Principles of Internetworking Protocols

Assignment Three (20 marks)
(Due on March 17)

Rocky K. C. Chang

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Instructions:

1. Submit a pdf file for your answers to i-Learning before 11:59 on March 17. Put down your name, student ID and program/year in your submission.
2. Late submission will not be accepted.
3. Observe also the penalty for plagiarism as stated in the Course Overview slides.

Question 1: ARP and ICMP

[10 MARKS] You can do the experiments for this question using either your WiFi router at your residence or your phone serving as a WiFi hotspot. In both cases, you need two machines that can run Wireshark and ICMP. Make sure you can ping from one machine (sender machine) to the other (receiver machine).

Clean up your ARP cache and start Wireshark on both machines. Start Wireshark on both machines and issue a ping from the sender machine to the receiver machine. Include relevant screenshots to support your answers.

Part 1-a [1 MARK] What are the IP addresses of the sender machine and the receiver machine?

Part 1-b [1 MARK] What are the MAC addresses of the sender machine and the receiver machine?

Part 1-c [1 MARK] How was the sender's ARP request sent to the receiver? If there is another machine connected to the AP/WiFi hotspot, do you think it will also receive the ARP request?

Part 1-d [1 MARK] A ping program typically issues an ICMP echo request message to elicit an ICMP echo reply message from the target host. How many pairs of ICMP echo and request messages issued by your ping program?

Part 1-e [1 MARK] What is the size of the ICMP echo request message (or echo reply message)?

Part 1-f [1 MARK] Are all the ICMP echo request messages identical?

Find an unused IP address in your subnet and issue a ping from the sender machine to this IP address. Answer the questions below from your Wireshark capture.

Part 2-a [1 MARK] Give a screenshot of the ping results.

Part 2-b [1 MARK] How many ARP requests are sent by the sender machine?

Part 2-c [1 MARK] Did the receiver machine receive these ARP messages and why?

Part 2-d [1 MARK] Create an ARP entry in the sender's machine which maps the unused IP address to the receiver machine's MAC address. Ping the unused IP address again from the sender machine. Is the ping successful and why?

Question 2: Link-local IP address

[10 MARKS] Besides using the Dynamic Host Configuration Protocol (DHCP), another way of configuring an IP address to a host is through self-configuration. In fact, the prefix 169.254.0.0/16 has been allocated for this purpose. This set of addresses is referred to as link-local addresses and they can only be used on the same link, i.e., without going through an IP router.

A host can therefore self-configure a link-local address by itself. But before claiming the self-configured address, it sends out an ARP probe to make sure that the address is not in use. Let the selected address be `169.254.1.1`.

(a) [3 MARKS] In this ARP probe, what should the target IP address and target MAC address be and why?

(b) [3 MARKS] In this ARP probe, what should the source IP address and source MAC address be and why?

(c) [4 MARKS] After claiming the selected address successfully, the host is required to announce the claimed address by sending another ARP message. What should be the value of the four parameters in this ARP announcement?