **101-2** to obtain streaming video images. However, the server **102** may directly make a push request to the information gathering devices **101-1** and **101-2** to be linked, and each of the information gathering devices **101-1** and **101-2** may send streaming video image information to the terminal device **103-***i*.

[0105] FIG. **10** shows a process flowchart of a modified version of the first embodiment of the present invention. In the figure, similar operations and steps to those in FIG. **8** are depicted by like reference numerals, and description thereof will be omitted.

[0106] In this modified version, when the server **102** obtains an access destination address in step S**2-3**, the server **102** makes a push request to the information gathering devices **101-1** and **101-2** designated by the link destination addresses, in step S**2-11**.

[0107] After accepting the push request from the server **102** in the steps S**3-1** and S**4-1**, the information gathering devices **101-1** and **101-2** send a streaming video image to the terminal device **103-***i* according to the push request from the server **102**, in the steps S**3-2** and S**4-2**, respectively.

[0108] According to this modified version, communication with the terminal device **103-***i* can be simplified.

[0109] The information exchange system **100** of this embodiment works better on cases where a number of information gathering devices are contained. For example, good results can be achieved when the information gathering devices are surveillance cameras along a river.

[0110] River monitoring is performed over a wide range of areas. A number of surveillance cameras are required for this purpose. It is impossible to monitor the images from these surveillance cameras altogether. In such a case, monitoring on the district basis provides better effects.

[0111] However, if the images from many surveillance cameras are managed altogether in the server **102** and are divided for districts as was done conventionally, the process load on the server **102** will increase. This raises the need to enhance the capacity of the server **102** and the communication lines.

[0112] On the contrary, in this embodiment, the terminal devices **103-1** to **103-***m* obtains the real-time and/or live streaming video images directly from the information gathering devices **101-1** to **101-***n*, so that the server **102** is not required to process the real-time and/or live streaming video images and distribute them to the individual terminal devices **103-1** to **103-***m*. This reduces process load on the server **102**. In addition, it is unnecessary for the server to transmit large volumes of data such as streaming video images, eliminating. This eliminates the necessity of widening the band of, for example, communication lines. The just-mentioned advantages ensure reliable delivery of necessary information and allow inexpensive configuration of a system.

[0113] Furthermore, the real-time or/and live streaming video images are supplied directly from the surveillance cameras as the information gathering devices **101-1** to **101-***n* to the terminal devices **103-1** to **103-***m*. Unless the access to a certain information gathering device, that is, a certain surveillance camera of the information gathering devices **101-1** to **101-***n*, is increasing, traffic concentration on the information gathering device can be avoided, so that problems such as frame dropouts will not occur. All pieces of information can thus be obtained without fail.

[0114] This embodiment assumes a case where the access to a certain information gathering device is not extremely increased, that is, a case where the number n of the information gathering devices is relatively larger than the number m of the terminal devices. It works better on such situations. For example, this applies to cases where there are a number of information gathering devices and where there are a lot of locations to be covered for security monitoring, for example, over a large area such as rivers, schools, offices, and factories, which are difficult to be monitored at the same time.

[0115] This embodiment avoids extreme concentration of access to a certain information gathering device. Real-time and/or live streaming video information can be reproduced without frame dropouts. Therefore, it is suitable for monitoring associated with anticrime or disaster-prevention purposes.

[0116] It should be noted that pieces of real-time or/and live streaming video information are supplied from the information gathering devices **101-1** to **101-***n* to the terminal device **103-***i* and are displayed thereon. However, information other than video information, such as disaster-prevention/anticrime information, community information, administrative information, environmental information, and infrastructural information, may be supplied from the server **102** and displayed.

[0117] In addition, this embodiment has been described in conjunction with the case where a plurality of streaming video images are displayed on a predetermined screen defined by the player in the terminal devices **103-1** to **103-***m*. However, two or more streaming video images may be displayed on different screens.

[0118] Alternatively, the terminal devices **103-1** to **103-***m* may be provided from the server **102** with a link destination setting table in which link destinations are dispersed so that process loads of the information gathering devices **101-1** to **101-***n* are distributed, and a predetermined terminal device **103-***i* of the terminal devices **103-1** to **103-***m* may be allowed to link only to the information gathering device **101** that is

specified in the link destination setting table, in order to distribute the process loads of the information gathering devices **101-1** to **101-***n*.

[0119] FIG. **11** shows a process flowchart of the second modified version.

