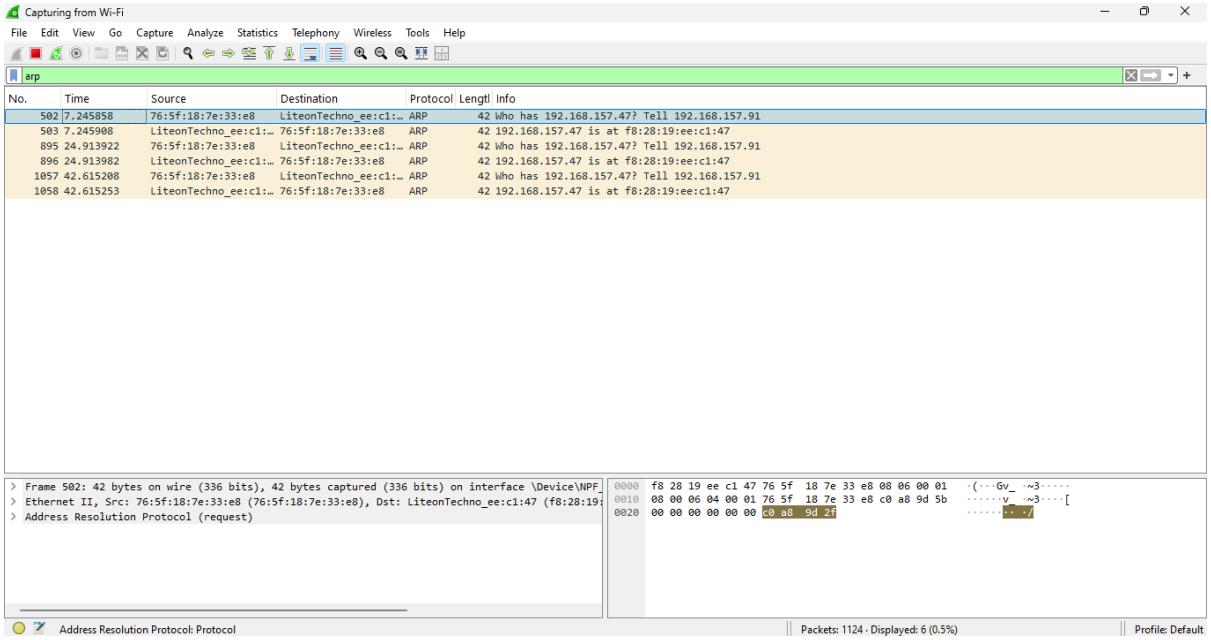
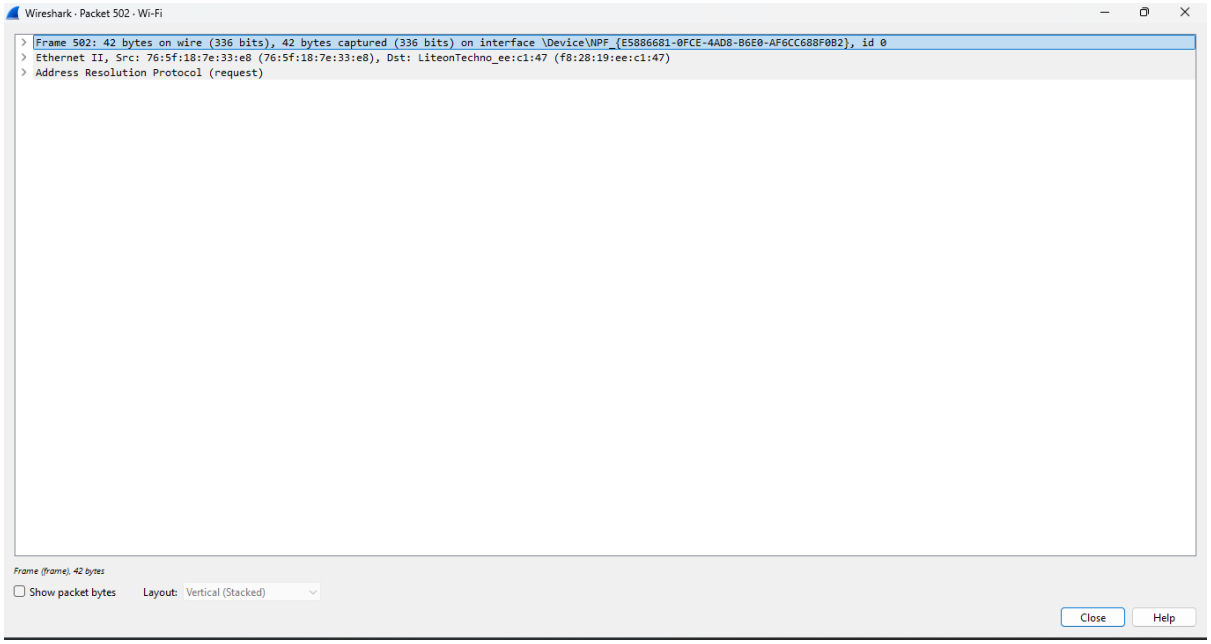
Q1) Capture and analyze ARP packets using Wireshark. Inspect the ARP request and reply frames when your device attempts to find the router's MAC address.

