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(54) **REMOTE MESSAGE ROUTING DEVICE AND METHODS THEREOF**

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H04L 12/725	(2013.01)
H04L 12/717	(2013.01)
H04L 29/08	(2006.01)

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CPC ***H04L 45/00*** (2013.01); ***H04L 45/302*** (2013.01); ***H04L 45/306*** (2013.01); ***H04L 45/42*** (2013.01); ***H04L 67/327*** (2013.01)

(58) **Field of Classification Search**

CPC H04L 45/00; H04L 45/306; H04L 45/42; H04L 67/327

USPC 370/389, 392, 401

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,353,412	A	10/1994	Douglas et al.
5,355,371	A	10/1994	Auerbach et al.
5,675,736	A	10/1997	Brady et al.
5,771,287	A	6/1998	Gilley et al.
5,890,963	A	4/1999	Yen
6,015,348	A	1/2000	Lambright et al.
6,240,517	B1	5/2001	Nishioka

(Continued)

FOREIGN PATENT DOCUMENTS

DE	10218795	11/2003
EP	1519531 A2	3/2005

(Continued)

OTHER PUBLICATIONS

International Search Report for PCT/US08/84937 dated Nov. 26, 2008, 2 pages.

(Continued)

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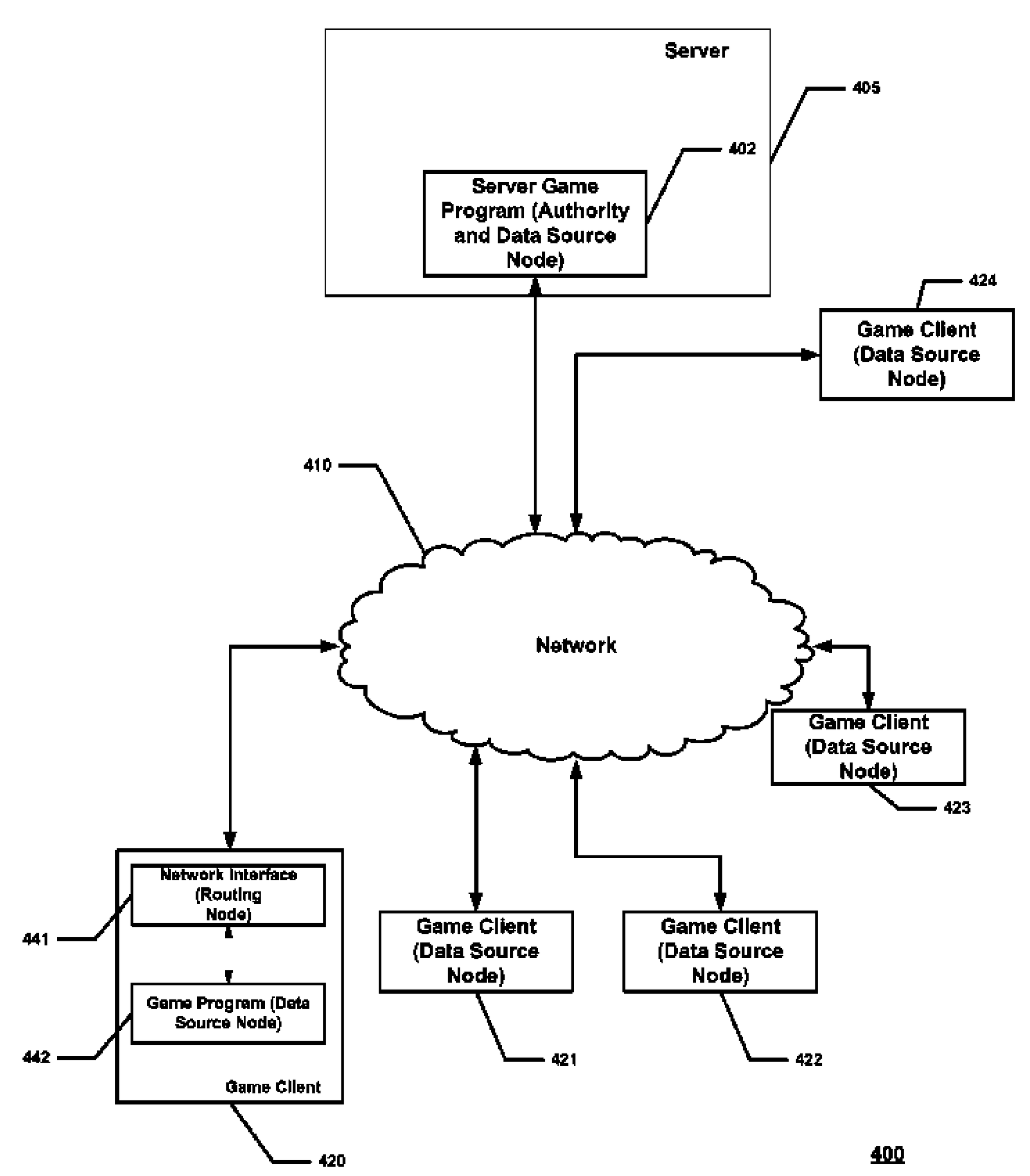
(57) **ABSTRACT**

A message routing method includes receiving a plurality of messages at a routing node. The routing node is configured to route each received message based on the message type. Accordingly, the routing node is able to establish a peer-to-peer connection between the message source and a destination node for a designated message type, while establishing a server-client connection between the message source and a server for other message types. The routing node can also route messages to different groups of destination nodes depending on the message type, thereby providing a flexible way to route messages over a network.

22 Claims, 7 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

6,615,218	B2	9/2003	Mandal et al.	
6,625,661	B1	9/2003	Baldwin, Jr. et al.	
6,650,640	B1 *	11/2003	Muller et al.	370/392
6,745,236	B1	6/2004	Hawkins et al.	
6,763,371	B1	7/2004	Jandel	
6,810,528	B1	10/2004	Chatani	
6,845,389	B1	1/2005	Sen et al.	
6,908,389	B1	6/2005	Puskala	
6,918,042	B1	7/2005	Debry	
6,941,353	B1	9/2005	Lane	
6,961,852	B2	11/2005	Craft	
6,988,196	B2	1/2006	Cromer et al.	
7,000,115	B2	2/2006	Lewis et al.	
7,003,548	B1	2/2006	Barck et al.	
7,046,680	B1	5/2006	McDysan et al.	
7,065,756	B2	6/2006	Barsness et al.	
7,139,780	B2	11/2006	Lee et al.	
7,209,449	B2	4/2007	Tang et al.	
7,249,109	B1	7/2007	Silverbrook et al.	
7,274,702	B2	9/2007	Toutant et al.	
7,457,290	B1 *	11/2008	Salama et al.	370/392
7,640,297	B2 *	12/2009	Obata	709/203
2001/0044842	A1 *	11/2001	Kawakami	709/223
2002/0078223	A1	6/2002	Baldonado et al.	
2002/0120711	A1	8/2002	Bantz et al.	
2002/0180583	A1	12/2002	Paatero et al.	
2002/0198932	A1	12/2002	Wagner	
2003/0028585	A1	2/2003	Yeager et al.	
2003/0117954	A1 *	6/2003	De Neve et al.	370/230
2003/0177187	A1	9/2003	Levine et al.	
2003/0191857	A1	10/2003	Terrell et al.	
2004/0015596	A1	1/2004	Sapuram et al.	
2004/0030794	A1	2/2004	Hugly et al.	
2004/0068580	A1	4/2004	Jo et al.	
2004/0230801	A1	11/2004	Sueyoshi et al.	
2004/0246905	A1	12/2004	Dunagan et al.	
2005/0107161	A1	5/2005	Fujimoto et al.	
2005/0188073	A1	8/2005	Nakamichi et al.	
2005/0251577	A1	11/2005	Guo et al.	
2005/0273855	A1 *	12/2005	Oberle et al.	726/22
2006/0136722	A1	6/2006	Ogura et al.	
2006/0259579	A1	11/2006	Beverly	
2006/0259632	A1	11/2006	Crawford et al.	
2007/0005986	A1	1/2007	Bernard et al.	
2007/0014292	A1	1/2007	Obata	
2007/0060373	A1	3/2007	Beverly	
2007/0086343	A1	4/2007	Kujawa et al.	
2007/0101408	A1	5/2007	Nakhjiri	
2007/0130253	A1	6/2007	Newson et al.	
2007/0133419	A1 *	6/2007	Segel	370/236
2007/0189517	A1	8/2007	Koseki et al.	
2007/0226498	A1	9/2007	Walmsley et al.	
2007/0285385	A1 *	12/2007	Albert et al.	345/107
2007/0297405	A1	12/2007	He	
2007/0298879	A1 *	12/2007	Kobayashi et al.	463/31
2008/0009337	A1	1/2008	Jackson et al.	
2008/0009352	A1	1/2008	Aoyama et al.	
2008/0010371	A1	1/2008	Yamamoto et al.	
2008/0013551	A1	1/2008	Scholl	
2008/0016236	A1	1/2008	Beverly et al.	
2008/0022389	A1	1/2008	Calcev et al.	
2008/0039208	A1	2/2008	Abrink et al.	
2008/0045285	A1	2/2008	Fujito	
2008/0049621	A1	2/2008	McGuire et al.	

