

Description

MULTICAST SYSTEM AND MULTICAST METHOD FOR IDENTIFIER RESOLUTION-BASED ROUTING

Cross-reference to Related Applications

This application claims priority to Chinese Patent Application No. 202011144897.7, filed on October 23, 2020, which is incorporated herein by reference in its entirety.

Technical Field

The present invention belongs to the technical field of network communication and data processing, and specifically to a multicast system and multicast method for identifier resolution-based routing.

Background

In recent years, a variety of new types of services and applications have appeared on the internet, most of which are multimedia services based on high bandwidth and high network resource requirements such as distance education, IPTV, video conferencing, and multiplayer games. The main characteristics of these services are single- or multiple-source sending and multiple-destination receiving (one-to-many or many-to-many), and data sent by senders is extremely repetitive. In addition, as 5G opens a new era of Internet of Everything, the IoT brings a large amount of one-to-many data transmission. For these services, when implemented in a unicast mode, repetitive sending of IP packets causes a huge waste of bandwidth and increases the burden of servers. When implemented in a broadcast mode, information is to be sent to some unwanted hosts, causing a waste of bandwidth, and a broadcast storm may be caused due to routing loops.

At present, multicast technology can adequately solve the above problems. The multicast technology refers to network communication in which a single sender corresponds to multiple receivers. In the multicast technology, by delivering a single information stream to multiple receivers, network communication traffic with multiple receivers listening to or viewing the same resource at the same time can be reduced. For n-party videoconferencing, a bandwidth length can be reduced by $a(n-1)$ times. The main feature of the multicast technology is to categorize members of an application into a group according to an actual case, and distribution of data is

only limited to the group, which can provide transmission of same data from a single point to multiple points in a network at the same time. Relying on multicast trees, two or more destination network hosts do not need to send packets individually on duplicate links, and only need to copy and distribute packets at branch nodes of the multicast trees. This can effectively save network resources and improve bandwidth utilization. However, in a conventional IP network architecture, all routers need to support distributed multicast protocols, and the construction, maintenance, and update of multicast trees require exchange of a lot of information between multicast routers. These control states consume a lot of network resources, which makes it difficult to deploy IP multicast in conventional networks on a large scale.

Summary

To solve the foregoing problems in existing multicast methods, the present invention provides a multicast system for identifier resolution-based routing, the system including multicast sources, multicast receivers, multicast member agents, and multicast processing nodes, where the system further includes identifier resolution service module deployed in a cloud or a network, and the identifier resolution service module is configured to use a globally unique identifier unrelated to any network address as a multicast identifier capable of uniquely identifying a multicast service, where an IP network address is still used as a network address;

the identifier resolution service module is further configured to maintain a mapping relationship between a multicast identifier and the IP network address(es) of one or more multicast processing nodes;

the identifier resolution service module is further configured to provide registration, deregistration, and resolution and query services;

network nodes hosting multicast include the multicast processing nodes and IP network routing and switching nodes; and

the multicast receiver is configured to apply, by using the multicast identifier, to join the multicast service.

As one of the improvements to the foregoing technical solution, that the identifier resolution service module is further configured to provide registration, deregistration, and resolution and query services is specifically:

the identifier resolution service module supports registration and deregistration of the mapping relationship between a multicast identifier and the IP network address(es) of one or more multicast processing nodes and resolution and query of an IP network address of a multicast processing node by using the multicast identifier, where one multicast identifier corresponds to the IP network address(es) of one or more multicast processing nodes.

As one of the improvements to the foregoing technical solution, one or more multicast processing nodes are used, and the multicast processing node is configured to implement a function of the IP network routing and switching nodes;

the multicast processing node is further configured to: forward or process a modified join request message, determine whether a destination network address in the modified join request message is a network address of a multicast processing node that currently receives the modified join request message, and forward the modified join request message or construct and forward a request response message according to a determination result;

the multicast processing node is further configured to: encapsulate and send a multicast data packet, and forward the multicast data packet according to an updated and locally maintained multicast forwarding table; and

a multicast processing node located at a network edge modifies, by using a multicast protocol agent, a join request message sent by the multicast member agent, and forwards the modified join request message to a selected multicast processing node.

As one of the improvements to the foregoing technical solution, a specific implementation process of that a multicast processing node located at a network edge modifies, by using a multicast protocol agent, a join request message sent by the multicast member agent, and forwards the modified join request message to a selected multicast processing node is:

receiving and processing, by the multicast processing node located at the network edge, a join request message that is forwarded by the multicast member agent and that is based on the multicast identifier, sending a resolution request to the identifier resolution service module, resolving the multicast identifier carried in the join request message to obtain a group of multicast processing nodes corresponding to the multicast identifier carried in the join request message and IP network addresses corresponding to the group of multicast processing nodes,

selecting one of the multicast processing nodes, modifying the destination network address in the join request message into an IP address of the selected multicast processing node, obtaining the modified join request message, and forwarding the modified join request message to the selected multicast processing node.

The modified join request message is further capable of being constructed, encapsulated, and sent by using the multicast protocol agent.

As one of the improvements to the foregoing technical solution, the modified join request message is forwarded in a network layer packet format, and includes a source network address, a destination network address, and the multicast identifier, where the source network address is an IP network address of the multicast member agent; and the destination network address is an IP network address of a multicast processing node.

As one of the improvements to the foregoing technical solution, the multicast forwarding table includes a group of multicast forwarding table entries;

each multicast forwarding table entry in the group of multicast forwarding table entries further includes one multicast identifier and an egress port list;

the egress port list further includes a plurality of forwarding ports; and

the multicast identifier is a key, and the egress port list is a value; and one multicast identifier corresponds to one or more forwarding ports.

As one of the improvements to the foregoing technical solution, a specific implementation process of that the multicast processing node is configured to: forward or process a modified join request message, determine whether a destination network address in the modified join request message is a network address of a multicast processing node that currently receives the modified join request message, and forward the modified join request message or construct and forward a request response message according to a determination result is:

receiving, by the multicast processing node, the modified join request message, and determining whether the destination network address carried in the modified join request message is an IP network address of the multicast processing node that currently receives the modified join request message;

if the destination network address carried in the modified join request message is not the

IP network address of the multicast processing node that currently receives the modified join request message, performing forwarding to a correct multicast processing node according to the destination network address in the modified join request message and based on an IP network route; and

if the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message, updating the local multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message.

As one of the improvements to the foregoing technical solution, the request response message is forwarded in a network layer packet format, and includes: a source network address, a destination network address, and the multicast identifier, where the source network address is the network address of the multicast processing node; and the destination network address is a network address of the multicast member agent.

