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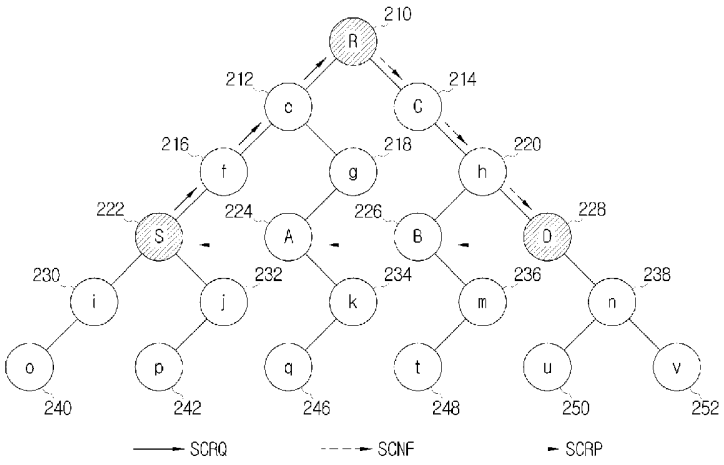
(54) Title: OPTIMAL PATH ROUTING METHOD IN WIRELESS NETWORK



(57) Abstract: An optimal path routing method is provided for transmitting data from a source node to a destination node. The optimal path setting method includes transmitting a shortcut request (SCRQ) message from the source node to a topology server; determining shortcut information at the topology server based on the SCRQ message; and transmitting a shortcut notification (SCNF) message containing the shortcut information from the topology server to the destination node.

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Description

OPTIMAL PATH ROUTING METHOD IN WIRELESS NETWORK

Technical Field

[1] The present invention relates to an optimal path routing method in wireless network. More particularly, the present invention relates to an optimal path routing method in wireless network which sets an optimal path transmitting data in a shortcut with the help of a server or a coordinator when the data is transmitted from a source node to a destination node through a tree mesh structure in the wireless network.

Background Art

[2] Generally, wireless networks have all the devices in the area cluster-tree structured. Devices joining with the cluster tree structure are allocated with an address according to the tree structure. The allocated address is used for routing in each network environment.

[3] FIG. 1 is a tree structure of a conventional wireless network.

[4] In FIG. 1, the conventional wireless network includes a parent node A 110 and a child node B through J 112 through 142.

[5] The child node B 112 has the parent node A 110 thereof and has the child nodes E, F and G 120, 122 and 124 thereof. The child node C 114 has the parent node A 110 thereof and has the child node H 130 thereof. The child node D 116 has the parent node A 100 thereof and has the child nodes I and J 140 and 142 thereof. In FIG. 1, each node may be implemented as a device, and each parent node has table-form address information on the child nodes thereof.

[6] When the data is transmitted from the H node 130 to F node 122 in the wireless network of FIG. 1, the H node 130 is a source node and the F node 122 is a destination node. A data packet transmitted from the H node 130 is transmitted along the only tree structure to the F node 122. The data packet is transmitted necessarily through the parent node thereof, so that it can be transmitted to neighboring nodes thereof along the tree structure.

Disclosure of Invention

Technical Problem

[7] Accordingly, the data packet transmitted from the H node 130 is sent to the F node 122 via the C, A and B nodes 114, 110 and 112 along the tree structure. In the tree structure of the conventional wireless network, the data packet is transmitted along the tree structure from the source node to the destination node, resulting in inconveniently lengthened routing path and subsequent rise in the communication costs.

[8] Compared to the tree mesh structure, the tree structure of the wireless network is unable to transmit the data packet and gives users difficulty in maintenance due to errors in the node, in case of any errors on an arbitrary node of the routing path.

Technical Solution

[9] An aspect of the present invention is to solve at least the above problems and/or disadvantages of the related art and to provide at least the advantages described below. Accordingly, an aspect of the present invention is to provide an optimal path routing method in wireless network which sets an optimal path transmitting data in a shortcut with the help of a server or a coordinator when the data is transmitted from a source node to a destination node through a tree mesh structure in the wireless network.

[10] In order to achieve the above-described aspects of the present invention, there is provided an optimal path setting method for transmitting data from a source node to a destination node, the optimal path setting method comprising: performing a shortcut request for transmitting a shortcut request (SCRQ) message to a topology server from the source node; generating a shortcut information for the topology server to transmit the data from the source node to the destination node based on the shortcut request message; and transmitting the shortcut notification (SCNF) message containing the shortcut information for the topology server to the destination node.