FOREIGN PATENT DOCUMENTS

JP	10314451	12/1998
JP	2001246147	9/2001
KR	20030063543	7/2003

OTHER PUBLICATIONS

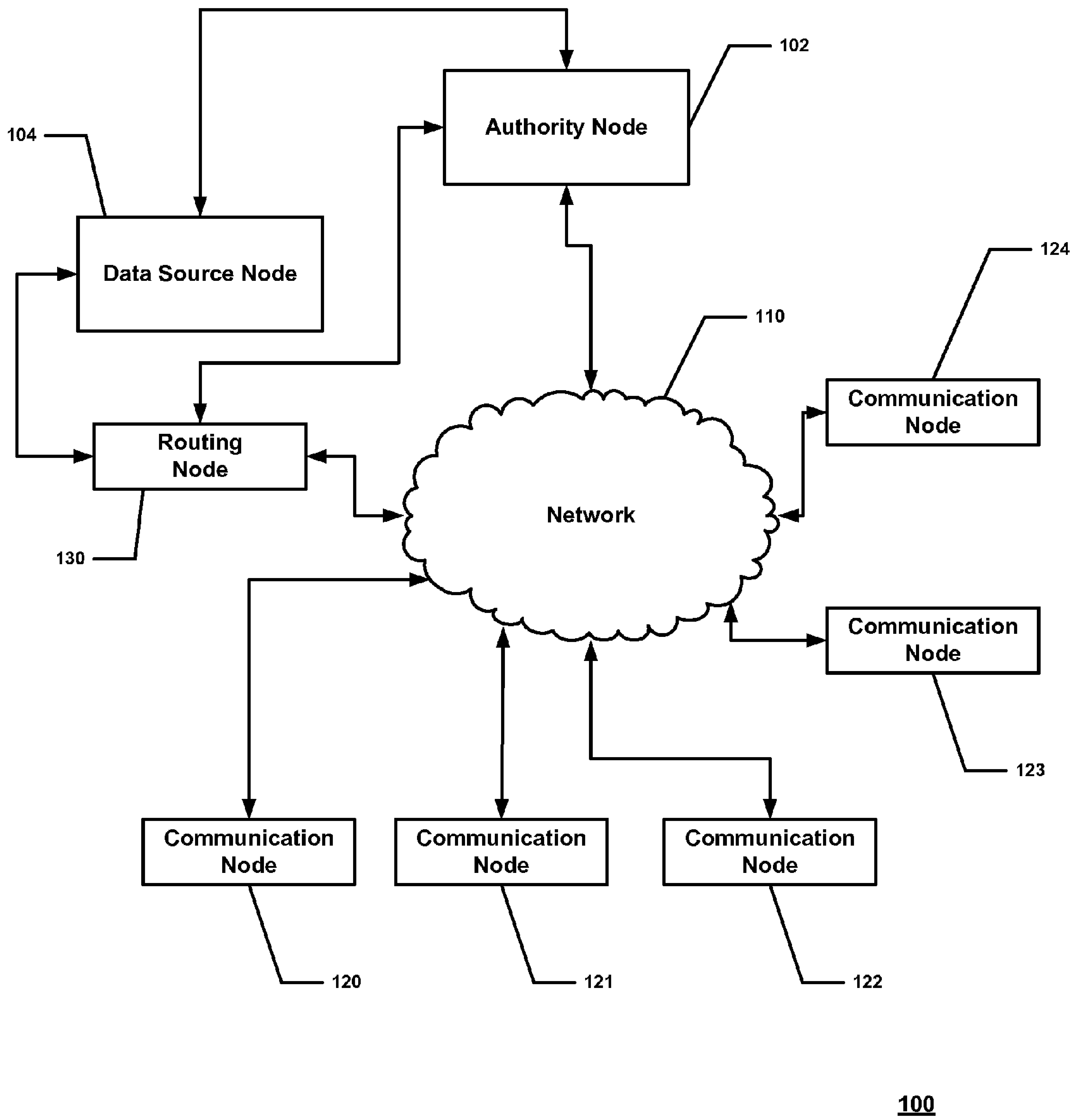
European Search Report for Application No. 08854980.3 dated Oct. 12, 2010, 6 pages.

Written Opinion—PCT/US2008/084937—ISA/EPO—Nov. 26, 2008.

"European Application No. 08854980.3, Communication pursuant to Article 94(3) EPC", Oct. 1, 2013 , 5 pages.

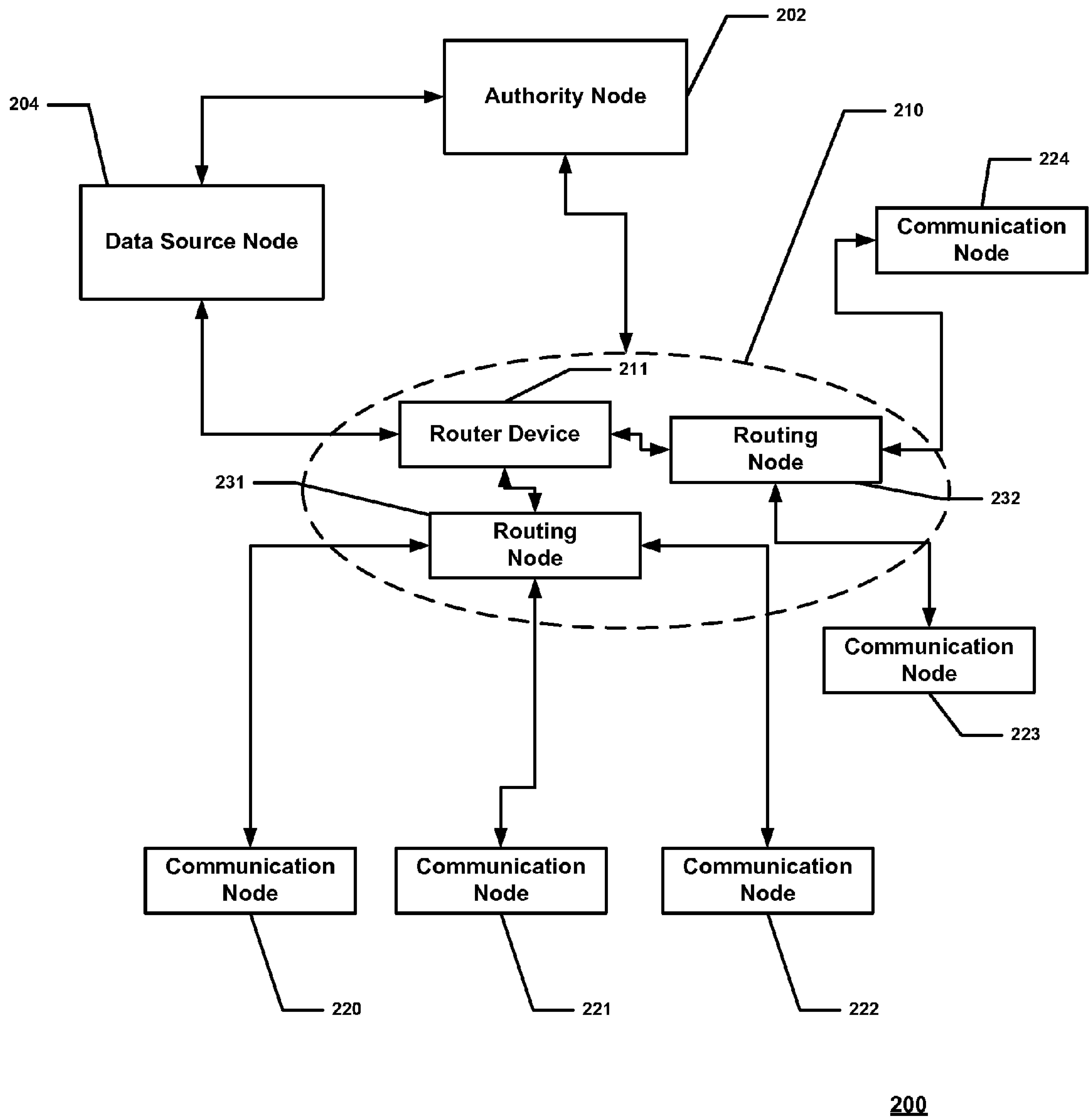
"Korean Application No. 2010-7014093, KIPO Notice of Grounds for Rejection", Sep. 12, 2014, 8 pages.

