Which of the following are examples of control plane operations?



**Computing a shortest path routing tree.**



**Determining the forwarding path that satisfies an access control policy.**



Rate-limiting traffic so that the overall sending rate does not exceed a certain throughput.



**Determining that a user's MAC address is authentic before allowing it to send traffic on the network.**



Load balancing traffic across two output ports based on the hash of each packet's source IP address.

1 point

2.Question 2

What are some of the reasons for separating the control and data planes?



No single point of failure or target of attack.



**Easier reasoning about network behavior.**



**Vendor-independence (being able to separate the hardware that is running in the network from the logic that determines network behavior).**



Ability to scale to much larger networks.



**Independent evolution of technologies for the data and control plane.**

1 point

3.Question 3

What could be the operational steps behind the AT&T's IRSCP (a commercial version of the Routing Control Platform) for detecting malicious traffic?



A victim end host sends an alert to an on-path firewall about the source and nature of an attack, at which point the firewall installs a null route to drop the traffic at the entry point where the attack is originating. Not Answer



**A measurement system detects an attack, identifies the entry point of the attack, and instructs a controller to re-route traffic through a deep-packet inspection device**.



**A victim end host sends an alert to the controller about the source and nature of an attack, at which point the controller installs a null route to drop the traffic at the entry point where the attack is originating.**



The end host changes its IP address so that it is no longer the target of the attack traffic.



The controller sees all traffic passing through the network, detects an attack, and installs a null route to drop traffic at the entry point where the attack traffic is originating.

1 point

4.Question 4

What are some example network management applications that become easier with control and data plane separation?



Forecasting of network capacity. Not Answer



**Customer-controlled egress selection.**



**Planned maintenance of an edge router.**



**Improved interdomain routing security.**



Improved logging capabilities.

1 point

5.Question 5

What are some of the motivations for using Layer-2 forwarding in a data center?



Better scaling properties.



Better security properties. Not Answer



Ability to use existing routing protocols to establish paths between hosts. Not Answer



**Easier configuration/administration, since there is no need to number hosts or configure subnets.**



Better load balancing properties.

1 point

6.Question 6

How does the separation of the control and data plane make networking in data centers easier?



**A network controller can permit the renumbering of end hosts to have topology-dependent Layer 2 MAC addresses.**



**All routes can be controlled and monitored from a central point of control.**



**Virtual machines can be migrated within the network without renumbering entire portions of the network or re-assigning network services to different IP addresses.**



The control plane allows traffic to be forwarded using Layer 2 addresses, thus allowing automatic load balance across the topology.



The separation allows fewer switches to be used in the data center topology, thus lowering costs.Not Answer

1 point

7.Question 7

What are some examples of problems that can arise from consistency problems in the control plane, where a network has multiple controller replicas?



Incorrect operation when one controller fails.



A flood of traffic at the controller. Not Answer



**Incorrect security policies.**

****

Inability to respond to link failures. Not answers



**Forwarding loops.**

1 point

8.Question 8

What are some approaches to coping with inconsistency across controller replicas?



**Only keeping a subset of the network state in memory at any time**.



**Running a consistency protocol across controller replicas.**



**Keeping a "hot spare" replica that has a complete view of the networks state.**

****

Having multiple controllers install forwarding table entries on the same router and resolving the conflict on the router itself.



**Using different controllers for independent parts of the network.**

1 point

9.Question 9

What are some approaches to coping with scalability challenges associated with control and data plane separation?



**Caching forwarding decisions in the data plane to reduce traffic at the controller.**



**Running multiple controllers, and having each controller only manage a part of the network.**



**Only performing control-plane operations for a limited set of network operations**.



Sending all traffic through the controller to minimize forwarding decisions that the routers and switches must make.not Answer



**Eliminating redundant data structures.**

1 point

10.Question 10

Which property guarantees that each RCP replica continues to install correct forwarding state in the network data plane, even in the case of a partition in the data plane?



The controllers are partitioned from the network routers, and the routers will fall back to running a distributed routing protocol.



**Each controller has a complete view of the portion of the network that it is controlling, and therefore can guarantee consistent routing within that partition.**



The controller cannot see many of the routers in the network anyway, so there is no way for it to install incorrect routing state in the routers that it is not connected to.



Running the network from a single high-level control plane guarantees that network partitions and loops never occur in the first place.

1 point