CLAIMS

What is claimed is:

1. A message forwarding method based on Remote Direct Memory Access (RDMA), comprising:

utilizing a memory and a processor, wherein the memory is used for storing one or more computer instructions, wherein the one or more computer instructions, when executed by the processor, implements operations of:

acquiring payload data corresponding to an RDMA message to be forwarded;

encapsulating a message header of the payload data by using a hardware module in a network card node to obtain a processed message;

forwarding the processed message by using the hardware module or a software module in the network card node,

wherein before acquiring the payload data corresponding to the RDMA message to be forwarded, the method further comprises:

acquiring build-connect payload data for implementing an RDMA build-connect operation;

encapsulating a message header of the build-connect payload data by using a virtual switch in the software module to obtain a build-connect message;

determining a build-connect flow table corresponding to the build-connect message by using a software manager in the software module, and sending the build-connect flow table to the virtual switch; and

performing, by the virtual switch, a forwarding operation on the build-connect message based on the build-connect flow table, to implement an RDMA build-connect operation.

2. The method according to claim 1, wherein forwarding the processed message by using the hardware module or the software module in the network card node, comprising:

detecting whether the processed message conforms a first flow table, wherein the first flow table is stored in the hardware module;

forwarding the processed message by using the hardware module and the first flow table in the event that the processed message conforms the first flow table;

forwarding the processed message by using the software module and a second flow table in the event that the processed message does not conform the first flow table, wherein the second flow table is stored in the software module.

3. The method according to claim 2, wherein after forwarding the processed message by using the software module and the second flow table, the method further comprises:

acquiring a target flow table corresponding to the processed message;

sending the target flow table to the hardware module for use as the first flow table.

4. The method according to claim 1, wherein encapsulating the message header of the payload data by using the hardware module in the network card node to obtain the processed message, comprising:

acquiring a data descriptor of the payload data by using the hardware module, the data descriptor being used to identify a length and RDMA header information of the payload data;

acquiring encapsulation information corresponding to the payload data by using the data descriptor;

encapsulating the message header of the payload data by using the hardware module and the encapsulation information to obtain the processed message.

5. The method according to claim 4, wherein acquiring the encapsulation information corresponding to the payload data by using the data descriptor, comprising:

sending the data descriptor to the software module by using the hardware module;

generating encapsulation information corresponding to the payload data by using the software module and the data descriptor, and sending the encapsulation information and the data descriptor to the hardware module.

6. The method according to claim 5, wherein generating the encapsulation information corresponding to the payload data by using the software module and the data descriptor, comprising:

performing protocol stack processing and congestion control processing on the data descriptor by using the software module to generate encapsulation information corresponding to the payload data, wherein the encapsulation information comprises: a congestion control value for identifying congestion control, Transmission Control Protocol TCP header information, Internet Protocol IP header information, and Medium Access Control MAC header information.

7. The method according to claim 2, wherein forwarding the processed message, comprising:

performing VxLAN encapsulation on the processed message to obtain a target message;

acquiring a congestion control value corresponding to the target message;

copying the congestion control value to an outer layer and generating, in the outer layer, a message format identifier corresponding to the target message, the message format identifier being used to identify the target message as the RDMA message;

forwarding the target message based on the congestion control value, the message format identifier, and a flow table forwarding rule.

8. The method according to any one of claims 1-7, further comprising:

acquiring a message to be forwarded;

performing a decapsulation operation on a message header of the message to be forwarded by using the hardware module in the network card node to obtain a decapsulated message corresponding to the message to be forwarded;

forwarding the decapsulated message by using the hardware module or the software module.

9. The method according to claim 8, wherein forwarding the decapsulated message by using the hardware module or the software module, comprising:

detecting whether the decapsulated message conforms a first flow table;

forwarding the decapsulated message by using the hardware module and the first flow table in the event that the decapsulated message conforms the first flow table;

forwarding the decapsulated message by using the software module and a second flow table in the event that the decapsulated message does not conform the first flow table.

10. The method according to claim 9, wherein forwarding the decapsulated message by using the hardware module and the first flow table, comprising:

performing VxLAN decapsulation on the decapsulated message by using the hardware module and the first flow table to obtain a target message;

acquiring a congestion control value corresponding to the target message, and copying the congestion control value to an inner layer;

forwarding the target message based on the congestion control value and the first flow table.