[11] The optimal path setting method further comprises: responding to the shortcut request for the destination node transmitting a shortcut response (SCRP) message to a neighboring node on a shortcut path based on the shortcut information; and setting the optimal path for setting the optimal path between the source node via the neighboring node on the shortcut path and the destination node, by the neighboring node on the shortcut path transmitting the SCRP message to the source node.

[12] The SCRP message comprises a media access control (MAC) header, a network header and a network payload. The MAC header comprises the receiver MAC address and the sender MAC address, the network header comprises a source network address and a destination network address, and the network payload comprises a first relay network address, a second relay network address, a third relay network address and a n^{th} relay network address.

[13] The topology server sets the shortcut information corresponding to the optimal path transmissible in a shortest distance from the source node to the destination node, based on addresses of lower nodes connected to the topology server. The topology server stores in an information table node information containing network addresses of the lower nodes connected thereto and the MAC address.

[14] The SCRQ message comprises a MAC header, a network header and a network payload. The MAC header comprises a receiver MAC address and a sender MAC

address, the network header comprises a PC network address, a PC MAC address, a source network address and a source MAC address, and the network payload comprises a destination network address and a destination MAC address.

[15] The SCNF message comprises the MAC header, the network header and the network payload. The MAC header comprises the receiver MAC address and the sender MAC address, the network header comprises the destination network address, the destination MAC address, the PC network address and the PC MAC address, and the network payload comprises the source network address, the source MAC address, the first relay network address, the second relay network address, the third relay network address and the n^{th} relay network address.

[16] The SCRQ message and the SCNF message are in a command form.

[17] When the source node and the destination node are located in an area other than a server coverage area (SCA) of the topology server, the topology server generates shortcut information on a shortest path of nodes in the SCA area, in the step of generating the shortcut information.

[18] In the step of performing the shortcut request, when the topology server is in error, neighboring nodes of the topology server replace the topology server and receive the SCRQ message.

[19] The neighboring node generates the shortcut information based on the SCRQ message, and transmits the SCNF message containing the shortcut information to the destination node via the neighboring node thereof.

[20] Other neighboring node of the neighboring node replacing the topology server, operates by a backup server with respect to the neighboring node.

Advantageous Effects

[21] As abovementioned, according to the present invention, the data is transmitted along the optimal path set based on the shortcut information such that the routing path shortens and accordingly, the communication cost is saved.

[22] Also, in case of any errors in an arbitrary node on the routing path, it is possible to transmit the data through another node substitute for the node in error, and accordingly ease maintenance.

Brief Description of the Drawings

[23] The above aspect and other features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawing figures, wherein;

[24] FIG. 1 is a view showing a tree structure of a conventional wireless network;

[25] FIG. 2 is a view showing a tree mesh structure of a wireless network provided to explain an optimal path setting method for according to an exemplary embodiment of

the present invention;

[26] FIG. 3 is a view showing a frame structure of a SCRQ message;

[27] FIG. 4 is a view showing a frame structure of a SCNF message;

[28] FIG. 5 is a view showing a frame structure of a SCRP message;

[29] FIG. 6 is a view showing a data transmitting path in case of errors of a topology server;

[30] FIG. 7 is a view showing a transmitting path according to a request for data transmitting from areas other than a coverage area of the topology server; and

[31] FIG. 8 is a view showing an operational flowchart of the optimal path setting method according to the exemplary embodiment of the present invention.

Best Mode for Carrying Out the Invention

[32] Hereinafter, an exemplary embodiment of the present invention will be described in detail with reference to the accompanying drawing figures.

[33] FIG. 2 is a view showing a tree mesh structure of a wireless network provided to explain an optimal path setting method according to an exemplary embodiment of the present invention.

[34] According to the exemplary embodiment of the present invention, the wireless network includes a source node S 222, a topology server R 210, a destination node D 228, coordinators e, c, f, h, A, B 212, 214, 216, 220, 224 and 226, and neighboring nodes 218 and 230 through 252. The source node 222, the destination node 228 and coordinators 212, 214, 216, 220, 224 and 226 may be a device for transmitting and receiving data.

[35] In FIG. 2, the source node 222 is to transmit the data, and the destination node 228 is to receive the data transmitted from the source node 222.

[36] The topology server 210 is the highest node in the wireless network forming the tree mesh structure and stores in an information table node information including network addresses and MAC addresses of lower nodes connected thereto.

