HANDS-ON SDN

Introduction to Software-defined Networking
Block Course – 16-20 March 2015

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Remarks on Presentations

- *We will have 11 presentations on Friday afternoon*
- *15 minutes instead of 20 minutes per presentation*
- *5 minutes Q&A remains unchanged*

- *Start at 1:30 pm, in order of appeareance on the course website*
- *Make sure your presentation works in this room beforehand*
- *Be present for all presentations and participate in the discussion*

Where we are now

You have now learned about:

- Python programming
- SDN basic principles
    - Basic concepts (CP/DP separation etc.)
    - De-facto standard interfaces (OpenFlow)
    - Controllers (NOX, POX, …)
    - Virtualization (FlowVisor)

Where we want to go

You have now learned about:

- Python programming
- SDN basic principles
  - Basic concepts (CP/DP separation etc.)
  - De-facto standard interfaces (OpenFlow)
  - Controllers (NOX, POX, …)
  - Virtualization (FlowVisor)

- **Put the stuff learned into practice:**
  - Implement OpenFlow?
  - Implement controllers?
  - Implement FlowVisor?

  - Rather: *learn how to use and program them!*
    - Hands-on work on state-of-the-art tools

Detailed Course overview

Day	Morning Session 1	Morning Session 2	Afternoon Session 1	Afternoon Session 2
Mon	Introducing SDN I	Lecture Exercises	Introduction to Python	Python Exercises
Tue	Introducing SDN II	Lecture Exercises	Introduction to Python (cont.)	Python Exercises
Wed	Current Research in SDN	Paper Selection and Reading (Teams)	**Hands-On SDN I**	**SDN Exercises**
Thu	**Hands-On SDN II**	**SDN Exercises**	**Hands-On SDN III**	Presentation Preparation
Fri	**Hands-On SDN IV**	**SDN Exercises**	Wrap-Up & Free Slot	Presentations

Hands-On Sessions: putting the concepts learned in the lectures into practice

How can we get there?

- Luckily, implementations are available.
  - Switches implementing OF
  - Controllers implementing OF

- So, how do we run them?
  - We don‘t have a hardware testbed at hand
  - We don‘t have access to a production network
  - We may want to test different things on different network topologies
  - Simulation?

Emulation of Networks

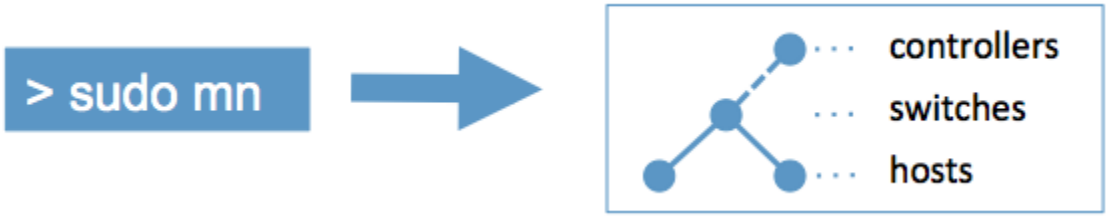
- Network emulation means to run unmodified code interactively on virtual hardware

- Huge benefit:
  - Can actually port our applications seamlessly to hardware

- Challenges:
  - Scalability: need to model hosts, switches, links, controllers, …
  - Ease-of-Use: easily allow to create different topologies with varying parameters
  - Accuracy: results have to match results obtained from running same experiment on hardware

Enter Mininet

"Mininet creates a **realistic virtual network**, running **real kernel, switch and application code**, on a single machine (VM, cloud or native), in seconds, with a single command"[1]



[1] mininet.org (Paper: Lantz et al.: *"A Network in a Laptop: Rapid Prototyping for Software-Defined Networks"*, ACM HotNets 2010)

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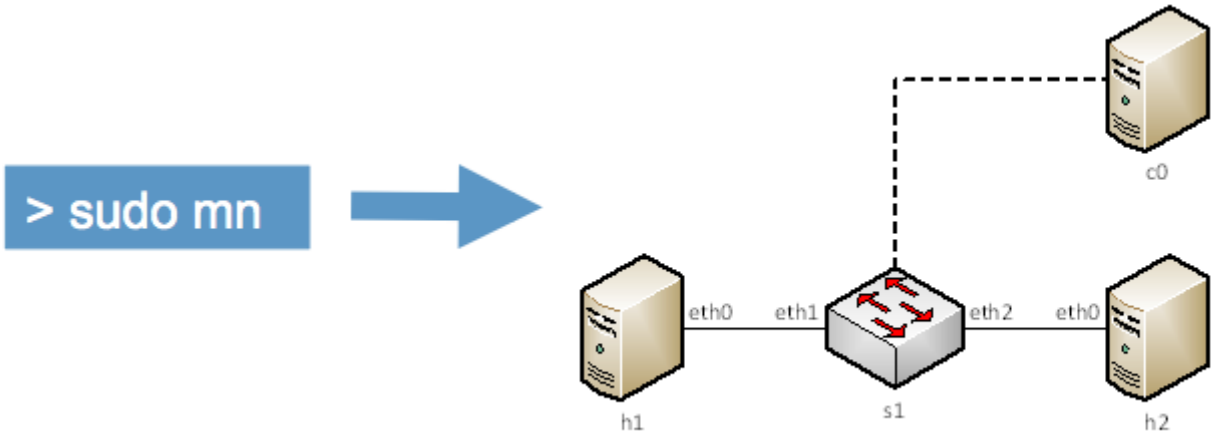

[1] mininet.org

Enter Mininet

Mininet offers CLI & API to interact with the network

(see demo)

Customize Topologies

Mininet is not limited to the very basic setup

(see demo)

Customize Topologies

```
from mininet.topo import Topo
class MyTopo( Topo ):
    "Simple topology example."

    def __init__( self ):
    "Create custom topo."

        # Initialize topology
        Topo.__init__( self )

        # Add hosts and switches
        leftHost = self.addHost( 'h1' )
        rightHost = self.addHost( 'h2' )
        leftSwitch = self.addSwitch( 's3' )
        rightSwitch = self.addSwitch( 's4' )

        # Add links
        self.addLink( leftHost, leftSwitch )
        self.addLink( leftSwitch, rightSwitch )
        self.addLink( rightSwitch, rightHost )


topos = { 'mytopo': ( lambda: MyTopo() ) }
```

Customize Switches and Controllers

You can connect different switches and controllers

(see demo)

Bring Links Up/Down

Change the topology at runtime

(see demo)

Python Interpreter

Can access each host, switch and controller with Python

(see demo)

Use of Wireshark

We can use Wireshark to debug our network

(see demo)

Limitations?

Limited by single system resources

Limited to Linux kernel (e.g., portability to Windows?)

Exercise!

Time for Exercise 5 and 6