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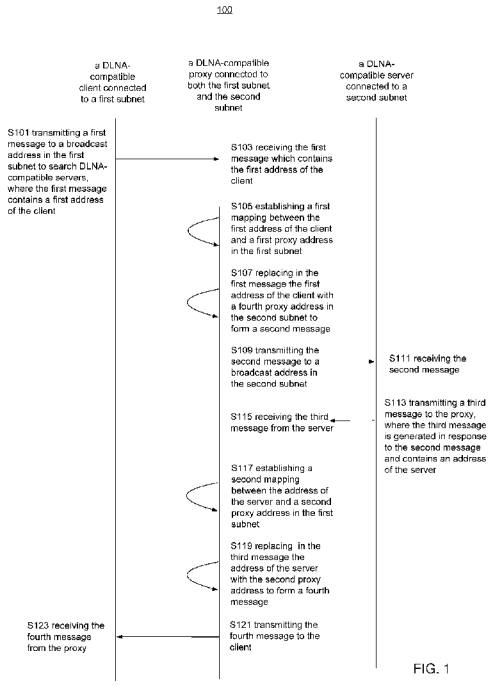

FIG. 1

(57) Abstract: A DLNA based communication method and a proxy system are provided. The method may include: a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message is a broadcast message for searching DLNA- compatible servers and contains an address of the client; the proxy replacing in the first message the address of the client with a first proxy address in the second subnet to form a second message; and the proxy transmitting the second message to a broadcast address in the second subnet. By using the method, the client connected to the first subnet can access the server connected to the second subnet.

WO 2015/089702 A1

DLNA BASED COMMUNICATIONS BETWEEN SUBNETS

TECHNICAL FIELD

[0001] The present disclosure generally relates to DLNA based communications between subnets.

BACKGROUND

[0002] Nowadays, communications of entertainment data between consumer devices has become increasingly prevalent. Digital Living Network Alliance (DLNA) is a standard that has been developed in order to facilitate consumer devices to communicate with each other in a home network. Generally, DLNA compatible devices communicate with each other via Universal Plug and Play (UPnP), which is a set of protocols that allow devices to seamlessly discover each other's presence on the network and establish functional network services for data sharing, communications, and entertainment. However, two devices, which are within two different DLNA subnets respectively, cannot access each other directly.

SUMMARY

[0003] In one embodiment, a DLNA based communication method is provided. The method may include: a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message is a broadcast message for searching DLNA-compatible servers and contains an address of the client; the proxy replacing in the first message the address of the client with a first proxy address in the second subnet to form a second message; and the proxy transmitting the second message to a broadcast address in the second subnet.

[0004] In some embodiments, the first proxy address may include a first IP address in

the second subnet and a first port number.

[0005] In some embodiments, the method may further include: the proxy receiving a third message from a DLNA-compatible server connected to the second subnet, where the third message is sent to the proxy in response to the second message and contains an address of the server; the proxy replacing in the third message the address of the server with a second proxy address in the first subnet to form a fourth message; and the proxy transmitting the fourth message to the client.

[0006] In some embodiments, the second proxy address may include a second IP address in the first subnet and a second port number.

[0007] In one embodiment, a DLNA based communication method is provided. The method may include: a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message contains a first proxy address in the first subnet and a request for a service from the first proxy address; the proxy replacing in the first message the first proxy address with an address of a DLNA-compatible server connected to the second subnet according to a first mapping between the first proxy address and the address of the server, to form a second message; and the proxy transmitting the second message to the server.

[0008] In some embodiments, the method may further include: the proxy receiving content of the service, which is sent to the proxy in response to the second message by the server; and the proxy transmitting the content of the service to the client.

[0009] In some embodiments, the method may further include: the proxy determining whether the content of the service contains the address of the server; if yes, the proxy replacing in the content of the service the address of the server with the first proxy address according to the first mapping and transmitting the modified content of the service to the client.

[0010] In one embodiment, a DLNA based communication method is provided. The

method may include: a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message contains a first proxy address in the first subnet, an address of the client and a request for registering the address of the client as a callback entry; the proxy replacing in the first message the first proxy address with an address of a DLNA-compatible server connected to the second subnet according to a first mapping between the first proxy address and the address of the server, and the address of the client with a second proxy address in the second subnet according to a second mapping between the second proxy address and the address of the client, to form a second message; and the proxy transmitting the second message to the server.

[0011] In some embodiments, the method may further include: the proxy receiving a third message from the server, where the third message contains the second proxy address and a server notice; the proxy replacing in the third message the second proxy address with the address of the client according to the second mapping to form a fourth message; and the proxy transmitting the fourth message to the client.

[0012] In one embodiment, a proxy system for DLNA based communication is provided. The proxy system may include: a first transceiver connected to a first subnet, a second transceiver connected to a second subnet, and a processing device configured to: after the first transceiver receives a first message from a DLNA-compatible client connected to the first subnet, where the first message is a broadcast message for searching DLNA-compatible servers and contains an address of the client, replace in the first message the address of the client with a first proxy address in the second subnet to form a second message; and control the second transceiver to transmit the second message to a broadcast address in the second subnet.

[0013] In some embodiments, the first proxy address may include a first IP address of the second transceiver and a first port number.

[0014] In some embodiments, the processing device may be further configured to: after the second transceiver receives a third message from a DLNA-compatible server connected to the second subnet, where the third message is sent in response to the

second message and contains an address of the server, replace in the third message the address of the server with a second proxy address in the first subnet to form a fourth message; and control the first transceiver to transmit the fourth message to the client.

[0015] In some embodiments, the second proxy address may include a second IP address of the first transceiver and a second port number.