As one of the improvements to the foregoing technical solution, a specific process of the updating the local multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message is:

querying, by the multicast processing node, whether the locally maintained multicast forwarding table includes a multicast identifier carried in the modified join request message;

if the multicast processing node finds that the local multicast forwarding table includes the multicast identifier carried in the modified join request message, querying a local routing table according to a source network address of the modified join request message and obtaining a forwarding port;

performing a search to determine whether an egress port list corresponding to the multicast identifier in the multicast forwarding table includes the forwarding port obtained through the query;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table does not include the forwarding port obtained through the query, adding the forwarding port to the egress port list;

if the egress port list corresponding to the multicast identifier in the multicast forwarding

table includes the forwarding port obtained through the query, turning to a next step:

constructing, by the multicast processing node, the request response message, returning the request response message, and updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent; and

if the multicast processing node finds that the local multicast forwarding table does not include the multicast identifier carried in the modified join request message, feeding back an exception.

As one of the improvements to the foregoing technical solution, the updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent is specifically:

receiving, by the next multicast processing node, the forwarded request response message, extracting the multicast identifier and the destination network address from the forwarded request response message, and searching the locally maintained routing table according to the destination network address carried in the request response message for a corresponding forwarding port;

querying whether the locally maintained multicast forwarding table includes the multicast identifier carried in the request response message;

if the next multicast processing node finds that the locally maintained multicast forwarding table includes the multicast identifier carried in the request response message, obtaining the egress port list corresponding to the multicast identifier, and further determining whether the egress port list includes the forwarding port;

if the egress port list includes the forwarding port, directly forwarding the request response message the forwarding port;

if the egress port list does not include the forwarding port, adding the forwarding port to the egress port list, and directly forwarding the request response message from the forwarding port; and

if the next multicast processing node finds that the local routing table does not include the

multicast identifier carried in the request response message, adding the multicast identifier and the forwarding port to the multicast forwarding table, updating the multicast forwarding table, and registering a mapping relationship between the multicast identifier and the IP network address of the multicast processing node with the identifier resolution service module, thus becoming one multicast processing node corresponding to the multicast service, and forwarding, by the multicast processing node, the request response message from the forwarding port, until the request response message is forwarded to the multicast member agent.

As one of the improvements to the foregoing technical solution, the multicast data packet includes a source network address, a destination network address, and the multicast identifier; and the source network address is a network address of an intra-network multicast processing node that implements multicast.

As one of the improvements to the foregoing technical solution, a specific implementation process of that the multicast processing node is further configured to forward the multicast data packet is:

querying whether the locally maintained multicast forwarding table includes the multicast identifier carried in the multicast data packet;

if the locally maintained multicast forwarding table includes the multicast identifier, obtaining all egress ports corresponding to the multicast identifier carried in the multicast data packet, and copying the multicast data packet to all egress ports corresponding to the multicast identifier in the multicast forwarding table; and

if the multicast forwarding table does not include the multicast identifier, executing error processing, and feeding back a corresponding processing result.

As one of the improvements to the foregoing technical solution, one or more multicast member agents are used, one or more multicast receivers are used, the multicast member agent and the multicast receiver are located in a same broadcast domain; the multicast member agent stores a local part identifier, and is configured to exchange information with the multicast receivers in a local broadcast domain;

the multicast member agent is further configured to maintain a mapping relationship between a multicast identifier and a local part identifier;

the multicast member agent is further configured to: obtain a multicast membership report messages sent by the multicast receivers, construct a join request message according to the multicast member report message, and then send the constructed join request message to the multicast processing node; and

the multicast member agent is further configured to: obtain a multicast data packet sent by the multicast processing node, and forward the multicast data packet to the multicast receivers,

where the local part identifier is unique in the local broadcast domain, and is specifically, but not limited to, an IP multicast group address.

The present invention further provides a multicast method for identifier resolution-based routing. The method includes:

step (1). sending, by a multicast receiver, a multicast member report message carrying a multicast identifier to a multicast member agent, constructing, by the multicast member agent, a join request message according to the multicast member report message, and sending the constructed join request message to a multicast processing node that is closest to the multicast member agent and that is located at a network edge, and modifying, by the multicast processing node by using a multicast protocol agent, the join request message sent by the multicast member agent, and forwarding a modified join request message to an appropriate multicast processing node;

step (2). determining, by the multicast processing node, whether a destination network address in the received modified join request message is a network address of a multicast processing node that currently receives the modified join request message, and forwarding the modified join request message or constructing and forwarding a request response message according to a determination result; and

step (3). updating, by the multicast processing node, a locally maintained multicast forwarding table according to the received request response message, and forwarding a multicast data packets to the multicast member agent according to the locally maintained multicast forwarding table.

As one of the improvements to the foregoing technical solution, a specific process of step (1) is as follows:

publishing, by a multicast source, a multicast service carrying the multicast identifier, applying, by the multicast receiver by using the multicast identifier, to join the multicast service carrying the multicast identifier, and sending the multicast member report message including the multicast identifier to a local broadcast domain;

receiving, by the multicast member agent, the multicast member report message, and constructing the join request message, and sending, by the multicast member agent, the constructed join request message to the multicast processing node that is closest to the multicast member agent and that is located at the network edge; and

receiving, by the multicast processing node that is located at the network edge, the join request message forwarded by the multicast member agent, requesting to query an identifier resolution service module to obtain a group of multicast processing nodes corresponding to the multicast identifier carried in the join request message and network addresses corresponding to the group of multicast processing nodes, selecting one of the multicast processing nodes, modifying the destination network address in the join request message into a network address of the selected multicast processing node, obtaining the modified join request message, and forwarding the modified request message to the selected multicast processing node.

As one of the improvements to the foregoing technical solution, a specific process of step (2) is as follows:

receiving, by the multicast processing node, the modified join request message, and determining whether the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message;

if the destination network address carried in the modified join request message is not the network address of the multicast processing node that currently receives the modified join request message, performing forwarding based on IP network route according to the destination network address in the modified join request message, until the modified join request message is forwarded to the correct multicast processing node; and

if the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join

request message, updating the locally maintained multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message.