11. The method according to claim 9, wherein forwarding the decapsulated message by using the software module and the second flow table, comprising:

acquiring a message format identifier corresponding to the decapsulated message by using the software module and the second flow table;

performing VxLAN decapsulation on the decapsulated message based on the second flow table to obtain a target message, in the event that the decapsulated message is determined as an RDMA message based on the message format identifier;

acquiring a congestion control value corresponding to the target message and copying the congestion control value to an inner layer;

forwarding the target message based on the congestion control value and the second flow table.

12. The method according to claim 9, wherein after performing the decapsulation operation on the message header of the message to be forwarded by using the hardware module in the network card node, the method further comprises:

acquiring a message descriptor corresponding to the message to be forwarded;

sending the decapsulated message and the message descriptor to the software module;

updating connection management information for implementing an RDMA message transmission operation by using the software module, the decapsulated message, and the message descriptor.

13. The method according to claim 10, wherein after acquiring the target message, the method further comprises:

generating and storing a data sequence value corresponding to the target message, the data sequence value being related to encapsulation information for performing encapsulation processing on message data.

14. The method according to claim 2, further comprising:

acquiring a message to be forwarded;

performing a decapsulation operation on a message header of the message to be forwarded by using the hardware module in the network card node to obtain a decapsulated message corresponding to the message to be forwarded;

forwarding the decapsulated message by using the hardware module or the software module.

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

acquiring a message to be forwarded;

performing a decapsulation operation on a message header of the message to be forwarded by using the hardware module in the network card node to obtain a decapsulated message corresponding to the message to be forwarded;

forwarding the decapsulated message by using the hardware module or the software module.

16. A message forwarding apparatus based on Remote Direct Memory Access (RDMA), comprising:

a physical machine for generating payload data corresponding to an RDMA message to be forwarded;

a memory and a processor, wherein the memory is used for storing one or more computer instructions, wherein the one or more computer instructions, when executed by the processor, provide:

acquiring the payload data corresponding to the RDMA message to be forwarded, and encapsulating a message header of the payload data by using a hardware module to obtain a processed message;

forwarding the processed message by using the hardware module or a software module;

acquiring build-connect payload data for implementing an RDMA build-connect operation by using the hardware module, before acquiring the payload data corresponding to the RDMA message to be forwarded;

encapsulating a message header of the build-connect payload data by using a virtual switch in the software module to obtain a build-connect message, and determining a build-connect flow table corresponding to the build-connect message by using a software manager in the software module, and sending the build-connect flow table to the virtual switch;

performing, by the virtual switch, a forwarding operation on the build-connect message based on the build-connect flow table, to implement an RDMA build-connect operation.

17. An electronic device, comprising a memory and a processor, wherein the memory is used for storing one or more computer instructions, wherein the one or more computer instructions, when executed by the processor, implements operations of the message forwarding method based on Remote Direct Memory Access (RDMA) in any one of claims 1-15.

18. A network card, comprising:

a memory and a processor, wherein the memory is used for storing one or more computer instructions, wherein the one or more computer instructions, when executed by the processor, provide:

acquiring payload data corresponding to an RDMA message to be forwarded, and encapsulating a message header of the payload data by using a hardware module to obtain a processed message;

forwarding the processed message by using the hardware module or a software module;

acquiring build-connect payload data for implementing an RDMA build-connect operation by using the hardware module, before acquiring the payload data corresponding to the RDMA message to be forwarded;

encapsulating a message header of the build-connect payload data by using a virtual switch in the software module to obtain a build-connect message, and determining a build-connect flow table corresponding to the build-connect message by using a software manager in the software module, and sending the build-connect flow table to the virtual switch;

performing, by the virtual switch, a forwarding operation on the build-connect message based on the build-connect flow table, to implement an RDMA build-connect operation.

19. A non-transitory computer storage medium for storing a computer program which, when executed, enables a computer to implement operations of the message forwarding method based on Remote Direct Memory Access (RDMA) in any one of claims 1-15.