

Exercise I: Data Centers

- (30P) Warmup (simple Tree) (\$ => commands on VM, > => commands on mininet/pox, Q => Question)

```
$ sudo mn --topo tree,3 --mac --arp --switch ovsk --controller remote
$ h1 ping h8
```

H1 and h8 are unreachable.

```
mininet@mininet-vm:~$ sudo mn --topo tree,3 --mac --arp --switch ovsk --controller remote
*** Creating network
*** Adding controller
Unable to contact the remote controller at 127.0.0.1:6633
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7
*** Adding links:
(s1, s2) (s1, s5) (s2, s3) (s2, s4) (s3, h1) (s3, h2) (s4, h3) (s4, h4) (s5, s6) (s5, s7)
(s6, h6) (s7, h7) (s7, h8)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8
*** Starting controller
c0
*** Starting 7 switches
s1 s2 s3 s4 s5 s6 s7
*** Starting CLI:
mininet> h1 ping h8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data.
```

```
$ ./pox/pox.py
$ h1 ping h8
```

Even the controller connected, h1 still cannot reach h8

```
mininet> h1 ping h8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data.
^C
--- 10.0.0.8 ping statistics ---
40 packets transmitted, 0 received, 100% packet loss, time 39011ms

mininet@mininet-vm: ~
mininet@mininet-vm:~$ ./pox/pox.py
POX 0.2.0 (carp) / Copyright 2011-2013 James McCauley, et al.
INFO:core:POX 0.2.0 (carp) is up.
INFO:openflow.of_01:[00-00-00-00-00-02 1] connected
INFO:openflow.of_01:[00-00-00-00-00-01 2] connected
INFO:openflow.of_01:[00-00-00-00-00-03 5] connected
INFO:openflow.of_01:[00-00-00-00-00-05 3] connected
INFO:openflow.of_01:[00-00-00-00-00-04 4] connected
INFO:openflow.of_01:[00-00-00-00-00-06 7] connected
INFO:openflow.of_01:[00-00-00-00-00-07 6] connected
```

```
$ ./pox/pox.py samples.spanning_tree
$ h1 ping h8
```

H1 can reach h8 now .

```

mininet> h1 ping -c1 h8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data.
64 bytes from 10.0.0.8: icmp_seq=1 ttl=64 time=43.9 ms

--- 10.0.0.8 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 43.996/43.996/43.996/0.000 ms

mininet@mininet-vm: ~
INFO:openflow.of_01:[00-00-00-00-00-05 3] disconnected
INFO:openflow.of_01:[00-00-00-00-00-06 7] disconnected
INFO:openflow.of_01:[00-00-00-00-00-07 6] disconnected
INFO:core:Down.
mininet@mininet-vm:~$ ./pox/pox.py samples.spanning_tree
POX 0.2.0 (carp) / Copyright 2011-2013 James McCauley, et al.
[core] POX 0.2.0 (carp) is up.
[openflow.of_01] [00-00-00-00-00-05 1] connected
[openflow.of_01] [00-00-00-00-00-04 2] connected
[openflow.of_01] [00-00-00-00-00-02 5] connected
[openflow.of_01] [00-00-00-00-00-07 4] connected
[openflow.of_01] [00-00-00-00-00-03 3] connected
[openflow.of_01] [00-00-00-00-00-06 6] connected
[openflow.of_01] [00-00-00-00-00-01 7] connected
[openflow.discovery] link detected: 00-00-00-00-00-05,3 -> 00-00-00-00-00-01
.2
[openflow.discovery] link detected: 00-00-00-00-00-05 1 -> 00-00-00-00-00-06

```

- (40P) Create your own simple tree (binary, i.e. each node will connect to two nodes below it)
 - copy dcsimple.py ([1]) to mininet/custom/
 - modify dcsimple.py to create hosts, switches and connections for a three level tree

```
$ sudo mn --custom dcsimple.py --topo simple
```

```

mininet@mininet-vm:~$ sudo mn --custom ./mininet/custom/dcsimple.py --topo simple
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7
*** Adding links:
(s1, s2) (s1, s3) (s2, s4) (s2, s5) (s3, s6) (s3, s7) (s4, h1) (s4, h2) (s5, h3)
(s5, h4) (s6, h5) (s6, h6) (s7, h7) (s7, h8)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8
*** Starting controller
c0
*** Starting 7 switches
s1 s2 s3 s4 s5 s6 s7
*** Starting CLI:
mininet> h1 ping -c1 h8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data.
64 bytes from 10.0.0.8: icmp_seq=1 ttl=64 time=46.6 ms

--- 10.0.0.8 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 46.672/46.672/46.672/0.000 ms

```

Code is in the attachment.