As one of the improvements to the foregoing technical solution, a specific process of the updating the local multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message is:

querying, by the multicast processing node, whether the locally maintained multicast forwarding table includes a multicast identifier carried in the modified join request message;

if the multicast processing node finds that the local multicast forwarding table includes the multicast identifier carried in the modified join request message, querying a local routing table according to a source network address of the modified join request message and obtaining a forwarding port;

performing a search to determine whether the egress port list corresponding to the multicast identifier in the multicast forwarding table includes the forwarding port obtained through the query;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table does not include the forwarding port obtained through the query, adding the forwarding port to the egress port list;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table includes the forwarding port obtained through the query, turning to a next step:

constructing, by the multicast processing node, the request response message, and returning the request response message, and updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent; and

if the multicast processing node finds that the local multicast forwarding table does not include the multicast identifier carried in the modified join request message, feeding back an exception.

As one of the improvements to the foregoing technical solution, the updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member

agent is specifically:

receiving, by the next multicast processing node, the forwarded request response message, extracting the multicast identifier and the destination network address from the forwarded request response message, and searching the locally maintained routing table according to the destination network address carried in the request response message for a corresponding forwarding port;

querying whether the locally maintained multicast forwarding table includes the multicast identifier carried in the request response message;

if the next multicast processing node finds that the local multicast forwarding table includes the multicast identifier carried in the request response message, obtaining the egress port list corresponding to the multicast identifier, and further determining whether the egress port list includes the forwarding port;

if the egress port list includes the forwarding port, directly forwarding the request response message from the forwarding port;

if the egress port list does not include the forwarding port, adding the forwarding port to the egress port list, and directly forwarding the request response message from the forwarding port; and

if the next multicast processing node finds that the local multicast forwarding table does not include the multicast identifier carried in the request response message, adding the multicast identifier and the forwarding port to the multicast forwarding table, updating the multicast forwarding table, and registering a mapping relationship between the multicast identifier and an IP network address of the multicast processing node with an identifier resolution service module, to make the identifier resolution service module thus becoming one multicast processing node corresponding to the multicast service, and forwarding, by the multicast processing node, the request response message from the forwarding port, until the request response message is forwarded to the multicast member agent.

As one of the improvements to the foregoing technical solution, a specific process of the forwarding a multicast data packet to the multicast member agent according to the locally maintained multicast forwarding table in step (3) is as follows:

after the multicast processing node receives the multicast data packet, querying whether the locally maintained multicast forwarding table includes the multicast identifier carried in the multicast data packet;

if the locally maintained multicast forwarding table includes the multicast identifier, obtaining all egress ports corresponding to the multicast identifier carried in the multicast data packet, and copying the multicast data packet to all egress ports corresponding to the multicast identifier in the multicast forwarding table; and

if the multicast forwarding table does not include the multicast identifier, executing error processing, and feeding back a corresponding processing result.

As one of the improvements to the foregoing technical solution, the error processing includes: discarding the multicast data packet; and feeding back error information to an upper-level multicast processing node, feeding back the error information to all multicast processing nodes adjacent to the multicast processing node, updating the multicast forwarding table, and adding a multicast forwarding table entry corresponding to the multicast identifier carried in the multicast data packet.

Compared with the prior art, the beneficial effects of the present invention are as follows:

In the method of the present invention, a characteristic that a multicast identifier and a network address are separate is fully utilized. A mapping between a multicast identifier and an IP network address of a multicast processing node is implemented by using the identifier resolution service module. A multicast processing node that forwards a multicast data packet in a network registers a multicast identifier and an IP address of the multicast processing node with the identifier resolution service module. The multicast receiver can perform resolution by using the identifier resolution service module to obtain a nearby multicast processing node, so that construction of multicast trees is simplified, and efficiency of a multicast service is improved.

Brief Description of Drawings

FIG. 1 is a schematic structural diagram of a multicast system for identifier resolution-based routing according to the present invention;

FIG. 2 is a schematic structural diagram of a multicast data packet of a multicast method

for identifier resolution-based routing according to the present invention;

FIG. 3 is a schematic structural diagram of a multicast forwarding table of a multicast method for identifier resolution-based routing according to the present invention;

FIG. 4 is a flowchart of processing a request response message by a multicast processing node in a multicast method for identifier resolution-based routing according to the present invention;

FIG. 5 is a flowchart of processing a multicast data packet by a multicast processing node in a multicast method for identifier resolution-based routing according to the present invention;

FIG. 6 is a flowchart of processing of a multicast receiver 1 joining in a multicast service EID1 in a specific embodiment of a multicast method for identifier resolution-based routing according to the present invention;

FIG. 7 is a schematic diagram of processing of a multicast processing node 2 returning a request response message in a specific embodiment of a multicast method for identifier resolution-based routing according to the present invention;

FIG. 8 is a schematic diagram of forwarding a multicast data packet in a specific embodiment of a multicast method for identifier resolution-based routing according to the present invention.

Detailed Description of Embodiments

The present invention is further described with reference to the accompanying drawings.

As shown in FIG. 1, the present invention provides a multicast system for identifier resolution-based routing. The system includes a multicast source, multicast receivers, a multicast member agent, and multicast processing nodes. The system further includes an identifier resolution service module deployed in a cloud or a network. The identifier resolution service module is configured to use a global unique identifier unrelated to any network address as a multicast identifier capable of uniquely identifying a multicast service. An IP network address is still used as a network address.

The identifier resolution service module is further configured to maintain a mapping relationship between a multicast identifier and the IP network address(es) of one or more multicast processing nodes that implement a multicast service.

The identifier resolution service module is further configured to provide registration, deregistration, and resolution and query services.

Network nodes hosting multicast include the multicast processing node and an IP network routing and switching nodes, that is, a common router.

The multicast receiver is configured to apply, by using the multicast identifier, to join the multicast service.

The multicast identifier is a global unique identifier that is unrelated to a network address and that can uniquely identify a multicast service. One multicast identifier only corresponds to one multicast service. Each multicast identifier corresponds to a plurality of multicast processing nodes and IP network addresses corresponding to the multicast processing nodes. In an information centric network-based architecture in which an identifier and an address are separate, an identifier unrelated to a network address is used to uniquely represent one multicast service. The identifier is a multicast identifier. An IP network address is still used as a network address.

The identifier resolution service module is further configured to provide registration, deregistration, and resolution and query services is specifically:

the identifier resolution service module supports registration and deregistration of the mapping relationship between a multicast identifier and the IP network address(es) of one or more multicast processing nodes that implement a multicast service and resolution and query of an IP network address of a multicast processing node by using the multicast identifier, where one multicast identifier corresponds to the IP network address(es) of one or more multicast processing nodes.

One or more multicast processing nodes are used, and the multicast processing node is configured to implement the function of the IP network routing and switching nodes. In addition to the function of the IP network routing and switching nodes, the following function is further provided:

The multicast processing node is further configured to: forward or process a modified join request message, determine whether a destination network address in the modified join request message is a network address of a multicast processing node that currently receives the modified

join request message, and forward the modified join request message or construct and forward a request response message according to a determination result.