[0016] In one embodiment, a proxy system for DLNA based communication. The proxy system may include: a first transceiver connected to a first subnet, a second transceiver connected to a second subnet, a memory device storing therein a first mapping between a first proxy address in the first subnet and an address of a DLNA-compatible server connected to the second subnet, and a processing device configured to: after the first transceiver receives a first message from a DLNA-compatible client connected to the first subnet, where the first message contains the first proxy address and a request for a service from the first proxy address, replace in the first message the first proxy address with the address of the server according to the first mapping to form a second message; and control the second transceiver to transmit the second message to the server.

[0017] In some embodiments, the processing device may be further configured to: after the second transceiver receives content of the service from the server, where the content of the service is sent in response to the request, control the first transceiver to transmit the content of the service to the client.

[0018] In some embodiments, the processing device may be further configured to: determine whether the content of the service contains the address of the server; and if yes, replace in the content of the service the address of the server with the first proxy address according to the first mapping and transmitting the modified content of the service to the client.

[0019] In one embodiment, a proxy system for DLNA based communication. The proxy system may include: a first transceiver connected to a first subnet, a second transceiver connected to a second subnet, a memory device storing therein a first

mapping between a first proxy address in the first subnet and an address of a DLNA-compatible server connected to the second subnet, and a processing device configured to: after the first transceiver receives a first message from a DLNA-compatible client connected to the first subnet, where the first message contains the first proxy address, an address of the client and a request for registering the address of the client as a callback entry, replace in the first message the first proxy address with the address of the server according to the first mapping, and the address of the client with a second proxy address in the second subnet according to a second mapping between the second proxy address and the address of the client, to form a second message; and control the second transceiver to transmit the second message to the server.

[0020] In some embodiments, the processing device may be further configured to: after the second transceiver receives a third message from the server, where the third message contains the second proxy address and a server notice, replace in the third message the second proxy address with the address of the client according to the second mapping to form a fourth message; and control the first transceiver to transmit the fourth message to the client.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The foregoing and other features of the present disclosure will become more fully apparent from the following description and appended claims, taken in conjunction with the accompanying drawings. Understanding that these drawings depict only several embodiments in accordance with the disclosure and are, therefore, not to be considered limiting of its scope, the disclosure will be described with additional specificity and detail through use of the accompanying drawings.

[0022] FIG. 1 illustrates a schematic flow chart of a DLNA based communication method 100 according to one embodiment;

[0023] FIG. 2 schematically illustrates a mapping table according to one embodiment;

[0024] FIG. 3 illustrates a schematic flow chart of a DLNA based communication

method 200 according to one embodiment;

[0025] FIG. 4 illustrates a schematic flow chart of a DLNA based communication method 300 according to one embodiment; and

[0026] FIG. 5 schematically illustrates a proxy system for DLNA based communication according to one embodiment.

DETAILED DESCRIPTION

[0027] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. The illustrative embodiments described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented here. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the Figures, can be arranged, substituted, combined, and designed in a wide variety of different configurations, all of which are explicitly contemplated and make part of this disclosure.

[0028] It should be noted that, the terms “first”, “second”, and the like in the description and in the claims, are used for distinguishing between similar elements and not tend to describe a particular sequential and chronological order.

[0029] FIG. 1 illustrates a schematic flow chart of a DLNA based communication method 100 according to one embodiment.

[0030] Referring to FIG. 1, in S101, a DLNA-compatible client connected to a first subnet transmits a first message to a broadcast address in the first subnet to search DLNA-compatible servers, where the first contains a first address of the client.

[0031] In some embodiments, the client may be a personal computer, a mobile device such as a smart phone or a tablet, or any other devices that can be connected to a

DLNA network. In some embodiments, the client may transmit the first message to search DLNA-compatible servers in the first subnet. In some embodiments, the first message may be based on Simple Service Discovery Protocol (SSDP), and User Datagram Protocol (UDP) is used as an underlying transport protocol. An example of a part of the first message based on SSDP is shown below:

"M-SEARCH * HTTP/1.1

USER-AGENT:

ST: urn:schemas-upnp-org: device: MediaRenderer: 1

MX: 5

MAN: "ssdp:discover"

HOST: 239.255.255.250:1900".

The "MAN" part of the first message indicates the first message is a discovery message based on SSDP. The "HOST" part of the message indicates the broadcast address, "239.255.255.250:1900", of the first subnet. The first message may also contain the first address of the client indicating where the first message is from.

[0032] In S103, a DLNA-compatible proxy connected to both the first subnet and a second subnet receives the first message which contains the first address of the client.

[0033] In some embodiments, the proxy may be a router, a computer or other DLNA-compatible devices that can be connected to both the first subnet and the second subnet. In some embodiments, the proxy may include a first transceiver connected to the first subnet, and a second transceiver connected to the second subnet. In some embodiments, the first transceiver may have an IP address in the first subnet, and the second transceiver may have an IP address in the second subnet. In some embodiments, the proxy may generate a UDP socket to monitor the broadcast address in the first subnet, and the first message may be received by the UDP socket.

[0034] In S105, the proxy establishes a first mapping between the first address of the

client and a first proxy address in the first subnet.

[0035] In some embodiments, the proxy may record the first address of the client and establish a first mapping between the first address of the client and the first proxy address. In some embodiments, the first proxy address may be an address of the first transceiver which includes the IP address of the first transceiver and a port number. In some embodiments, the first mapping may be saved in a mapping table, and the mapping table may be stored in a memory device of the proxy. An example of the mapping table is shown in FIG. 2. The first mapping includes the first address of the client 192.168.43.1:1900, and the first proxy address 192.168.43.23:32920 corresponding to the first address of the client.

[0036] In S107, the proxy replaces in the first message the first address of the client with a fourth proxy address in the second subnet to form a second message.

