

17 How does Bob obtain an IP address?

- Bob wires up his laptop, connects it to an Ethernet cable connected to school's Ethernet switch.
- Operating System of laptop creates an DHCP request message, puts this message within an UDP segment with destination port 67 (DHCP server) and source port 68 (DHCP client). The UDP segment is then placed within an IP datagram with a broadcast IP destination address (255.255.255.255) and source IP address (0.0.0.0) because the laptop does not have any IP address.
- If datagram is then placed within an Ethernet Frame, this frame has a destination MAC address of FF:FF:FF:FF:FF:FF (broadcast MAC address). The source MAC address is Laptop's MAC address.

The frame will be broadcast to all devices connected to the Ethernet switch.

Bob's laptop sent the frame to the Ethernet switch.

The switch broadcast the incoming frame on all outgoing ports.

Therefore is connected to the switch, therefore, received the frame.

The router extracts IP datagram from the frame. The broadcast IP destination address indicates that this IP datagram should be processed by upper layer protocol. So the IP datagram's payload is then demultiplexed up to UDP, and then the transport layer extracts the DHCP message.

The DHCP server is within router.

The DHCP server is responsible for allocating IP address and DHCP allocates 68.85.2.14 to Bob's laptop.

The DHCP server creates a DHCP response message.

The DHCP response is then placed within an Ethernet Frame. The Ethernet Frame has destination MAC address of the router's interface that connects to the school's network (68.85.2.1) and source MAC address of the router's interface that connects to Bob's laptop.

The Ethernet Frame is then sent by the router to the switch.

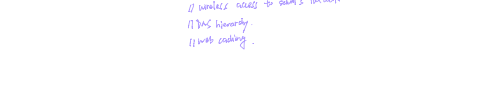
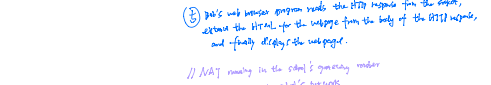
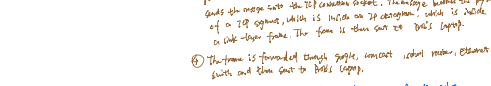
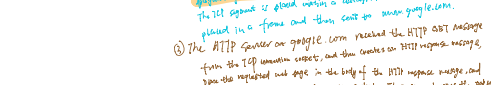
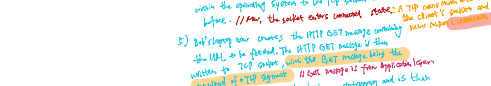
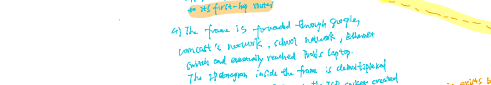
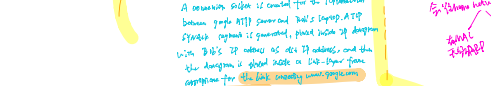
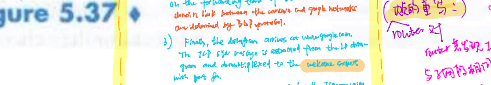
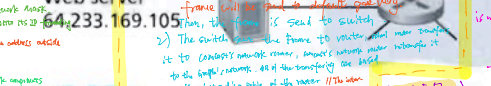
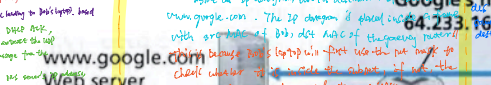
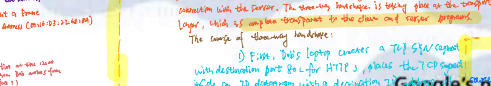
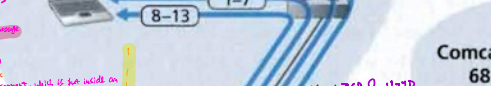
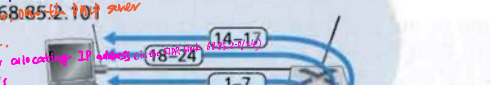
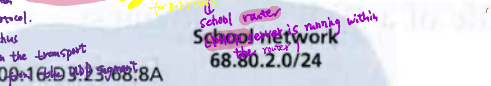
Bob's laptop receives the Ethernet Frame containing the DHCP response message. The IP datagram from the Ethernet Frame contains the IP address of the DHCP server (68.85.2.1) and the IP address of the laptop (68.85.2.14).

Bob's laptop extracts the DHCP response message from the Ethernet Frame.

Bob's laptop extracts the IP address of the DHCP server (68.85.2.1) and the IP address of the laptop (68.85.2.14).

Bob's laptop extracts the default gateway IP address (192.168.1.1) and the default gateway MAC address (08:00:27:00:00:00).

Bob's laptop has already initialized its network interfaces.



18 How does Bob sending HTTP request to www.google.com.

Bob types the URL for www.google.com into his web browser. Bob's web browser needs to create a TCP socket. This TCP socket will be used to send HTTP request to www.google.com.

A TCP socket specifies the destination of the server (www.google.com) and the port number of the server (80).

The opening system of Bob's laptop creates a TCP socket, putting the socket in the opening system of the laptop.

The message is then placed within a TCP segment with a destination port (80) and source port (10000).

The IP datagram is placed within an Ethernet frame.

The destination IP address is 64.233.169.105 within the school's network. However, Bob's laptop doesn't know the MAC address of the destination IP address. So it needs to get the default gateway router's MAC address.

Bob's laptop creates an ARP query with a target IP address (192.168.1.1) and a target MAC address (08:00:27:00:00:00).

The Ethernet frame is sent to the switch.

The switch receives the frame and extracts the ARP query.

The switch checks its ARP table and finds the target IP address (192.168.1.1) and the target MAC address (08:00:27:00:00:00).

The switch places the target MAC address in the ARP query's response.

Bob's laptop receives the ARP query's response and extracts the target MAC address (08:00:27:00:00:00).

Bob's laptop places the target MAC address in the Ethernet frame.

The Ethernet frame is sent to the switch.

The switch receives the frame and extracts the HTTP request.

The switch forwards the HTTP request to the default gateway router.

The default gateway router receives the frame and extracts the HTTP request.

The default gateway router forwards the HTTP request to the destination IP address (64.233.169.105).

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The Ethernet frame is sent to the switch.

The switch receives the frame and extracts the ARP query.

The switch checks its ARP table and finds the target IP address (192.168.1.1) and the target MAC address (08:00:27:00:00:00).

The switch places the target MAC address in the ARP query's response.

Bob's laptop receives the ARP query's response and extracts the target MAC address (08:00:27:00:00:00).

Bob's laptop places the target MAC address in the Ethernet frame.

The Ethernet frame is sent to the switch.

The switch receives the frame and extracts the HTTP request.

The switch forwards the HTTP request to the default gateway router.

The default gateway router receives the frame and extracts the HTTP request.

The default gateway router forwards the HTTP request to the destination IP address (64.233.169.105).

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Figure 5.37

