Mid-Term – Software Defined Network

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A1 –
```
{
    "dpid": 1,
    "table_id": 5,
    "idle_timeout": 0,
    "hard_timeout": 0,
    "priority": 100,
    "match":{
        "eth_type": 2048,

"ipv4_src": "0.0.0.0/0",
        "ipv4_dst": "192.0.2.1",
        "ip_proto": 6,
        "tcp_dst": "0xffff"
      "ip_proto": 1
    },
    "actions":[
    ]
}
```

A2 –To create 6 VPCs from a class C network with ID 192.168.15.0/25 and subnet mask 255.255.255.128, each VPC would need 21 usable IP addresses. We can change the subnet mask to 255.255.255.224 to get 32 usable IP addresses in each VPC. Here's the network ID, subnet mask, broadcast IP and usable IP range for each VPC:

VPC 1: Net ID: 192.168.15.0 Broadcast: 192.168.15.31 Mask: 255.255.255.224 IP Range: 192.168.15.1 - 192.168.15.30

VPC 2: Net ID: 192.168.15.32 Broadcast: 192.168.15.63 Mask: 255.255.255.224 IP Range: 192.168.15.33 - 192.168.15.62

VPC 3: Net ID: 192.168.15.64 Broadcast: 192.168.15.95 Mask: 255.255.255.224 IP Range: 192.168.15.65 - 192.168.15.94

VPC 4: Net ID: 192.168.15.96 Broadcast: 192.168.15.127 Mask: 255.255.255.224 IP Range: 192.168.15.97 - 192.168.15.126

VPC 5: Net ID: 192.168.15.128 Broadcast: 192.168.15.159 Mask: 255.255.255.224 IP Range: 192.168.15.129 - 192.168.15.158

VPC 6: Net ID: 192.168.15.160 Broadcast: 192.168.15.191 Mask: 255.255.255.224 IP Range: 192.168.15.161 - 192.168.15.190

A3 – To reduce the number of flows in SDN switches for the client, we can:
1. Split flows into categories and direct each to a separate flow processor.
2. Change the flow processing algorithms to prioritize certain types of flows.
3. Use flow-based load balancing to control the processing order.

A4 –
o Use multiple flow tables where each category of flow has its own table and set the SDN switch to process the tables in desired order, without changing the flow priority.
o Flow-based load balancing divides flows into categories and sends each to a separate processor for processing in desired order.
o Change flow processing algorithm to prioritize certain flows or use queuing to hold flows until resources are available, to process in desired order.

A5 – The code will build a linear topology. To make it a ring topology add a link from s3 to s1(`self.addLink(s3, s1)`) should do it.

A6 – No, it won't be able to forward packets if the connection to its controller fails. Without a central controller or backup controller it won't be able to configure switch or forward data to the right port/machine since sdn switches are dependent on central controller to get updated routes and network information.

A7 – The following are a few symmetric messages of the OpenFlow protocol:-
o Hello msg starts a new connection between controller & switch. Sent by switch upon connection establishment, or by controller to reset connection.
o Error msg indicates an error in previous msg between controller & switch. Includes error type & causing msg info.
o Echo Request/Reply msg tests the connection between controller & switch. Controller sends Request, switch returns Reply.
o Features Request/Reply msg retrieves switch features & capabilities. Controller sends Request, switch returns Reply with info.
o Packet-In msg sends packet to controller for processing. Switch sends msg to controller when a packet doesn't match flow rules.

A8 – Ethane Architecture was built with three key principles in mind: simplicity, scalability, and flexibility. The goal is to offer a straightforward, efficient, and adaptable solution for data centers. This involves reducing complexity, maximizing resource utilization, and supporting multiple applications.

A9 – As a cloud administrator, to create 6 equal size vpc networks in a single aws account, you can follow the steps below:
o Log in to the AWS Management Console.

- From the AWS Services menu, select "VPC."
- Select "Create VPC."
- Enter a unique name for each VPC, such as "VPC 1," "VPC 2," etc.
- Set the IP address range for each VPC. For example, you can use a /16 CIDR block and divide it into 6 equal subnets, such as /18 for each VPC.
- Select the VPCs you want to create and click "Create VPC."
- Repeat the process for each VPC you want to create.
- After all the VPCs are created, you can create subnets within each VPC, assign security groups and network ACLs, and configure route tables as needed.
- To ensure that the VPCs are equal in size, you can verify the IP address range and subnet configuration for each VPC.

By following these steps, you can create 6 equal size VPCs in a single AWS account, allowing you to segment your network for improved security and isolation.