Specifically, the multicast processing node receives the modified join request message, and determines whether the destination network address carried in the modified join request message is an IP network address of the multicast processing node that currently receives the modified join request message;

if the destination network address carried in the modified join request message is not the IP network address of the multicast processing node that currently receives the modified join request message, performs forwarding to a correct multicast processing node according to the destination network address in the modified join request message and based on an IP network route; and

if the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message, updates the local multicast forwarding table according to the modified join request message, and constructs and forwards the request response message.

Specifically, the multicast processing node queries whether the locally maintained multicast forwarding table includes a multicast identifier carried in the modified join request message;

if the multicast processing node finds that the local multicast forwarding table includes the multicast identifier carried in the modified join request message, queries a local routing table according to a source network address of the modified join request message and obtains a forwarding port; and

performs a search to determine whether an egress port list corresponding to the multicast identifier in the multicast forwarding table includes the forwarding port obtained through the query;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table does not include the forwarding port obtained through the query, adds the forwarding port to the egress port list; and

if the egress port list corresponding to the multicast identifier in the multicast forwarding

table includes the forwarding port obtained through the query, turns to a next step:

constructs, by the multicast processing node, the request response message, and returns the request response message, and updates, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent.

Specifically, as shown in FIG. 4, the next multicast processing node receives the forwarded request response message, extracts the multicast identifier and the destination network address from the forwarded request response message, and searches the locally maintained routing table according to the destination network address carried in the request response message for a corresponding forwarding port;

queries whether the locally maintained multicast forwarding table includes the multicast identifier carried in the request response message;

if the next multicast processing node finds that the locally maintained multicast forwarding table includes the multicast identifier carried in the request response message, obtains the egress port list corresponding to the multicast identifier, and further determines whether the egress port list includes the forwarding port;

if the egress port list includes the forwarding port, directly forwards the request response message the forwarding port;

if the egress port list does not include the forwarding port, adds the forwarding port to the egress port list, and directly forwards the request response message from the forwarding port; and

if the next multicast processing node finds that the local routing table does not include the multicast identifier carried in the request response message, adds the multicast identifier and the forwarding port to the multicast forwarding table, updates the multicast forwarding table, and registers a mapping relationship between the multicast identifier and the IP network address of the multicast processing node with the identifier resolution service module, thus becomes one multicast processing node corresponding to the multicast service, where the multicast processing node forwards the request response message from the forwarding port, until the request response message is forwarded to the multicast member agent;

if the multicast processing node finds that the local multicast forwarding table does not include the multicast identifier carried in the modified join request message, feeds back an exception.

The request response message is forwarded in a network layer packet format, and includes: a source network address, a destination network address, and the multicast identifier, where the source network address is the network address of the multicast processing node; and the destination network address is a network address of the multicast member agent.

The multicast processing node is further configured to: encapsulate and send a multicast data packet, and forward the multicast data packet according to an updated and locally maintained multicast forwarding table.

Specifically, a specific process of forwarding the multicast data packet is as follows:

queries whether the locally maintained multicast forwarding table includes the multicast identifier carried in the multicast data packet;

if the locally maintained multicast forwarding table includes the multicast identifier, obtains all egress ports corresponding to the multicast identifier carried in the multicast data packet, and copies the multicast data packet to all egress ports corresponding to the multicast identifier in the multicast forwarding table; and

if the multicast forwarding table does not include the multicast identifier, executes error processing, and feeding back a corresponding processing result.

The structure of the multicast data packet is shown in FIG. 2. The multicast data packet includes a source network address, a destination network address, and the multicast identifier; and the source network address is a network address of an intra-network multicast processing node that implements multicast.

The multicast processing node at the network edge modifies the join request message sent by the multicast member agent by using the multicast protocol agent, and forwards the modified connection request message to the selected multicast processing node.

Specifically, the multicast processing node at the edge of the network receives and processes the join request message forwarded by the multicast member agent and based on the multicast identifier, sends a resolution request to the identifier resolution service module,

resolves the multicast identifier carried in the join request message, and obtains a group of multicast processing nodes corresponding to the multicast identifier carried in the join request message and its corresponding IP network addresses, selects one of the multicast processing nodes, modifies the destination network address in the join request message to the IP address of the selected multicast processing node, obtains the modified join request message, and forwards the modified join request message to the selected multicast processing node.

The modified join request message is further capable of being constructed, encapsulated, and sent by using the multicast protocol agent.

The modified join request message is forwarded in a network layer packet format, and includes a source network address, the destination network address, and the multicast identifier, where the source network address is an IP network address of the multicast member agent; and the destination network address is an IP network address of a multicast processing node.

The multicast forwarding table includes a group of multicast forwarding table entries.

Each multicast forwarding table entry in the group of multicast forwarding table entries further includes one multicast identifier and one egress port list.

The egress port list further includes a plurality of forwarding ports.

The multicast identifier is a key, and the egress port list is a value. One multicast identifier corresponds to a plurality of forwarding ports.

One or more multicast member agents are used, one or more multicast receivers are used, and the multicast member agent and the multicast receiver are located in a same broadcast domain. The multicast member agent stores a local part identifier, and is configured to exchange information with the multicast receiver in a local broadcast domain.

The multicast member agent is further configured to maintain a mapping relationship between a multicast identifier and the local part identifier.

The multicast member agent is further configured to: obtain a multicast member report message sent by the multicast receiver, construct a join request message according to the multicast member report message, and then send the constructed join request message to the multicast processing node.

The multicast member agent is further configured to: obtain a multicast data packet sent

by the multicast processing node, and forward the multicast data packet to the multicast receiver.

The local part identifier is unique in the local broadcast domain, and is specifically, but not limited to, an IP multicast group address.

The present invention further provides a multicast method for identifier resolution-based routing. The method includes the following steps.

Step (1). A multicast receiver sends a multicast member report message carrying a multicast identifier to a multicast member agent, the multicast member agent constructs a join request message according to the multicast member report message, and sends the constructed join request message to the closest multicast processing node that is located at a network edge, and the multicast processing node modifies, by using a multicast protocol agent, the join request message sent by the multicast member agent, and forwards a modified join request message to a correct multicast processing node.

Specifically, a multicast source publishes a multicast service carrying the multicast identifier, and the multicast receiver applies, by using the multicast identifier, to join the multicast service carrying the multicast identifier, and sends the multicast member report message including the multicast identifier to a local broadcast domain.