* cited by examiner



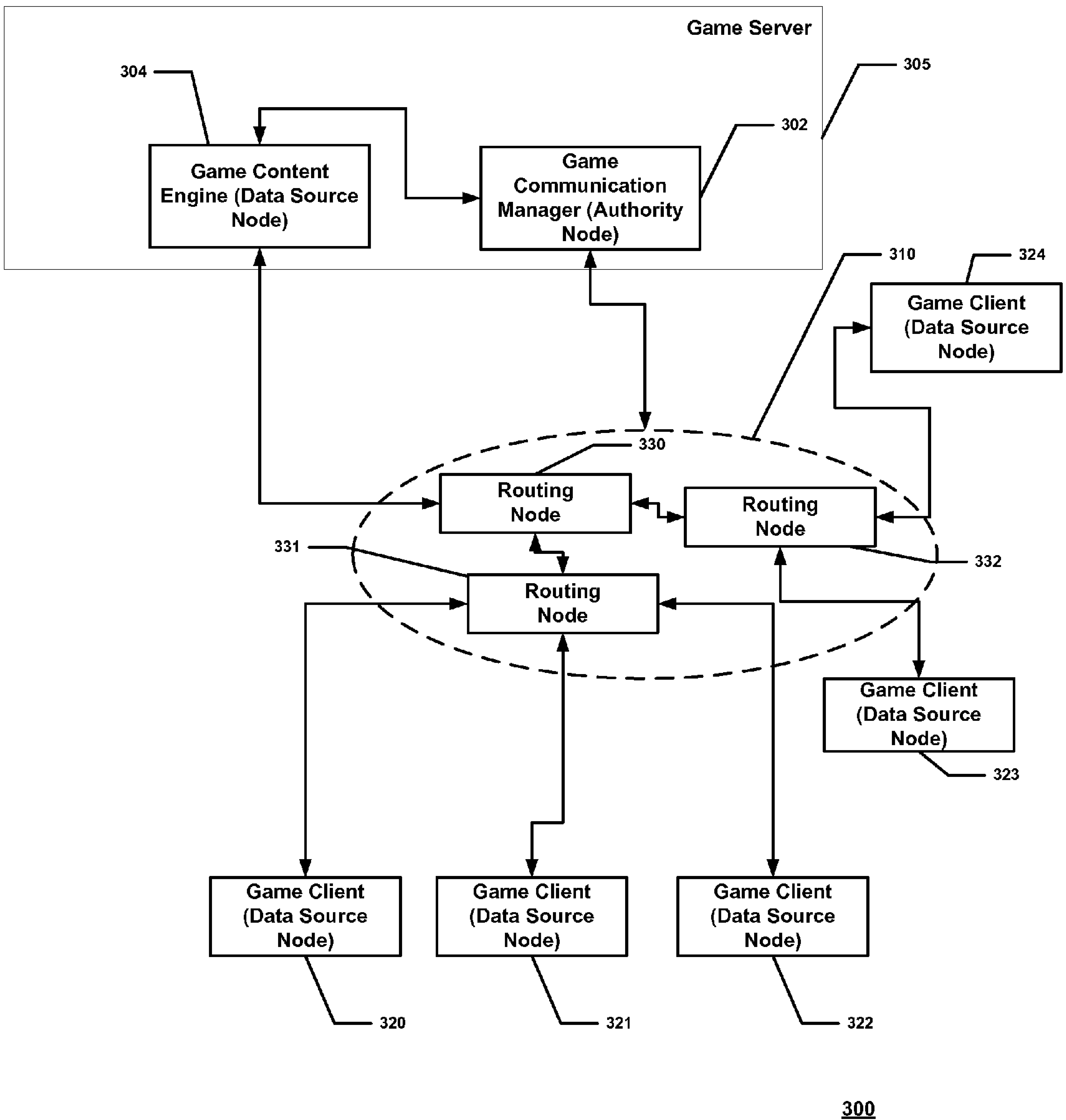
102
Authority Node
104
Data Source Node
124
110
Communication Node
Routing Node
Network
130
Communication Node
123
Communication Node
Communication Node
Communication Node
120
121
122
100

FIG. 1



202
Authority Node
204
Data Source Node
210
224
Communication Node
211
Router Device
Routing Node
231
232
Routing Node
Communication Node
223
Communication Node
Communication Node
Communication Node
220
221
222
200

FIG. 2



Game Server
304
305
302
Game Content Engine (Data Source Node)
Game Communication Manager (Authority Node)
310
324
Game Client (Data Source Node)
330
Routing Node
Routing Node
331
332
Routing Node
Game Client (Data Source Node)
323
Game Client (Data Source Node)
Game Client (Data Source Node)
Game Client (Data Source Node)
320
321
322
300

