**Programming Assignment 3: SDN and Ryu**

**(jcs232542- SHARATH KUMAR REDDY GANDHAM)**

Part 1:

For Learning\_switch:

1. h 2 ping h5:

rtt min/avg/max/mdev = 0.087/5.973/29.280/11.653 ms

1. h2 ping h3:

rtt min/avg/max/mdev = 0.080/2.660/12.656/4.999 ms

1. h1 ping h4:

rtt min/avg/max/mdev = 0.082/5.222/25.491/10.134 ms

For Controller\_hub:

1. h2 ping h5:

rtt min/avg/max/mdev = 14.563/19.846/25.975/3.697 ms

1. h2 ping h3:

rtt min/avg/max/mdev = 5.762/11.102/20.417/4.942 ms

1. h1 ping h4:

rtt min/avg/max/mdev = 10.727/15.731/26.693/5.633 ms

Here we can observe that the latencies for the learning switch are much smaller than the controller hub because the controller hub needs to use the controller to find the way to send the received packet, which overheads the hub to send the packet. Here it does not store anything about the hosts.

Whereas in the learning switch(it uses layer2 mechanism) at every first-time learning switch also does the same thing done by the hub, but for the next subsequent packets of the same destination it just sends the packet directly without any delay or overhead because here it stores the previous path to send.

**Throughput test:**

Learning Switch:

mininet> iperf h1 h5

\*\*\* Iperf: testing TCP bandwidth between h1 and h5

\*\*\* Results: ['24.3 Gbits/sec', '24.4 Gbits/sec']

Controller Hub:

mininet> iperf h1 h5

\*\*\* Iperf: testing TCP bandwidth between h1 and h5

\*\*\* Results: ['4.77 Mbits/sec', '5.38 Mbits/sec']

The Learning Switch offers higher local network performance due to its efficient, decentralized operation, while the Controller Hub introduces lower performance but provides more centralized control

After pingall the rules installed:

**Learning\_switch:**

mininet> dpctl dump-flows

\*\*\* s1 ------------------------------------------------------------------------

cookie=0x0, duration=6.104s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth2",dl\_src=12:bb:45:77:40:f6,dl\_dst=c6:40:90:cb:1e:12 actions=output:"s1-eth1"

cookie=0x0, duration=6.100s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth1",dl\_src=c6:40:90:cb:1e:12,dl\_dst=12:bb:45:77:40:f6 actions=output:"s1-eth2"

cookie=0x0, duration=6.087s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth3",dl\_src=aa:a9:ea:1f:1d:57,dl\_dst=c6:40:90:cb:1e:12 actions=output:"s1-eth1"

cookie=0x0, duration=6.084s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth1",dl\_src=c6:40:90:cb:1e:12,dl\_dst=aa:a9:ea:1f:1d:57 actions=output:"s1-eth3"

cookie=0x0, duration=6.058s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth4",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=c6:40:90:cb:1e:12 actions=output:"s1-eth1"

cookie=0x0, duration=6.054s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth1",dl\_src=c6:40:90:cb:1e:12,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s1-eth4"

cookie=0x0, duration=6.035s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth4",dl\_src=36:fc:d9:10:99:f2,dl\_dst=c6:40:90:cb:1e:12 actions=output:"s1-eth1"

cookie=0x0, duration=6.030s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth1",dl\_src=c6:40:90:cb:1e:12,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s1-eth4"

cookie=0x0, duration=6.007s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth3",dl\_src=aa:a9:ea:1f:1d:57,dl\_dst=12:bb:45:77:40:f6 actions=output:"s1-eth2"

cookie=0x0, duration=6.004s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth2",dl\_src=12:bb:45:77:40:f6,dl\_dst=aa:a9:ea:1f:1d:57 actions=output:"s1-eth3"

cookie=0x0, duration=5.988s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth4",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=12:bb:45:77:40:f6 actions=output:"s1-eth2"

cookie=0x0, duration=5.986s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth2",dl\_src=12:bb:45:77:40:f6,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s1-eth4"

