Assignment 2 – Analytical assignment

Instructions:

Please complete this assignment by individuals. Both graduate and undergraduate students are expected to complete this analytical assignment. This assignment is designed to help you learn the forwarding rules and behavior of OpenFlow switches.

Getting started:

Please refer to the Figure 1 for the questions below.

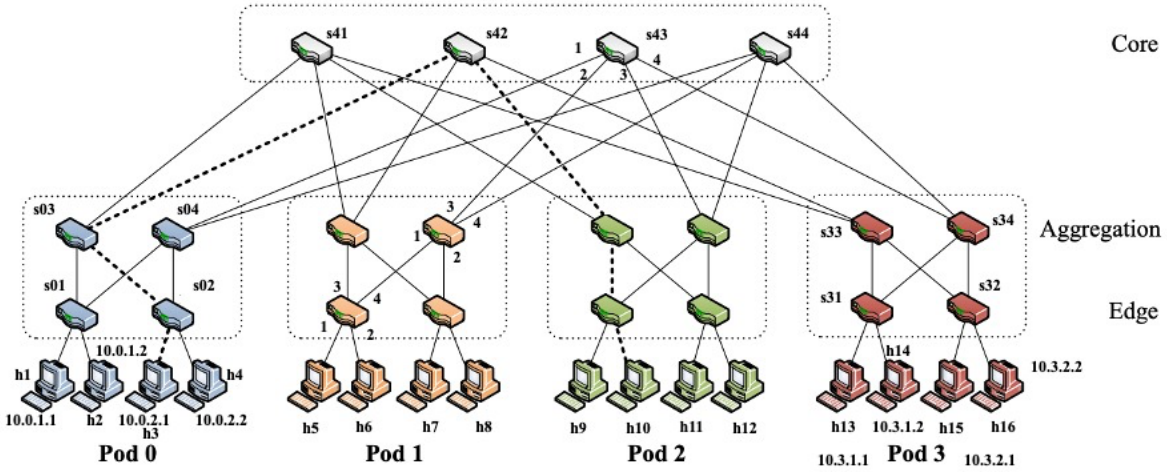

Figure 1. Simple Fat-tree topology with *k=4*.

The **naming format** and the **port numbering** follows the same pattern in each pod. For example, the switches in the pod 1 are named as follows:

- the bottom-left switch is "s11"
- the bottom-right switch is "s12"
- the top-left switch is "s13"
- and finally, the top-right switch is "s14"

And for the port numbering you can check the ports in the Pod 1.

NOTE: for all the questions, please only consider the shortest paths.

NOTE: For the sake of simplicity, I have not shown the OpenFlow controller in the picture, but all of the switches are connected to the controller, and the rules are being written by it.

NOTE: The hosts' IP addresses are assigned in this pattern:

"10.Pod #.right digit of Switch#.Host's position"

Question 1:

Consider the SDN OpenFlow network shown in Figure 1. Suppose that the desired forwarding behavior for datagrams arriving at s01 is as follows:

- Any datagrams arriving on input port 3 from other hosts destined for hosts h3 or h4 should be forwarded over output port 4.
- Any datagrams arriving on input port 4 from other hosts destined for hosts h3 or h4 should be forwarded over output port 3.
- Any arriving datagrams on input ports 3 or 4 and destined to hosts h1 or h2 should be delivered to the host specified.
- Hosts h1 and h2 should be able to send datagrams to each other.
  Specify the flow table entries in s01 that implement this forwarding behavior.

Question 2:

Consider again the SDN OpenFlow network shown in Figure 1. Suppose that the desired forwarding behavior for datagrams arriving from hosts h3 or h4 at s02 is as follows:

- Any datagrams arriving from host h3 and destined for h1, h2 should be forwarded in a clockwise direction in the network.
- Any datagrams arriving from host h4 and destined for h1, h2 should be forwarded in a counterclockwise direction in the network.

  Specify the flow table entries in s02 that implement this forwarding behavior.

Question 3:

Consider again the SDN OpenFlow network shown in Figure 1. Suppose that the desired forwarding behavior for datagrams arriving from hosts h1, h2, h3 or h4 at s03 is as follows:

- Any datagrams arriving on input port 1 from other hosts destined for hosts h13, h14, h15 or h16 should be forwarded to s41.
- Any datagrams arriving on input port 2 from other hosts destined for hosts h13, h14, h15 or h16 should be forwarded to s42.
- Any arriving datagrams on input ports 3 or 4 and destined to hosts h1 or h2 should be forwarded over port 1.

- Any arriving datagrams on input ports 3 or 4 and destined to hosts h3 or h4 should be forwarded over port 2.
- All the hosts in Pod 0 (h1, h2, h3, h4) should be able to send datagrams to each other. (Only consider the shortest path)
  Specify the flow table entries in s03 that implement this forwarding behavior.

Question 4:

Consider again the SDN OpenFlow network shown in Figure 1. Please specify the desired forwarding behavior of s42 in a way that any arriving datagrams destined to the hosts in each pod is forwarded over the right port.

Question 5:

Consider again the SDN OpenFlow network shown on page 1. Suppose we want to switch s2 to function as a firewall. Specify the flow table in s21 that implements the following firewall behaviors (specify a different flow table for each of the four firewalling behaviors below) to deliver datagrams destined to h9 and h10. You do not need to specify the forwarding behavior in s21 that forwards traffic to other routers.

- Only traffic arriving from hosts h11 and h12 should be delivered to hosts h9 or h10 (i.e., that arriving traffic from other hosts should be blocked).
- Only TCP traffic can be delivered to hosts h9r h10 (i.e., that UDP traffic is blocked).
- Only traffic destined for h9 is to be delivered (i.e., all traffic to h10 is blocked).

What to turn in:

For these questions in this assignment, please prepare a report with the solutions to all the problems.
You can submit the assignment through Canvas.