**Homework 4:** **End-to-End Data Plane Forwarding**

Given the network topology at the end of this document, answer the following questions.

1. Suppose an application on host A is sending a UDP packet to an application on host B. The application is bound to port 10000 on host A and port 20000 on host B. Fill in the source and destination addresses used at each layer of the protocol stack when the packet leaves Host A.

|  |  |  |
| --- | --- | --- |
|  | **Source** | **Destination** |
| **UDP Header:**  **Port** | 10000 | 20000 |
| **IP Header:**  **IP Address** | 10.10.10.2/24 | 10.10.10.3/24 |
| **Ethernet Header:**  **MAC address** | AA-AA-AA-33-33-33 | BB-BB-BB-22-22-22 |

Same subnet

1. Suppose an application on host A is sending a UDP Packet to an application on Server 1. The application is bound to port 10000 on host A and port 30000 on Server 1. Fill in the source and destination addresses used at each layer of the protocol stack at every L3 hop along the way.

|  |  |  |
| --- | --- | --- |
| **Hop 1** | **Hop 2** | **Hop 3** |
| **UDP Header**  **OS Source Port :10000**  **Standard Well Known Value Dest Port:30000** | **UDP Header**  **Source Port :10000**  **Dest Port:30000**  Packet | **UDP Header**  **Source Port :10000**  **Dest Port:30000**  PACKET |
| **IP Header**  **DHCP Source IP:10.10.10.2**  **DNS Dest IP:128.235.10.10** | **IP Header**  **Source IP: 10.10.10.2**  **Dest IP: 128.235.10.10**  PACKET | **IP Header**  **Source IP: 10.10.10.2**  **Dest IP: 128.235.10.10**  PACKET |
| **Ethernet Header**  **Hardcoded NIC Source MAC AA-AA-AA-33-33-33**  **ARP for mac of first hop router because server is off-net**  **Dst MAC RR-RR-RR-11-11-11** | **Ethernet Header**  **Hardcoded NIC Source MAC Source MAC RR-RR-RR-12-12-12**  **ARP for mac of next router because server is off-net**  **Dst MAC RR-RR-RR-21-21-21** | **Ethernet Header**  **Hardcoded NIC Source MAC Source MAC RR-RR-RR-22-22-22**  **ARP for mac of next router because server is off-net**  **Dst MAC 11-11-11-11-11-11** |

Link layer can only transmit or communicate with hosts on same link. Otherwise IP is needed

ARP request when not on same subnet.

1. In hop 1, how does host A learn the addresses needed at each layer prior to sending the packet? The answer may be one or more of: manual or static host configuration, dynamically learned via some protocol (in which case state the protocol), dynamically selected by operating system, or “well-known” (i.e. some standard reserved value known a priori). Choose the most common mechanism for each address in above table.

Host A gets the port number of source from OS system, and the port number of server is a well know protocol, The IP address of source is gotten from DHCP, dest ip address using DNS, source mac is hardcoded in NIC, and Dest MAC from ARP requests

1. Repeat the above question for hop 2. In this case, the addresses may also be known by virtue of the fact that they are carried in the packet.
2. Repeat the above question for hop 3.

D and e same as C but gets the source dest port and source dest from packet in UDP and IP headers