[0120] The server **102** sends a link destination setting table to the terminal devices **103-1** to **103-***m*, in step S**11-1**.

[0121] FIG. **12** is a diagram showing a data structure of a link destination setting table.

[0122] A link destination setting table **200** includes genre codes and link destination URLs for respective channels stored therein. Different patterns of link destination setting table **200** are defined for the terminal devices **103-1** to **103-***m*. For example, they are defined with different combinations of channels and links.

[0123] A predetermined terminal device **103-***i* of the terminal devices **103-1** to **103-***m* stores the link destination setting table from the server **102**, in step S**12-1**. The terminal devices **103-1** to **103-***m* are allowed to gather desired information from the link destination setting table **200**.

[0124] When a user selects a channel that he or she wants to watch and listen from the link destination setting table **200** in step S**12-2**, a predetermined terminal device **103-***i* of the terminal devices **103-1** to **103-***m* sends, to the server **102**, the selected channel along with the link destination setting table **200**, in step S**12-3**. The server **102** determines, in step S**11-2**, whether the link destination setting table **200** from the terminal device **103-***i* is previously registered or not.

[0125] When step S**11-2** indicates that the link destination setting table **200** is the one that is previously registered, the server **102** permits transmittance of information from the terminal device **103-***i* and the information gathering device **101-***i* on the selected channel, in step S**11-3**.

[0126] When step S**11-2** indicates that the link destination setting table **200** is not a previously registered one, the server **102** notifies the terminal device **103-***i* of an error, in step S**11-4**. In response to the reception of the notification of error from the server **102**, the terminal device **103-***i* displays the error, in step S**12-4**.

[0127] In this way, the different patterns of link destination setting table **200** for the terminal devices **103-1** to **103-***m* allow authentication using the link destination setting table **200**. It should be noted that unauthorized access can be prevented by updating the link destination setting table **200** regularly.

[0128] When linking is permitted and a link request is received from the server **102** in step S**13-1**, the information gathering device **101-***i* sends the information such as a real-time image gathered in step S**13-2** to the terminal device **103-***i*.

[0129] After receiving the gathered pieces of information from the information gathering device **101-***i* in step S**12-5**, the terminal device **103-***i* displays the received information in a predetermined small area within a display window.

[0130] Although the server **102** manages the link destination setting table **200** in this embodiment, it may be managed by the information gathering devices **101-1** to **101-***i*. By managing the link destination setting table **200** on the information gathering devices **101-1** to **101-***i*, even when the system on the server **102** is out of service, the information gathering devices **101-1** to **101-***i* can perform authentication operation and provide the gathered information.

[0131] The above embodiment has thus been described in conjunction with an example of the river surveillance cameras, but it is not limited thereto. The information gathering devices **101-1** to **101-***i* may be replaced with the content server to deliver a desired content or contents.

[0132] According to this modified version, the server **102** sends the link destination setting table **200** to the terminal devices **103-1** to **103-***m*, and each of the terminal devices **103-1** to **103-***m* accesses the information gathering devices **101-1** to **101-***n* according to the link destination setting table **200**. Access concentration to a certain information gathering device of the information gathering devices **101-1** to **101-***n* will not occur, allowing distribution of the loads of the information gathering devices **101-1** to **101-***n*.

[0133] Furthermore, according to this modified example, by performing authentication using the link destination setting table **200** supplied from the server **102**, access control can be done surely. In addition, this modified example can be applied to a push request.

Second Embodiment

[0134] FIG. **13** is a diagram showing a system configuration of a second embodiment of the present invention.

[0135] A content exchange system **300** of this embodiment is configured having a client **301**, a network **302**, a node server **303**, and a content server **304**.

[0136] The client **301** makes a request to the node server **303** through the network **302**. The node server **303** makes a push request to the content server **304** in response to the request from the client **301**.

[0137] The content server **304** sends the content to the client **301** through the network **302** in response to the push request from the node server **303**. The client **301** displays the content from the content server **304**. It should be noted that the node server **303** may let a link destination reply in response to a request from the client **301** and the client **301** may have direct access to the content server **304** to provide the content to the client **301**.

[0138] In addition, the network **302** has a net-like structure of communication routes L connecting a plurality of routers Rt. The router Rt finds the optimum communication route L according to the destination IP address of a received packet, and sends the received packet to the communication route L.

[0139] Here, the system of this embodiment is configured in such a manner that the route from the client **301** to the node server **303** or the route from the content server **304** to the client **301** can be determined previously. The route to be used is determined by means of sending a routing command from the client **301** to the node server **303** or from the content server **304** to the client **301**.