[0037] In some embodiments, the proxy may parse the first message and replace the first address of the client with the fourth proxy address in the second subnet. In some embodiments, the fourth proxy address in the second subnet may include the IP address of the second transceiver and a port number.

[0038] In S109, the proxy transmits the second message to a broadcast address in the second subnet.

[0039] In some embodiments, the proxy may transmit the second message to the broadcast address in the second subnet to search DLNA-compatible servers in the second subnet. In some embodiments, the second message may be transmitted by the second transceiver, because the second transceiver is connected to the second subnet. In some embodiments, the broadcast address in the second subnet may be 239.255.255.250:1900.

[0040] In S111, a DLNA-compatible server connected to the second subnet receives the second message.

[0041] In some embodiments, the DLNA-compatible server may be a personal

computer, a server, a net attached storage device, a printer, a mobile device and other DLNA-compatible device that can provide a service. In some embodiments, the server in the second subnet device may be a Media Server (MS) which can provide media files, or a Media Render (MR) which can process media files.

[0042] In S113, the server transmits a third message to the proxy, where the third message is generated in response to the second message and contains an address of the server.

[0043] In some embodiments, after receiving the second message, the server may generate the third message indicating that the server can provide a service. In some embodiments, the third message may contain an address of the server and indicate that a description file of the server can be obtained from the address. For example, a part of the third message is shown below:

"HTTP/1.1 200 OK

CACHE-CONTROL: max-age=604800

DATA: Sun, 17 Feb 2013 03:10:50 GMT

EXT:

LOCATION: http://192.168.0.1:49152/description.xml

OPT: http://schemas.upnp.org/upnp/1/0/; ns=01".

The "LOCATION" part of the third message includes the address of the server. The address of the server may include the IP address of the server 192.168.0.1, and a port number 49152.

[0044] In some embodiments, because the server receives the second message from the second transceiver of the proxy, the server may transmit the third message to the second transceiver.

[0045] In S115, the proxy receives the third message from the server connected to the second subnet.

[0046] In some embodiments, the proxy may receive the third message by the second transceiver connected to the second subnet.

[0047] In S117, the proxy establishes a second mapping between the address of the server and a second proxy address in the first subnet.

[0048] In some embodiments, after receiving the third message, the proxy may parse the third message and identify the address of the server in the third message. In some embodiments, the proxy may record the address of the server and establish a second mapping between the address of the server and a second proxy address in the first subnet. In some embodiments, the second proxy address may be an address of the first transceiver which includes the IP address of the first transceiver and a port number. The port number of the second proxy address should be different from the port number of the first proxy address. In some embodiments, the second mapping may also be saved in the mapping table. As shown in FIG. 2, the second mapping includes the address of the server 192.168.0.1:49152, and the second proxy address 192.168.43.23:42977 corresponding to the address of the server.

[0049] In S119, the proxy replaces in the third message the address of the server with the second proxy address to form a fourth message.

[0050] In some embodiments, the proxy may parse the third message and replace the address of server in the “LOCATION” part of the third message, with the second proxy address to form the fourth message.

[0051] In S121, the proxy transmits the fourth message to the client.

[0052] In some embodiments, the proxy may read the first mapping saved in the mapping table to obtain the first address of the client, and transmit the fourth message to the first address of the client according to the first mapping. In some embodiments, the proxy may transmit the fourth message to the client by the first transceiver connected to the first subnet.

[0053] In S123, the client receives the fourth message from the proxy.

[0054] Therefore, the service of the server may be available to the client.

[0055] Then the client connected to the first subnet may access the server connected to the second subnet for a service. FIG. 3 illustrates a schematic flow chart of a DLNA based communication method 200 according to one embodiment.

[0056] Referring to FIG. 3, in S125, the client transmits a fifth message to the proxy, where the fifth message contains the second proxy address and a request for a service from the second proxy address.

[0057] In some embodiments, the client may request for a description file from the second proxy address. In some embodiments, the client may request for a data file from the second proxy address. In some embodiment, the fifth message may be a HTTP request package. An example of a part of the fifth message is shown below:

"GET /description.xml HTTP/1.1

User-Agent:

TIMEOUT: 3000

HOST: 192.168.43.23:42977

Connection: Keep-Alive".

In this example, the client requests for a description file. The "HOST" part of the fifth message includes the second proxy address, 192.168.43.23:42977.

[0058] In S127, the proxy receives the fifth message from the client.

[0059] In some embodiments, the proxy may receive the fifth message by the first transceiver connected to the first subnet.

[0060] In S129, the proxy replaces in the fifth message the second proxy address with the address of the server connected to the second subnet according to the second mapping between the second proxy address and the address of the server, to form a sixth message.

[0061] In some embodiments, the proxy may read the second mapping saved in the mapping table, and replace the second proxy address with the address of the server according to the second mapping to form the sixth message. For example, the address of the server 192.168.0.1:49152 may be used to replace the second proxy address, 192.168.43.23:42977 in the fifth message.

[0062] In S131, the proxy transmits the sixth message to the server connected to the second subnet.

[0063] In some embodiments, the sixth message may be transmitted by the second transceiver of the proxy because the second transceiver is connected to the second subnet.

[0064] In S133, the server receives the sixth message.

[0065] In S135, the server transmits content of the service in response to the request in the sixth message, to the proxy.

[0066] In some embodiments, the server may transmit an XML file which describes the server to the proxy. The XML file may include a name of the server, a manufacturer name of the server, URLs to vender-specific web sites and other vendor-specific information. In some embodiments, the server may transmit a data file to the proxy.

[0067] In S137, the proxy receives the content of the service, which is sent to the proxy in response to the request by the server.

[0068] In some embodiments, the content of the service may be received by the second transceiver of the proxy because the second transceiver is connected to the second subnet.

