CHAPTER 5 – KNOWLEDGE CHECKS - NETWORK LAYER: CONTROL PLANE

INTRODUCTION TO THE NETWORK LAYER CONTROL PLANE

- **Which of the following statements correctly identify the differences between routing and forwarding.**
  - **QUICK ASIDE → ROUTING IS DONE IN THE CONTROL PLANE & FORWARDING DONE IN THE DATA PLANE**
  - *Routing* refers to determining the route taken by packets from source to destination, and is implemented in the **control plane**.
  - *Forwarding* refers to moving the packets from a router's input to the appropriate router output, and is implemented in the **data plane**

- **Match the name of the approach towards implementing a control plane with a description of how this approach works.**
  -

QUESTION LIST:

Per-router control plane.

C

Software-defined networking (SDN).

A

ANSWER LIST:

A. A (typically) remote controller gathers information from routers, and then computes and installs the forwarding tables in routers.

B. The network operator installs forwarding tables using the Simple Network Management Protocols (SNMP).

C. Individual routing algorithm components - with a component operating in each and every router - interact with each other in the control plane. The individual routing algorithm component executing in a given router computes the local fowarding table fir that router.

ROUTING ALGORITHMS

- **What is the definition of a "good" path for a routing protocol? Chose the best single answer.**
  - Routing algorithms typically work with abstract link weights that could represent any of, or combinations of, all **other answers → the other answers are (A path that has little or no congestion, A path that has a minimum number of hops, A low delay path and A high bandwidth path.)**

- **Consider Dijkstra's link-state routing algorithm that is computing a least-cost path from node a to other nodes b, c, d, e, f. Which of the following statements is true.**
  - In the initialization step, the initial cost from *a* to each of these destinations is initialized to either the cost of a link directly connecting *a* to a direct neighbor, or infinity otherwise
  - The values computed in the vector D(v), the currently known least cost of a path from *a* to any node v, will **never increase** following an iteration
  - Suppose nodes *b,c and d* are in the set N'. These nodes will remain in N' for the rest of the algorithm, since the least-cost paths from *a* to *b,c and d* are known.

- Match the name of a general approach to routing with characteristics of that approach.

QUESTION LIST:

Centralized, global routing.

A

Decentralized routing.

B

Static routing.

C

Dynamic routing.

D

ANSWER LIST:

A. All routers have complete topology, and link cost information.

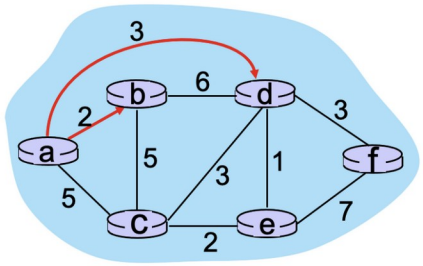
B. An iterative process of computation, exchange of informatoin with neighbors. Routers may initially only know link costs to directly-attached neighbors.

C. Routes change slowly over time.

D. Routing changes quickly over time.

  - "Centralized, global routing" refers to a routing approach in computer networking where a central entity or controller is responsible for making routing decisions for the entire network. This central controller has a complete view of the network's topology and is aware of the status of all links and nodes.
  - Decentralized routing refers to a method of making routing decisions in a computer network where each node (or router) independently determines the best path to forward data packets based on local information. Unlike centralized routing, which relies on a single central entity or controller to make all routing decisions for the entire network, decentralized routing distributes decision-making authority across multiple nodes.
  - Static routing is a simple and basic method of routing in computer networking. In a static routing configuration, network administrators manually configure the routing table on routers or networking devices. This involves specifying explicit routes for data packets to take based on their destination IP addresses.
  - Dynamic routing is a networking technique that allows routers to automatically adjust their routing tables and adapt to changes in the network topology. Unlike static routing, where routes are manually configured by network administrators, dynamic routing protocols enable routers to exchange information about the state of the network with their neighboring routers.

- Consider the graph shown below and the use of Dijkstra's algorithm to compute a least cost path from a to all destinations. Suppose that nodes b and d have already been added to N'. What is the next node to be added to N' (refer to the text for an explanation of notation).



[Note: You can find more examples of problems similar to this here.]

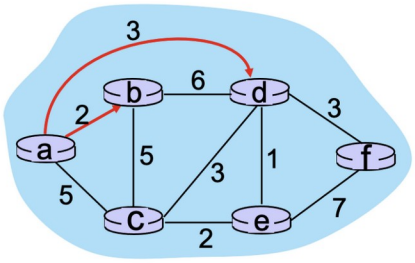
c

f

e

That's Correct!

  - DUHHHH
- Consider the graph shown below and the use of Dijkstra's algorithm to compute a least cost path from a to all destinations. Suppose that nodes b and d have already been added to N'. What is the *path cost* to the next node to be added to N' (refer to the text for an explanation of notation).



[Note: You can find more examples of problems similar to this here.]

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6

5

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That's Correct!

  - AGAIN DUHH

Intra-AS Routing in the internet: OSPF

- Match the terms "interdomain routing" and intradomain routing" with their definitions. Recall that in Internet parlance, an “AS” refers to “Autonomous System” – a network under the control of a single organization.

QUESTION LIST:

Interdomain routing.

D

Intradomain routing.