The multicast member agent receives the multicast member report message, and constructs the join request message, and the multicast member agent sends the constructed join request message to the multicast processing node that is closest to the multicast member agent and that is located at the network edge.

The multicast processing node that is located at the network edge receives the join request message forwarded by the multicast member agent, requests to query an identifier resolution service module to obtain a group of multicast processing nodes corresponding to the multicast identifier carried in the join request message and network addresses corresponding to the group of multicast processing nodes, selects one of the multicast processing nodes, modifies the destination network address in the join request message into a network address of the selected multicast processing node, obtains the modified join request message, and forwards the modified request message to the selected multicast processing node.

Step (2). The multicast processing node determines whether a destination network address

in the received modified join request message is a network address of a multicast processing node that currently receives the modified join request message, and forwards the modified join request message or constructs and forwards a request response message according to a determination result.

Specifically, the multicast processing node receives the modified join request message, and determines whether the destination network address carried in the modified join request message is a network address of the multicast processing node that currently receives the modified join request message;

if the destination network address carried in the modified join request message is not the network address of the multicast processing node that currently receives the modified join request message, performs forwarding according to the destination network address in the modified join request message ,based on an IP network route, until the modified join request message is forwarded to the correct multicast processing node; and

if the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message, updates the locally maintained multicast forwarding table according to the modified join request message, and constructs and forwards the request response message.

Specifically, the multicast processing node queries whether the locally maintained multicast forwarding table includes a multicast identifier carried in the modified join request message;

if the multicast processing node finds that the local multicast forwarding table includes the multicast identifier carried in the modified join request message, queries a local routing table according to a source network address of the modified join request message and obtains a forwarding port;

performs a search to determine whether the egress port list corresponding to the multicast identifier in the multicast forwarding table includes the forwarding port obtained through the query;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table does not include the forwarding port obtained through the query, adds the forwarding port

to the egress port list; and

if the egress port list corresponding to the multicast identifier in the multicast forwarding table includes the forwarding port obtained through the query, turns to a next step:

construct, by the multicast processing node, the request response message, and return the request response message, and update, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent.

Specifically, the next multicast processing node receives the forwarded request response message, extracts the multicast identifier and the destination network address from the forwarded request response message, and searches the locally maintained routing table according to the destination network address carried in the request response message for a corresponding forwarding port;

query whether the locally maintained multicast forwarding table contains the multicast identifier carried in the request response message;

if the next multicast processing node finds that the local multicast forwarding table includes the multicast identifier carried in the request response message, obtains the egress port list corresponding to the multicast identifier, and further judges whether the egress port list includes the forwarding port;

if the egress port list includes the forwarding port, directly forwards the request response message from this forwarding port;

if the egress port list does not include the forwarding port, adds the forwarding port to the egress port list, and directly forwards the request response message from the forwarding port; and

if the next multicast processing node finds that the local multicast forwarding table does not include the multicast identifier carried in the request response message, adds the multicast identifier and the forwarding port to the multicast forwarding table, updates the multicast forwarding table, and registers a mapping relationship between the multicast identifier and the IP network address of the multicast processing node, thus becomes one multicast processing node corresponding to the multicast service, where the multicast processing node forwards the

request response message from the forwarding port, until the request response message is forwarded to the multicast member agent.

If the multicast processing node finds that the local multicast forwarding table does not include the multicast identifier carried in the modified join request message, an exception will be fed back.

Step (3). The multicast processing node updates a locally maintained multicast forwarding table according to the received request response message, and forwards a multicast data packet to the multicast member agent according to the locally maintained multicast forwarding table.

Specifically, after receiving the multicast data packet, the multicast processing node queries whether the locally maintained multicast forwarding table includes the multicast identifier carried in the multicast data packet;

if the locally maintained multicast forwarding table includes the multicast identifier, obtains all egress ports corresponding to the multicast identifier carried in the multicast data packet, and copies the multicast data packet from all egress ports corresponding to the multicast identifier in the multicast forwarding table; and

if the multicast forwarding table does not include the multicast identifier, performs error processing, and feeds back a corresponding processing result.

The error processing includes: discarding the multicast data packet; feeding back error information to an upper-level multicast processing node; feeding back the error information to all multicast processing nodes adjacent to the multicast processing node; updating the multicast forwarding table and adding a multicast forwarding table entry corresponding to the multicast identifier carried in the multicast data packet.

In the process of forwarding the multicast data packet, as shown in FIG. 3, the multicast forwarding table includes a multicast identifier and an egress port list. The multicast identifier is a key, and corresponds to the multicast identifier carried in the multicast data packet. The egress port list is a value, and corresponds to a group of forwarding ports for forwarding the multicast data packet.

Embodiment 1

To better describe the technical solutions of the present invention, the following

embodiments are provided to further describe a multicast method for identifier resolution-based routing of the present invention. The technical terms are explained as follows:

A multicast identifier is a global unique identifier that is unrelated to a network address and that can represent a multicast service. A network address is network-routable address information of a location of a terminal, and includes, but not limited to, information such as an IP address.

Each port of a multicast processing node has an IP address. One IP address is designated as an IP address of the multicast processing node and represents location information of the multicast processing node.

In the described embodiments, the multicast identifier is represented by an EID (Entity ID), and the network address is represented by an IP address. The multicast source 1 publishes a multicast service with a multicast identifier EID1, and a mapping relationship between the multicast identifier EID1 and a network address IP2 of a multicast processing node 1 has been registered in an identifier resolution service module. A multicast processing node 3 and a multicast processing node 4 are edge nodes of a network and have the function of a multicast protocol agent.

As shown in FIG. 6, the multicast source 1 publishes the multicast service with the multicast identifier EID1. A multicast receiver 2 has joined the multicast service through the multicast identifier EID1. The multicast processing node 1, the multicast processing node 2, and the multicast processing node 4 have all registered mappings between the multicast identifier EID1 and network addresses of the nodes with the identifier resolution service module. The identifier resolution service module maintains mapping relationships between the multicast identifier EID1 and IP2, IP3, and IP7.

A multicast receiver 1 applies, by using the multicast identifier EID1, to join the multicast service with the multicast identifier EID1. The multicast receiver 1 obtains a multicast group network address IPm1 corresponding to the multicast identifier EID1, and sends a multicast member report message including the multicast identifier to a local broadcast domain.

A multicast member agent 1 receives the multicast member report message, maintains a mapping relationship with the multicast group network address IPm1 corresponding to the

multicast identifier EID1, and constructs a join request message. The join request message is forwarded in a network layer packet format, and includes: a network address IP5 of a multicast member agent as a source network address, a network address IP4 of the multicast processing node 3 that is closest to the multicast member agent and that is located at a network edge as a destination network address, and the multicast identifier EID1. The multicast member agent 1 sends the join request message to the multicast processing node 3 that is closest to the multicast member agent and that is located at the network edge.

