Διαχείριση Δικτύων Βασισμένων στο Λογισμικό
5ο εργαστήριο: "SDN basics"

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https://gaia.cs.umass.edu/kurose_ross/knowledgechecks/
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ΠΡΟΣΟΧΗ: ΜΗΝ ΑΠΑΝΤΗΣΕΤΕ ΜΕ ΤΟΝ ΑΡΙΘΜΟ ΤΗΣ ΣΩΣΤΗΣ ΑΠΑΝΤΗΣΗΣ (π.χ. a) b) c) κτλ.) ΚΑΘΩΣ Η ΠΡΟΒΛΗΘΕΙΣΑ ΣΕΙΡΑ ΤΩΝ ΑΠΑΝΤΗΣΕΩΝ ΑΛΛΑΖΕΙ ΚΑΘΕ ΦΟΡΑ ΜΕ REFRESH ΤΟΥ BROWSER.
Συνεπώς βάλτε screenshots με τις σωστές απαντήσεις (και την ένδειξη "That's correct" εάν καταφέρετε να βρείτε τη σωστή απάντηση / τις σωστές απαντήσεις). Εναλλακτικά, αντιγράψτε εδώ ως απλό κείμενο τις σωστές απαντήσεις ΜΟΝΟ.
Θα βαθμολογείται ως σωστή μία ερώτηση μόνο εάν συμπεριλαμβάνει ΟΛΕΣ τις σωστές απαντήσεις.

CHAPTER 4: NETWORK LAYER: DATA PLANE
1. Network Layer Overview

THE CONTROL PLANE VERSUS THE DATA PLANE.

For each of the actions below, select those actions below that are primarily in the network-layer data plane. The other actions that you don't select below then correspond to control-plane actions.

- ☐ Computing the contents of the forwarding table.
- ☑ Dropping a datagram due to a congested (full) output buffer.
- ☐ Monitoring and managing the configuration and performance of an network device.
- ☑ Looking up address bits in an arriving datagram header in the forwarding table.
- ☑ Moving an arriving datagram from a router's input port to output port

That's Correct!

← | CHECK | →

WHAT TYPE OF CONTROL PLANE?

We've seen that there are two approaches towards implementing the network control plane - a per-router control-plane approach and a software-defined networking (SDN) control-plane approach. Which of the following actions occur in a per-router control-plane approach? The other actions that you don't select below then correspond to actions in an SDN control plane.

- ☑ Routers send information about their incoming and outgoing links to other routers in the network.
- ☐ A control agent in router receives a complete forwarding table, which it installs and uses to locally control datagram forwarding.
- ☐ All routers in the network send information about their incoming and outgoing links to a logically centralized controller.
- ☑ A router exchanges messages with another router, indicating the cost for it (the sending router) to reach a destination host.

That's Correct!

← | CHECK | →

BEST EFFORT SERVICE.

Which of the following quality-of-service guarantees are part of the Internet's best-effort service model? Check all that apply.

- ☐ A guaranteed minimum bandwidth is provided to a source-to-destination flow of packets
- ☐ In-order datagram payload delivery to the transport layer of those datagrams arriving to the receiving host.
- ☑ *None* of the other services listed here are part of the best-effort service model. Evidently, best-effort service really means no *guarantees* at all!
- ☐ Guaranteed delivery time from sending host to receiving host.
- ☐ Guaranteed delivery from sending host to receiving host.

That's Correct!

← | CHECK

4. Generalized Forwarding

DESTINATION-BASED MATCH+ACTION.

Destination-based forwarding, which we studied in section 4.2, is a specific instance of match+action and generalized forwarding. Select the phrase below which best completes the following sentence:

"In destination-based forwarding, ..."

○ ... after *ddmatch* on the URL contained in an HTTP GET request in the TCP segment within the IP datagram, the *action* taken is to determine the IP address of the server associated with that URL, and to forward the datagram to the output port associated with that destination IP address.

○ ... after *ddmatch* on the port number in the segment's header, the *action* taken is to decide whether or not to drop the datagram containing that segment.

○ ... after *ddmatch* on the source and destination IP address in the datagram header, the *action* taken is to forward the datagram to the output port associated with that source and destination IP address pair.

● ... after *ddmatch* on the destination IP address in the datagram header, the *action* taken is to forward the datagram to the output port associated with that destination IP address.

