FIT9137 Workshop Session

Week 9

Topics

- Network Layer:
  - Address Resolution
  - Dynamic Addressing of IP addresses
  - Routing
  - Static & Dynamic Routing

Covered Learning Outcomes:

- Analyse and formulate the functions and architectures of local area networks, wide area networks and the Internet.
- Examine networks using the underlying fundamental theories, models, and protocols for data transmission.

Instructions

- One of the main purposes of an applied session is to build the learning community, create connections and include the learners. The other goal is to give and receive feedback from your peers and or your tutors.
- Form groups of 4-5 students to work through the exercises. If you meet a problem, try to solve it by asking direct questions to your peers. If the issue was not solved within peers, ask your tutor. If you did not get a chance to solve the problem during your applied session with your peer or tutor, jump into one of many consultation hours and ask any of the tutors to help you. Please visit the "Teaching Team and Unit Resources" tile in the FIT9137 Moodle site.

ACTIVITY A: Address Resolution

1. Explain how application layer addresses (e.g. `www.monash.edu` or `www.bom.gov.au`) are resolved to IP addresses and why this is necessary.

2. Explain how IP addresses are resolved to MAC addresses (in Ethernet) and why this is necessary.

3. Find the file "`FIT9137-Workshop-Week-9-A.imn`" that you have downloaded from Moodle in week 9. Open the core in VM and open this "imn" file using the File tab. While performing the following steps also observe how the address range `10.1.1.0/24` is divided into 4 subnets and 3 of these subnets assigned to the three interfaces of node `phoenix`.

Start the emulation (click on the green play button) and wait until the emulation process boots all the emulated nodes. Open Wireshark on the eth0 interface of the node named `phoenix` by *Right* clicking on the node `phoenix` then move the mouse over Wireshark and select `eth0` from the list. Wait until the Wireshark window opens and starts capturing. Open a terminal on the node named `selene` and issue the following command:

```
lynx www.argos.edu
```

This command uses the text-based web browser to visit the page `www.argos.edu`. Select the Wireshark window and stop the capture.

a) Can you identify any application layer address resolution in captured traffic?

b) Can you identify any MAC address to IP address resolution in the captured traffic? *(Hint: check out the address resolution protocol for mapping data link address to IP address in linux checkout* ***man arp*** *or in windows* ***arp /?*** *)*

ACTIVITY B: Dynamic Assignment of IP Addresses

The Dynamic Host Configuration Protocol is used to automate the process of assigning network addresses and other network related settings such as the address of the default gateway, DNS server etc. The core configuration file `FIT9137-Workshop-Week-9-A.imn` has a DHCP server configured on node `phoenix`. It has also configured a packet capture on the node `selene` that starts as soon as the emulation starts which allows the DHCP traffic to be captured. If you have completed the previous exercise you should find a captured traffic file under
`/home/muni/` named `selene.eth0.pcap`.

Note: For Cloud VM users, you will find the `selene.eth0.pcap file in the /tmp folder, cp the file to your home directory`.

Now open the file in Wireshark and answer the following questions:

1. What source and destination addresses are used in the `DHCP Discover` message? And, why?
2. What are the source and destination addresses in the DHCP `Offer`? What parameters are provided by the server? Did the server offer every option requested by the client?
3. Identify and explain the next two steps in the DHCP protocol in the captured traffic.

Stop the configuration and open the services on the node `phoenix` and then click on the wrench icon of `DHCP` service. Compare the values offered in the captured DHCP traffic with the settings. For more information on DHCP protocol, please check out this page.

Activity C. Network Routing - Static Routing

Download the file `FIT9137-Workshop-Week-9-B.imn` from Moodle week 9 page and save it. Open the CORE emulator and open this "imn" file using the File tab. Perform the following tasks.

1. Run the emulation and open a terminal on the node `clio` and ping the two interfaces of the node `zeus`. Do you receive replies? Explain why by inspecting the routing table of both nodes (`ip route` command, `man ip-route` for more information).

2. From the node `clio` ping the `eth0` interface of the node `hera`.
   a) Do you receive replies? Explain why or why not.
   b) Open a terminal on the node `hera` and run the following command:

```
tcpdump -l -i eth0
```

The `tcpdump` is a command line packet capture tool (`man tcpdump` for more information). With the above options it starts capturing packets on `eth0` interface and prints a summary on the screen (standard output `stdout`). Try the ping command from `clio` and observe whether `hera` receives the ping requests.

c) If you did not receive replies in the previous step then find out how to resolve the issue. Apply your fix and try the ping from `clio` again.

d) From `clio` ping the node `calliope`. Do you receive replies?

e) If you did not receive replies in the previous step then find out how to resolve the issue. Explain why your fix resolves the issue.

f) Stop the emulation.

Note: Any changes you make while the emulation is running will be lost when you stop the emulation. To test this run the emulation again and try the steps and observe that none of the changes we made via command line on the nodes persisted. To make the changes persistent we need to use the core GUI and edit proper script / configuration files.

g) Place the necessary changes to the StaticRoute scripts of the identified nodes in previous steps so that `clio` can ping `calliope`. Save the configuration.

Note: If you make changes to a core configuration file and then close the window without saving the changes, you will not be warned, and the changes will be lost. If you have made changes that you want to keep, make sure to save the file before closing the core GUI window.