The multicast processing node 3 receives the join request message sent by the multicast member agent 1, and sends, through the multicast protocol agent to the identifier resolution service module, a resolution request for the multicast identifier EID1 carried in the join request message. The identifier resolution service module returns the network addresses IP2, IP3, and IP7 of a group of multicast processing nodes corresponding to the multicast identifier EID1. The multicast processing node 3 selects the multicast processing node 2 with the network address IP3 as a destination multicast processing node, and modifies the destination network address in the join request message into the IP network address IP3 of the multicast processing node 2, to obtain a modified join request message. The modified join request message is forwarded in the network layer packet format, and includes: the source network address being a multicast group network address IP5 of the multicast member agent 1, and the destination network address being the network address IP3 and the multicast identifier EID1 of the multicast processing node 2. The multicast processing node 3 forwards the modified join request message to the multicast processing node 2.

As shown in FIG. 7, the multicast processing node 2 receives the modified join request message, and judges whether the target IP address IP3 of the join request message is an IP address of the multicast processing node 2. The multicast processing node 2 extracts a source network address IP5 and the multicast identifier EID1 in the join request message.

The multicast processing node 2 queries a locally maintained multicast forwarding table to obtain the modified multicast identifier EID1 carried in the join request message. The multicast processing node 2 queries a local routing table according to the source network address IP5 of the modified join request message and obtains a forwarding port 2.

If finding that the egress port list corresponding to the multicast identifier EID1 in the multicast forwarding table does not include the forwarding port 2 obtained through the query, the multicast processing node 2 adds the forwarding port 2 to the egress port list.

The multicast processing node constructs and returns a request response message. The request response message is forwarded in the network layer packet format, and includes: the source network address being the network address IP3 of the multicast processing node 2, and the destination network address being the network address IP5 and the multicast identifier EID1 of the multicast member agent 1.

After receiving the request response message, the multicast processing node 3 extracts the multicast identifier EID1 and the destination network address IP5 from the request response message, and searches the locally maintained routing table for a corresponding forwarding port 2 according to the destination network address IP5 carried in the request response message.

The multicast processing node 3 queries whether the locally maintained multicast forwarding table includes the multicast identifier EID1 carried in the request response message.

If failing to find the multicast identifier EID1 in the locally maintained multicast forwarding table, the multicast processing node 3 adds the multicast identifier EID1 and the forwarding port 2 to the multicast forwarding table, and registers a mapping relationship between the multicast identifier EID1 and an IP network address IP4 of the multicast processing node 3 with the identifier resolution service module to make the identifier resolution service module become one multicast processing node for implementing multicast corresponding to the multicast service. The multicast processing node 3 forwards the request response message to the multicast member agent 1 from the foregoing the forwarding port 2.

As shown in FIG. 8, the multicast source 1 generates and sends a multicast data packet.

After receiving the multicast data packet, the multicast processing node 1 queries the locally maintained multicast forwarding table and obtains that an egress port corresponding to the multicast identifier EID1 carried in the multicast data packet is the port 2, and forwards the multicast data packet to the multicast processing node 2 from the port 2.

After receiving the multicast data packet, the multicast processing node 2 queries the locally maintained multicast forwarding table to obtain that the egress port corresponding to the

multicast identifier EID1 carried in the multicast data packet is the port 2 and a port 3, copies the multicast data packet to obtain two multicast data packets, and forwards the two multicast data packets to the corresponding multicast processing node 3 and multicast processing node 4 from the port 2 and the port 3, respectively.

After receiving the multicast data packet, the multicast processing node 3 queries the locally maintained multicast forwarding table and obtains that an egress port corresponding to the multicast identifier EID1 carried in the multicast data packet is the port 2, and forwards the multicast data packet to the multicast member agent 1 from the port 2.

After receiving the multicast data packet, the multicast member agent 1 changes the destination network address of the multicast data packet into the multicast group network address IPm1, and forwards the multicast data packet to the multicast receiver 1 using IP Multicast. The multicast receiver 1 receives the multicast data packet.

After receiving the multicast data packet, the multicast processing node 4 queries the locally maintained multicast forwarding table and obtains that an egress port corresponding to the multicast identifier EID1 carried in the multicast data packet is the port 2, and forwards the multicast data packet to the multicast member agent 2 from the port 2.

After receiving the multicast data packet, the multicast member agent 2 changes the destination network address of the multicast data packet into the multicast group network address IPm1, and forwards the multicast data packet to the multicast receiver 2 using IP Multicast. The multicast receiver 2 receives the multicast data packet.

Finally, it should be noted that the foregoing embodiments are merely intended for describing the technical solutions of the present invention rather than limiting the present invention. Although the present invention is described in detail with reference to the embodiments, persons of ordinary skill in the art should understand that they may still make modifications or equivalent replacements to the technical features of the present invention without departing from the spirit and scope of the technical solutions of the technical solutions of the present invention. These modifications or equivalent replacements shall all fall within the scope of the claims the present invention.

Claims

1. A multicast system for identifier resolution-based routing, the system comprising a multicast sources, multicast receivers, multicast member agents, and multicast processing nodes, wherein the system further comprises an identifier resolution service module deployed in a cloud or a network, and the identifier resolution service module is configured to use a globally unique identifier unrelated to any network address as a multicast identifier capable of uniquely identifying a multicast service, wherein the network address is still the address of IP network;

the identifier resolution service module is further configured to maintain a mapping relationship between a multicast identifier and the IP network address(es) of one or more multicast processing nodes;

the identifier resolution service module is further configured to provide registration, deregistration, and resolution and query services;

network nodes hosting multicast comprise the multicast processing nodes and IP network routing and switching nodes; and

the multicast receiver is configured to apply, by using the multicast identifier, to join the multicast service.

2. The multicast system for identifier resolution-based routing according to claim 1, wherein the identifier resolution service module is further configured to provide registration, deregistration, and resolution and query services is specifically:

the identifier resolution service module supports registration and deregistration of the mapping relationship between a multicast identifier and the IP network address(es) of one or more multicast processing nodes and resolution and query of the IP network address(es) of a multicast processing node by using the multicast identifier, wherein one multicast identifier corresponds to the IP network address(es) of one or more multicast processing nodes.