FIG. 3

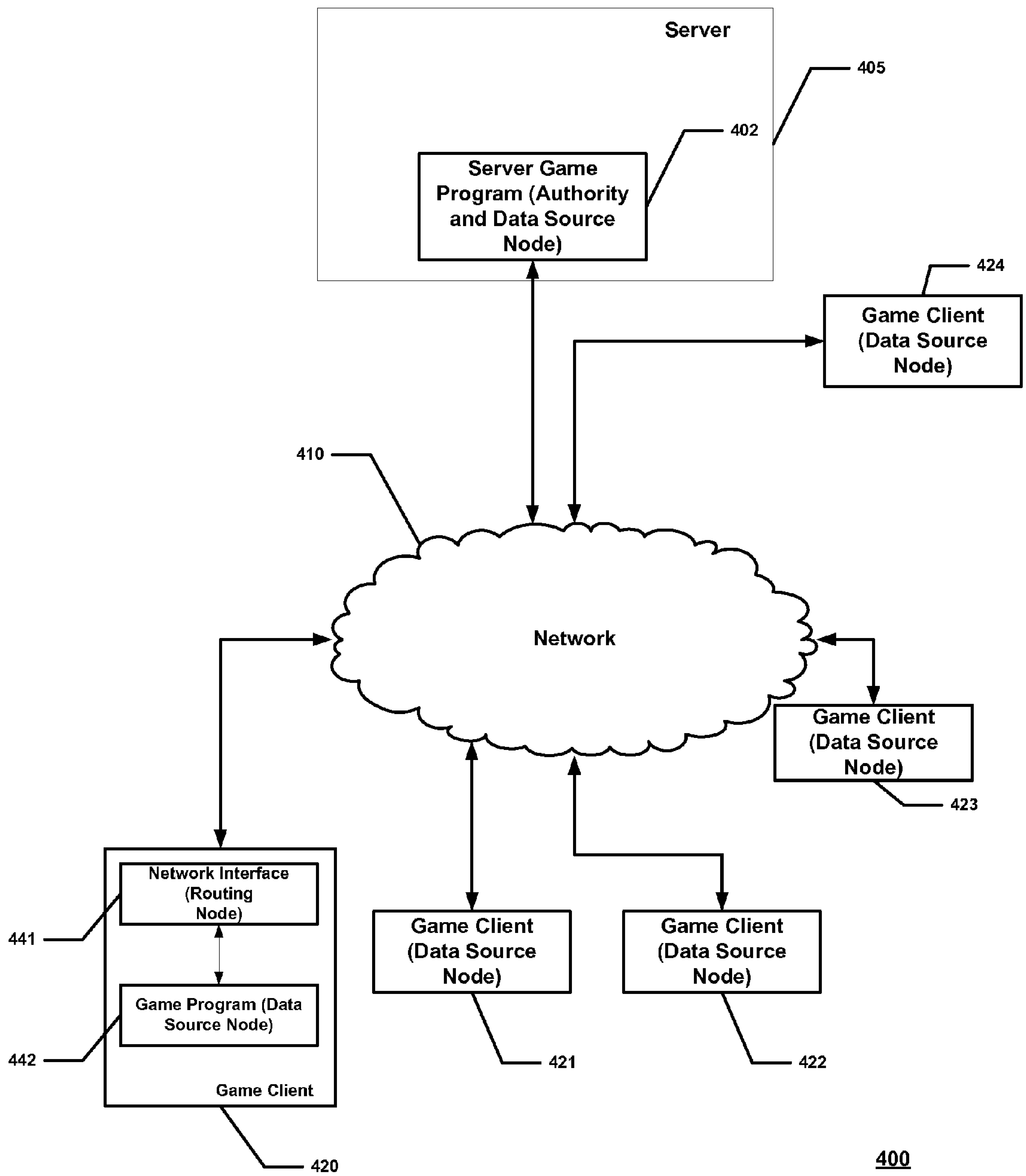

Server
405
402
Server Game Program (Authority and Data Source Node)
424
Game Client (Data Source Node)
410
Network
Game Client (Data Source Node)
423
Network Interface (Routing Node)
441
Game Program (Data Source Node)
442
Game Client
420
Game Client (Data Source Node)
421
Game Client (Data Source Node)
422
400

FIG. 4

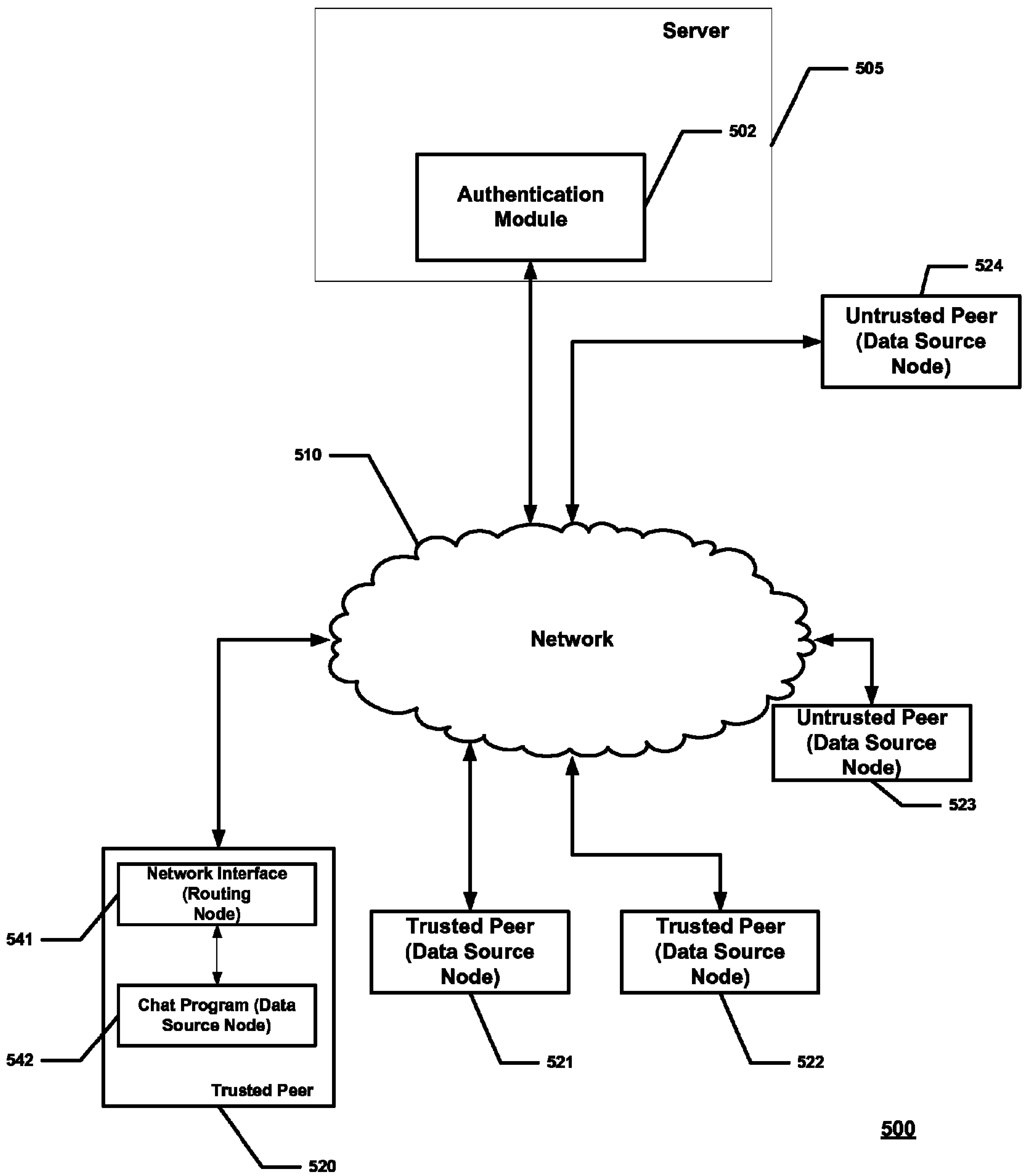

Server
505
502
Authentication Module
524
Untrusted Peer (Data Source Node)
510
Network
Untrusted Peer (Data Source Node)
523
Network Interface (Routing Node)
541
Chat Program (Data Source Node)
542
Trusted Peer
520
Trusted Peer (Data Source Node)
521
Trusted Peer (Data Source Node)
522
500