[37] If an arbitrary source node among the lower nodes requests data transmission, the topology server 210 searches the information table and confirms the destination node for the data to be transmitted. If the destination node is confirmed through the information table, the topology server 210 sets shortcut information equivalent to the optimal path for transmitting the data in a short distance from the source node to the destination node. The topology server 210 transmits the optimal path setting information to nodes on the optimal path.

[38] The nodes on the optimal path form the optimal path through the optimal path setting information. Accordingly, the data transmitted from the source node is sent to the destination node through the optimal path, not via the topology server 210. Two or

more topology servers 210 may operate by each other's backup nodes.

[39] In FIG. 2, the e node 212 which is a child node of the topology server 210, is connected to the f and g nodes 216 and 218 as a parent node thereof. Also, the h node 220 is the child node of the c node 214 which is the child node of the topology server 210, and is connected to the B and D nodes 226 and 228 as the parent node thereof.

[40] In the wireless network of FIG. 2, one of the coordinators 212, 214, 216, 220, 224 and 226, or nodes with sufficient resources may operate like the topology server 210. Nodes other than the topology server 210 may use tree routing, to reach the topology server 210.

[41] Each coordinators 212, 214, 216, 220, 224 and 226 report to the topology server 210 major link changes such as beacon message scanning or data transmission failure of neighboring nodes. The coordinators 212, 214, 216, 220, 224 and 226 are aware of an address of the topology server 210 for joining the network and address information of children nodes thereof.

[42] Referring to an operational flowchart in FIG. 8, the optimal path setting method is described.

[43] In order to transmit the data to the destination node 228, the source node 222 transmits a shortcut request (SCRQ) message to the topology server 210 along a tree route via the f and e nodes 216 and 212 which are higher nodes thereof (S602).

[44] The SCRQ message is in a command form, containing information on MAC address including the addresses of the source node 222 and the destination node 228, and network address.

[45] That is, illustrated in FIG. 3, the frame structure of the SCRQ command transmitted to the topology server 210 from the source node 222, includes a MAC header, a network header and a network payload. The MAC header includes a receiver MAC address and a sender MAC address. The network header includes a PC network address, a PC MAC address, a source network address and a source MAC address. The network payload includes a destination network address and a destination MAC address.

[46] The topology server 210 receives the SCRQ message transmitted from the source node 222 and confirms shortcut information based on address information in the SCRQ message (S604).

[47] The topology server 210 searches the information table and, based on the address information of each node, confirms which node to be used for setting the shortcut path for transmitting the data from the source node 222 to the destination node 228.

[48] As illustrated in FIG. 2, the topology server 210 confirms that the A and B nodes 224 and 226 are needed for the shortcut path for transmitting the data from the source node 222 to the destination node 228.

[49] The topology server 210 generates shortcut information including address information of the A and B nodes 224 and 226 on the shortcut path, and transmits a shortcut notification (SCNF) message including the shortcut information to the destination node 228 (S606). The topology server 210 may transmit the SCNF message including the shortcut information to the source node 222.

[50] The frame structure of the SCNF message transmitted from the topology server 210 to the source node 222 or the destination node 228, includes the MAC header, the network header and the network payload, as illustrated in FIG. 4. The MAC header includes the receiver MAC address and the sender MAC address. The network header has the destination network address, the destination MAC address, the PC network address and the PC MAC address. The network payload includes the source network address, the source MAC address, a first relay network address, a second relay network address, a third relay network address and an n^{th} relay network address.

[51] The destination node 228 receives the SCNF message transmitted by the topology server 210 and confirms the shortcut information. The destination node 228 generates a shortcut reply message based on the shortcut information. Also, based on the shortcut information, the destination node 228 transmits the SCRP message to the neighboring B node 226 on the shortcut path (S608).

[52] The frame structure of the SCRP message transmitted from the destination node 228 to the neighboring B node 226, includes the MAC header, the network header and the network payload, as illustrated in FIG. 5. The MAC header has the receiver MAC address and the sender MAC address. The network header has the source network address and the destination network address. The network payload includes the first relay network address, the second relay network address, the third relay network address and the n^{th} relay network address.

[53] The neighboring B node 226 of the destination node 228 receives the SCRP message and confirms the neighboring A node 224 thereof on the shortcut path, through the shortcut information included in the SCRP message. The B node 226 transmits the SCRP message including the shortcut information to the A node 224 neighboring thereof on the shortcut path.