3. The multicast system for identifier resolution-based routing according to claim 1, wherein one or more multicast processing nodes are used, and the multicast processing node is configured to implement a function of the IP network routing and switching nodes;

the multicast processing node is further configured to: forward or process a modified join

request message, determine whether a destination network address in the modified join request message is a network address of a multicast processing node that currently receives the modified join request message, and forward the modified join request message or construct and forward a request response message according to a determination result;

the multicast processing node is further configured to: encapsulate and send a multicast data packet, and forward the multicast data packet according to an updated and locally maintained multicast forwarding table; and

the multicast processing node at the network edge modifies, by using a multicast protocol agent, the join request message sent by the multicast member agent, and forwards the modified join request message to the selected multicast processing node.

4. The multicast system for identifier resolution-based routing according to claim 3, wherein a specific implementation process of that a multicast processing node located at a network edge modifies, by using a multicast protocol agent, a join request message sent by the multicast member agent, and forwards the modified join request message to a selected multicast processing node is:

receiving and processing, by the multicast processing node located at the network edge, the join request message that is forwarded by the multicast member agent and that is based on the multicast identifier, sending a resolution request to the identifier resolution service module, resolving the multicast identifier carried in the join request message to obtain a group of multicast processing nodes corresponding to the multicast identifier carried in the join request message and IP network addresses corresponding to the group of multicast processing nodes, selecting one of the multicast processing nodes, modifying the destination network address in the join request message into the IP address of the selected multicast processing node, obtaining the modified join request message, and forwarding the modified join request message to the selected multicast processing node,

wherein the modified join request message is further capable of being constructed, encapsulated, and sent by using the multicast protocol agent.

5. The multicast system for identifier resolution-based routing according to claim 4, wherein the modified join request message is forwarded in a network layer packet format, and

comprises a source network address, a destination network address, and the multicast identifier, wherein the source network address is the IP network address of the multicast member agent; and the destination network address is the IP network address of a multicast processing node.

6. The multicast system for identifier resolution-based routing according to claim 3, wherein the multicast forwarding table comprises a group of multicast forwarding table entries;

each multicast forwarding table entry in the group of multicast forwarding table entries further comprises one multicast identifier and an egress port list;

the egress port list further comprises a plurality of forwarding ports; and

the multicast identifier is a key, and the egress port list is a value; and one multicast identifier corresponds to one or more forwarding ports.

7. The multicast system for identifier resolution-based routing according to claim 3, wherein a specific implementation process of that the multicast processing node is configured to: forward or process a modified join request message, determine whether the destination network address in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message, and forward the modified join request message or construct and forward a request response message according to a determination result is:

receiving, by the multicast processing node, the modified join request message, and determining whether the destination network address carried in the modified join request message is an IP network address of the multicast processing node that currently receives the modified join request message;

if the destination network address carried in the modified join request message is not the IP network address of the multicast processing node that currently receives the modified join request message, performing forwarding to a correct multicast processing node based on IP network route according to the destination network address in the modified join request message; and

if the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message, updating the local multicast forwarding table according to the modified join

request message, and constructing and forwarding the request response message.

8. The multicast system for identifier resolution-based routing according to claim 7, wherein the request response message is forwarded in a network layer packet format, and comprises: a source network address, a destination network address, and the multicast identifier, wherein the source network address is the network address of the multicast processing node; and the destination network address is a network address of the multicast member agent.

9. The multicast system for identifier resolution-based routing according to claim 7, wherein a specific process of updating the local multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message is:

querying, by the multicast processing node, whether the locally maintained multicast forwarding table comprises a multicast identifier carried in the modified join request message;

if the multicast processing node finds that the local multicast forwarding table comprises the multicast identifier carried in the modified join request message, querying a local routing table according to a source network address of the modified join request message and obtaining a forwarding port;

performing a search to determine whether an egress port list corresponding to the multicast identifier in the multicast forwarding table comprises the forwarding port obtained through the query;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table does not comprise the forwarding port obtained through the query, adding the forwarding port to the egress port list;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table comprises the forwarding port obtained through the query, turning to a next step:

constructing, by the multicast processing node, the request response message, returning the request response message, and updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent; and

if the multicast processing node finds that the local multicast forwarding table does not comprise the multicast identifier carried in the modified join request message, feeding back an exception.

10. The multicast system for identifier resolution-based routing according to claim 9, wherein the updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent is specifically:

receiving, by the next multicast processing node, the forwarded request response message, extracting the multicast identifier and the destination network address from the forwarded request response message, and searching the locally maintained routing table according to the destination network address carried in the request response message for a corresponding forwarding port;

querying whether the locally maintained multicast forwarding table comprises the multicast identifier carried in the request response message;

if the next multicast processing node finds that the locally maintained multicast forwarding table comprises the multicast identifier carried in the request response message, obtaining the egress port list corresponding to the multicast identifier, and further determining whether the egress port list comprises the forwarding port;

if the egress port list comprises the forwarding port, directly forwarding the request response message from the forwarding port;

if the egress port list does not comprise the forwarding port, adding the forwarding port to the egress port list, and directly forwarding the request response message from the forwarding port; and

if the next multicast processing node finds that the local routing table does not comprise the multicast identifier carried in the request response message, adding the multicast identifier and the forwarding port to the multicast forwarding table, updating the multicast forwarding table, and registering a mapping relationship between the multicast identifier and the IP network address of the multicast processing node with the identifier resolution service module, thus becoming one multicast processing node corresponding to the multicast service,

and forwarding, by the multicast processing node, the request response message from the forwarding port, until the request response message is forwarded to the multicast member agent.

11. The multicast system for identifier resolution-based routing according to claim 3, wherein the multicast data packet comprises a source network address, a destination network address, and the multicast identifier; and the source network address is a network address of an intra-network multicast processing node that implements multicast.

12. The multicast system for identifier resolution-based routing according to claim 11, wherein a specific implementation process of that the multicast processing node is further configured to forward the multicast data packet is:

querying whether the locally maintained multicast forwarding table comprises the multicast identifier carried in the multicast data packet;

if the locally maintained multicast forwarding table comprises the multicast identifier, obtaining all egress ports corresponding to the multicast identifier carried in the multicast data packet, and copying the multicast data packet to all egress ports corresponding to the multicast identifier in the multicast forwarding table; and

if the multicast forwarding table does not comprise the multicast identifier, executing error processing, and feeding back a corresponding processing result.