FIG. 5

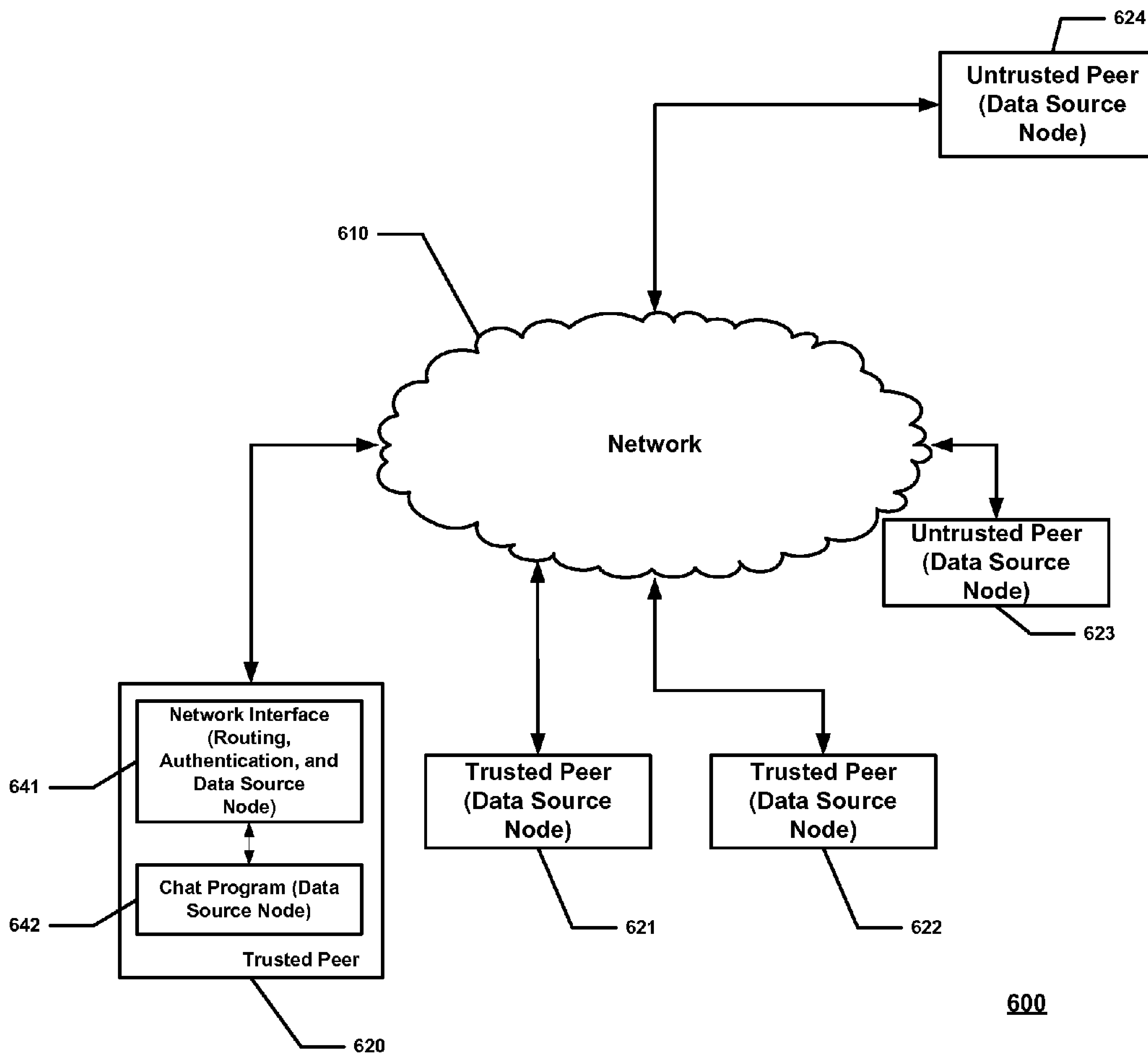

624
Untrusted Peer (Data Source Node)
610
Network
Untrusted Peer (Data Source Node)
623
641
Network Interface (Routing, Authentication, and Data Source Node)
642
Chat Program (Data Source Node)
Trusted Peer
620
Trusted Peer (Data Source Node)
621
Trusted Peer (Data Source Node)
622
600

FIG. 6

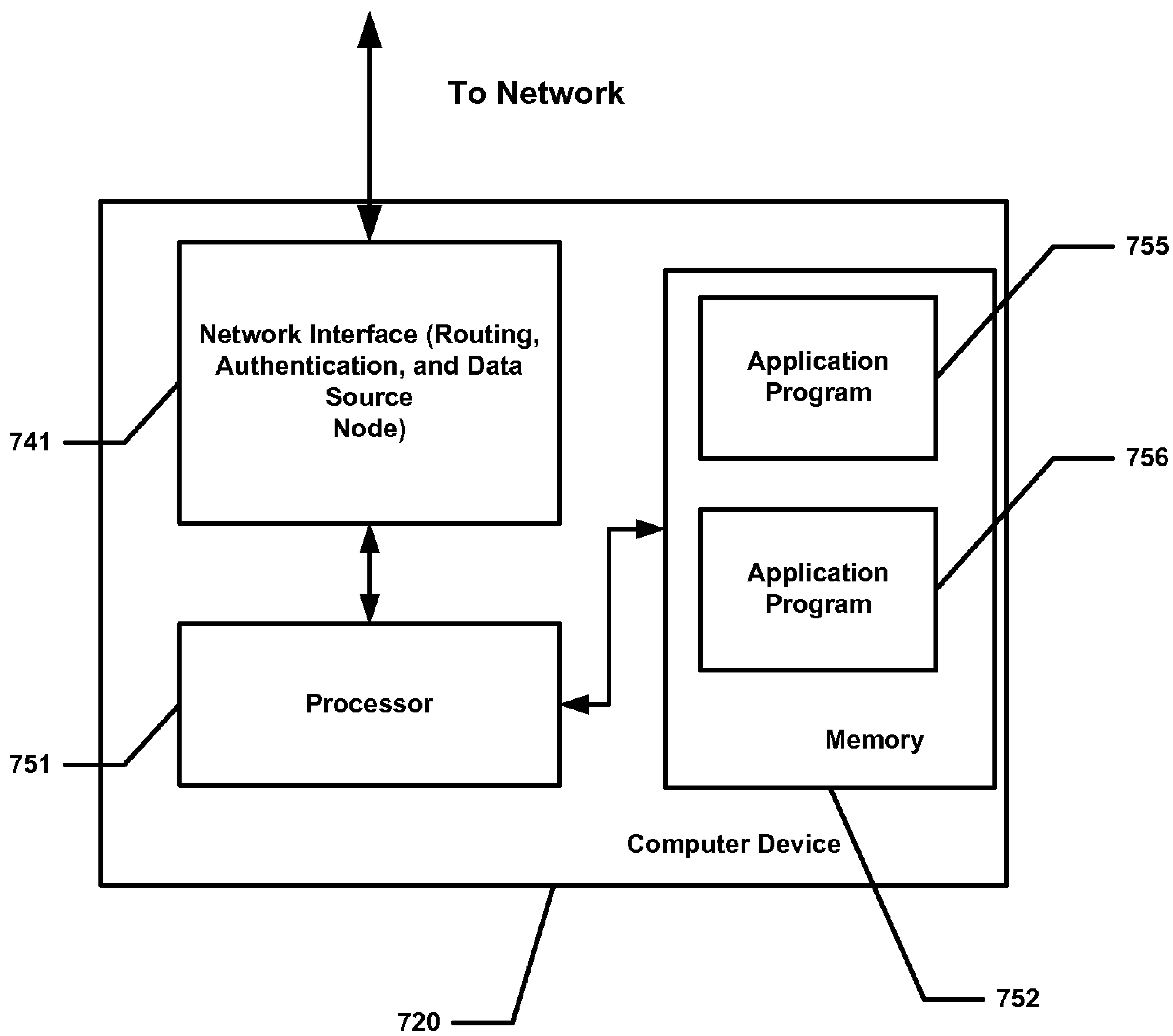

To Network
Network Interface (Routing, Authentication, and Data Source Node)
Application Program
Application Program
Processor
Memory
Computer Device
741
751
755
756
752
720

FIG. 7

REMOTE MESSAGE ROUTING DEVICE AND METHODS THEREOF

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application claims priority to U.S. Provisional Patent Application No. 60/991,140, entitled "System and Method for Distributed Method Routing," filed on Nov. 29, 2007, which is assigned to the current assignee hereof and is incorporated herein by reference in its entirety.

BACKGROUND

1. Field of the Disclosure

The present disclosure relates to communication between nodes, and more particularly to communication between electronic devices.

2. Description of the Related Art

A network may be characterized by several factors like who can use the network, the type of traffic the network carries, the medium carrying the traffic, the typical nature of the network's connections, and the transmission technology the network uses. For example, one network may be public and carry circuit switched voice traffic while another may be private and carry packet switched data traffic. Whatever the make-up, most networks facilitate the communication of information between at least two nodes, and as such act as communication networks.

In recent years, several applications have been developed that rely on timely and effective interactions between two or more elements of a communication network. For example, an online banking server, or host, may interact with hundreds or thousands of client computers via the communication network. With such an architecture, the networked host computer is frequently tasked with providing content to clients, receiving client requests, processing those requests, and responding to those requests, and synchronizing those requests with the requests of other clients. However, a large number of communications between client and host, or between peers in a peer-to-peer network can be difficult to communicate over a network in an efficient manner, undesirably slowing communications.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure may be better understood, and its numerous features and advantages made apparent to those skilled in the art by referencing the accompanying drawings.

FIG. **1** is a block diagram of a communications network in accordance with one embodiment of the present disclosure.

FIG. **2** is a block diagram illustrating a particular embodiment of the communications network of FIG. **1**.

FIG. **3** is a block diagram of a communications network implementing a network game in accordance with one embodiment of the present disclosure.

FIG. **4** is a block diagram of a particular embodiment of the communications network of FIG. **3**.

FIG. **5** is a block diagram of a particular embodiment of a communications network implement a peer-to-peer chat program in accordance with one embodiment of the present disclosure.

FIG. **6** is a block diagram of a communications network in accordance with another embodiment of the present disclosure.

FIG. **7** is a block diagram of a computer device in accordance with one embodiment of the present disclosure.

DETAILED DESCRIPTION

A message routing method includes receiving a plurality of messages at a routing node. The routing node is configured to route each received message based on the message type. Accordingly, the routing node is able to establish a peer-to-peer connection between the message source and a destination node for a designated message type, while establishing a server-client connection between the message source and a server for other message types. The routing node can also route messages to different groups of destination nodes depending on the message type, thereby providing a flexible way to route messages over a network.

Referring to FIG. **1**, a block diagram of a particular embodiment of a communications network **100** is illustrated. The communications network **100** includes an authority node **102**, a data source node **104**, a routing node **130**, and communication nodes **120-124**. The authority node **102**, routing node **130**, and communication nodes **120-124** are each connected to a network **110**. In addition, the data source node **104** is connected to the authority node **102** and is also connected to the routing node **130**. The authority node **102** is further connected to the routing node **130**. As used herein a node refers to an electronic device in a network that is able to receive, transmit, or route a communication message. Nodes are also referred to herein as communication nodes.