[0140] First, the routing command is described.

[0141] FIG. **14** is a diagram showing a data structure of a packet containing a routing command.

[0142] A routing command **400** consists of a header section **401** and a data section **402**. The header section **401** contains header information **411** such as an identification number of a datagram, an IP address **412** of a sending computer, and an IP address **413** of a destination computer. Furthermore, the header section **401** has an option region **414**. A user is allowed to record information in the option region **414**.

[0143] The data section **402** contains a routing command **421** and an address history information **422**. The routing command **421** is a command for searching a routing to obtain the optimum communication route. The address history information **422** stores the number **431** of relays and IP addresses

432-1 to **432-*n*** of the relayed routers Rt. The address history information **422** is updated every time when the packet passes through a router Rt.

[0144] By sending the above-mentioned routing command **400** from the client **301** to the node server **303**, the node server **303** can obtain the address history information **422** from the client **301** to the node server **303**. In addition, by sending it from the content server **303** to the client **301**, the client **301** can obtain the address history information **422** from the content server **304** to the client **301**. This address history information **422** is used as route information from the client **301** to the node server **303** or route information from the content server **304** to the client **301**.

[0145] The client **301** obtains from the node server **303**, at the time of sending a request, route information from the client **301** to the node server **303**, creates the route information according to the obtained address history information **422**, adds it to the request, and send them.

[0146] FIG. **15** is a diagram showing a data structure of a packet including a request to be sent from the client **301** to the node server **303**. In the figure, similar components and parts to those in FIG. **13** are depicted by like reference numerals and description thereof will be omitted.

[0147] In a packet **500** including a request to be sent from the client **301** to the node server **303**, for example, the option region **414** of the header section **401** contains the number **431** of relays and the IP addresses **432-1** to **432-*n*** of the relayed routers Rt. In addition, a request **511** is set in the data section **402**.

[0148] The router Rt refers to the option region **414** of the header section **401** to determine the subsequent route. It should be noted that, when a content is supplied from the content server **304** to the client **301**, the content may be transmitted through a desired route by setting the content in the data section **402** in place of the request.

[0149] The request to be supplied from the client **301** to the node server **303** is supplied to the node server **303** through the router(s) Rt corresponding to the routing address(es) that is/are associated with the request. In addition, the content to be supplied from the content server **304** to the client **301** is supplied to the client **301** through the router(s) Rt corresponding to the routing address(es) that is/are associated with the content.

[0150] Next, operation of each router Rt is described.

[0151] FIG. **16** shows an operation flowchart for a router Rt.

[0152] When receiving a packet in step S**21-1**, the router Rt analyzes the received packet in step S**21-2**. The router Rt determines in step S**21-3** whether the received data is a routing command or not according to the result of the analysis.

[0153] When the result of the determination in step S**21-3** indicates that it is the routing command, the router Rt accepts the received packet and performs a predetermined operation, in step S**21-4**. Then, the router Rt adds its local IP address to the address history information in the routing command in the packet and sends the packet to a downstream communication route L, in step S**21-5**. In this event, the router Rt finds the optimum communication route L according to the destination IP address in the packet and sends the packet.

[0154] By repeating the above-mentioned steps S**21-1** to S**21-5**, a route from the client **301** to the node server **303** can be detected. The detected route may be named and stored in a route table provided in the node server **303**.

[0155] FIG. **17** is a diagram showing a data structure of a route table.

[0156] A route table **600** contains IP addresses A**11** to A**1***m* . . . An**1** to Anm of the passed routers Rt for respective route names R**1** to Rn.

[0157] The node server **303** has a route information table for each route stored in the route table **600**.

[0158] FIG. **18** is a diagram showing a data structure of a route information table.

[0159] A route information table **700** has information related to routes stored therein for respective route names R**1**, R**2**, . . . , Rn. The information may be, for example, information about periods of time T**11** to T**12** . . . Tn**1** to Tn**2** during which comfortable use is allowed, data transfer rates S**1** to Sn, and response times Tres**1** to Tresn.

[0160] The node server **303** refers to the route information table **700** in answer to a request from the client **301**, finds the optimum route, reads the routing address of it from the route table **600**, and supplies it to the client **301**.

[0161] The client **301** puts the routing address received from the node server **303** into the option region **414** of the packet and sends a request.