[0069] In S139, the proxy determines whether the content of the service contains the address of the server; if no, the proxy transmit the content of the service to the client; if yes, the proxy replaces the address of the server with the second proxy address according to the second mapping, and transmits the modified content of the service to the client.

[0070] After receiving the content of the service, the proxy may determine whether the content of the service contains the address of the server. In some embodiments, the content of the service may be determined to be a data file without the address of the server. The proxy may transmit the data file to the client directly. In some embodiments, the content of the service may be determined to be an XML file with the address of the server. The proxy may replace the address of the server with the second proxy address in the XML file according to the second mapping, and transmit the modified XML file to the client.

[0071] In S141, the client receives the content of the service or the modified content of the service.

[0072] In some embodiments, the client may register a callback entry on the server, so that the server can transmit a server notice to the client. FIG. 4 illustrates a schematic flow chart of a DLNA based communication method 300 according to one embodiment.

[0073] Referring to FIG. 4, in S143, the client transmits a seventh message to the proxy, where the seventh message contains the second proxy address, a second address of the client, and a request for registering the second address of the client as a callback entry.

[0074] For example, a part of the seventh message is shown below:

"SUBSCRIBE /upnp/event/rendertransport1 HTTP /1.1

USER-AGENT:

HOST: 192.168.43.23:42977

CALLBACK: http://192.168.43.1:9858/evetSub

NT: upnp: event"

The "HOST" part of the seventh message includes the second proxy address 192.168.43.23:42977. The "CALLBACK" part includes the second address of the client,

192.168.43.1:9858.

[0075] It should be noted that the first address of the client and the second address of the client may have the same IP address but different port numbers.

[0076] In S145, the proxy receives the seventh message from the client.

[0077] In some embodiments, the proxy may receive the seventh message by the first transceiver connected to the first subnet.

[0078] In S147, the proxy establishes a third mapping between the second address of the client and a third proxy address in the second subnet.

[0079] In some embodiments, after receiving the seventh message, the proxy may parse the seventh message and identify the second address of the client in the seventh message. In some embodiments, the proxy may record the second address of the client and establish a third mapping between the second address of the client and a third proxy address in the second subnet. In some embodiments, the third proxy address may be an address of the second transceiver which includes the IP address of the second transceiver and a port number. In some embodiments, the third mapping may be saved in the mapping table. As shown in FIG. 2, the third mapping includes the second address of the client 192.168.43.1:9858, and the third proxy address 192.168.0.2: 52357 corresponding to the second address of the client.

[0080] In S149, the proxy replaces in the seventh message the second proxy address with the address of the server according to the second mapping, and the second address of the client with the third proxy address according to the third mapping, to form an eighth message.

[0081] In S151, the proxy transmits the eighth message to the server connected to the second subnet.

[0082] In some embodiments, the proxy may transmit the eighth message to the server by the second transceiver connected to the second subnet.

[0083] In S153, the server receives the eighth message.

[0084] After the server receiving the eighth message, the server may register the third proxy address in the eighth message as a callback entry.

[0085] In S155, the server transmits a ninth message to the proxy, where the ninth message contains the third proxy address and a server notice.

[0086] In some embodiments, if the configuration of the server is changed, the server may transmit the server notice indicating the change of the server to the third proxy address.

[0087] In S157, the proxy receives the ninth message.

[0088] In some embodiments, the ninth message may be received by the second transceiver connected to the second subnet.

[0089] In S159, the proxy replaces in the ninth message the third proxy address with the second address of the client according to the third mapping to form a tenth message.

[0090] In some embodiments, the proxy may read the third mapping saved in the mapping table, and replace the third proxy address with the second address of the client according to the third mapping.

[0091] In S161, the proxy transmits the tenth message to the client.

[0092] In some embodiments, the tenth message may be transmitted by the first transceiver connected to the first subnet.

[0093] In S163, the client receives the tenth message.

[0094] According to one embodiment of the present disclosure, a system for DLNA based communications between a first subnet and a second subnet is provided. In some embodiments, the system may be mounted on a router or a computer.

[0095] Referring to FIG. 5, the system 400 may include a first transceiver 401 connected to the first subnet, a second transceiver 403 connected to the second subnet,

a memory device 405 and a processing device 407. In some embodiments, the first transceiver 401 and the second transceiver 403 may be network cards. The first transceiver 401 may be used to receive and transmit messages in the first subnet, and the second transceiver 403 may be used to receive and transmit messages in the second subnet. The processing device 407 can control the system 400 to perform steps of the method 100, the method 200 and the method 300. The memory device 405 may be used to save mappings generated in the steps. In some embodiments, the memory device 405 may be a SRAM, a DRAM, a flash memory, a hard disk etc, or any combination thereof. In some embodiments, the processing device 407 may be a CPU, a GPU, a DSP etc, or any combination thereof.

[0096] By using the method and the system according to embodiments of the disclosure, the client connected to the first subnet can access the server connected to the second subnet, and the server can transmit a server notice to the client.

[0097] There is little distinction left between hardware and software implementations of aspects of systems; the use of hardware or software is generally a design choice representing cost vs. efficiency tradeoffs. For example, if an implementer determines that speed and accuracy are paramount, the implementer may opt for a mainly hardware and/or firmware vehicle; if flexibility is paramount, the implementer may opt for a mainly software implementation; or, yet again alternatively, the implementer may opt for some combination of hardware, software, and/or firmware.

[0098] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

We Claim:

1. A DLNA based communication method, comprising:

a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message is a broadcast message for searching DLNA-compatible servers and contains an address of the client;

the proxy replacing in the first message the address of the client with a first proxy address in the second subnet to form a second message; and

the proxy transmitting the second message to a broadcast address in the second subnet.

