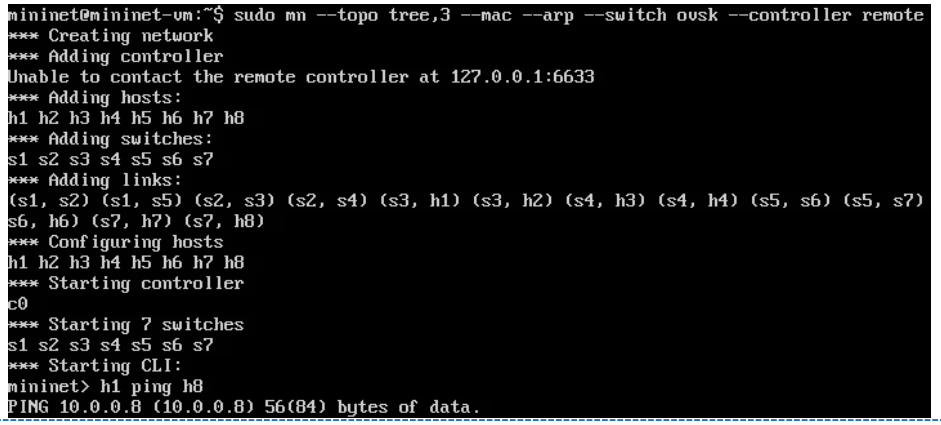
Exercise I: Data Centers

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

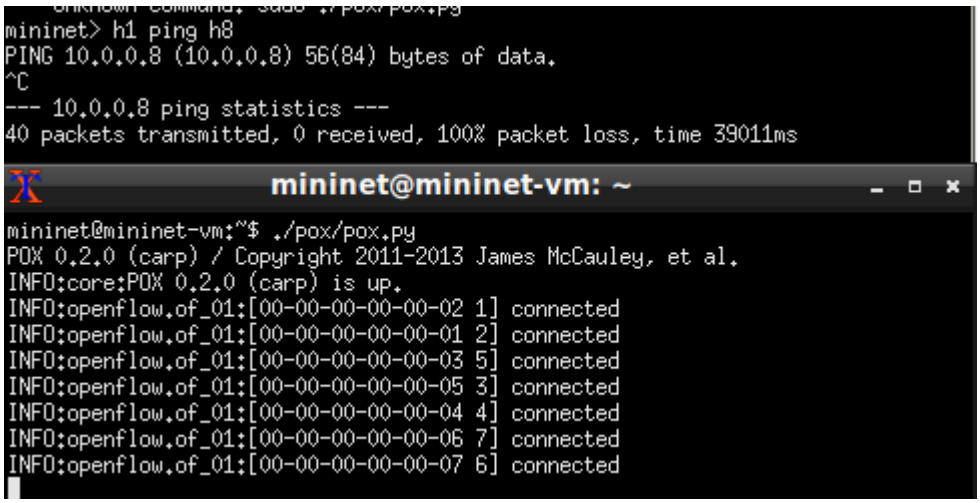
```
$ sudo mn --topo tree,3 --mac --arp --switch ovsk --controller remote
$ h1 ping h8
```

H1 and h8 are unreachable.




