High-speed Networks, Cybersecurity, and Software-defined Networking Workshop

Jorge Crichigno
University of South Carolina

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Lab 1: Introduction to Mininet
Introduction to Mininet

Invoking Mininet using the CLI

Building and emulating a network in Mininet using the GUI
Section 1: Introduction to Mininet
Mininet

- Mininet is a virtual testbed enabling the development and testing of network tools and protocols
- It creates a realistic virtual network on any type of machine (VM, cloud-hosted, or native)
- It is an inexpensive solution and streamlined development running in line with production networks
- Mininet offers the following features
  - Fast prototyping for new networking protocols
  - Simplified testing for complex topologies without the need of buying expensive hardware
  - Realistic execution as it runs real code on the Unix and Linux kernels
  - Open source environment backed by a large community contributing extensive documentation

- Mininet is useful for development, teaching, and research
- Originally designed to experiment with Software-Defined Networking (SDN)
Mininet

- Mininet provides network *emulation* opposed to simulation, allowing all network software at any layer to be simply run as is
- Mininet’s logical nodes can be connected into networks
- Nodes are sometimes called containers, or more accurately, *network namespaces*
- Containers consume sufficiently few resources that networks of over a thousand nodes have been created, running on a single laptop
Mininet Nodes

- A Mininet container is a process (or group of processes) that no longer has access to all the host system’s native network interfaces.
- Containers are then assigned virtual Ethernet interfaces, which are connected to other containers through a virtual switch.
- Mininet connects a host and a switch using a virtual Ethernet (veth) link.
- The veth link is analogous to a wire connecting two virtual interfaces.
Section 2: Invoking Mininet using the CLI
Starting Mininet using the CLI

• To start a minimal topology, enter the command `sudo mn` at the CLI.
Useful Commands

• To display the available nodes, type *nodes*

![Image of nodes command output]

• To display the links between the devices, type *net*

![Image of net command output]
Useful Commands

- To execute commands at a specific device, type the device first, followed by the command.
- For example, to execute the command `ifconfig` on host `h1`, type `h1 ifconfig`.
Useful Commands

- To test connectivity between end-hosts, use the ping command.
- Type \textit{h1 ping 10.0.0.2} to test the connectivity between host h1 and host h2 (10.0.0.2).
Section 3: Building and emulating a network in Mininet using the GUI
MiniEdit

- MiniEdit is a simple GUI network editor for Mininet
MiniEdit

• To build Mininet’s minimal topology, two hosts and one switch must be deployed
Host Configuration

- Configure the IP addresses at host h1 and host h2
- A host can be configured by holding the right click and selecting properties on the device
Starting Emulation

• Before testing the connection between host h1 and host h2, the emulation must be started
• Click on the Run button to start the emulation
• The emulation will start and the buttons of the MiniEdit panel will gray out, indicating that they are currently disabled
Executing Commands on Hosts

- Open a terminal on host by holding the right click and selecting *Terminal*
Testing Connectivity

- On host h1’s terminal, type the command `ping 10.0.0.2`
Stopping Emulation

- Stopping the emulation removes:
  - Network namespaces (nodes)
  - Virtual interfaces
  - Links between switches and hosts
- Stops the virtual switches instances
- Stop the emulation by clicking on the *Stop* button