SYSTEM AND METHODS FOR CONTROLLING NETWORK TRAFFIC THROUGH VIRTUAL SWITCHES

This application claims priority to United States patent application 13/237,806, filed September 20, 2011, which is hereby incorporated by reference herein in its entirety.

Background

This relates to communication networks, and more particularly, to forwarding network packets through communication networks.

Packet-based networks such as the internet and local data networks that are connected to the internet include network switches. Network switches are used in forwarding packets from packet sources to packet destinations. The packets may be sometimes referred to as frames.

It can be difficult or impossible to control the switches of one vendor using the equipment of another

What is Claimed is:

1. A method of forwarding packets from a packet source to a packet destination through a network of switches, wherein the switches include ports and wherein groups of the ports form respective virtual switches, the method comprising:

with a controller, identifying, from information from the packet that identifies the packet destination and packet source, a virtual path through the virtual switches from a first virtual switch associated with the packet source to a second virtual switch associated with the packet destination; and

with the controller, identifying a packet forwarding path through the switches from the packet source to the packet destination based on the virtual path and a network policy.

2. The method defined in claim 1 wherein identifying the packet forwarding path comprises generating flow table entries based at least partly on the network policy.

3. The method defined in claim 2 further comprising providing the flow table entries to at least some of the switches to configure the switches to form the packet forwarding path through the switches.

4. The method defined in claim 1 wherein identifying the packet forwarding path comprises identifying network switch capabilities associated with at least a given one of the switches.

5. The method defined in claim 4 wherein identifying the network switch capabilities comprises

determining whether the given one of the switches is capable of modifying the packets.

6. The method defined in claim 1 wherein the network policy specifies that at least some of the packets should be dropped.

7. The method defined in claim 6 wherein generating the forwarding path comprises generating a flow table entry for at least a given one of the switches that directs the given one of the switches to drop packets.

8. The method defined in claim 1 wherein the network policy specifies that the packets should be allowed to flow along the forwarding path from the packet source to the packet destination.

9. The method defined in claim 8 wherein generating the forwarding path comprises:

generating flow table entries for the switches in the forwarding path to forward the packet from the packet source to the packet destination.

10. The method defined in claim 1 further comprising:

identifying which of a plurality of network protocols is associated with the packets; and

identifying which of a plurality of network policies to use as the network policy based on which of the protocols has been identified as being associated with the packets.

11. The method defined in claim 1 further comprising:

identifying which of a plurality of network policies to use as the network policy by determining which of the plurality of network policies is associated with the packet source.

12. The method defined in claim 1 further comprising:

identifying which of a plurality of network policies to use as the network policy by determining which of the plurality of network policies is associated with the packet destination.

13. The method defined in claim 1 wherein the first virtual switch contains ports from at least two of the switches.

14. The method defined in claim 1 wherein the first virtual switch contains no more than a subset of the ports from a given one of the switches and contains at least some ports from at least an additional one of the switches.

15. The method defined in claim 1 wherein the packet source has a network address, the method further comprising:

dynamically determining which port to include in the group of ports for the first virtual switch based on the network address.

16. The method defined in claim 1 further comprising:

with the controller, determining which ports to include in each of the groups of ports based on user input received by the controller.

17. A method of forwarding a packet from a packet source to a packet destination through a network of switches, wherein the switches include ports and wherein groups of the ports form respective virtual switches, the method comprising:

with a controller, receiving the packet;

with the controller, identifying an ingress virtual switch from among the virtual switches based on information from the packet that identifies the packet source; and

with the controller, identifying an egress virtual switch from among the virtual switches based on information from the packet that identifies the packet destination.

18. The method defined in claim 17 further comprising:

with the controller, identifying a virtual path from the ingress virtual switch to the egress virtual switch.

19. The method defined in claim 18 further comprising:

with the controller, identifying which network policy of a plurality of network policies to apply to the virtual path.

20. The method defined in claim 19 further comprising:

with the controller, generating a forwarding path through the switches based on the identified network policy and the identified virtual path.

21. The method defined in claim 18 further comprising:

with the controller, receiving information from a user that identifies a given one of the ports at which to apply the identified network policy to the packet.

22. A method of forwarding packets from a packet source to a packet destination through a network of switches, wherein the switches include ports and wherein groups of the ports form respective virtual switches, the method comprising:

with a controller, receiving information from a user identifying which group of ports is associated with each of the virtual switches;

with the controller, receiving information from the user identifying a plurality of network policies;

with the controller, identifying, from information from the packet that identifies the packet destination and packet source, a virtual path through the virtual switches from a first virtual switch associated with the packet source to a second virtual switch associated with the packet destination; and

with the controller, identifying a packet forwarding path through the switches from the packet source to the packet destination based on the virtual path and a network policy from among the plurality of network policies.