[0162] It should be noted that the route table **600** and the route information table **700** in this embodiment are kept in the node server **303**, but they may be kept in the client **301**.

[0163] Now, returning to FIG. **16**, description continues.

[0164] When the packet supplied is not the routing command in step S**21-3**, that is, for example, when it is a packet in which a request or a content is set as data, the routing address information **432-1** to **432-*n*** in the option region **414** within the packet is analyzed in step S**21-6**.

[0165] Next, in step S**21-7**, it is determined whether the routing address contains the IP address of the local router Rt according to the result obtained in step S**21-6**. When, in step S**21-7**, the IP address of the local router Rt is contained in the routing address, the subject router is considered as being the router Rt which the packet should pass through. The router accepts the packet, performs a predetermined operation, and thereafter, sends the packet to a subsequent routing address (es), in step S**21-8**.

[0166] When, in step S**21-7**, the IP address of the local router Rt is not contained in the routing address information **432-1** to **432-*n***, then the router returns the received packet to the packet sending router Rt in step S**21-9**. The packet sending router Rt sends the packet to another downstream communication route L.

[0167] By repeating the operations in the above-mentioned steps S**21-1** to S**21-3** and S**21-6** to S**21-9** by the routers Rt, the packet from the client **301** is supplied to the node server **303** through a predetermined route.

[0168] Likewise, the node server **303** sends a routing command through the content server **304** to the client **301** according to a request from the client **301**. This makes it possible to obtain a route from the content server **304** to the client **301**. By managing the route table **600** and the route information table **700** in the client **301** and supplying the routing address to the node server **303** upon a request for example, the route for the content to be supplied from the content server **304** to the client **301** can be optimized.

[0169] It should be noted that the routing address obtained in the client **301** may be supplied to the node server **303** by the routing command from the content server **304** and the node server **303** may manage the route table **600** and the route information table **700** for determining the route from the

content server **304** to the client **301**. In such a case, the optimum routing address is provided along with a push request to the content server **304** upon a request from the client **301**. The content server **304** adds the routing address to the option region **414** of the packet containing the content to be supplied to the client **301** and sends the content. This allows the content to be supplied to the client **301** through the optimum route designated by the routing address.

[0170] If the route designated by the routing address is congested, a satellite may be used to bypass the congested portion in the network **302**.

[0171] FIG. **19** is a diagram showing a system configuration of a modified version of one embodiment of the present invention. FIG. **20** is a diagram for explaining the operation of the modified version of one embodiment of the present invention. In these figures, similar components and parts to those in FIG. **13** are depicted by like reference numerals, and description thereof will be omitted.

[0172] This modified version is featured by comprising a satellite communication system **800**.

[0173] If no response is made for a predetermined period of time in step S**22-2** after the client **301** makes a request to the node server **303** in step S**22-1**, the client **301** sends a request to a satellite base **801** that is provided nearby in step S**22-3**. When the satellite base **801** receives the request from the client **301** in step S**22-11**, it sends the request from the client **301** to a satellite base **803** near the node server **303** through the satellite **802** in step S**22-12**. In this event, the satellite base **801** determines the satellite base **803** according to the destination IP address of the request. The satellite base **803** sends the request to the node server **303** according to the destination IP address of the request in step S**22-13**.

[0174] In addition, when the node server **303** receives the request from the satellite base **803** in step S**22-21**, it sends a push request to the content server **304** according to the request supplied from the satellite base **803** in step S**22-22**. When the content server **304** receives the request from the node server **303** in step S**22-31**, it sends a content toward the client **301** according to the push request from the node server **303** in step S**22-32**. The content from the content server **304** is first supplied to the satellite base **803** provided nearby. The satellite base **803** sends the content to the satellite base **801** near the client **301** through the satellite **802** in step S**22-14**. In this event, the satellite base **803** determines the satellite base **801** according to the destination IP address of the content. The satellite base **801** sends the content to the client **301** according to the destination IP address of the content.

[0175] When the client **301** receives the content from the satellite base **801** in the step **22-4**, it displays the received content in step S**22-5**.

[0176] As described above, by sending requests or contents using the satellite system **800**, contents can be exchanged at a high speed regardless of the status of the network **302**.

[0177] It should be noted that, the network **302** detects congestion and uses the satellite system **800** automatically in this modified version, but the satellite system **800** may be utilized when necessary through the operation by a user of the client **301**, or a node server **303**, or a content server **304**. This makes it possible to provide contents without fail regardless of the state of the network **302**.

