Software Defined Networking

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In this course, you will learn about software defined networking and how it is changing the way communications networks are managed, maintained, and secured.

Testing a Simple Mininet Setup

- Try setting up a simple topology with three hosts connected to a single switch:
  - sudo mn --test pingall --topo single,3
- This setup uses a default switch controller and switch
  - Mininet also allows you to use custom remote controllers (and custom switches)

Basic Mininet Command Line

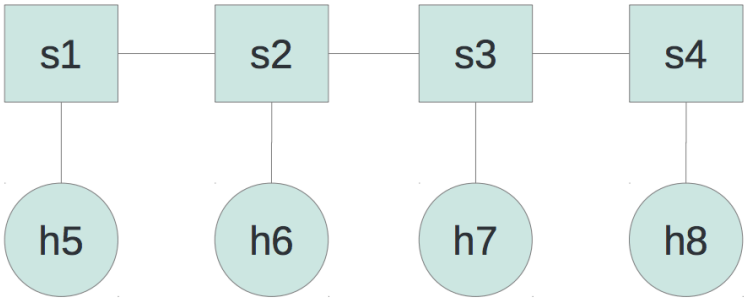
- **--topo** – defines a topology via command line upon mininet start-up.
- **--switch** – defines the switch to be used. By default the OVSK software switch is used.
- **--controller** – defines the controller to be used. If unspecified default controller is used with a default hub behavior.

Trying Out Different Mininet Topologies

- Minimal network with two hosts, one (1) switch
  - sudo mn –topo minimal
- Example with 4 hosts and 4 switches
  - sudo mn --topo linear,4
- Example with 3 hosts all connected to one switch.
  - sudo mn --topo single,3
- Tree topology with defined depth and fan-out.
  - sudo mn --topo tree,depth=2,fanout=2

How mn Works: mn executes Python

- "mn" is a launch script that executes Python
- Consider: "—topo linear, 4"




```
from mininet.net import Mininet

from mininet.topo import LinearTopo

Linear = LinearTopo(k=4)

net = Mininet(topo=Linear)

net.start()
net.pingAll()
net.stop()
```

Writing Your Own Mininet Topologies

- Example: Two hosts, one switch
- **mininet.cli.CLI(net)** before net.stop() will escape to interactive CLI before script terminates
- **addLink** allows you to specify: Bandwidth (bw) in Mbps, Delay (delay), Maximum Queue Size (max_queue_size), Loss (loss) in percentage

```
from mininet.net import Mininet
net = Mininet()

# Creating nodes in the network.
c0 = net.addController()
h0 = net.addHost('h0')
s0 = net.addSwitch('s0')
h1 = net.addHost('h1')

# Creating links between nodes in network (2-ways)
net.addLink(h0, s0)
net.addLink(h1, s0)

# Configuration of IP addresses in interfaces
h0.setIP('192.168.1.1', 24)
h1.setIP('192.168.1.2', 24)

net.start()
net.pingAll()
net.stop()
```

https://github.com/mininet/mininet/wiki/Introduction-to-Mininet

More Complicated Topology Generation

```
#!/usr/bin/python

from mininet.topo import Topo
from mininet.net import Mininet
from mininet.util import dumpNodeConnections
from mininet.log import setLogLevel

class SingleSwitchTopo(Topo):
    "Single switch connected to n hosts."
    def build(self, n=2):

        # Initialize topology and default options
        switch = self.addSwitch('s1')

        # Python's range(N) generates 0..N-1
        for h in range(n):
            host = self.addHost('h%s' % (h + 1))
            self.addLink(host, switch)
```

```
def simpleTest():
    "Create and test a simple network"
    topo = SingleSwitchTopo(n=4)
    net = Mininet(topo)
    net.start()
    print "Dumping host connections"
    dumpNodeConnections(net.hosts)
    print "Testing network connectivity"
    net.pingAll()
    net.stop()

if __name__ == '__main__':
    # Tell mininet to print useful information
    setLogLevel('info')
    simpleTest()
```

Things Not (Yet) Covered

- Access to (common) filesystem
- Setting link speeds and properties
- Using custom controllers and switches
- Host configuration
- Performance measurement

Summary

- Mininet is a network emulator that runs in a Virtual Machine
  - Lightweight OS virtualization to achieve scale
  - Fast, easy, sharable
- Next Part of Lesson: Topology examples
  - mn wrapper, Python
  - Topologies and controllers