23. The method defined in claim 22 further comprising:

identifying from information in the packet which of a plurality of network protocols is associated with the packet; and

identifying which of the plurality of network policies to use as the network policy based on which of the protocols has been identified as being associated with the packet.

24. The method defined in claim 22 further comprising:

obtaining information from the packet identifying which of a plurality of protocol ports is associated with the packet; and

identifying which of the plurality of network policies to use as the network policy based on which of the protocol ports is associated with the packet.

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What is Claimed is:

1. A method of forwarding packets from a packet source to a packet destination through a network of switches, wherein the switches include ports and wherein groups of the ports form respective virtual switches, the method comprising:

with a controller, identifying, from information from the packet that identifies the packet destination and packet source, a virtual path through the virtual switches from a first virtual switch associated with the packet source to a second virtual switch associated with the packet destination; and

with the controller, identifying a packet forwarding path through the switches from the packet source to the packet destination based on the virtual path and a network policy.

2. The method defined in claim 1 wherein identifying the packet forwarding path comprises generating flow table entries based at least partly on the network policy, the method further comprising:

providing the flow table entries to at least some of the switches to configure the switches to form the packet forwarding path through the switches.

3. The method defined in claim 1 wherein identifying the packet forwarding path comprises identifying network switch capabilities associated with at least a given one of the switches and wherein identifying the network switch capabilities comprises determining whether the given one of the switches is capable of modifying the packets.

4. The method defined in claim 1 wherein the network policy specifies that at least some of the packets should be dropped and wherein generating the forwarding path comprises generating a flow table entry for at least a given one of the switches that directs the given one of the switches to drop packets.

5. The method defined in claim 1 wherein the network policy specifies that the packets should be allowed to flow along the forwarding path from the packet source to the packet destination and wherein generating the forwarding path comprises:

generating flow table entries for the switches in the forwarding path to forward the packet from the packet source to the packet destination.

6. The method defined in claim 1 further comprising:

identifying which of a plurality of network protocols is associated with the packets; and

identifying which of a plurality of network policies to use as the network policy based on which of the protocols has been identified as being associated with the packets.

7. The method defined in claim 1 further comprising:

identifying which of a plurality of network policies to use as the network policy by determining which of the plurality of network policies is associated with the packet source.

8. The method defined in claim 1 further comprising:

identifying which of a plurality of network policies to use as the network policy by determining which of the plurality of network policies is associated with the packet destination.

9. The method defined in claim 1 wherein the first virtual switch contains ports from at least two of the switches.

10. The method defined in claim 1 wherein the first virtual switch contains no more than a subset of the ports from a given one of the switches and contains at least some ports from at least an additional one of the switches.

11. The method defined in claim 1 wherein the packet source has a network address, the method further comprising:

dynamically determining which port to include in the group of ports for the first virtual switch based on the network address.

12. The method defined in claim 1 further comprising:

with the controller, determining which ports to include in each of the groups of ports based on user input received by the controller.

13. A method of forwarding a packet from a packet source to a packet destination through a network of switches, wherein the switches include ports and wherein

groups of the ports form respective virtual switches, the method comprising:

with a controller, receiving the packet;

with the controller, identifying an ingress virtual switch from among the virtual switches based on information from the packet that identifies the packet source; and

with the controller, identifying an egress virtual switch from among the virtual switches based on information from the packet that identifies the packet destination.

14. The method defined in claim 13 further comprising:

with the controller, identifying a virtual path from the ingress virtual switch to the egress virtual switch.

15. The method defined in claim 14 further comprising:

with the controller, identifying which network policy of a plurality of network policies to apply to the virtual path.

16. The method defined in claim 15 further comprising:

with the controller, generating a forwarding path through the switches based on the identified network policy and the identified virtual path.

17. The method defined in claim 14 further comprising:

with the controller, receiving information from a user that identifies a given one of the ports at

which to apply the identified network policy to the packet.

18. A method of forwarding packets from a packet source to a packet destination through a network of switches, wherein the switches include ports and wherein groups of the ports form respective virtual switches, the method comprising:

with a controller, receiving information from a user identifying which group of ports is associated with each of the virtual switches;

with the controller, receiving information from the user identifying a plurality of network policies;

with the controller, identifying, from information from the packet that identifies the packet destination and packet source, a virtual path through the virtual switches from a first virtual switch associated with the packet source to a second virtual switch associated with the packet destination; and

with the controller, identifying a packet forwarding path through the switches from the packet source to the packet destination based on the virtual path and a network policy from among the plurality of network policies.

19. The method defined in claim 18 further comprising:

identifying from information in the packet which of a plurality of network protocols is associated with the packet; and

identifying which of the plurality of network policies to use as the network policy based on which of the protocols has been identified as being associated with the packet.

20. The method defined in claim 18 further comprising:

obtaining information from the packet identifying which of a plurality of protocol ports is associated with the packet; and

identifying which of the plurality of network policies to use as the network policy based on which of the protocol ports is associated with the packet.