13. The multicast system for identifier resolution-based routing according to claim 1, wherein one or more multicast member agents are used, one or more multicast receivers are used, the multicast member agent and the multicast receiver are located in the same broadcast domain; the multicast member agent stores a local part identifier, and is configured to exchange information with the multicast receivers in a local broadcast domain;

the multicast member agent is further configured to maintain a mapping relationship between a multicast identifier and a local part identifier;

the multicast member agent is further configured to: obtain a multicast membership report messages sent by the multicast receivers, construct a join request message according to the multicast member report message, and then send the constructed join request message to the multicast processing node; and

the multicast member agent is further configured to: obtain a multicast data packet sent by the multicast processing node, and forward the multicast data packet to the multicast receiver,

wherein the local part identifier is unique in the local broadcast domain, and is specifically, but not limited to, an IP multicast group address.

14. A multicast method for identifier resolution-based routing, wherein the method is implemented based on the multicast system for identifier resolution-based routing according to any one of claims 1 to 13, and the method comprises:

step (1). sending, by a multicast receiver, a multicast member report message carrying a multicast identifier to a multicast member agent, constructing, by the multicast member agent, a join request message according to the multicast member report message, and sending the constructed join request message to a multicast processing node that is closest to the multicast member agent and that is located at a network edge, and modifying, by the multicast processing node by using a multicast protocol agent, the join request message sent by the multicast member agent, and forwarding a modified join request message to an appropriate multicast processing node;

step (2). determining, by the multicast processing node, whether a destination network address in the received modified join request message is a network address of a multicast processing node that currently receives the modified join request message, and forwarding the modified join request message or constructing and forwarding a request response message according to a determination result; and

step (3). updating, by the multicast processing node, the locally maintained multicast forwarding table according to the received request response message, and forwarding a multicast data packets to the multicast member agent according to the locally maintained multicast forwarding table.

15. The multicast method for identifier resolution-based routing according to claim 14, wherein a specific process of step (1) is as follows:

publishing, by a multicast source, a multicast service carrying the multicast identifier, applying, by the multicast receiver by using the multicast identifier, to join the multicast service

carrying the multicast identifier, and sending the multicast member report message comprising the multicast identifier to a local broadcast domain;

receiving, by the multicast member agent, the multicast member report message, and constructing the join request message, and sending, by the multicast member agent, the constructed join request message to the multicast processing node that is closest to the multicast member agent and that is located at the network edge; and

receiving, by the multicast processing node that is located at the network edge, the join request message forwarded by the multicast member agent, requesting to query an identifier resolution service module to obtain a group of multicast processing nodes corresponding to the multicast identifier carried in the join request message and network addresses corresponding to the group of multicast processing nodes, selecting one of the multicast processing nodes, modifying the destination network address in the join request message into the network address of the selected multicast processing node, obtaining the modified join request message, and forwarding the modified request message to the selected multicast processing node.

16. The multicast method for identifier resolution-based routing according to claim 14, wherein a specific process of step (2) is as follows:

receiving, by the multicast processing node, the modified join request message, and determining whether the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message;

if the destination network address carried in the modified join request message is not the network address of the multicast processing node that currently receives the modified join request message, performing forwarding based on IP network route according to the destination network address in the modified join request message, until the modified join request message is forwarded to the correct multicast processing node; and

if the destination network address carried in the modified join request message is the network address of the multicast processing node that currently receives the modified join request message, updating the locally maintained multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message.

17. The multicast method for identifier resolution-based routing according to claim 16, wherein the updating the local multicast forwarding table according to the modified join request message, and constructing and forwarding the request response message is specifically:

querying, by the multicast processing node, whether the locally maintained multicast forwarding table comprises a multicast identifier carried in the modified join request message;

if the multicast processing node finds that the local multicast forwarding table comprises the multicast identifier carried in the modified join request message, querying the local routing table according to the source network address of the modified join request message and obtaining a forwarding port;

performing a search to determine whether the egress port list corresponding to the multicast identifier in the multicast forwarding table comprises the forwarding port obtained through the query;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table does not comprise the forwarding port obtained through the query, adding the forwarding port to the egress port list;

if the egress port list corresponding to the multicast identifier in the multicast forwarding table comprises the forwarding port obtained through the query, turning to a next step:

constructing, by the multicast processing node, the request response message, and returning the request response message, and updating, by a next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent; and

if the multicast processing node finds that the local multicast forwarding table does not comprise the multicast identifier carried in the modified join request message, feeding back an exception.

18. The multicast method for identifier resolution-based routing according to claim 17, wherein updating, by the next multicast processing node, the multicast forwarding table according to the forwarded request response message, until the request response message is forwarded to the multicast member agent is specifically:

receiving, by the next multicast processing node, the forwarded request response message,

extracting the multicast identifier and the destination network address from the forwarded request response message, and searching the locally maintained routing table according to the destination network address carried in the request response message for a corresponding forwarding port;

querying whether the locally maintained multicast forwarding table comprises the multicast identifier carried in the request response message;

if the next multicast processing node finds that the local multicast forwarding table comprises the multicast identifier carried in the request response message, obtaining the egress port list corresponding to the multicast identifier, and further determining whether the egress port list comprises the forwarding port;

if the egress port list comprises the forwarding port, directly forwarding the request response message from the forwarding port;

if the egress port list does not comprise the forwarding port, adding the forwarding port to the egress port list, and directly forwarding the request response message from the forwarding port; and

if the next multicast processing node finds that the local multicast forwarding table does not comprise the multicast identifier carried in the request response message, adding the multicast identifier and the forwarding port to the multicast forwarding table, updating the multicast forwarding table, and registering a mapping relationship between the multicast identifier and the IP network address of the multicast processing node with the identifier resolution service module, thus becoming one multicast processing node corresponding to the multicast service, and forwarding, by the multicast processing node, the request response message from the forwarding port, until the request response message is forwarded to the multicast member agent.

19. The multicast method for identifier resolution-based routing according to claim 14, wherein a specific process of the forwarding a multicast data packet to the multicast member agent according to the locally maintained multicast forwarding table in step (3) is as follows:

after the multicast processing node receives the multicast data packet, querying whether the locally maintained multicast forwarding table comprises the multicast identifier carried in

the multicast data packet;

if the locally maintained multicast forwarding table comprises the multicast identifier, obtaining all egress ports corresponding to the multicast identifier carried in the multicast data packet, and copying the multicast data packet to all egress ports corresponding to the multicast identifier in the multicast forwarding table; and

if the multicast forwarding table does not comprise the multicast identifier, executing error processing, and feeding back a corresponding processing result.

20. The multicast method for identifier resolution-based routing according to claim 19, wherein the error processing comprises: discarding the multicast data packet; and feeding back error information to an upper-level multicast processing node, feeding back the error information to all multicast processing nodes adjacent to the multicast processing node, updating the multicast forwarding table, and adding a multicast forwarding table entry corresponding to the multicast identifier carried in the multicast data packet.