CS 168 Introduction to the Internet: Architecture and Protocols
Spring 2024 Sylvia Ratnasamy & Rob Shakir Discussion 11: End-to-End, L2

1 Multiple Choice

1. Which protocol does a host use to learn its own IP address?

   (a) DHCP
   (b) DNS
   (c) ARP
   (d) ICMP
   (e) None of these

2. Which protocol does a host use to learn its own MAC address?

   (a) DHCP
   (b) DNS
   (c) ARP
   (d) ICMP
   (e) None of these

3. Which protocol does a host use to learn the MAC address of another host on the same network?

   (a) DHCP
   (b) DNS
   (c) ARP
   (d) ICMP
   (e) None of these

4. DHCP is a protocol in which of the following layers?

   (a) Physical
   (b) Datalink
   (c) Network
   (d) Transport
   (e) Application

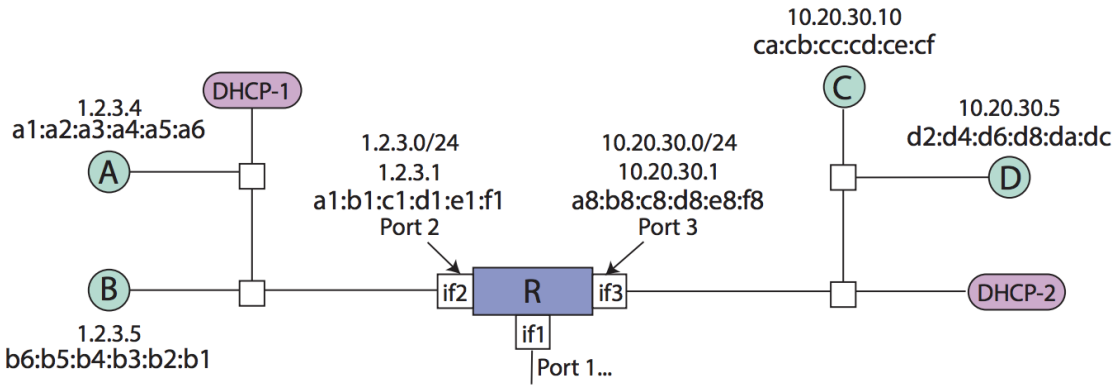
5. ARP is a protocol in which of the following layers?

   (a) Physical
   (b) Datalink
   (c) Network
   (d) Transport
   (e) Application

6. Which of the following can a host learn with DHCP? Select all that apply.

   (a) Its own MAC address.
   (b) Its own IP address.
   (c) The MAC address of another host.
   (d) The IP address of another host.
   (e) The IP address of its first-hop router.
   (f) The MAC address of its first-hop router.
   (g) Its own subnet mask.

2 Host-to-Host



Consider the above topology. Here, two networks are connected through router *R*. *R* has three interfaces, each associated with a port, MAC address, IP address, and subnet.

We are going to consider what happens when *A* sends a packet to *C*. Assume that *A* just attached to the network, but already knows the IP address of *C* (10.20.30.10). No hosts or routers have sent any previous ARP requests.

1. First *A* needs to learn its own IP address, subnet mask, and the IP of its first-hop router by using DHCP. For each of the following DHCP messages, indicate the message's timing in the packet exchange (1 is first, 4 is last), who sends the message, and whether the message is broadcast or unicast.

Message	Order	Sender	Message Type
DHCP request	1 / 2 / 3 / 4	Client / Server	Broadcast / Unicast
DHCP ACK	1 / 2 / 3 / 4	Client / Server	Broadcast / Unicast
DHCP discovery	1 / 2 / 3 / 4	Client / Server	Broadcast / Unicast
DHCP offer	1 / 2 / 3 / 4	Client / Server	Broadcast / Unicast

2. Using this information, how does *A* determine if *C* is on the same subnet?

3. Given that *C* is not on the same subnet as *A*, *A* must send the packet to its first hop router *R*. Which requests and responses are exchanged before this can happen?

Request	**Response**
ARP request for 1.2.3.4	ARP response: 1.2.3.4
ARP request for 1.2.3.1	ARP response: 1.2.3.1
ARP request for 10.20.30.10	ARP response: 10.20.30.10
ARP request for a1:a2:a3:a4:a5:a6	ARP response: a1:a2:a3:a4:a5:a6
ARP request for a1:b1:c1:d1:e1:f1	ARP response: a1:b1:c1:d1:e1:f1
ARP request for ca:cb:cc:cd:ce:cf	ARP response: ca:cb:cc:cd:ce:cf

4. Is the ARP request broadcast or unicast? What about the ARP response?

5. In the packet *A* now sends to *R*, what are the source and destination IP and MAC addresses?

   Source IP: _____

   Source MAC: _____

   Destination IP: _____

   Destination MAC: _____

6. How does *R* know which interface to forward *A*'s packet on?

7. Now *R* has the packet. List all remaining packets that are exchanged until *C* receives the packet from *A*.

8. What are the source and destination IP and MAC addresses for the packet that *R* sends to *C*?

   Source IP: _____

   Source MAC: _____

   Destination IP: _____

   Destination MAC: _____