Assignment 5

R1. What is meant by a control plane that is based on per-router control? In such cases, when we say the network control and data planes are implemented “monolithically,” what do we mean?

Individual routing algorithm components in each and every router interact with each other in the control plane to compute forwarding tables.

R2. What is meant by a control plane that is based on logically centralized control? In such cases, are the data plane and the control plane implemented within the same device or in separate devices? Explain.

A distinct (typically remote) controller interacts with local control agents (CAs) in routers to compute forwarding tables.

R3. Compare and contrast the properties of a centralized and a distributed routing algorithm. Give an example of a routing protocol that takes a centralized and a decentralized approach.

A centralized routing algorithm computes the least-cost path between a source and destination by using complete, global knowledge about the network. The algorithm needs to have the complete knowledge of the connectivity between all nodes and all links costs. The actual calculation can be run at one site or could be replicated in the routing component of each and every router. A distributed routing algorithm calculates the least-cost path in an iterative, distributed manner by the routers. With a decentralized algorithm, no node has the complete information about the costs of all network links. Each node begins with only the knowledge of the costs of its own directly attached links, and then through an iterative process of calculation and information exchange with its neighboring nodes, a node gradually calculates the least-cost path to a destination or a set of destinations. OSPF protocol is an example of centralized routing algorithm, and BGP is an example of a distributed routing algorithm

R4. Compare and contrast link-state and distance-vector routing algorithms.

Link state algorithms: Computes the least-cost path between source and destination using complete, global knowledge about the network.

Distance-vector routing: The calculation of the least-cost path is carried out in an iterative, distributed manner. A node only knows the neighbor to which it should forward a packet in order to reach a given destination along the least-cost path, and the cost of that path from itself to the destination.

R5. What is the “count to infinity” problem in distance vector routing?

One of the important issues in Distance Vector Routing is “count to infinity” problem. Counting to infinity is just another name for a routing loop. In distance vector routing, routing loops usually occur when an interface goes down. It can also occur when two routers send updates to each other at the same time.

R6. Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not?

No, because it is not necessary that every autonomous system use the same intra-AS routing algorithm. Because each autonomous system routing has administrative autonomy for routing within an AS.

R7. Why are different inter-AS and intra-AS protocols used in the Internet?

Border Gateway Protocol(BGP) is used for inter-AS(Autonomous System (AS)) protocols.But, Router Information Protocol(RIP) and Open Shortest Path First (OSPF) protocols are used for intra-AS protocols.

Inter-AS protocol provides for the controlled distribution of routing information, but Intra-As protocol are the policy issues play a much less important role in choosing routes

Inter-AS protocol dominates the quality and the performance, but Intra-As protocol focuses on the performance.

R8. True or false: When an OSPF route sends its link state information, it is sent only to those nodes directly attached neighbors. Explain.

True, when an OSPF route sends its link state information, it is sent only to those nodes directly attached neighbors.

R9. What is meant by an area in an OSPF autonomous system? Why was the concept of an area introduced?

In OSPF, a single autonomous system (AS) can be divided into smaller groups called areas. This reduces the number of link-state advertisements (LSAs) and other OSPF overhead traffic sent on the network, and it reduces the size of the topology database that each router must maintain. The routing devices that participate in OSPF routing perform one or more functions based on their location in the network.

R10. Define and contrast the following terms: subnet, prefix, and BGP route.

The definition and differences of mentioned terms are

* A Subnet is a logical subdivision of an IP network. It does not contain a router.
* A Prefix is the portion of the network CIDR address. It does contain a router. One or more subnets are covered.
* The BGP messages along with the TCP connection sent over a link.It does contain a router.

R11. How does BGP use the NEXT-HOP attribute? How does it use the AS-PATH attribute?

BGP protocol: BGP (Border Gateway Protocol) is an Inter-AS routing protocol. The two most important attributes are AS-PATH and NEXT-HOP.

* The advertisement passed for the prefix values contains the AS’s in the AS-PATH.
* The NEXT-HOP is the router interface that initiates the AS-PATH.
* The routers also uses the AS-PATH attribute for multiple paths.
* The first router is configured in the forward table, the router uses the NEXT-HOP attribute.