- (30P) Create your own Fattree
 - copy dcfat.py ([2]) to mininet/custom/
 - modify dcfat.py to create a fat tree (level 0: s0 & s1, level 1: s2 & s3, level 2: s4, s5, s6, s7, Level 3: Hosts)

```
$ sudo mn --custom dcfat.py --topo fat
$ sudo mn --custom dcfat.py --topo fat --controller remote
$ ./pox/pox.py samples.spanning_tree
```

```
mininet@mininet-vm:~$ sudo mn --custom ./mininet/custom/dcfat.py --topo fat --controller remote
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7 s8
*** Adding links:
(s1, s3) (s1, s4) (s2, s3) (s2, s4) (s3, s5) (s3, s6) (s3, s7) (s3, s8) (s4, s5)
(s4, s6) (s4, s7) (s4, s8) (s5, h1) (s5, h2) (s5, h3) (s5, h4) (s5, h5) (s5, h6)
(s5, h7) (s5, h8) (s6, h1) (s6, h2) (s6, h3) (s6, h4) (s6, h5) (s6, h6) (s6, h7)
(s6, h8) (s7, h1) (s7, h2) (s7, h3) (s7, h4) (s7, h5) (s7, h6) (s7, h7) (s7, h8)
(s8, h1) (s8, h2) (s8, h3) (s8, h4) (s8, h5) (s8, h6) (s8, h7) (s8, h8)
*** Configuring hosts
h1 h2 h3 h4 h5 h6 h7 h8
*** Starting controller
c0
*** Starting 8 switches
s1 s2 s3 s4 s5 s6 s7 s8
*** Starting CLI:
mininet> pingall
*** Ping: testing ping reachability
h1 -> h2 h3 h4 h5 h6 h7 h8
h2 -> h1 h3 h4 h5 h6 h7 h8
h3 -> h1 h2 h4 h5 h6 h7 h8
h4 -> h1 h2 h3 h5 h6 h7 h8
h5 -> h1 h2 h3 h4 h6 h7 h8
h6 -> h1 h2 h3 h4 h5 h7 h8
h7 -> h1 h2 h3 h4 h5 h6 h8
h8 -> h1 h2 h3 h4 h5 h6 h7
```

```

mininet@mininet-vm:~$ ./pox/pox.py samples.spanning_tree
POX 0.2.0 (carp) / Copyright 2011-2013 James McCauley, et al.
[core] POX 0.2.0 (carp) is up.
[openflow.of_01] [00-00-00-00-00-07 1] connected
[openflow.of_01] [00-00-00-00-00-06 2] connected
[openflow.of_01] [00-00-00-00-00-08 3] connected
[openflow.of_01] [00-00-00-00-00-05 4] connected
[openflow.of_01] [00-00-00-00-00-01 6] connected
[openflow.of_01] [00-00-00-00-00-02 5] connected
[openflow.of_01] [00-00-00-00-00-03 8] connected
[openflow.of_01] [00-00-00-00-00-04 7] connected
[openflow.discovery] link detected: 00-00-00-00-00-07,2 -> 00-00-00-00-00-04
.5
[openflow.discovery] link detected: 00-00-00-00-00-06,1 -> 00-00-00-00-00-03
.4
[openflow.discovery] link detected: 00-00-00-00-00-06,2 -> 00-00-00-00-00-04
.4
[openflow.discovery] link detected: 00-00-00-00-00-07,1 -> 00-00-00-00-00-03
.5
[openflow.discovery] link detected: 00-00-00-00-00-08,1 -> 00-00-00-00-00-03
.6
[openflow.discovery] link detected: 00-00-00-00-00-08,2 -> 00-00-00-00-00-04
.6
[openflow.discovery] link detected: 00-00-00-00-00-05,1 -> 00-00-00-00-00-03
.3
[openflow.discovery] link detected: 00-00-00-00-00-05,2 -> 00-00-00-00-00-04
.3
[openflow.discovery] link detected: 00-00-00-00-00-01,1 -> 00-00-00-00-00-03
.1
[openflow.discovery] link detected: 00-00-00-00-00-01,2 -> 00-00-00-00-00-04
.1
[openflow.discovery] link detected: 00-00-00-00-00-02,1 -> 00-00-00-00-00-03
.2
[openflow.discovery] link detected: 00-00-00-00-00-02,2 -> 00-00-00-00-00-04
.2
[openflow.discovery] link detected: 00-00-00-00-00-03,3 -> 00-00-00-00-00-05
.

```