2. The method according to claim 1, wherein the first proxy address comprises a first IP address in the second subnet and a first port number.

3. The method according to claim 1, further comprising:

the proxy receiving a third message from a DLNA-compatible server connected to the second subnet, where the third message is sent to the proxy in response to the second message and contains an address of the server;

the proxy replacing in the third message the address of the server with a second proxy address in the first subnet to form a fourth message; and

the proxy transmitting the fourth message to the client.

4. The method according to claim 3, wherein the second proxy address comprises a second IP address in the first subnet and a second port number.

5. A DLNA based communication method, comprising:

a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message contains a first proxy address in the first subnet and a request for a service from the first proxy address;

the proxy replacing in the first message the first proxy address with an address of a DLNA-compatible server connected to the second subnet according to a first mapping between the first proxy address and the address of the server, to form a second message; and

the proxy transmitting the second message to the server.

6. The method according to claim 5, further comprising:

the proxy receiving content of the service, which is sent to the proxy in response to the second message by the server; and

the proxy transmitting the content of the service to the client.

7. The method according to claim 6, further comprising:

the proxy determining whether the content of the service contains the address of the server;

if yes, the proxy replacing in the content of the service the address of the server with the first proxy address according to the first mapping and transmitting the modified content of the service to the client.

8. A DLNA based communication method, comprising:

a DLNA-compatible proxy, connected to both a first subnet and a second subnet, receiving a first message from a DLNA-compatible client connected to the first subnet, where the first message contains a first proxy address in the first subnet, an address of the client and a request for registering the address of the client as a callback entry;

the proxy replacing in the first message the first proxy address with an address of a DLNA-compatible server connected to the second subnet according to a first mapping between the first proxy address and the address of the server, and the address of the client with a second proxy address in the second subnet according to a second mapping between the second proxy address and the address of the client, to form a second message; and

the proxy transmitting the second message to the server.

9. The method according to claim 8, further comprising:

the proxy receiving a third message from the server, where the third message contains the second proxy address and a server notice;

the proxy replacing in the third message the second proxy address with the address of the client according to the second mapping to form a fourth message; and

the proxy transmitting the fourth message to the client.

10. A proxy system for DLNA based communication, comprising: a first transceiver connected to a first subnet, a second transceiver connected to a second subnet, and a processing device configured to:

after the first transceiver receives a first message from a DLNA-compatible client connected to the first subnet, where the first message is a broadcast message for searching DLNA-compatible servers and contains an address of the client, replace in the first message the address of the client with a first proxy address in the second subnet to form a second message; and

control the second transceiver to transmit the second message to a broadcast address in the second subnet.

11. The proxy system according to claim 10, wherein the first proxy address comprises a first IP address of the second transceiver and a first port number.

12. The proxy system according to claim 10, wherein the processing device is further configured to:

after the second transceiver receives a third message from a DLNA-compatible server connected to the second subnet, where the third message is sent in response to the second message and contains an address of the server, replace in the third message the address of the server with a second proxy address in the first subnet to form a fourth message; and

control the first transceiver to transmit the fourth message to the client.

13. The proxy system according to claim 12, wherein the second proxy address comprises a second IP address of the first transceiver and a second port number.

14. A proxy system for DLNA based communication, comprising: a first transceiver connected to a first subnet, a second transceiver connected to a second subnet, a memory device storing therein a first mapping between a first proxy address in the first subnet and an address of a DLNA-compatible server connected to the second subnet, and a processing device configured to:

after the first transceiver receives a first message from a DLNA-compatible client connected to the first subnet, where the first message contains the first proxy address and a request for a service from the first proxy address, replace in the first message the first proxy address with the address of the server according to the first mapping to form a second message; and

control the second transceiver to transmit the second message to the server.

15. The proxy system according to claim 14, wherein the processing device is further configured to: after the second transceiver receives content of the service from the server, where the content of the service is sent in response to the request, control the first transceiver to transmit the content of the service to the client.

16. The proxy system according to claim 15, wherein the processing device is further configured to:

determine whether the content of the service contains the address of the server; and

if yes, replace in the content of the service the address of the server with the first proxy address according to the first mapping and transmitting the modified content of the service to the client.

17. A proxy system for DLNA based communication, comprising: a first transceiver connected to a first subnet, a second transceiver connected to a second subnet, a

memory device storing therein a first mapping between a first proxy address in the first subnet and an address of a DLNA-compatible server connected to the second subnet, and a processing device configured to:

after the first transceiver receives a first message from a DLNA-compatible client connected to the first subnet, where the first message contains the first proxy address, an address of the client and a request for registering the address of the client as a callback entry, replace in the first message the first proxy address with the address of the server according to the first mapping, and the address of the client with a second proxy address in the second subnet according to a second mapping between the second proxy address and the address of the client, to form a second message; and

control the second transceiver to transmit the second message to the server.

18. The proxy system according to claim 17, wherein the processing device is further configured to:

after the second transceiver receives a third message from the server, where the third message contains the second proxy address and a server notice, replace in the third message the second proxy address with the address of the client according to the second mapping to form a fourth message; and

control the first transceiver to transmit the fourth message to the client.