For purposes of discussion herein, communication nodes are generally classified into one or more of several types, including authority nodes, data source nodes, routing nodes, and interested nodes (also referred to as destination nodes). As used herein, an authority node is a communication node configured to establish message routing rules based on requests from a data source node. As used herein, a data source node is communication node configured to generate messages for communication to other nodes. A message refers to a unit of information designated for communication to another node or nodes, and can typically be divided into data segments for communication via the physical layer of the network being used for communication. Thus, a message can be divided into multiple packets for communication via a packet-switched network. A routing node refers to a communication node that is configured to receive messages from other communication nodes, and route the received messages to one or more nodes based on one or more message routing rules. A routing node is distinguished from a routing device, such as a conventional router, in that the routing node is able to determine the message type and route the message to more than one destination node based on the message type. A router device, in contrast, routes a packet (which may be associated with a message) based on a packet address. An interested node refers to a communication node that is one of the targeted destinations of a message.

It will be appreciated that a particular communication node can be associated with more than one type of node. Thus, for example, a single communication node can be an authority node, a data source node, a routing node, an interested node, or any combination thereof. Moreover, although for purposes of discussion the communication nodes of FIG. **1** are illustrated as being of a particular node type, it will be appreciated that any of the illustrated nodes could also be associated with other types of communication nodes. Thus, for example, authority node **102** could also be a routing node, or a data source node, or an interested node, or any combination thereof.

It will further be appreciated that nodes can be associated with different types of electronic devices. For example, communication network **100** can be associated with a wide area network configuration, where network **110** represents the Internet or other wide area network. In this configuration, the authority node **102** and data source node **104** can be located at a server device, and communication nodes **120-124** can represent separate client devices, such as desktop computers, portable computers, cell phones, and the like. In another embodiment, communication network **100** can represent a communication network internal to an electronic device, where network **110** is a communication bus. In such an embodiment, the authority node **102** can be a data processor device, and communication nodes **120-124** can represent additional processor devices, peripheral devices, memory devices, and the like. For purposes of discussion herein, it is assumed that network **110** is a wide-area packet-switched network, such as the Internet.

In operation, data source node **104** can send a request to authority node **102** to establish node **104** as a data source node. This request may optionally contain a set of types of messages that the data source node is requesting to be able to generate. In response, authority node **102** can determine if the request is authorized, according to a set of authorization rules (such as password authentication or other security procedure). If the request is authorized, authority node **102** determines a set of message routing rules, based on the types of messages to be communicated by data source node **104** or based on the types of messages requested by the data source node **104**. For example, authority node **102** can determine that data source node will be communicating three types of messages, and establish message routing rules for each type of message.

Authority node **102** communicates the message routing rules to the routing node **130**. The message routing rules, as a whole, indicate the type of messages to be communicated and the interested nodes associated with each group. In an embodiment, the message type can be indicated by one or more fields in a header of a packet associated with the message. In another embodiment, the routing node **130** can determine the message type by inspecting the data payload of a packet associated with the message. In addition, in a particular embodiment, the message type refers to a characteristic of the message, such as an intended use of the message or a type of data being communicated by the message, that is different and distinct from a target or source address of packets associated with the message. This allows the routing node **130** to route messages (and their associated packets) based on criteria different from a particular address assigned by the data source node.

The authority node **102** can communicate the message routing rules to the routing node **130** using one or more control messages. For example, the authority node can communicate an ADD_CONNECTION_TO GROUP message, an ADD_MESSAGE_ROUTING_RULE_TO_GROUP message, a REMOVE_CONNECTION_FROM_GROUP message, and a REMOVE_MESSAGE_ROUTING_RULE_TO_GROUP message. In a particular embodiment, each node defines a connection based on an Internet Protocol (IP) address and port number. In response to the ADD_CONNECTION_TO GROUP message, the node will add an interested node to a group. In response to an ADD_MESSAGE_ROUTING_RULE_TO_GROUP message, the node will associate the group with a particular routing rule. The routing rule indicates what type of message gets sent to nodes in the group. In an embodiment, each message routing rule can indicate an offset, a size, and a value to which messages will be compared in order to determine if ADD_MESSAGE_ROUTING_RULE_TO GROUP message specifies the offset, size, value, and group with which the rule is associated. Thus, each group is associated with a particular message type, and indicates the interested nodes to which messages of that type should be communicated. The REMOVE_CONNECTION_FROM_GROUP message, and REMOVE_MESSAGE_ROUTING_RULE_TO_GROUP message remove a connection and a routing rule, respectively, from a designated group.

In response to receiving a message, the routing node **130** checks the offset, size, and value of the message, and based on this determination communicate the message to the interested nodes indicated by the group. It will be appreciated each group can indicate more than one interested node, so a particular message can be communicated to multiple interested nodes. For example, if a group includes connections indicating two different nodes, each received message associated with that group (i.e. each message of the message type associated with the group) will be communicated to each node in the group. The routing node **130** can determine an address, such as an IPv4 or other IP address, for each interested node, form packets including the message content addressed to each interested node, and route the packets to the interested nodes via the network **110**. The routing node **130** thus provides an interface that allows the conventional network **110** to be employed to route packets to multiple interested nodes based on the type of received message.

Further, by using the authority node **102** to establish the message routing rules, the design of data source node **104** can be simplified. In particular, different data source nodes can communicate with authority node **102**, which can establish message routing rules at the network **110** for different message types from each data source node. The establishment of message routing rules is thus abstracted from the data source nodes and the routing nodes, simplifying the design and operation of each node. In addition, it can reduce the communication bandwidth of the data source node **104** because the data source node does not itself have to communicate each message to each destination node. Moreover, by locating the routing nodes closer to the interested nodes, message communication latency can be reduced.

FIG. **2** illustrates a particular embodiment of a communications network **200**. Communications network **200** includes authority node **202**, data source node **204**, a network **210**, and communication nodes **220-224**, each of which are configured similarly to the corresponding portions of communication network **100**. In addition, in the illustrated embodiment of FIG. **2**, the network **210** includes a router device **211** and routing nodes **231** and **232**.

In the illustrated example of FIG. **2**, it is assumed that data source node **204** has associated communication nodes **220-222** with a first group, designated Group A, and has associated communication nodes **223** and **224** with a second group, designated Group B. For example, data source node **204** can be a web server program that has determined nodes **220-222** should be provided with a first web page, while communication nodes **223** and **224** should be provided with a second, different web page. Accordingly, data source node **204** requests authority node **202** to establish node **204** as a data source node. In response, authority node **202** determines a set of message routing rules for each type of message associated with data source node **204**. In particular, messages targeted to Group A are of a different type than messages targeted to Group B. Accordingly, authority node determines a set of message routing rules so that messages targeted to Group A (referred to as A-type messages) will be routed to communication nodes **220-222**, and determines a set of message routing rules so that messages targeted to Group B (referred to as B-type messages) will be communicated to communication node **234** and communication node **235**.

In response to determining the message routing rules, the authority node **202** communicates the message routing rules to routing nodes **231** and **232**. In addition, authority node **202** communicates an address, such as an IP address, of each of the routing nodes **231** and **232** to data source node **204**. The data source node **204** is configured to form one or more packets for each message to be communicated, with each packet including the address of the associated routing node, and provides each packet to the router device **211** for routing. Router device **211** does not route the received packets based on the type of message associated with each packet, but instead routes each packet based on the associated address. In an embodiment, the router device **211** is a unicast router device that is configured to route each packet to the associated unicast address. It will be appreciated that the network **210** can include additional router devices between each of the illustrated nodes. For example, additional router devices can be placed between the routing nodes **231** and **232** and the associated communication nodes. The routing nodes **231** and **232** can thus employ the router devices to route messages to interested nodes.

Data source node **204** communicates both A-type and B-type messages to router device **211**, which routes the messages to one of routing nodes **231** or **232** based on the address of the packets associated with each message. Authority node **202** communicates message routing rules to routing node **231** so that all A-type messages are routed to each of communication nodes **220-222**. In addition, authority node **202** communicates message routing rules to routing node **232** so that all B-type messages are communicated to routing nodes **223** and **224**. Thus, data source node **204** does not have to determine the routing path for A-type message and B-type messages, but instead can rely on the message routing rules established by authority node **202** to handle message routing. This simplifies the design of data source node **204**, improving communication efficiency.