[54] The neighboring A node 224 of the B node 226 receives the SCRP message from the B node 226, and based on the shortcut information in the SCRP message, the SCRP message to the source node 222.

[55] The source node 222 receives the SCRP message from the neighboring node on the shortcut path (S610).

[56] Accordingly, the optimal path is set via the A node 224 and the B node 226 between the source node 222 and the destination node 228 (S612).

[57] As illustrated in FIG. 6, there may be data transmission failures due to errors of the

topology server 410, when the data is transmitted from the source 422 to the destination node 428 through the topology server 410.

[58] In FIG. 6, the source node 422 transmits the data to the higher e node 416, and the e node 416 transmits the data to the higher A node 412.

[59] The A node 412 as the child node of the topology server 410 recognizes that the topology server 410 has an error, so transmits the data to the B node 418 in the same level as the child node of the topology server 410.

[60] The B node 418 as the child node of the topology server 410 transmits the data received from the A node 412 to the neighboring C node 414 as the child node of the topology server 410.

[61] The C node 414 as the child node of the topology server 410 confirms, through the data received from the B node 418, that the destination node is the child node thereof. The C node 414 transmits the data to the f node 420 as the child node thereof.

[62] The f node 420 confirms that the destination node is the child node thereof through the data received from the C node 414, and transmits the data to the destination node 428 as the child node.

[63] As abovementioned, the mesh-structured network according to an exemplary embodiment of the present invention, may transmit the data through a node substitute for the topology server 410 even when the topology server 410 on the data transmission path is in error. The neighboring node substitute for the topology server 410 generates the shortcut information based on the SCRQ message, and transmits the SCNF message including the shortcut information too the destination node 428, via the neighboring node.

[64] A U node 432 is another topology server as a neighboring node of the B node 418 substitute for the topology server 410 in error. The U server 432 may operate by a backup server with respect to the B node 418.

[65] FIG. 7 is a view showing a transmitting path according to a request for data transmitting from areas other than a coverage area of the topology server.

[66] As illustrated in FIG. 7, the source node 530 for transmitting the data and the destination node 532 for receiving the data transmitted form the source node 530 may be positioned in areas other than a server coverage area (SCA) of the topology server 510.

[67] If the source node 530 transmits the SCRQ message to the topology server 510 via the E node 520 and the A node 512, the topology server 510 confirms the shortcut information going via the SCA thereof, based on the SCRQ message.

[68] The topology server 510 searches the information table and generates shortcut information on a shortest path going via the nodes in the SCA thereof. The shortcut information is on the optimal path data-transmissible in a shortest distance from the

source node 530 to the destination node 532. That is, a first shortcut information or a second shortcut information is generated. The first shortcut information includes the A node 512, an i node 514, a j node 516 and a B node 518, and the second shortcut information includes the E node 520, a k node 522, a m node 524, a n node 526 and a F node 528.

[69] The topology server 510 transmits a shortcut notification (SCNF) message including the first and second shortcut information to the destination node 532.

[70] The destination node 532 transmits a shortcut reply message including the first and second shortcut information to the source node 530, via the neighboring node on the shortcut path.

[71] Accordingly, the optimal path may be set between the source node 530, a neighboring node corresponding to the first shortcut information and the destination node 532, or the optimal path may be set between the source node 530, a neighboring node corresponding to the second shortcut information and the destination node 532.

[72] The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims.

[73] The scope of the present invention should be read on the appended claims, and all the technical concepts of the equivalent scope should be defined in the appended claims.

Industrial Applicability

[74] The present invention applies to a wireless network, particularly, a wireless apparatus having a tree mesh structure.

Claims

[1] An optimal path setting method for transmitting data from a source node to a destination node, the optimal path setting method comprising:
performing a shortcut request for transmitting a shortcut request (SCRQ) message to a topology server from the source node;
generating a shortcut information for the topology server generating the shortcut information to transmit the data from the source node to the destination node based on the SCRQ message; and
transmitting the shortcut notification (SCNF) message containing the shortcut information for the topology server to the destination node.

[2] The optimal path setting method of claim 1, further comprises:
responding to the shortcut request for the destination node transmitting a shortcut response (SCRP) message to a neighboring node on a shortcut path based on the shortcut information; and
setting an optimal path between the source node via the neighboring node on the shortcut path and the destination node, by the neighboring node on the shortcut path transmitting the SCRP message to the source node.