[0178] Alternatively, contents may be downloaded to a node server depending on the frequency of accesses in order to immediately cope with a request from a client.

Third Embodiment

[0179] FIG. **21** is a diagram showing a system configuration of a third embodiment of the present invention. FIG. **22** is a diagram showing a hierarchical structure of a node server.

[0180] A content exchange system **900** of this embodiment has a configuration in which clients **901**, node servers **902**, and content servers **903** are connected through a network **904**.

[0181] The node server **902** may have a hierarchical structure on a regional basis as shown in FIG. **22**. The client **901** usually makes a request to a node server **902** at the lowest level. The node server **902** has an address table, a cache table, and a statistics table. It makes a push request to the content server(s) **903** and also makes a request to a node server(s) **902** at the upper or lower level(s) according to these tables.

[0182] The node server **902** first refers to the address table according to the request from the client **901**.

[0183] FIG. **23** is a diagram showing a data structure of an address table.

[0184] The address table **911** contains, for each content, URLs of the content servers **903** from which the content is supplied, call destination addresses of the cache table, and link destination addresses to the node servers **902** that manage the content.

[0185] When the node server **902** is designated by the request from the client **901** and a content C**1** on a channel ch**1** is designated, it refers to the cache table address of a corresponding portion in the address table **911**. The cache table address of the content C**1** on the channel ch**1** is considered to be a valid address. Therefore, it then refers to data of a corresponding cache table address in the cache table.

[0186] When an invalid cache table address is stored as in a content C**2** on the channel ch**1** of the address table **911** shown in FIG. **23**, this is a case where that node server **902** does not manage the content that is asked for. In such a case, a link destination address L**2** of the node server **902** is indicated. The request from the client **901** is supplied to the node server **902** at the link destination address L**2**.

[0187] FIG. **24** is a diagram showing a data structure of a cache table.

[0188] A cache table **912** contains, for each address, a directory name, information indicating validity of the cache, and time stamp information. When the content C**1** on the channel ch**1** is designated, the cache table address adr**11** in the cache table **912** is referred to. The directory name of the cache table address adr**11** in the cache table **912** is d**1**, the validity is "O", the time stamp is t**11**. This indicates that the content C**1** is cached in a storage device having the directory name d**1** at the time instant t**11**, and the data is currently valid. Thus, the content C**1** can be obtained by reading the data from the storage device having the directory name of d**1**. It should be noted that the storage device corresponds to the caching means described in claims.

[0189] In this case, the node server **902** is only required to send the cached content C**1** directly to the client **901**. It is unnecessary to make a push request to the content server **903**. The validity of "X" in the cache table **912** indicates, for example, a time-out content. Such a content is deleted first and thereafter is read from the content server **903** and cached again. The re-cached content is supplied to the client **901**. In

addition, the validity of the cache table **912** is changed to "O" by the update to the latest content.

[0190] It should be noted that the node server **902** can cache only a limited volume of data, so that the data to be cached are determined according to a statistics table.

[0191] FIG. **25** is a diagram showing a data structure of a statistics table.

[0192] A statistics table **913** has a configuration in which data such as a content name, a link destination, the number of retrievals, an access time, and a volume are stored for each rank level. The rank in the statistics table **913** may be, for example, determined in order of the number of retrievals.

[0193] For example, contents up to the rank "5" are cached. The statistics table is updated in the number of retrievals and the access time according to a request from the client **901**, and the rank is updated according to the number of retrievals.

[0194] Next, operations in the node server **902** are described in detail.

[0195] FIG. **26** shows a process flowchart of the node server **902**.

[0196] When receiving a request from the client **901** in step S**23-1**, the node server **902** refers to the address table **911** and determines whether the content that is asked for by the request is under the management of the local node server **902**, in step S**23-2**. The determination in step S**23-2** may be done according to, for example, the validity of the node server address in the address table **911**. The state in which a valid link destination address is stored in the node server address indicates that the content that is asked for is under the management of the link destination node server **902**, so that the request is sent to the link destination node server in step S**23-3**.

[0197] On the other hand, when step S**23-3** indicates that the content that is asked for is under the management of the local node server **902**, the statistics table **913** is updated. Next, the node server refers to the cache address table **912** in step S**23-5** in order to determine whether the cached content is valid or not.

[0198] When, in step S**23-5**, the cached content is valid, the node server reads the content from the storage device having the directory name designated by the cache address table **912** and sends it to the client **901**, in step S**23-6**.