○ ... after *ddmatch* on the 48-bit link-layer destination MAC address, the *action* taken is to forward the datagram to the output port associated with that link-layer address.

○ ... after *ddmatch* on the destination IP address in the datagram header, the *action* taken is to decide whether or not to drop that datagram.

○ ... after *ddmatch* on the port number in the segment's header, the *action* taken is to forward the datagram to the output port associated with that port number.

That's Correct!

[CHECK] [→]

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GENERALIZED MATCH+ACTION.

Which of the following match+actions can be taken in the generalized OpenFlow 1.0 match+action paradigm that we studied in Section 4.4? Check all that apply.

☑ ... after *ddmatch* on the 48-bit link-layer destination MAC address, the *action* taken is to forward the datagram to the output port associated with that link-layer address.

☑ ... after *ddmatch* on the destination IP address in the datagram header, the *action* taken is to forward the datagram to the output port associated with that destination IP address.

☑ ... after *ddmatch* on the source and destination IP address in the datagram header, the *action* taken is to forward the datagram to the output port associated with that source and destination IP address pair.

☑ ... after *ddmatch* on the port number in the segment's header, the *action* taken is to decide whether or not to drop that datagram containing that segment.

☑ ... after *ddmatch* on the port number in the segment's header, the *action* taken is to forward the datagram to the output port associated with that destination IP address.

☐ ... after *ddmatch* on the URL contained in an HTTP GET request in the TCP segment within the IP datagram, the *action* taken is to determine the IP address of the server associated with that URL, and to forward the datagram to the output port associated with that destination IP address.

☑ ... after *ddmatch* on the destination IP address in the datagram header, the *action* taken is to decide whether or not to drop that datagram.

That's Correct!

[←] [CHECK] [→]

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WHAT FIELDS CAN BE MATCHED IN GENERALIZED MATCH+ACTION.

Which of the following fields in the frame/datagram/segment/application-layer message can be matched in OpenFlow 1.0? Check all that apply.

☑ Source and/or destination port number

☑ IP source address

☑ IP type-of-service field

☐ Time-to-live field

☐ Number of bytes in the datagram

☑ Upper layer protocol field

☐ URL in HTTP message

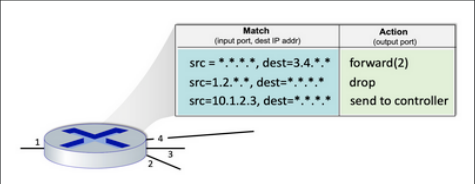☑ IP destination address

That's Correct!

[←] [CHECK] [→]

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MATCH+ACTION IN OPENFLOW 1.0.

Consider the figure below that shows the generalized forwarding table in a router. Recall that a * represents a wildcard value. Now consider an arriving datagram with the IP source and destination address fields indicated below. For each source/destination IP address pair, indicate which rule is matched. Note: assume that a rule that is earlier in the table takes priority over a rule that is later in the table and that a datagram that matches none of the table entries is dropped.

Match (input port, dest IP addr)	Action (output port)
src = *.*.*.*, dest=3.4.*.*	forward(2)
src=1.2.*.*, dest=*.*.*.*	drop
src=10.1.2.3, dest=*.*.*.*	send to controller

QUESTION LIST:

Source: 1.2.56.32 Destination:128.116.40.186

    B

Source: 65.92.15.27 Destination: 3.4.65.76

    A

Source: 10.1.2.3 Destination: 7.8.9.2

    C

Source: 10.1.34.56 Destination: 54.72.29.90

    D

ANSWER LIST:

A. Rule 1, with action _forward(2)_

B. Rule 2, with action _drop_

C. Rule 3, with action _send to controller_

D. No match to any rule.

← CHECK →

Consider the network below. We want to specify the match+action rules at s3 so that only the following network-wide behavior is allowed:

1. traffic from 128.119/16 and destined to 137.220/16 is forwarded on the direct link from s3 to s1;
2. traffic from 128.119/16 and destined to 67.56/16 is forwarded on the direct link from s3 to s2;
3. incoming traffic via port 2 or 3, and destined to 128.119/16 is forwarded to 128.119/16 via local port 1.
4. No other forwarding should be allowed. In particular s3 should not forward traffic arriving from 137.220/16 and destined for 67.56/16 and vice versa.