[3] The optimal path setting method of claim 2, wherein the SCRP message comprises a media access control (MAC) header, a network header and a network payload.

[4] The optimal path setting method of claim 3, wherein the MAC header comprises the receiver MAC address and the sender MAC address, the network header comprises a source network address and a destination network address, and the network payload comprises a first relay network address, a second relay network address, a third relay network address and a n^{th} relay network address.

[5] The optimal path setting method of claim 1, wherein the topology server sets the shortcut information corresponding to the optimal path transmissible in a shortest distance from the source node to the destination node, based on addresses of lower nodes connected to the topology server.

[6] The optimal path setting method of claim 5, wherein the topology server stores in an information table node information containing network addresses of the lower nodes connected thereto and the MAC address.

[7] The optimal path setting method of claim 1, wherein the SCRQ message comprises a MAC header, a network header and a network payload.

[8] The optimal path setting method of claim 7, wherein the MAC header comprises a receiver MAC address and a sender MAC address, the network header comprises a PC network address, a PC MAC address, a source network address

and a source MAC address, and the network payload comprises a destination network address and a destination MAC address.

[9] The optimal path setting method of claim 1, wherein the SCNF message comprises the MAC header, the network header and the network payload.

[10] The optimal path setting method of claim 9, wherein the MAC header comprises the receiver MAC address and the sender MAC address, the network header comprises the destination network address, the destination MAC address, the PC network address and the PC MAC address, and the network payload comprises the source network address, the source MAC address, the first relay network address, the second relay network address, the third relay network address and the n^{th} relay network address.

[11] The optimal path setting method of claim 1, wherein the SCRQ message and the SCNF message are in a command form.

[12] The optimal path setting method of claim 1, wherein when the source node and the destination node are located in an area other than a server coverage area (SCA) of the topology server, the topology server generates shortcut information on a shortest path of nodes in the SCA area, in the step of generating the shortcut information.

[13] The optimal path setting method of claim 1, wherein in the step of performing the shortcut request, when the topology server is in error, neighboring nodes of the topology server replace the topology server and receive the SCRQ message.

[14] The optimal path setting method of claim 13, wherein the neighboring node generates the shortcut information based on the SCRQ message, and transmits the SCNF message containing the shortcut information to the destination node via the neighboring node thereof.

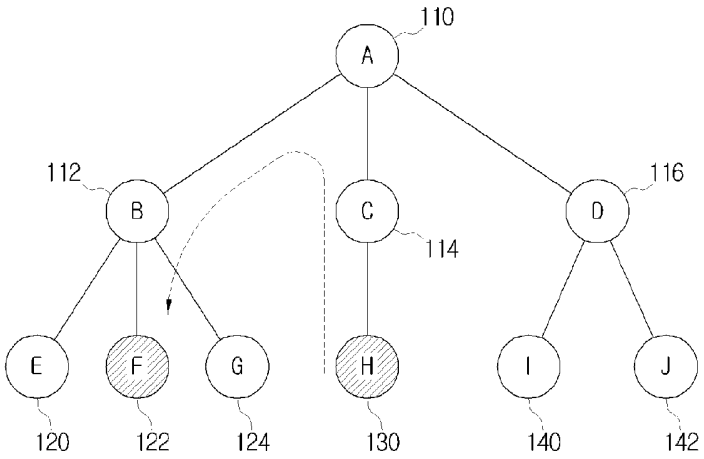
[15] The optimal path setting method of claim 13, wherein other neighboring node of the neighboring node replacing the topology server, operates by a backup server with respect to the neighboring node.

[16] A topology server comprising a processor that determines a path for transmitting data from a source node to a destination node based on a shortcut request message from the source node; and
an optimal path being a shortest transmissible distance from the source node to the destination node based on addresses of lower nodes connected to the topology server.

[17] A wireless network comprising:
a plurality of nodes comprising a source node, a destination node, and a server; and the server including a processor that determines an optimal path for a transmission between the source node and the destination node based on a

shortcut request message from a source node, the optimal path being a shortest transmissible distance from the source node to the destination node based on addresses of lower nodes connected to the server.

