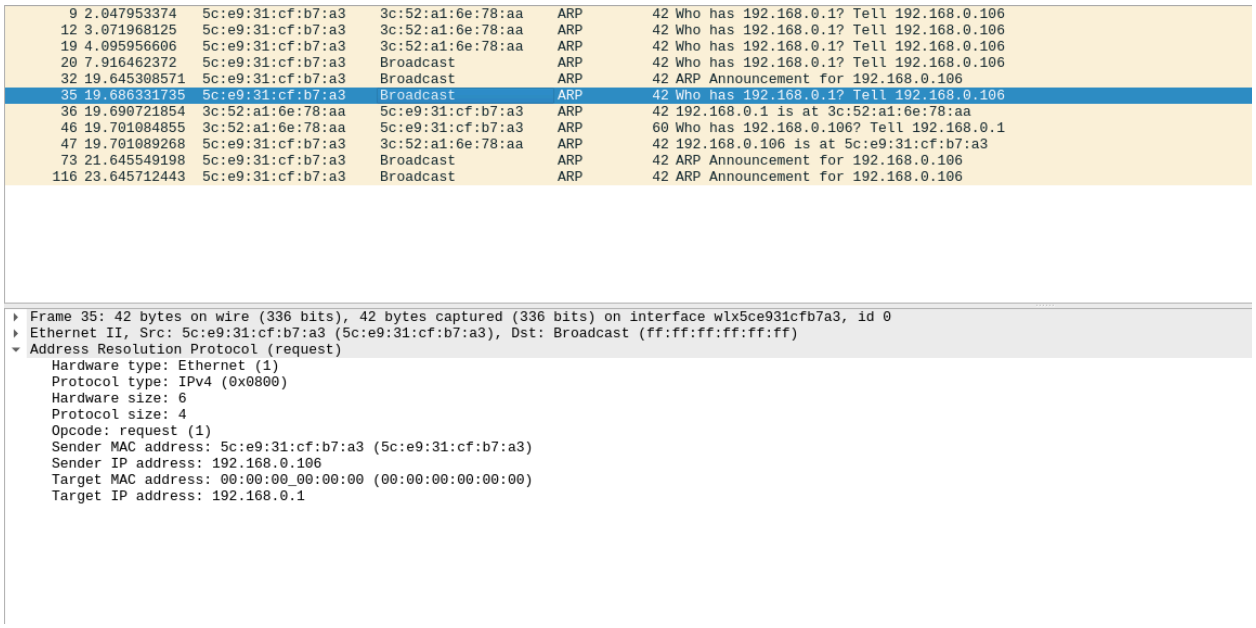
Q1) ARP packets from host device to router to get the MAC address of the router

The following packets were taken right after reconnecting to the home network after forgetting the connection.