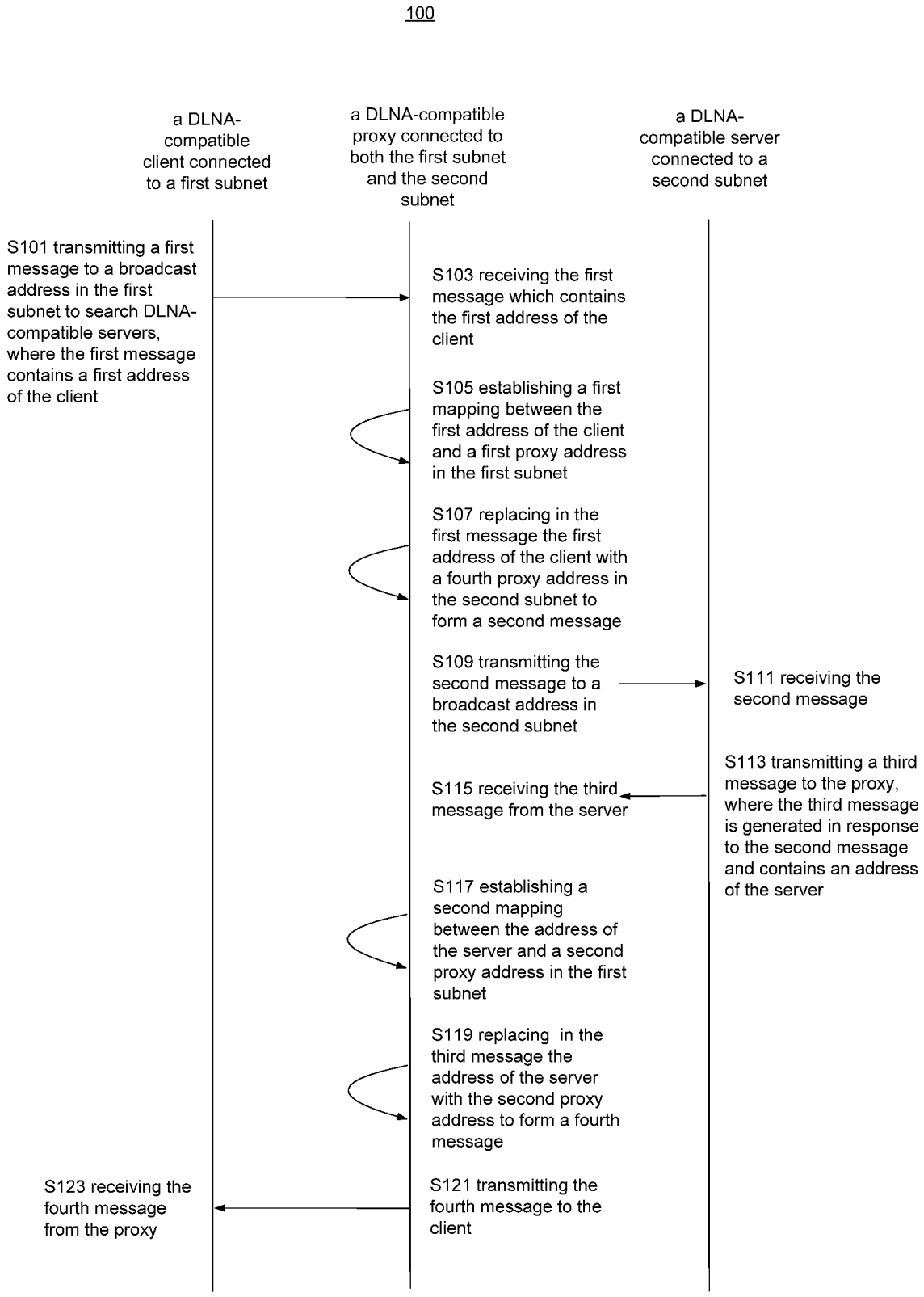
100
a DLNA-compatible client connected to a first subnet
a DLNA-compatible proxy connected to both the first subnet and the second subnet
a DLNA-compatible server connected to a second subnet
S101 transmitting a first message to a broadcast address in the first subnet to search DLNA-compatible servers, where the first message contains a first address of the client
S103 receiving the first message which contains the first address of the client
S105 establishing a first mapping between the first address of the client and a first proxy address in the first subnet
S107 replacing in the first message the first address of the client with a fourth proxy address in the second subnet to form a second message
S109 transmitting the second message to a broadcast address in the second subnet
S111 receiving the second message
S113 transmitting a third message to the proxy, where the third message is generated in response to the second message and contains an address of the server
S115 receiving the third message from the server
S117 establishing a second mapping between the address of the server and a second proxy address in the first subnet
S119 replacing in the third message the address of the server with the second proxy address to form a fourth message
S121 transmitting the fourth message to the client
S123 receiving the fourth message from the proxy

FIG. 1

	address of the client	proxy address	address of the server
1st mapping	192.168.43.1:1900	192.168.43.23:32920	
2nd mapping		192.168.43.23:42977	192.168.0.1:49152
3rd mapping	192.168.43.1:9858	192.168.0.2:52357	