[0199] When, in step S**23-5**, the cached content is invalid, then the node server refers to the statistics table **913** in step S**23-7** and determines whether the rank of the content that is asked for is equal to or higher than a predetermined rank in step S**23-8**. By referring to the address table **911**, the node server reads the content from the content server **903** and then caches the content that is read from the content server **903** in step S**23-8**.

[0200] When the rank of the content that is asked for is equal to or lower than the predetermined rank in step S**23-8**, then the address table **911** is referred to in step S**23-10** to issue a push request to the content server **903** that provides the corresponding content. The content server **903** reads the content in response to the push request from the node server **902** and supplies it to the client **901**.

[0201] As described above, the contents that are retrieved many times can be supplied from the node server **902** directly to the client **901**. Therefore, contents can be exchanged at a high speed.

[0202] It should be noted that the node server **902** may redundantly have address tables **911** of the node servers **902** in the upper and lower levels thereof.

[0203] FIG. **27** is a configuration diagram of essential parts which is applied to a case where the node server **902** contains address tables **911** at the upper and lower levels of the hierarchical structure.

[0204] As shown in FIG. **27**, a node server **902**-*i* contains the address tables **911** of the node servers **902**-*i*+**1** and **902**-*i*-**1** at the upper and lower levels of the hierarchical structure. This makes it possible to use the node server **902**-*i* in place of the function of the node servers **902**-*i*+**1** and **902**-*i*-**1** in case where they are not available for some reasons. This increases reliability of the system.

1-19. (canceled)

20. A content presentation program that directs a computer to execute:

a content acquisition step to acquire a content on each of predetermined channels; and

a display control step to cause the content that is acquired in the first step to be displayed in a window that is determined previously for said channels, out of a plurality of display sections that are defined within a predetermined window.

21. An information processor that causes a content to be displayed on a display unit, comprising:

content acquisition means for acquiring a content on each of predetermined channels; and

display control means that causes the content that is acquired in the first step to be displayed in a window that is determined previously for said channels, out of a plurality of display sections that are defined within a predetermined window.

22. An information processing method comprising:

a content acquisition step to acquire a content on each of predetermined channels; and

a display control step to cause the content that is acquired in the first step to be displayed in a window that is determined previously for said channels, out of a plurality of display sections that are defined within a predetermined window.

23. A communication method for transmitting packets between a client and a server through a plurality of intermediary devices, comprising:

performing communications more than once by using a certain command between said client and said server;

measuring a communication performance during said communications; detecting a communication route of said certain command by adding the addresses of the intermediary devices to said certain command on an add-per-passage basis; and

performing communications between said client and said server through the communication route which yields the maximum communication performance with respect to said communication route.

24. An intermediary device which intermediates a client and a server, comprising:

command detection means for detecting a certain command that is transmitted between said client and said server;

route information detection means for detecting route information contained in communication data that are transmitted between said client and said server; and

intermediacy control means which is adapted to send said certain command to a network after adding its local address to it when said certain command is detected, said intermediacy control means relaying the communica-

tion data when its local address is contained in the route information detected by said route information detection means.

25. A communication system for performing communications between a client and a server through a network, comprising:

bypassing means which allows communication between said client and said server while bypassing said network.

26. The communication system as claimed in claim **25**, comprising:

measuring means for measuring a communication performance between said client and said server; and

communication control means that causes said bypassing means to bypass said network when the communication performance measured by said measuring means is lowered under a certain level.

27. A communication system for performing communications between a client and a server through a network, wherein

said server comprises a node server adapted to accept a request from said client; and

a content server adapted to send, to said client, a content that is asked for by said client in answer to a request from said node server.

28. A communication system for performing communications between a client and a server through a network, wherein

said server comprises a content server which provides a content to said client; and

a node server adapted to accept a request from said client and to provide said client with link destination information of said content server that stores a content that is asked for by said client;

said client being adapted to ask for a content to said content server according to the link destination information from said node server.

29. The communication system as claimed in claim **28**, wherein said node server has a hierarchical structure based on said content or its link destination;

said node server having a function to backup information about contents managed by node servers at upper and lower levels.

30. A communication device for performing communications with a client through a network, said communication device being adapted to provide a content to said client by means of accessing a content server that provides content in answer to a request from said client, comprising:

caching means for caching contents in said content server according to the frequency of accesses from said client;

said communication device being adapted to send, to said client, a cashed content in answer to a request from said client.

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