Further, the routing nodes **231** and **232** are able to employ the routing devices that form the backbone of the network **210** to communicate messages. In an embodiment, the routing node **231** establishes a one-to-one connection with each of the communication nodes **220-222**. As used herein, a one-to-one connection is a connection established based on an address of the destination node that is unique with respect to addresses of other destination nodes. By establishing one-to-one connections, the routing node **231** is able to route messages using one or more unicast routers, allowing messages to be routed to multiple destinations based on message type, without extensive redesign of the network **210**.

Referring to FIG. **3**, a block diagram of a communication network **300** implementing a network game is illustrated. Communication network **300** includes a server **305** and game clients **320-324** (which can also be game peers in a peer-to-peer network), each connected to a network **310** having routing nodes **330-332**. Game server **305** includes a game content engine **304**, which is configured as a data source node, and a game communication manger **302**, which is configured as an authority node.

In operation, the game content engine **304** is configured to provide game content information for a network game, such as multiplayer online game (MOG), to game programs operating at game clients **320-324**. In the illustrated embodiment, game clients **320-322** are assumed to be associated with a first group, designated Group A, while game clients **323** and **324** are associate with a second game group, designated Group B. The grouping of game clients can be based on one or more predetermined or dynamic criteria. For example, Group A and Group B may each be associated with participants of different player-vs.-player game sessions. In another embodiment, Group A may be associated with players in a first game region, while Group B is associated with players in a second game region. It will be appreciated that each game client or game peer can be a member of more than one group. Further, any arbitrary grouping can be employed for each type of message, so that two game clients or game peers can be in a first group for a first type of message and in two different groups for a second type of message.

Game communication manager **302** establishes, in response to request from game content engine **304**, message routing rules for different message types associated with each group. Thus, messages associated with Group A (referred to as A-type messages) are routed, based on the message routing rules, to each of game clients **320-322**, while messages associated with Group B (referred to as B-type messages, are routed to each of game clients **323** and **324**. Because routing of types of messages is handled by the message routing rules, rather than by the game content engine determining a unique address for each targeted recipient of a message, the game content engine **304** is simplified and communications can occur more efficiently.

In addition, it will be appreciated that each game program and game client can act as a data source and routing node. This can be better understood with reference to FIG. **4**, which illustrates a communication network **400**. The communication network **400** includes a server **405**, and game clients **420-424**, each connected to a network **410**. The game server **405** includes a server game program that is configured as a data source and authority node. Game client **420** includes a network interface **441** and a game program **442**. The network interface **441** is a network interface card, processor, or other hardware module configured to interface with the network **410**. The game program **442** is a program executing at a processor to interact with the server game program in order to provide a game experience to a user. The game program **442** can be executed at a different processor or other hardware module from the network interface **441**. Game clients **421-424** can each be configured similarly to game client **420**.

In the illustrated embodiment of FIG. **4**, the network interface **441** can be configured as a routing node. In particular, network interface **441** can communicate a request to server game program **402** to be configured as a routing node. In response, server game program **402** can communicate message routing rules to the network interface **441** so that messages of different types can be routed to different destination nodes. In a particular embodiment, network interface **441** can employ the message routing rules to route messages directly to other game clients without sending the message through the server game program **402**. For example, network interface **441** can receive a message from game program **442**, indicating the user has interacted with the game in a particular way. The message will indicate a particular message type, indicating a group of game clients associated with the message, the type of interaction represented by the message, and the like. Based on the message type, the network interface **441** can route the message to another game client via the network **410** without routing the message via the server game program **402**. The network interface **441** can thus establish a peer-to-peer connection between the game client **420** and each interested node for messages of a first message type, while establishing a client-server connection between the game client **420** and the server **405** for messages of a second message type. As used herein, a peer-to-peer connection refers to a connection between communication nodes where messages are routed between the nodes without routing the messages to a designated central server or set of servers for processing. A client-server connection refers to a connection where messages are routed to a designated server or set of servers for processing.

For example, if network interface **441** receives a message associated with Group A, which includes game client **421** and game client **422**, network interface **441** can route a copy of the message to game client **421** and a copy of the message to game client **422**, without routing the message copies through server game program **402**. This allows game interactions to be communicated to the appropriate groups in a peer-to-peer fashion, without direct interaction with the server game program **402**. Messages can thereby be communicated more quickly, providing for more efficient communication and an improved user experience. Further, the peer-to-peer communication is implemented using the message routing rules at the network interface **441** and other routing nodes, so that communication of messages to different game clients is relatively transparent to game program **442**. Accordingly, game program **442** can communicate in a peer-to-peer fashion without extensive modification of the program.

This configuration allows for messages associated with different software applications, or different portions of a software application, to be routed via a peer-to-peer connection or via a server-client connection, depending on the application. For example, in some network games, the game program itself includes a chat portion, where game participants can send text or voice chat messages to other participants. These chat messages typically do not impact the game play itself. Accordingly, network interface **441** can route chat messages in a peer-to-peer fashion, while routing messages associated with game events (e.g. firing a weapon, moving a character, and the like) to the server game program **402** for processing. This allows the server game program **402** to process only those messages that impact the game play itself, improving communication bandwidth between the server game program **402** and the game participants.

Referring to FIG. **5**, a particular embodiment of a communication network **500** implementing a peer-to-peer chat program is illustrated. The communication network **500** includes a server **505**, and peer devices **520-524**, each connected to a network **510**. The server **505** includes a peer authentication module that is configured as an authority node. Peer device **520** is a computer device, such as a cell phone, desktop or laptop computer, and the like, that includes a network interface **541** and a chat program **542**. The network interface **541** is a network interface card, processor, or other hardware module configured to interface with the network **510**. The chat program **542** is a program executing at a processor to interact with the other chat programs at peer devices **521-524** to allow users to chat, via text input, voice input, and the like, with other users. The chat program **542** can be executed at a different processor or other hardware module from the network interface **541**. Peer devices **521-524** can each be configured similarly to game client **520**.

In the illustrated embodiment of FIG. **5**, each of the peer devices **520-524** can be either a trusted peer or an untrusted peer. In particular, each peer device can provide authentication information via the network **510** to the peer authentication module **502**. The peer authentication module **502** can perform an authentication procedure to determine if each peer device is a trusted or untrusted peer. A peer can also be untrusted if it provides no authentication information to the peer authentication module **502**.

The network interface **541** can be configured as a routing node. In particular, network interface **541** can communicate a request to peer authentication module **502** to be configured as a routing node. In response, peer authentication module **502** can communicate message routing rules to the network interface **541** so that messages of different types can be routed to different destination nodes. In a particular embodiment, the message routing rules cause the network interface **541** to route messages between trusted peers without routing those messages via peer authentication module **502**. Further, the message routing rules can cause messages to be routed to untrusted peers to be routed to peer authentication module **502**, so that the module can perform designated security functions, such as encrypting messages, dropping messages, checking message content, and the like. The message routing rules thus establish a security protocol for trusted and untrusted peers without extensive modification of the chat program **542**.

Referring to FIG. **6**, another embodiment of a communication network **600** is illustrated. The communication network **600** is configured similarly to the communication network **500**. However, in the communication network **600** the network interface **641** is configured as an authentication node and a data source node, as well as a routing node. Further, in the embodiment of FIG. **6**, the network interface **641** is configured to perform an authentication procedure whereby it determines which of the nodes **620-624** are trusted peers. For example, network interface **641** can perform a password authentication procedure, an automated exchange of authentication codes or certificates, or other authentication procedure where it determines which of nodes **620-624** can be designated as trusted nodes or untrusted nodes. Further, network interface **641** can provide message routing rules to routing nodes in the network **610** or at the nodes **621-624** so that all messages of a type associated with an untrusted node are routed to the network interface **641** or other device for processing. Thus, in the illustrated embodiment of FIG. **6**, message routing rules are determined and provided to each routing node from a peer in a peer-to-peer network, rather than from a central server or other device.