From the list of match+action rules below, select the rules to include in s3's flow table to implement this forwarding behavior. Assume that if a packet arrives and finds no ddmatch rule, it is dropped.
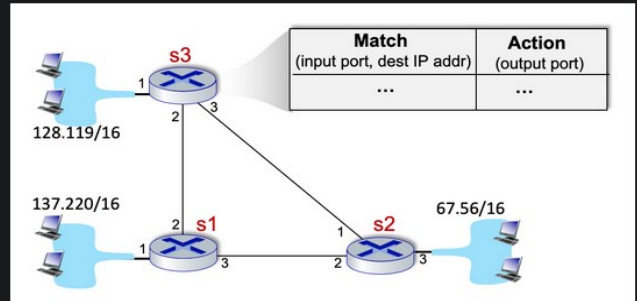
☑ Input port:1 ; Dest: 137.220/16   Action: forward(2)

☐ Input port: 2; Dest: 67.56/16   Action: forward(3)

☑ Input port: 2; Dest: 128.119/16   Action: forward(1)

☑ Input port: 1; Dest: 67.56/16   Action: forward(3)

☐ Input port: 3; Dest: 137.220/16   Action: forward(2)

☑ Input port: 3; Dest: 128.119/16   Action: forward(1)

☐ Input port:1 ; Dest: 137.220/16   Action: forward(3)

☐ Input port: 1; Dest: 67.56/16   Action: forward(2)

That's Correct!

← CHECK →

Consider the network below. We want to specify the match+action rules *at s3* so that s3 *acts only as a relay* for traffic between 137.220/16 and 67.56/16. In particular s3 should not accept/forward and traffic to/from 128.119/16.

From the list of match+action rules below, select the rules to include in s3's flow table to implement this forwarding behavior. Assume that if a packet arrives and finds no ddmatch rule, it is dropped.

	Match (input port, dest IP addr)	Action (output port)
	...	...
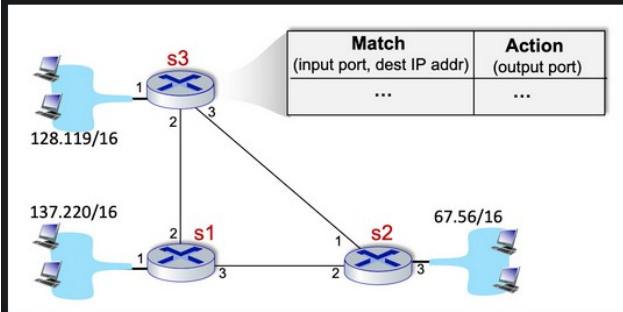
☐ Input port: 2; Dest: 128.119/16   Action: forward(1)

☑ Input port: 3; Dest: 137.220/16   Action: forward(2)

☐ Input port: 1; Dest: 67.56/16   Action: forward(3)

☐ Input port:1 ; Dest: 137.220/16   Action: forward(3)

☐ Input port:1 ; Dest: 137.220/16   Action: forward(2)

☐ Input port: 3; Dest: 128.119/16   Action: forward(1)

☐ Input port: 1; Dest: 67.56/16   Action: forward(2)

☑ Input port: 2; Dest: 67.56/16   Action: forward(3)

That's Correct!

← | CHECK

CHAPTER 5: NETWORK LAYER: CONTROL PLANE
1. Introduction to the Network-layer control plane expand

ROUTING VERSUS FORWARDING.

Which of the following statements correctly identify the differences between routing and forwarding. Select one or more statements.

☐ *Routing* refers to determining the route taken by packets from source to destination, and is implemented in the data plane.

☐ *Forwarding* refers to determining the route taken by packets from source to destination, and is implemented in the data plane.

☐ *Routing* refers to moving packets from a router's input to appropriate router output, and is implemented in the data plane.

☐ *Forwarding* refers to moving packets from a router's input to appropriate router output, and is implemented in the control plane.

☑ *Routing* refers to determining the route taken by packets from source to destination, and is implemented in the control plane.

☐ *Forwarding* refers to determining the route taken by packets from source to destination, and is implemented in the control plane.

☐ *Routing* refers to moving packets from a router's input to appropriate router output, and is implemented in the control plane.

☑ *Forwarding* refers to moving packets from a router's input to appropriate router output, and is implemented in the data plane.