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

Even the controller connected, h1 still cannot reach h8




```
$ ./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

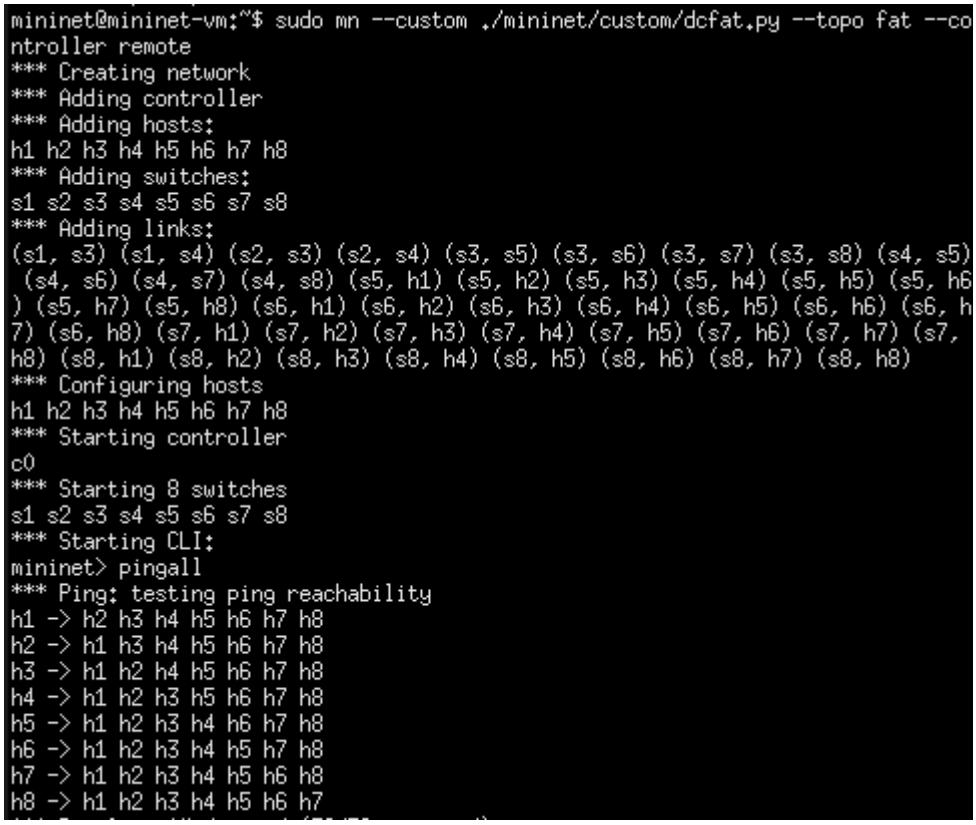
```
$ sudo mn --custom dcsimple.py --topo simple
```

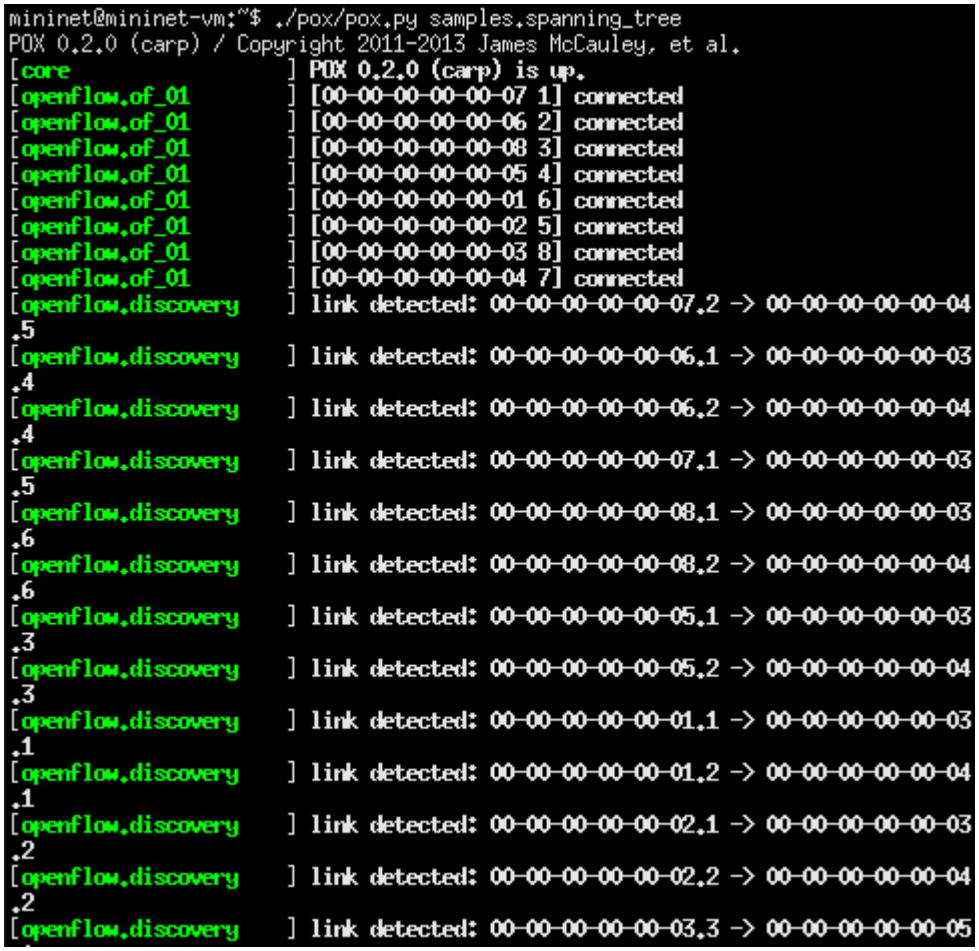
```
mininet@mininet-vm:~$ sudo mn --custom ./mininet/custom/dcsimple.py --topo simpl
e
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6 h7 h8
*** Adding switches:
s1 s2 s3 s4 s5 s6 s7
*** Adding links:
(s1, s2) (s1, s3) (s2, s4) (s2, s5) (s3, s6) (s3, s7) (s4, h1) (s4, h2) (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: so & 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:~$ ./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