Discuss the importance of ARP in packet forwarding.





Inspection of ARP Request and Reply Frames

Captured ARP Request Frame Details:

Field	Value	Explanation
Source MAC	`76:5f:18:7e:33:e8`	The device at this MAC address is requesting the MAC of a specific IP.
Source IP	`192.168.157.91`	The sender wants to know the MAC address of `192.168.157.47`.
Destination MAC	`FF:FF:FF:FF:FF:FF`	ARP requests are **broadcast** to all devices on the LAN.
Target IP	`192.168.157.47`	The sender is looking for the MAC address of this IP.
Target MAC	`00:00:00:00:00:00`	Unknown at this stage, as the sender does not know it yet.
Message	**"Who has 192.168.157.47? Tell 192.168.157.91"**	The sender is asking which device owns this IP.

ARP Reply Frame Details:

Field	Value	Explanation
Source MAC	`LiteonTechno_ee:c1:47`	This is the MAC of `192.168.157.47`, responding to the request.
Source IP	`192.168.157.47`	Confirms ownership of this IP address.
Destination MAC	`76:5f:18:7e:33:e8`	Reply is unicast back to the requesting device.
Destination IP	`192.168.157.91`	The IP of the device that originally made the ARP request.
Message	**"192.168.157.47 is at LiteonTechno_ee:c1:47"**	Confirms its MAC address to the requestor.

Importance of ARP in Packet Forwarding

The **Address Resolution Protocol (ARP)** is crucial in packet forwarding as it enables communication between devices on a local network by resolving **IP addresses to MAC addresses**. Since network communication requires both **logical addressing (IP) and physical addressing (MAC)**, ARP acts as a bridge between these two layers.

1. MAC Address Resolution for Local Delivery

When a device wants to send a packet to another device within the same subnet, it requires the destination's MAC address. If the MAC address is unknown, the sender uses **ARP Request** to find it. The destination device responds with an **ARP Reply**, allowing packet delivery.

2. Enabling Router Communication

In inter-network communication, a device must forward packets to a **default gateway (router)** if the destination is outside its subnet. ARP helps resolve the **router's MAC address**, allowing packets to be forwarded correctly.

3. Caching for Efficiency

To reduce network overhead, ARP stores resolved addresses in an **ARP cache**. This prevents frequent ARP requests, speeding up communication and reducing congestion.

4. Handling Broadcast and Unicast Traffic

ARP requests use **broadcasts** (sent to all devices in the subnet), while ARP replies use **unicast** (sent only to the requester). This mechanism ensures that address resolution is efficient and does not overload the network.

5. Support for Dynamic Network Changes

In dynamic environments where IP-to-MAC mappings change (e.g., due to DHCP), ARP ensures that devices always have up-to-date MAC addresses, preventing packet forwarding failures.

Without ARP, devices would be unable to determine **MAC addresses** from IP addresses, causing packet delivery failures. By resolving addresses efficiently, ARP ensures seamless communication within a subnet and enables proper packet forwarding through routers.