[Fig. 1]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A
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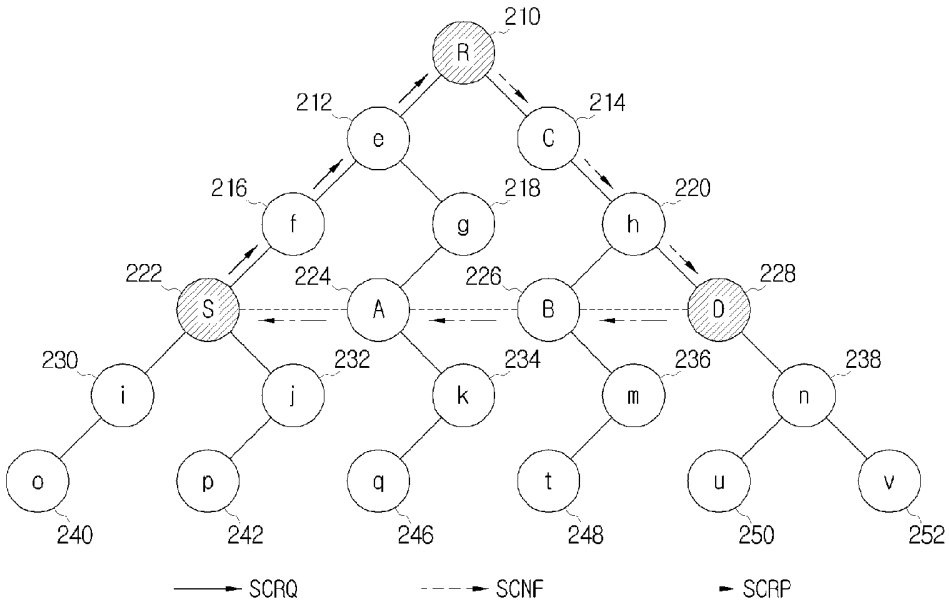
[Fig. 2]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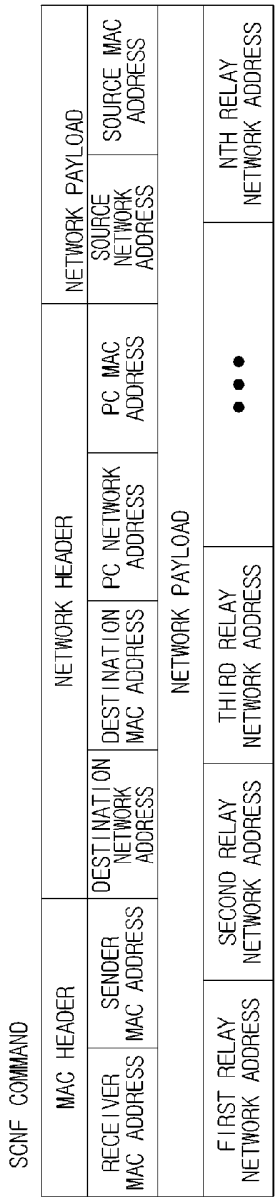
i
j
232
k
234
m
236
n
238
o
p
q
t
u
v
240
242
246
248
250
252
SCRQ
SCNF
SCRP

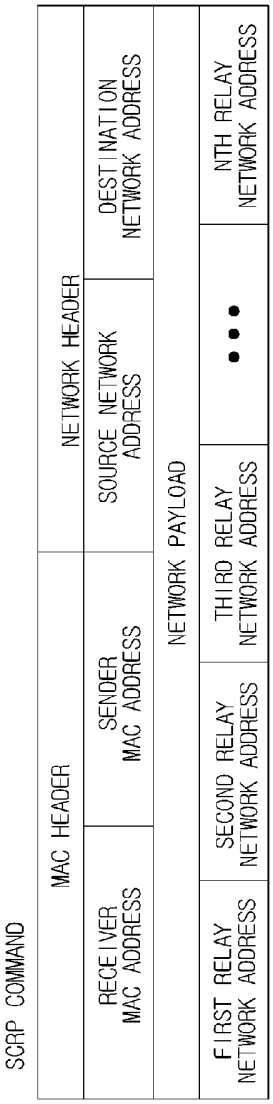
[Fig. 3]


SCRQ COMMAND
MAC HEADER
RECEIVER MAC ADDRESS
SENDER MAC ADDRESS
NETWORK HEADER
PC NETWORK ADDRESS
PC MAC ADDRESS
SOURCE NETWORK ADDRESS
SOURCE MAC ADDRESS
NETWORK PAYLOAD
DESTINATION NETWORK ADDRESS
DESTINATION MAC ADDRESS

