CLAIMS

What is claimed is:

1. A method for load balancing in multicast tunneling, wherein the method is applied to a gateway device that has established AMT tunnels with multiple relay devices, and the method comprises:

receiving a Multicast Join Request packet sent by a multicast receiver, wherein the Multicast Join Request packet includes information about a multicast group;

acquiring a priority value and a load value of each relay device among the multiple relay devices, wherein the priority value is to represent multicast service quality of the relay device;

selecting one target relay device for the multicast group from the multiple relay devices based on the priority value and the load value of each relay device;

sending a first Membership Update packet to the target relay device, wherein the first Membership Update packet includes the information about the multicast group, so that the target relay device forwards a multicast data stream of the multicast group to the multicast receiver.

2. The method according to claim 1, wherein the gateway device is configured with an anycast address for each relay device included in a relay device group, and a process of establishing the AMT tunnels between the gateway device and the multiple relay devices comprises:

after the gateway device goes online, sending a Relay Discovery packet to each relay device included in the relay device group respectively, wherein each Relay Discovery packet contains a different anycast address;

within a first preset period, receiving Relay Advertisement packets sent by a first number of relay devices, wherein the Relay Advertisement packets include priority values of the relay devices;

establishing AMT tunnels with the first number of relay devices respectively

and recording the priority values of the first number of relay devices;

recording priority values of a second number of relay devices as 0, wherein the second number of relay devices are relay devices in the relay device group which do not send a Relay Advertisement packet within the first preset period, and a sum of the first number and the second number is the number of relay devices included in the relay device group.

3. The method according to claim 2, wherein after recording the priority values of the first number of relay devices, the method further comprises:

sending Request packets to the first number of relay devices every second preset period;

receiving Membership Query packets sent by the first number of relay devices, wherein the Membership Query packets include the priority values of the relay devices;

updating the recorded priority values of the first number of relay devices based on the priority values included in the Membership Query packets.

4. The method according to claim 1, wherein selecting one target relay device for the multicast group from the multiple relay devices based on the priority value and the load value of each relay device, comprises:

acquiring a shared weight value of each relay device;

selecting shared weight values that exceed a preset threshold from multiple shared weight values;

selecting a relay device with a lowest load value as the target relay device from relay devices corresponding to the selected shared weight values.

5. The method according to claim 4, wherein acquiring the shared weight value of each relay device, comprises:

determining a shared weight value corresponding to the priority value of each relay device based on preset mapping relationships between priority values and

shared weight values; or,

for each relay device, determining the shared weight value of the relay device as a ratio between the priority value of the relay device and a sum of the priority values of the multiple relay devices.

6. The method according to claim 1, wherein after sending the first Membership Update packet to the target relay device, the method further comprises:

in response to determining that the target relay device fails, acquiring the priority value of each relay device among the multiple relay devices other than the target relay device;

from the multiple relay devices other than the target relay device, reselecting a new target relay device for the multicast group based on the priority value and the load value acquired for each relay device;

sending a second Membership Update packet to the reselected target relay device, wherein the second Membership Update packet includes the information about the multicast group, so that the reselected target relay device forwards the multicast data stream of the multicast group to the multicast receiver.

7. The method according to claim 2, wherein a Relay Advertisement packet from a relay device includes a priority field, to carry the priority value of the relay device.

8. The method according to claim 3, wherein a Membership Query packet from a relay device includes a first tag bit field and a priority field, when a value of the first tag bit field is a first value, it indicates that the priority value of the relay device is carried in the priority field.

9. The method according to claim 8, wherein the Membership Query packet further includes a second tag bit field;

if a value of the second tag bit field is the first value, it indicates that the priority field is located after and adjacent to a gateway address field;

if the value of the second tag bit field is a second value, it indicates that the priority field is located after and adjacent to encapsulation information of a general query message.

10. The method according to claim 7 or 8, wherein the priority field occupies 8 reserved bits, when a value of the priority field is 0, it indicates that the priority field does not carry a priority value.

11. The method according to claim 1, wherein the priority value of a relay device is determined based on health parameters of the relay device, which includes any one or more of:

the number of accessible multicast sources;

network quality with the multicast sources;

failure ratios of transmission paths with the multicast sources;

quality of routing links with the multicast sources.

12. The method according to claim 1, wherein the load value of a relay device is the number of multicast groups for which the relay device is responsible.