That's Correct!

CHECK | →

APPROACHES TOWARDS IMPLEMENTING THE CONTROL 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.

> B

Software-defined networking (SDN).

> A

ANSWER LIST:

A. A (typically) remote controller computes and installs forwarding tables in routers.

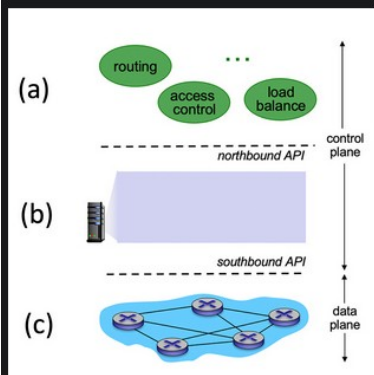B. An individual routing algorithm components in each and every router interact in the control plane

← | CHECK

5. The SDN Control Plane expand

SDN LAYERS.

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

QUESTION LIST:

SDN Controller (network operating system)

> B

SDN-controlled switches

> C

Network-control applications
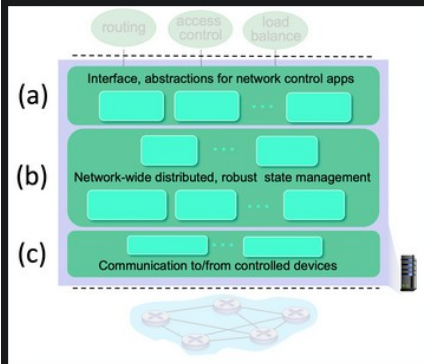
> A

ANSWER LIST:

A. (a)

B. (b)

C. (c)

CHECK | →

INTERNAL STRUCTURE OF THE SDN CONTROLLER (1).

Which of the functions below belong in the controller layer labeled "Interface, abstractions for network control apps"? Check all below that apply.

- ☐ Switch information
- ☐ OpenFlow protocol
- ☑ Intent
- ☐ Link-state information
- ☐ Host information
- ☐ Statistics
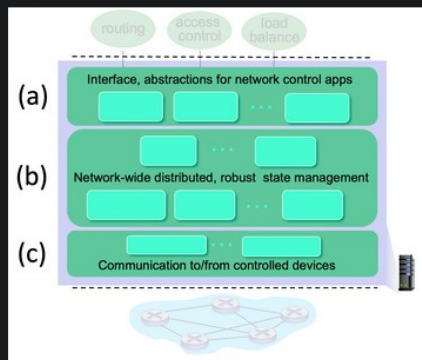- ☐ Flow tables
- ☑ Network graph
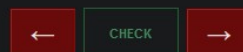
That's Correct!

←   CHECK   →

INTERNAL STRUCTURE OF THE SDN CONTROLLER (2).

Which of the functions below belong in the controller layer labeled "Network-wide distributed, robust state management"? Check all below that apply.

- ☑ Statistics
- ☑ Link-state information
- ☑ Switch information
- ☐ Intent
- ☐ Network graph
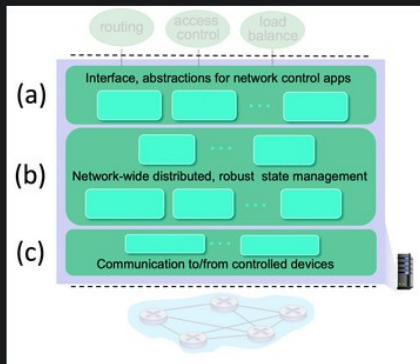- ☑ Host information
- ☐ OpenFlow protocol
- ☑ Flow tables

That's Correct!

←   CHECK   →

Which of the functions below belong in the controller layer labeled "Communication to/from controlled device"? Check all below that apply.

- ☐ Network graph
- ☐ Host information
- ☐ Switch information
- ☐ Link-state information
- ☐ Flow tables
- ☑ OpenFlow protocol
- ☐ Intent
- ☐ Statistics

That's Correct!

[←]   [CHECK]

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EXTRA (NAT protocol):
Answer Question 10 (ONLY) in the "Εργαστήριο: NAT protocol – TUTORIAL":

10. Fill in the NAT translation table entries for HTTP connection:

NAT translate table	
WAN side	LAN side
IP: 71.192.34.104, Port: 4335	IP: 192.168.1.100, Port: 4335