FIG. 2

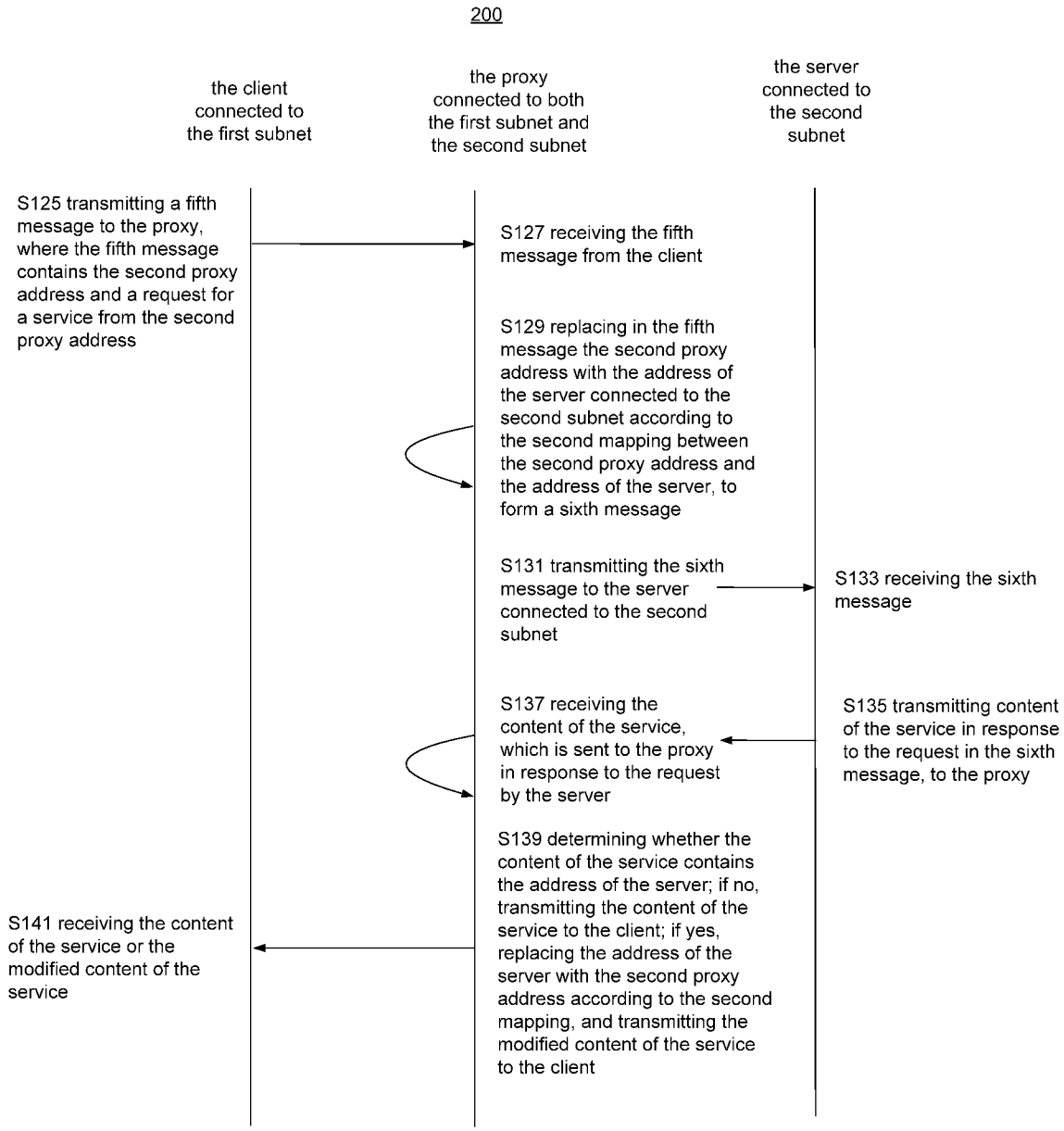

FIG. 3

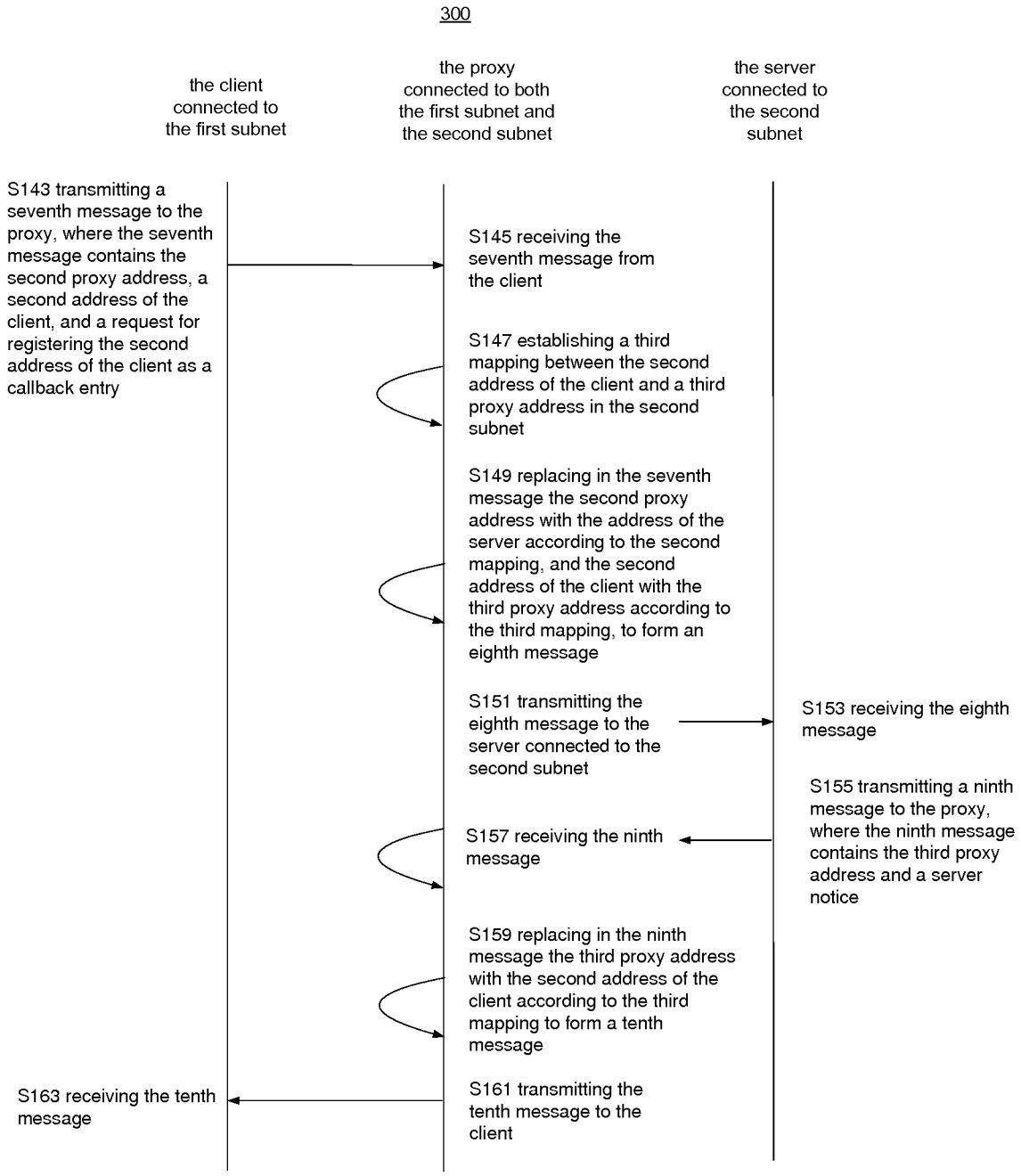
300
the client connected to the first subnet
the proxy connected to both the first subnet and the second subnet
the server connected to the second subnet
S143 transmitting a seventh message to the proxy, where the seventh message contains the second proxy address, a second address of the client, and a request for registering the second address of the client as a callback entry
S145 receiving the seventh message from the client
S147 establishing a third mapping between the second address of the client and a third proxy address in the second subnet
S149 replacing in the seventh message the second proxy address with the address of the server according to the second mapping, and the second address of the client with the third proxy address according to the third mapping, to form an eighth message
S151 transmitting the eighth message to the server connected to the second subnet
S153 receiving the eighth message
S155 transmitting a ninth message to the proxy, where the ninth message contains the third proxy address and a server notice
S157 receiving the ninth message
S159 replacing in the ninth message the third proxy address with the second address of the client according to the third mapping to form a tenth message
S161 transmitting the tenth message to the client
S163 receiving the tenth message