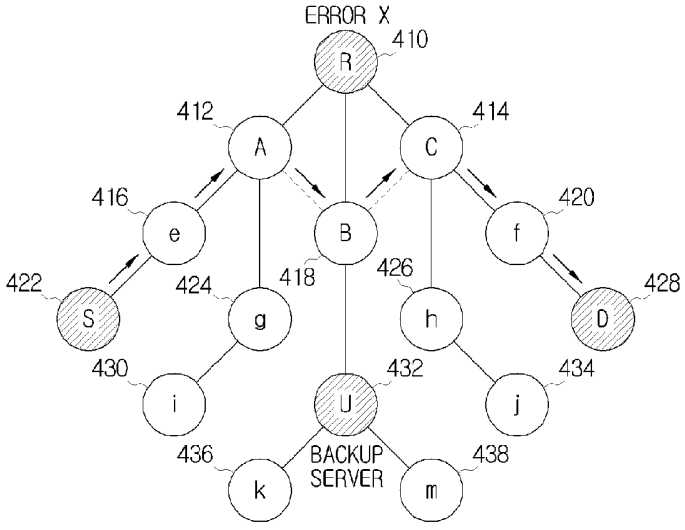
[Fig. 4]


SCNF COMMAND
MAC HEADER
NETWORK HEADER
NETWORK PAYLOAD
RECEIVER MAC ADDRESS
SENDER MAC ADDRESS
DESTINATION NETWORK ADDRESS
DESTINATION MAC ADDRESS
PC NETWORK ADDRESS
PC MAC ADDRESS
SOURCE NETWORK ADDRESS
SOURCE MAC ADDRESS
NETWORK PAYLOAD
FIRST RELAY NETWORK ADDRESS
SECOND RELAY NETWORK ADDRESS
THIRD RELAY NETWORK ADDRESS
• • •
NTH RELAY NETWORK ADDRESS

[Fig. 5]


SCRP COMMAND
MAC HEADER
RECEIVER MAC ADDRESS
SENDER MAC ADDRESS
NETWORK HEADER
SOURCE NETWORK ADDRESS
DESTINATION NETWORK ADDRESS
NETWORK PAYLOAD
FIRST RELAY NETWORK ADDRESS
SECOND RELAY NETWORK ADDRESS
THIRD RELAY NETWORK ADDRESS
• • •
NTH RELAY NETWORK ADDRESS

[Fig. 6]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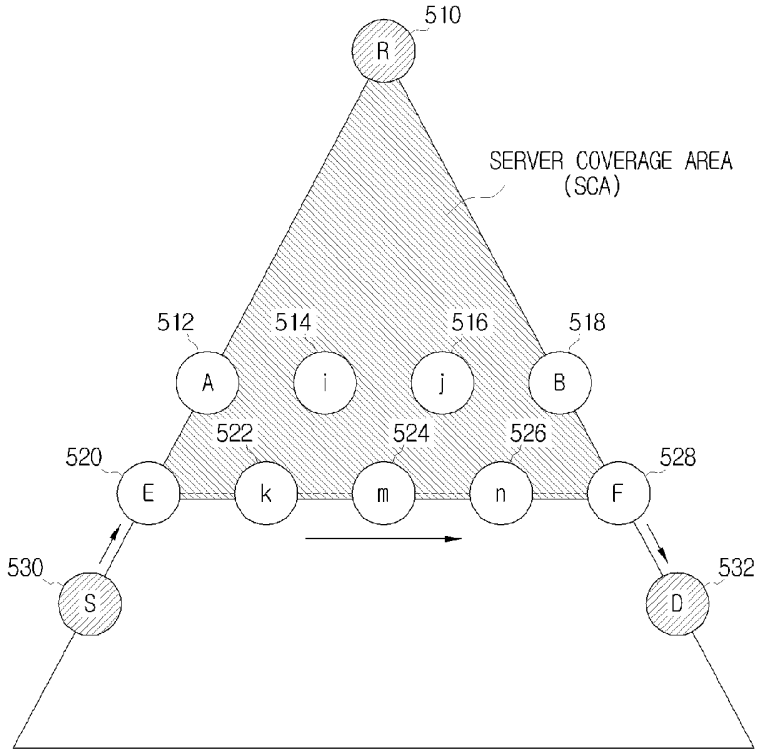
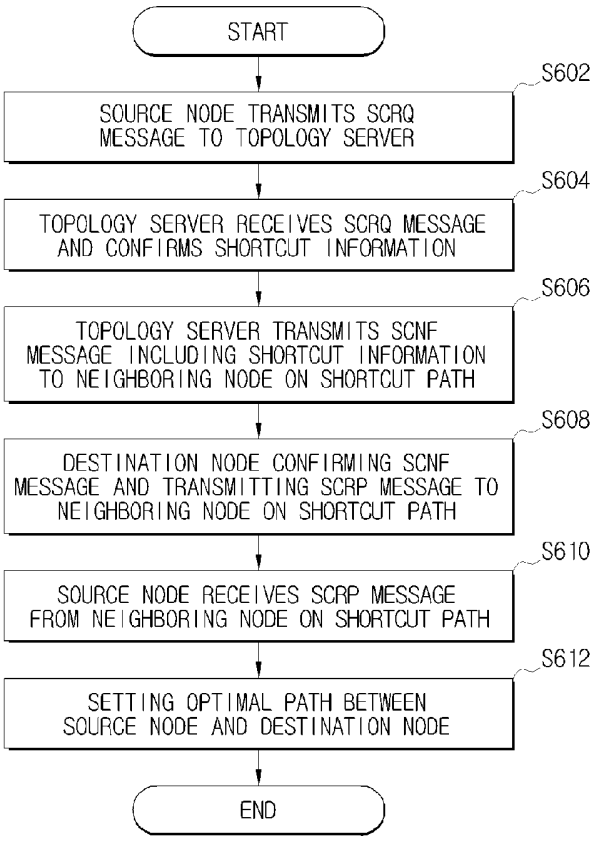
A
414
C
416
e
B
f
420
422
S
424
g
418
426
h
D
428
430
i
U
432
j
434
436
k
BACKUP SERVER
m
438