R12. Describe how a network administrator of an upper-tier ISP can implement policy when configuring BGP.

1. Let us assume the three ISPs such as ISP A, ISP B and ISP C.
2. Take ISP B does not carry between ISP A and ISP C.
3. Then ISP A and ISP C have ISP B as their BGP peers
4. ISP B does not promote to ISP A, which authorization through ISP C

R13. True or false: When a BGP router receives an advertised path from its neighbor, it must add its own identity to the received path and then send that new path on to all of its neighbors. Explain.

False. A BGP router can choose not to add its own identity and send a new path to all of its neighbors.

R14. Describe the main role of the communication layer, the network-wide state-­management layer, and the network-control application layer in an SDN controller.

The Management Plane handles functions such device management, firmware updates, SNMP and external configuration via the CLI. The Data Plane refers to packet and frame forwarding through the device. The Control Plane is routing protocols such as BGP & OSPF and switching protocols such as STP & TRILL. The control plane will use the routing table to build the forwarding table used by the data plane. The forwarding table is delivered to the data plane by the management plane as part of the device operating system. Thus when an Ethernet frame arrives on the switch interface, the data plane then forwards it to the output port.

R15. Suppose you wanted to implement a new routing protocol in the SDN control plane. At which layer would you implement that protocol? Explain.

Routing would occur in the management layer. The management layer is the one that interacts with SNMP, SSH, Telnet, and TFTP.

R16. What types of messages flow across an SDN controller’s northbound and southbound APIs? Who is the recipient of these messages sent from the controller across the southbound interface, and who sends messages to the controller across the northbound interface?

Northbound: messages which help read/write state of network and developing flow tables within management layer, notifications for state-change events, network control apps send messages to the controller

Southbound: messages which help for the up-to-date view of the network's state, communication between controller and devices which receive messages

R17. Describe the purpose of two types of OpenFlow messages (of your choosing) that are sent from a controlled device to the controller. Describe the purpose of two types of Openflow messages (of your choosing) that are send from the controller to a controlled device.

Purpose of two types of OpenFlow messages sent from a controlled device to the controller:

Flow-removed: are used to notify the controller about flow table entry removal.

Port-status: are used in order to notify the controller about status changes of the port.

R18. What is the purpose of the service abstraction layer in the OpenDaylight SDN controller?

OpenDaylight is an open-source controller developed in partnership with Linux foundation. Service Abstraction Layer (SAL): controllers nerve center, helps the internal applications communicate, helps underlying protocols in providing uniform abstract interface in the communication layer

R19. Names four different types of ICMP messages

1. Echo Reply, type 0, code 0.
2. Destination Network unreachable, type 3, code 0.
3. Destination host unreachable, type 3, code 1.
4. Source quench (congestion control.), type 4, code 0.

R20. What two types of ICMP messages are received at the sending host executing the Traceroute program?

ICMP warning message, type 11 code 0

Destination port unreachable, type 3 code 3

R21. Define the following terms in the context of SNMP: managing server, ­managed device, network management agent and MIB.

Managing server: an application, typically with a human in the loop, running in a centralized network management station in the network operations center (NOC).

Managed device: is a piece of network equipment (including its software) that resides on a managed network. A managed device might be a host, router, switch, middlebox, modem, thermometer, or other network-connected device

Network management agent: a process running in the managed device that communicates with the managing server, taking local actions at the managed device under the command and control of the managing server.

MIB: A MIB object might be a counter, such as the number of IP datagrams discarded at a router due to errors in an IP datagram header, or the number of UDP segments received at a host; descriptive information such as the version of the software running on a DNS server; status information such as whether a particular device is functioning correctly; or protocol-specific information such as a routing path to a destination

R22. What are the purposes of the SNMP GetRequest and SetRequest messages?

GetRequest: get value of one or more MIB object instances

SetRequest: set value of one or more MIB object instances

R23. What is the purpose of the SNMP trap message?

A second common usage of SNMP is for an agent to send an unsolicited message, known as a trap message, to a managing server. Trap messages are used to notify a managing server of an exceptional situation (e.g., a link interface going up or down) that has resulted in changes to MIB object values.

**Work Cited**

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