FIG. 4

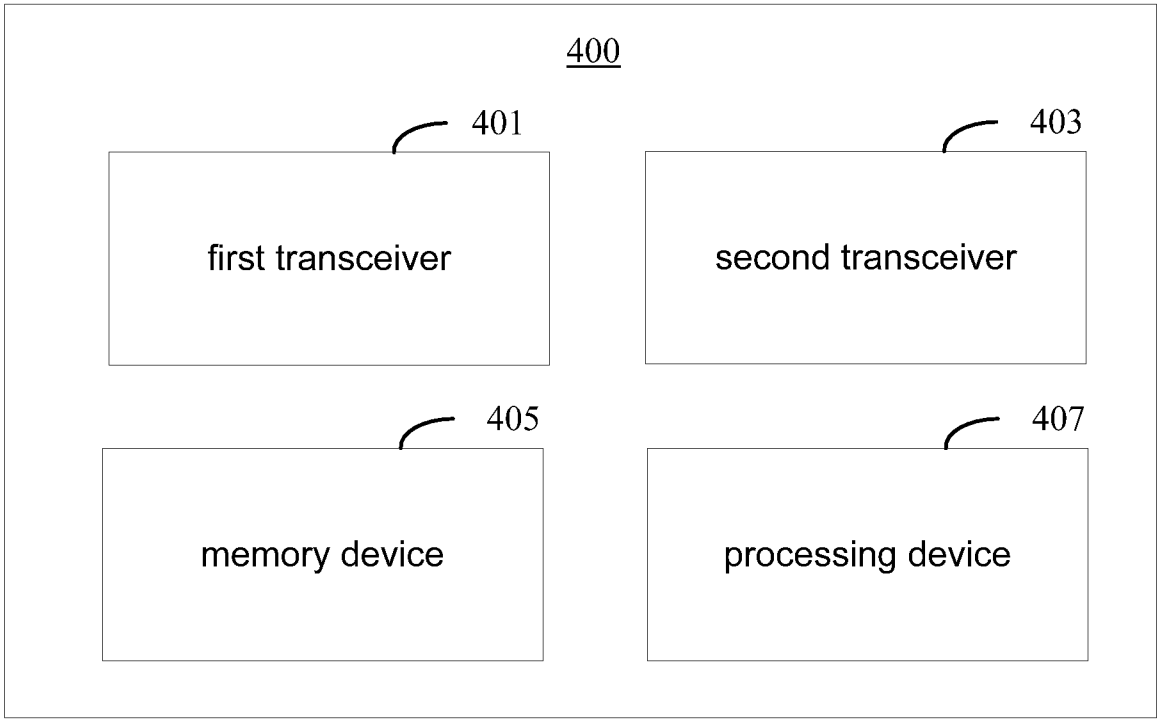
400
401
first transceiver
403
second transceiver
405
memory device
407
processing device

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/089527

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/66(2006.01)i; H04L 29/06(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)

H04L

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

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

CNTXT;CNABS;CNKI;WOTXT;DWPI:DLNA, digital living network alliance, first, second, different, multiple, network section?, subnet?, address

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009240785 A1 (KIKKAWA NORIFUMI) 24 September 2009 (2009-09-24) the description, page 3, paragraphs [0048]-[0050], page 4, paragraphs [0060]-[0064], figures 1, 15, 16	1-18
A	CN 102811223 A (ZTE CORP) 05 December 2012 (2012-12-05) the whole document	1-18

☐ 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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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
15 September 2014	**26 November 2014**

Name and mailing address of the ISA/CN	Authorized officer
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/089527

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2009240785	A1	24 September 2009	CN	101540743	A	23 September 2009
				EP	2104317	A1	23 September 2009
				CN	101540743	B	07 November 2012
				JP	2009231974	A	08 October 2009
				JP	4569649	B2	27 October 2010
CN	102811223	A	05 December 2012	WO	2013178142	A1	05 December 2013