13. An apparatus for load balancing in multicast tunneling, wherein the apparatus is applied to a gateway device that has established AMT tunnels with multiple relay devices, and the apparatus comprises:

a receiving module, to receive a Multicast Join Request packet sent by a multicast receiver, wherein the Multicast Join Request packet includes information about a multicast group;

an acquiring module, to acquire a priority value and a load value of each relay device among the multiple relay devices, wherein the priority value is to represent multicast service quality of the relay device;

a selecting module, to select one target relay device for the multicast group from the multiple relay devices based on the priority value and the load value of each relay device;

a sending module, to send a first Membership Update packet to the target relay device, wherein the first Membership Update packet includes the information about the multicast group, so that the target relay device forwards a multicast data stream of the multicast group to the multicast receiver.

14. The apparatus according to claim 13, wherein the gateway device is configured with an anycast address for each relay device included in a relay device group, and a process of establishing the AMT tunnels between the gateway device and the multiple relay devices comprises:

after the gateway device goes online, sending a Relay Discovery packet to each relay device included in the relay device group respectively, wherein each Relay Discovery packet contains a different anycast address;

within a first preset period, receiving Relay Advertisement packets sent by a first number of relay devices, wherein the Relay Advertisement packets include priority values of the relay devices;

establishing AMT tunnels with the first number of relay devices respectively and record the priority values of the first number of relay devices;

recording priority values of a second number of relay devices as 0, wherein the second number of relay devices are relay devices in the relay device group which do not send a Relay Advertisement packet within the first preset period, and a sum of the first number and the second number is the number of relay devices included in the relay device group.

15. The apparatus according to claim 14, wherein after recording the priority values of the first number of relay devices, the apparatus further comprises an updating module;

the sending module is further to send Request packets to the first number of relay devices every second preset period;

the receiving module is further to receive Membership Query packets sent by the first number of relay devices, wherein the Membership Query packets include

the priority values of the relay devices;

the updating module is to update the recorded priority values of the first number of relay devices based on the priority values included in the Membership Query packets,

wherein a Membership Query packet from a relay device includes a first tag bit field and a priority field, when a value of the first tag bit field is a first value, it indicates that the priority value of the relay device is carried in the priority field,

wherein the Membership Query packet further includes a second tag bit field;

if a value of the second tag bit field is the first value, it indicates that the priority field is located after and adjacent to a gateway address field;

if the value of the second tag bit field is a second value, it indicates that the priority field is located after and adjacent to encapsulation information of a general query message.

16. The apparatus according to claim 13, wherein the selecting module is specifically to:

acquire a shared weight value of each relay device;

select shared weight values that exceed a preset threshold from multiple shared weight values;

select a relay device with a lowest load value as the target relay device from relay devices corresponding to the selected shared weight values,

wherein the selecting module is specifically to:

determine a shared weight value corresponding to the priority value of each relay device based on preset mapping relationships between priority values and shared weight values; or,

for each relay device, determine the shared weight value of the relay device as a ratio between the priority value of the relay device and a sum of the priority values of the multiple relay devices.

17. The apparatus according to claim 13, wherein,

the acquiring module is further to: in response to determining that the target relay device fails, acquire the priority value of each relay device among the multiple relay devices other than the target relay device;

the selecting module is further to: from the multiple relay devices other than the target relay device, reselect a new target relay device for the multicast group based on the priority value and the load value acquired for each relay device;

the sending module is further to: send a second Membership Update packet to the reselected target relay device, wherein the second Membership Update packet includes the information about the multicast group, so that the reselected target relay device forwards the multicast data stream of the multicast group to the multicast receiver.

18. The apparatus according to claim 14, wherein a Relay Advertisement packet from a relay device includes a priority field, to carry the priority value of the relay device, wherein the priority field occupies 8 reserved bits, when a value of the priority field is 0, it indicates that the priority field does not carry a priority value.

19. The apparatus according to claim 13, wherein the load value of a relay device is the number of multicast groups for which the relay device is responsible.

20. A gateway device, which has established AMT tunnels with multiple relay devices and comprises:

a processor;

a transceiver;

a machine readable storage medium, which stores machine executable instructions that can be executed by the processor to cause the processor to implement the method according to any one of claims 1-12.

21. A machine readable storage medium, which stores machine executable instructions that, when called and executed by a processor, cause the processor to

implement the method according to any one of claims 1-12.

22. A computer program product, which causes a processor to implement the method according to any one of claims 1-12.