FIG. **7** illustrates a particular embodiment of a computer device **720**, corresponding to a communication node, client device or peer device illustrated at FIGS. **1-6**. The computer device **720** includes a processor **751** connected to a network interface device **741** and a memory **752**. The memory **752** stores application programs **755** and **756**, which are configured to manipulate the processor **751** to perform designated tasks. The network interface device **741** is a device, such as a network interface card, that is configured to provide a physical and logical interface to the network **110**. In addition, the network interface is configured as one or more of a routing node, authentication node, and data source node as described with respect to FIGS. **1-7**. Thus, in the illustrated embodiment of FIG. **7**, the network interface **741** can perform the function of providing a network interface for communications from the processor **751**, such as formation of packets and provision of a physical interface for packet communication to the network, and also perform the function of routing messages to different groups of interested nodes based on the message type. The network interface **741** can thereby increase the bandwidth of communications from the processor **751** without extensive modification of the application programs **755** and **756**.

The above disclosed subject matter is to be considered illustrative, and not restrictive, and the appended claims are intended to cover all such modifications, enhancements, and other embodiments that fall within the true spirit and scope of the present invention. Thus, to the maximum extent allowed by law, the scope of the present invention is to be determined by the broadest permissible interpretation of the following claims and their equivalents, and shall not be restricted or limited by the foregoing detailed description.

What is claimed is:

1. A method for routing messages, the method comprising:
receiving, via a network interface of a routing node, a first message and a second message from a first data source node of a communication network;
determining, by a processor of the routing node, a first message type associated with the first message and a second message type associated with the second message based at least in part on inspecting a first data payload of the first message and a second data payload of the second message;
in response to determining, based at least in part on the first message type, that the first message is a first type of message, establishing a peer-to-peer connection at the routing node between the first data source node and a first destination node and routing the first message to the first destination node; and
in response to determining, based at least in part on the second message type, that the second message is a second type of message, establishing at the routing node a server-client connection between the first data source node and a server of the communication network and routing the second message to the server;
wherein the first type of message is associated with a first software component and the second type of message is associated with a second software component.

2. The method of claim 1, further comprising:
in response to determining that the first message is the first type of message, establishing a first plurality of peer-to-peer connections at the routing node between the first data source node and a first plurality of destination nodes comprising the first destination node and routing the first message to the first plurality of destination nodes;
receiving a third message; and
in response to determining that the third message is a third type of message, establishing a second plurality of peer-to-peer connections at the routing node between the first data source node and a second plurality of destination nodes and routing the third message to the second plurality of destination nodes, the second plurality of destination nodes different from the first plurality of destination nodes.

3. The method of claim 2, wherein:
said routing the first message of the first type of message to the first plurality of destination nodes comprises:
determining a first plurality of destination addresses associated with the first plurality of destination nodes, each of the first plurality of destination addresses uniquely associated with a corresponding one of the first plurality of destination nodes;
forming a first packet including at least a portion of the first message; and
routing the first packet to each of the first plurality of destination addresses; and
said establishing the server-client connection between the first data source node and the server comprises:
determining a server address associated with the server;
forming a second packet including at least a portion of the second message of the second type of message; and
routing the second packet to the server address.

4. The method of claim 1, further comprising:
receiving an establishment request from the first data source node;
in response to the establishment request, receiving a set of rules at the routing node, the set of rules indicating routing rules for the first type of message and the second type of message; and
routing the first type of message and the second type of message based on the routing rules.

5. The method of claim 1, wherein the first type of message is associated with a first game event of a network game and the second type of message is associated with a second game event.

6. The method of claim 1, further comprising:
receiving a third message and a fourth message at the routing node from the first data source node;
in response to determining that the third message is a third type of message, establishing at the routing node a second peer-to-peer connection between the first data source node and a second destination node; and
in response to determining that the fourth message is a fourth type of message, establishing at the routing node a second server-client connection between the first data source node, the second destination node, and the server.

7. The method of claim 1, further comprising:
receiving a third message at the routing node from a second data source node;
establishing at the routing node a second server-client connection between the second data source node, a second destination node, and the server in response to determining that the third message is a third type of message.

8. The method of claim 1, wherein establishing the peer-to-peer connection comprises establishing the peer-to-peer connection in response to determining the first destination node is a trusted node based on a trust authentication procedure.

9. The method of claim 8, wherein establishing the server-client connection comprises establishing the server-client connection in response to determining a second destination node is not a trusted node based on the trust authentication procedure.

10. The method of claim 9, wherein the trust authentication procedure is performed between the routing node and the first destination node.

11. The method of claim 1, wherein the routing node comprises a network interface card for a computer device.

12. The method of claim 1, wherein inspecting the first data payload comprises inspecting the first data payload according to a routing rule that indicates an offset into the first data payload and a size of the first message.

13. A method for routing messages, the method comprising:
receiving, via a network interface of a routing node, a first plurality of messages from a first data source node of a communication network;
determining, by a processor of the routing node, types of messages associated with the first plurality of messages received at the routing node from the first data source node;
in response to determining that a first message of the first plurality of messages is a first type of message, determining at the routing node a first group of destination nodes associated with the first type of message;
in response to determining that a second message of the first plurality of messages is a second type of message, determining at the routing node a second group of destination nodes associated with the second type of mes-

sage, the second group of destination nodes different from the first group of destination nodes;

routing the first message of the first type of message to the first group of destination nodes via a first set of peer-to-peer connections; and

routing the second message of the second type of message to the second group of destination nodes via a second set of peer-to-peer connections, the second message not routed to the first group of destination nodes;

wherein the first type of message is associated with a first software component and the second type of message is associated with a second software component.

14. The method of claim **13**, wherein routing the first message comprises:

establishing a one-to-one connection between the routing node and a destination node of the first group of destination nodes; and

routing the first message via the one-to-one connection.

15. The method of claim **13**, further comprising:

receiving a communication rule at the routing node; and

determining the first group of destination nodes based, at least in part, on the communication rule.

16. The method of claim **13**, wherein said determining the types of messages associated with the first plurality of messages comprises determining the types of messages associated with the first plurality of messages based, at least in part, on corresponding data payloads of the first plurality of messages.

17. The method of claim **15**, wherein the communication rule indicates an offset value, and wherein routing the first message comprises determining the first group of destination nodes based on the offset value.

18. A network device, comprising:

a processor configured to execute a first software component and a second software component; and

a network interface device coupled with the processor, the network interface device configured to:

receive a first message and a second message from the processor;

determine, based at least in part on inspection of a first data payload of the first message and a second data payload of the second message, a first message type associated with the first message and a second message type associated with the second message;

in response to determining, based at least in part on the first message type, that the first message is a first type of message, establish a peer-to-peer connection between the network device and a first destination node and route the first message to the first destination node; and

in response to determining, based at least in part on the second message type, that the second message is a second type of message, establish a server-client connection between the network device and a remote server of a communication network;

wherein the first type of message is associated with the first software component and the second type of message is associated with the second software component.

19. The network device of claim **18**, wherein the network interface device is further configured to:

in response to determining that the first message is the first type of message, establish a first plurality of peer-to-peer connections between the network device and a first plurality of destination nodes comprising the first destination node;

receive a third message; and

in response to determining that the third message is a third type of message, establish a second plurality of peer-to-peer connections between the network device and a second plurality of destination nodes, the second plurality of destination nodes different from the first plurality of destination nodes.

20. The network device of claim **19**, wherein the network interface device is configured to provide a physical layer interface for communications between the processor and the communication network.

21. A network device, comprising:

a processor configured to execute a first software component and a second software component; and

a network interface device coupled with the processor, the network interface device configured to:

receive a first plurality of messages from the processor;

determine types of messages associated with the first plurality of messages ;

in response to determining that a first message of the first plurality of messages is a first type of message,

determine a first group of destination nodes associated with the first type of message;

route the first message of the first type of message to the first group of destination nodes via a first set of peer-to-peer connections; and

in response to determining that a second message of the first plurality of messages is a second type of message,

determine a second group of destination nodes associated with the second type of message, the second group of destination nodes different from the first group of destination nodes;

route the second message of the second type of message to the second group of destination nodes via a second set of peer-to-peer connections;

wherein the first type of message is associated with the first software component and the second type of message is associated with the second software component.

22. The network device of claim **21**, wherein the network interface device is further configured to:

communicate an establishment request to a server of a communication network to be configured as a routing node; and

in response to the establishment request, receive a set of routing rules from the server and employ the set of routing rules to determine different groups of destination nodes associated with different types of messages and to route messages received at the network interface device from the processor to a corresponding group of destination.

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