[Fig. 7]


510
R
SERVER COVERAGE AREA
(SCA)
512
514
516
518
A
i
j
B
522
524
526
520
528
E
k
m
n
F
530
532
S
D

[Fig. 8]


START
S602
SOURCE NODE TRANSMITS SCRQ MESSAGE TO TOPOLOGY SERVER
S604
TOPOLOGY SERVER RECEIVES SCRQ MESSAGE AND CONFIRMS SHORTCUT INFORMATION
S606
TOPOLOGY SERVER TRANSMITS SCNF MESSAGE INCLUDING SHORTCUT INFORMATION TO NEIGHBORING NODE ON SHORTCUT PATH
S608
DESTINATION NODE CONFIRMING SCNF MESSAGE AND TRANSMITTING SCRP MESSAGE TO NEIGHBORING NODE ON SHORTCUT PATH
S610
SOURCE NODE RECEIVES SCRP MESSAGE FROM NEIGHBORING NODE ON SHORTCUT PATH
S612
SETTING OPTIMAL PATH BETWEEN SOURCE NODE AND DESTINATION NODE
END

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/001735

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/28(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC8: H04L, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

EKIPASS(KIPO internal), IEEE xplore

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6760314 B1 (NEC Corporation), 6. Jul. 2004 See the abstract, fig. 1-3, and column 2 line 24 - column 4 line 4	16 - 17
A	US 6760314 B1 (NEC Corporation), 6. Jul. 2004 See the abstract, fig. 1-3, and column 2 line 24 - column 4 line 4	1- 15
A	US 6674757 B1 (Telefonaktiebolaget LM Ericsson), 6. Jan. 2004 See the abstract and all figures	1- 17
P A	US 2005/0259637 A1 (Moser, Patterson & Sheridan, L.L.P. / Lucent Technology, Inc.) 24. Nov. 2005 See the abstract	1- 17

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 AUGUST 2006 (21.08.2006)	**21 AUGUST 2006 (21.08.2006)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/001735

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6760314 B1	06.07.2004	JP2001024699 A2	26.01.2001
		JP3546764 B2	28.07.2004
US 6674757 B1	06.01.2004	AU200015922 A1	05.06.2000
		AU200015922 A5	05.06.2000
		CA2351174 A1	25.05.2000
		EP01129549 A2	05.09.2001
		JP2002530936 T2	17.09.2002
		SE514727 C2	09.04.2001
		SE9803869 A0	12.11.1998
		SE9803869 A	13.05.2000
		TW462167 B	01.11.2001
		US6674757 BA	06.01.2004
		WO200030305 A3	10.08.2000
US2005/0259637 A1	24.11.2005	None	