B

ANSWER LIST:

A. Forwarding packets between two physically connected interfaces in a common subnetwork.

B. Routing among routers within same AS (“network”).

C. Forwarding packets between two interfaces in different but adjacent subnetworks.

D. Routing among different ASes (“networks”).

  - Interdomain routing, also known as BGP (Border Gateway Protocol) routing, is the process of exchanging routing information and making decisions about how to route data packets between different autonomous systems (ASes) on the internet. An autonomous system is a collection of IP networks and routers under the control of a single organization that presents a common routing policy to the internet.
  - Intradomain routing, also known as interior gateway routing, refers to the process of exchanging routing information and making decisions about how to route data packets within a single autonomous system (AS) or administrative domain. An autonomous system is a collection of IP networks and routers under the control of a single organization that presents a common routing policy to the internet.

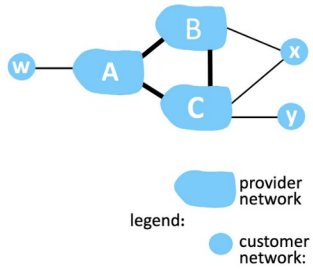
- **Check the one or more of the following statements about the OSPF protocol that are true.**
  - OSFP uses a Dijkstra-like algorithm to implement least cost path routing.
  - OSPF implements hierarchical routing
  - OSPF is an intra-domain routing protocol.

- **Consider the OSPF routing protocol. Which of the following characteristics are associated with OSPF (as opposed to BGP)?**
  - Finds a least cost path from source to destination
  - Floods link state control information
  - Is an intra-domain routing protocol

ROUTING AMONG THE ISPs: BGP

- **Among the following protocols, terminology or considerations, indicate those that are associated with "routing within a single network (typically owned and operated by one organization)."**
  - OSPF
  - intra-domain routing
  - Driven more by performance than by routing policy
  - intra-AS routing

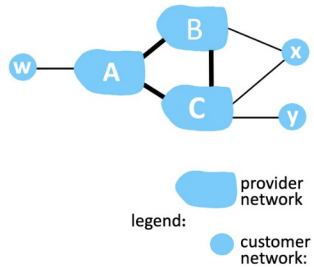
- Suppose a provider network only wants to carry traffic to/from its customer networks (i.e., to provide no transit service), and customer networks only want to carry traffic to/from itself. Consider the figure below. To implement this policy, to which of the following networks would network C advertise the path Cy?



- [x] x
- [x] A
- [ ] w
- [x] B

That's Correct!

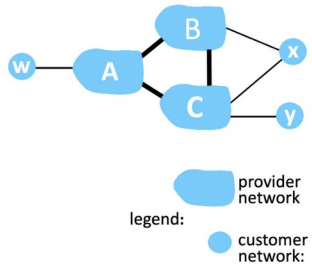
- Again, suppose a provider network only wants to carry traffic to/from its customer networks (i.e., to provide no transit service), and customer networks only want to carry traffic to/from itself. Suppose C has advertised path Cy to A. To implement this policy, to which of the following networks would network A advertise the path ACy?



- [ ] C
- [ ] B
- [ ] x
- [x] w

That's Correct!

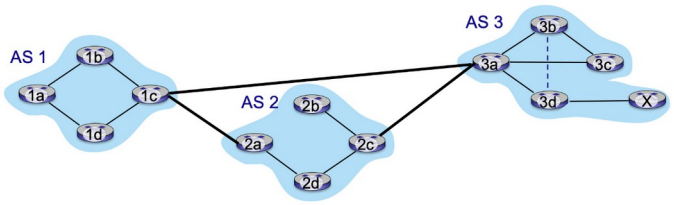
- Again, suppose a provider network only wants to carry traffic to/from its customer networks (i.e., to provide no transit service), and customer networks only want to carry traffic to/from itself. Suppose C has advertised path Cy to x. To implement this policy, to which of the following networks would network x advertise the path xCy?



- [ ] C
- [ ] A
- [x] None of these other networks
- [ ] w
- [ ] B

That's Correct!

- Consider routers 2c and 2d in Autonomous System AS2 in the figure below. Indicate the flavor of BGP and the router from which each of 2c and 2d learns about the path to destination x.



QUESTION LIST:

How does router 2c learn of the path AS3, X to destination network X?

C

How does router 2d learn of the path AS3, X to destination network X?

B

ANSWER LIST:

A. From x via eBGP.

B. From 2c via iBGP.

C. From 3a via eBGP.

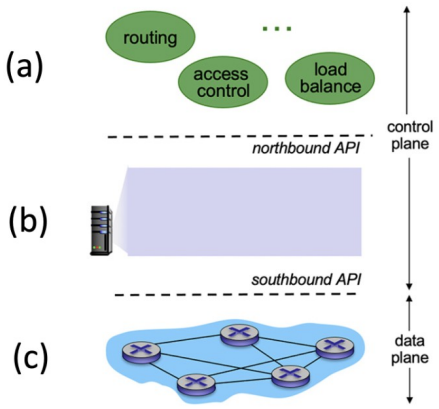
D. From 3a via iBGP.

E. From 2c via eBGP.

That's Correct!

THE SDN CONTROL PLANE:

- Consider the SDN layering shown below. Match each layer name below with a layer label (a), (b) or (c) as shown in the diagram.



CHEGG CANT FIND THE ANSWER

- **QUESTION LIST:**

SDN Controller (network operating system)

A

SDN-controlled switches

B

Network-control applications

C

ANSWER LIST:

A. (b)

B. (c)

C. (a)

That's Correct!

ICMP

- **Which of the statements below about ICMP are true?**
  - The TTL-expired message type in ICMP is used by the traceroute program
  - ICMP is used by hosts and routers to communicate network-level information.
  - ICMP messages are carried directly in IP datagrams rather than as payload in UDP or TCP segments.