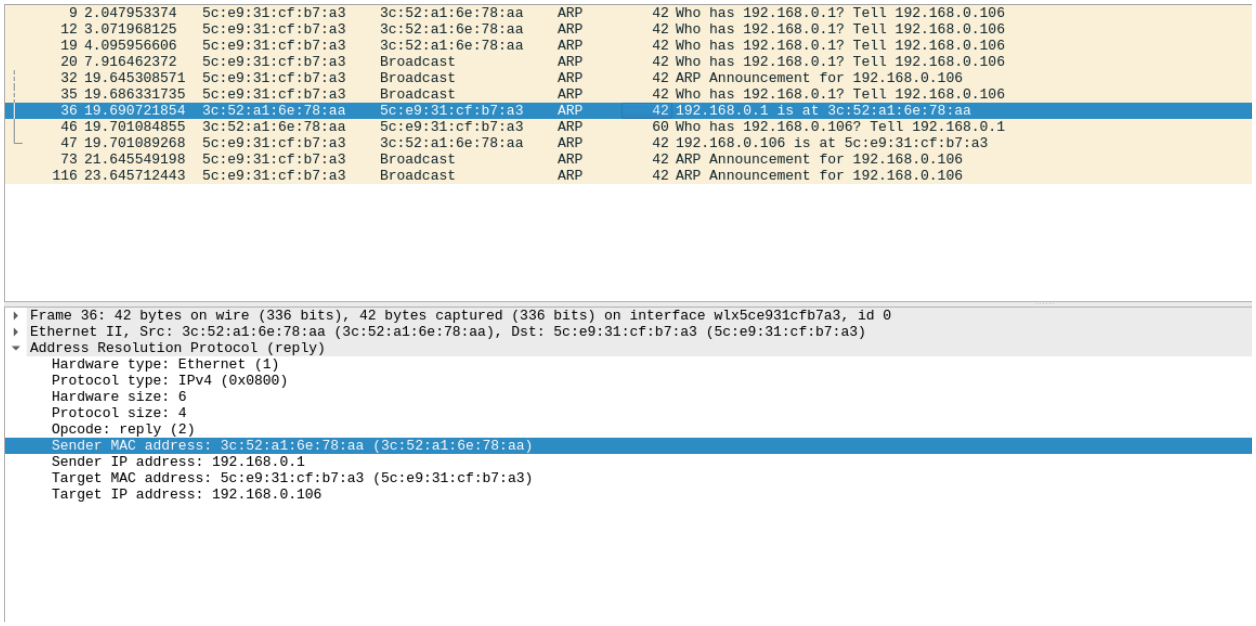


9	2.047953374	5c:e9:31:cf:b7:a3	3c:52:a1:6e:78:aa	ARP	42	Who has 192.168.0.1? Tell 192.168.0.106
12	3.071968125	5c:e9:31:cf:b7:a3	3c:52:a1:6e:78:aa	ARP	42	Who has 192.168.0.1? Tell 192.168.0.106
19	4.095956606	5c:e9:31:cf:b7:a3	3c:52:a1:6e:78:aa	ARP	42	Who has 192.168.0.1? Tell 192.168.0.106
20	7.916462372	5c:e9:31:cf:b7:a3	Broadcast	ARP	42	Who has 192.168.0.1? Tell 192.168.0.106
32	19.645308571	5c:e9:31:cf:b7:a3	Broadcast	ARP	42	ARP Announcement for 192.168.0.106
35	19.686331735	5c:e9:31:cf:b7:a3	Broadcast	ARP	42	Who has 192.168.0.1? Tell 192.168.0.106
36	19.690721854	3c:52:a1:6e:78:aa	5c:e9:31:cf:b7:a3	ARP	42	192.168.0.1 is at 3c:52:a1:6e:78:aa
46	19.701084855	3c:52:a1:6e:78:aa	5c:e9:31:cf:b7:a3	ARP	60	Who has 192.168.0.106? Tell 192.168.0.1
47	19.701089268	5c:e9:31:cf:b7:a3	3c:52:a1:6e:78:aa	ARP	42	192.168.0.106 is at 5c:e9:31:cf:b7:a3
73	21.645549198	5c:e9:31:cf:b7:a3	Broadcast	ARP	42	ARP Announcement for 192.168.0.106
116	23.645712443	5c:e9:31:cf:b7:a3	Broadcast	ARP	42	ARP Announcement for 192.168.0.106

```
▸ Frame 35: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface wlx5ce931cfb7a3, id 0
▸ Ethernet II, Src: 5c:e9:31:cf:b7:a3 (5c:e9:31:cf:b7:a3), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
▾ Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: 5c:e9:31:cf:b7:a3 (5c:e9:31:cf:b7:a3)
    Sender IP address: 192.168.0.106
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.0.1
```

The above highlighted packet is a BROADCAST ARP request from 192.168.0.106, requesting the MAC address of the router, 192.168.0.1.

From the ARP Request contents, we can see that the sender MAC address is 5c:e9:31:cf:b7:a3, while the Target MAC Address is 0. This shows that the system is asking for the MAC Address of the router.



```
     9 2.047953374   5c:e9:31:cf:b7:a3    3c:52:a1:6e:78:aa    ARP         42 Who has 192.168.0.1? Tell 192.168.0.106
    12 3.071968125   5c:e9:31:cf:b7:a3    3c:52:a1:6e:78:aa    ARP         42 Who has 192.168.0.1? Tell 192.168.0.106
    19 4.095956606   5c:e9:31:cf:b7:a3    3c:52:a1:6e:78:aa    ARP         42 Who has 192.168.0.1? Tell 192.168.0.106
    20 7.916462372   5c:e9:31:cf:b7:a3    Broadcast            ARP         42 Who has 192.168.0.1? Tell 192.168.0.106
    32 19.645308571  5c:e9:31:cf:b7:a3    Broadcast            ARP         42 ARP Announcement for 192.168.0.106
    35 19.686331735  5c:e9:31:cf:b7:a3    Broadcast            ARP         42 Who has 192.168.0.1? Tell 192.168.0.106
    36 19.690721854  3c:52:a1:6e:78:aa    5c:e9:31:cf:b7:a3    ARP         42 192.168.0.1 is at 3c:52:a1:6e:78:aa
    46 19.701084855  3c:52:a1:6e:78:aa    5c:e9:31:cf:b7:a3    ARP         60 Who has 192.168.0.106? Tell 192.168.0.1
    47 19.701089268  5c:e9:31:cf:b7:a3    3c:52:a1:6e:78:aa    ARP         42 192.168.0.106 is at 5c:e9:31:cf:b7:a3
    73 21.645549198  5c:e9:31:cf:b7:a3    Broadcast            ARP         42 ARP Announcement for 192.168.0.106
   116 23.645712443  5c:e9:31:cf:b7:a3    Broadcast            ARP         42 ARP Announcement for 192.168.0.106

▸ Frame 36: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface wlx5ce931cfb7a3, id 0
▸ Ethernet II, Src: 3c:52:a1:6e:78:aa (3c:52:a1:6e:78:aa), Dst: 5c:e9:31:cf:b7:a3 (5c:e9:31:cf:b7:a3)
▾ Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: 3c:52:a1:6e:78:aa (3c:52:a1:6e:78:aa)
    Sender IP address: 192.168.0.1
    Target MAC address: 5c:e9:31:cf:b7:a3 (5c:e9:31:cf:b7:a3)
    Target IP address: 192.168.0.106
```

The above highlighted packet is of the ARP reply packet from the router, giving the MAC addres of the router 3c:52:a1:6e:78:aa, to the system. NOTE that the packet reply is UNICAST, as the router is directly sending the packet to the system MAC address.

The importance of ARP in packet forwarding is so that devices can know the MAC address of other devices, and by knowing so, can send a UNICAST message directly to the desired destination, instead of a BROADCAST message. It also helps devices to get the MAC address of a system when only its IP Address is known.