cookie=0x0, duration=5.970s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth4",dl\_src=36:fc:d9:10:99:f2,dl\_dst=12:bb:45:77:40:f6 actions=output:"s1-eth2"

cookie=0x0, duration=5.968s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth2",dl\_src=12:bb:45:77:40:f6,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s1-eth4"

cookie=0x0, duration=5.941s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth4",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=aa:a9:ea:1f:1d:57 actions=output:"s1-eth3"

cookie=0x0, duration=5.939s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth3",dl\_src=aa:a9:ea:1f:1d:57,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s1-eth4"

cookie=0x0, duration=5.923s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s1-eth4",dl\_src=36:fc:d9:10:99:f2,dl\_dst=aa:a9:ea:1f:1d:57 actions=output:"s1-eth3"

cookie=0x0, duration=5.921s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s1-eth3",dl\_src=aa:a9:ea:1f:1d:57,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s1-eth4"

cookie=0x0, duration=9.456s, table=0, n\_packets=28, n\_bytes=1680, priority=0 actions=CONTROLLER:65535

\*\*\* s2 ------------------------------------------------------------------------

cookie=0x0, duration=6.068s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth1",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=c6:40:90:cb:1e:12 actions=output:"s2-eth3"

cookie=0x0, duration=6.059s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth3",dl\_src=c6:40:90:cb:1e:12,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s2-eth1"

cookie=0x0, duration=6.045s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth2",dl\_src=36:fc:d9:10:99:f2,dl\_dst=c6:40:90:cb:1e:12 actions=output:"s2-eth3"

cookie=0x0, duration=6.036s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth3",dl\_src=c6:40:90:cb:1e:12,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s2-eth2"

cookie=0x0, duration=5.998s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth1",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=12:bb:45:77:40:f6 actions=output:"s2-eth3"

cookie=0x0, duration=5.991s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth3",dl\_src=12:bb:45:77:40:f6,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s2-eth1"

cookie=0x0, duration=5.979s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth2",dl\_src=36:fc:d9:10:99:f2,dl\_dst=12:bb:45:77:40:f6 actions=output:"s2-eth3"

cookie=0x0, duration=5.971s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth3",dl\_src=12:bb:45:77:40:f6,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s2-eth2"

cookie=0x0, duration=5.950s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth1",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=aa:a9:ea:1f:1d:57 actions=output:"s2-eth3"

cookie=0x0, duration=5.944s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth3",dl\_src=aa:a9:ea:1f:1d:57,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s2-eth1"

cookie=0x0, duration=5.932s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth2",dl\_src=36:fc:d9:10:99:f2,dl\_dst=aa:a9:ea:1f:1d:57 actions=output:"s2-eth3"

cookie=0x0, duration=5.926s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth3",dl\_src=aa:a9:ea:1f:1d:57,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s2-eth2"

cookie=0x0, duration=5.899s, table=0, n\_packets=3, n\_bytes=238, priority=1,in\_port="s2-eth2",dl\_src=36:fc:d9:10:99:f2,dl\_dst=e2:ce:d8:c8:42:cb actions=output:"s2-eth1"

cookie=0x0, duration=5.897s, table=0, n\_packets=2, n\_bytes=140, priority=1,in\_port="s2-eth1",dl\_src=e2:ce:d8:c8:42:cb,dl\_dst=36:fc:d9:10:99:f2 actions=output:"s2-eth2"

cookie=0x0, duration=9.460s, table=0, n\_packets=24, n\_bytes=1400, priority=0 actions=CONTROLLER:65535

**Controller\_hub:**

mininet> dpctl dump-flows

\*\*\* s1 ------------------------------------------------------------------------

cookie=0x0, duration=494.209s, table=0, n\_packets=2697, n\_bytes=3717250, priority=0 actions=CONTROLLER:65535

\*\*\* s2 ------------------------------------------------------------------------

cookie=0x0, duration=494.218s, table=0, n\_packets=3881, n\_bytes=3795394, priority=0 actions=CONTROLLER:65535

part-2: