ARP (Address Resolution Protocol):

- ARP is a term which is stand for Address Resolution Protocol.
- ARP translate 32-bit addresses to 48-bit addresses and vice-versa.
- ARP translate Internet Protocol address to Media Access Control address.
- Address Resolution Protocol translate Layer 3 address to Layer 2 address.
- Network Layer protocol used to convert an IP address into a physical address.
- ARP is used to convert the IP address into its physical correspondence called MAC.
- Address Resolution Protocol request is broadcast & ARP response is a Unicast.
- The protocol that determines MAC address from the IP address is called ARP.
- Address Resolution Protocol (ARP) has always been a Layer 2 protocol not Layer 3.
- Address Resolution Protocol default ARP aging time is 4 hours or equal 240 mints.
- By default, entry will be removed from ARP table if it wasn't used in 240 minutes.
- Just keep in mind the cisco Switch hold the CAM table entries only for 5 minutes.
- If see "0" that means having traffic in that interface just less than a minute ago.
- Permanent ARP entry does not have any timer associated with it is show as "-".
- Address Resolution Protocol only works between devices in the same IP Subnet.

```
R1#show ip arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  1.1.1.1                -   aaaa.aaaa.1111  ARPA   FastEthernet0/0
Internet  1.1.1.2                0   aaaa.aaaa.2222  ARPA   FastEthernet0/0
```

```
BO#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  1.1.1.1                -   ca02.18fc.0008  ARPA
Internet  1.1.1.2                -   ca01.1ffc.0008  ARPA   FastEthernet0/0
Internet  192.168.1.1          122   0a67.08e8.b93d  ARPA   FastEthernet0/1
Internet  192.168.1.254          -   ca01.1ffc.0006  ARPA   FastEthernet0/1
```

Protocol – The protocol type, almost always Internet.

Address – The IP address associated with the MAC address, The IP address of R1.

Age – By default, entry remove from ARP table if it wasn't used in 240 minutes.

0 in this column means that the entry was last used 0 minutes ago.

Each time an entry is used, the age will be reset back to zero.

Hardware – The MAC address of the host with the corresponding IP address.

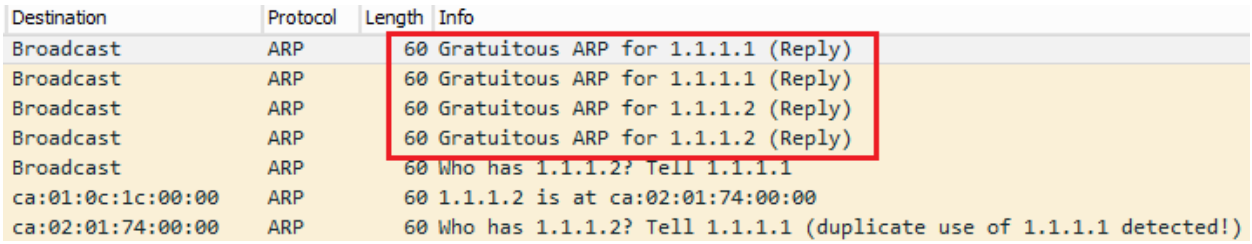
Type – The type of hardware address. For Ethernet, this value will always be ARPA.

Interface – The interface on R1 on which the corresponding host is connected.

R1(config)# ARP 1.1.1.1 ca02.18fc.0008 ARPA	C:\Users\aali.c>arp -a
R1# show ip arp	C:\Users\aali.c>arp -d
R1# clear arp-cache	R1=debug arp

Gratuitous ARP:

- Gratuitous Address Resolution Protocol is used in advance network scenarios.
- It is something performed by computer or network devices while booting up.
- When device booted up first time, it automatically broadcast its MAC address.
- After Gratuitous ARP MAC address of the computer is known to every device.
- And allow DHCP servers to know where to send the IP address if requested.
- Gratuitous ARP could mean both Gratuitous ARP request & Gratuitous ARP reply.
- Gratuitous ARP is ARP-Reply that was not prompted by an ARP-Request.
- Hosts on network send out a Gratuitous ARP when they are initializing their IP stack.
- GARP is an ARP request for their own IP address & is used to check for duplicate IP.
- Gratuitous Address Resolution Protocol is useful to detect IP conflict.
- If there is a duplicate address, then the stack does not complete initialization.
- GARP is also used to update ARP mapping table & Switch port MAC address table.
- Gratuitous ARP update the ARP mappings of other devices on the network.
- There are many use cases for Gratuitous ARP (Address Resolution Protocol).
- HSRP (and many other redundancy protocols) use Gratuitous ARP frequently.



Destination	Protocol	Length	Info
Broadcast	ARP	60	Gratuitous ARP for 1.1.1.1 (Reply)
Broadcast	ARP	60	Gratuitous ARP for 1.1.1.1 (Reply)
Broadcast	ARP	60	Gratuitous ARP for 1.1.1.2 (Reply)
Broadcast	ARP	60	Gratuitous ARP for 1.1.1.2 (Reply)
Broadcast	ARP	60	Who has 1.1.1.2? Tell 1.1.1.1
ca:01:0c:1c:00:00	ARP	60	1.1.1.2 is at ca:02:01:74:00:00
ca:02:01:74:00:00	ARP	60	Who has 1.1.1.2? Tell 1.1.1.1 (duplicate use of 1.1.1.1 detected!)

Please google them & understand the difference.

1-ARP

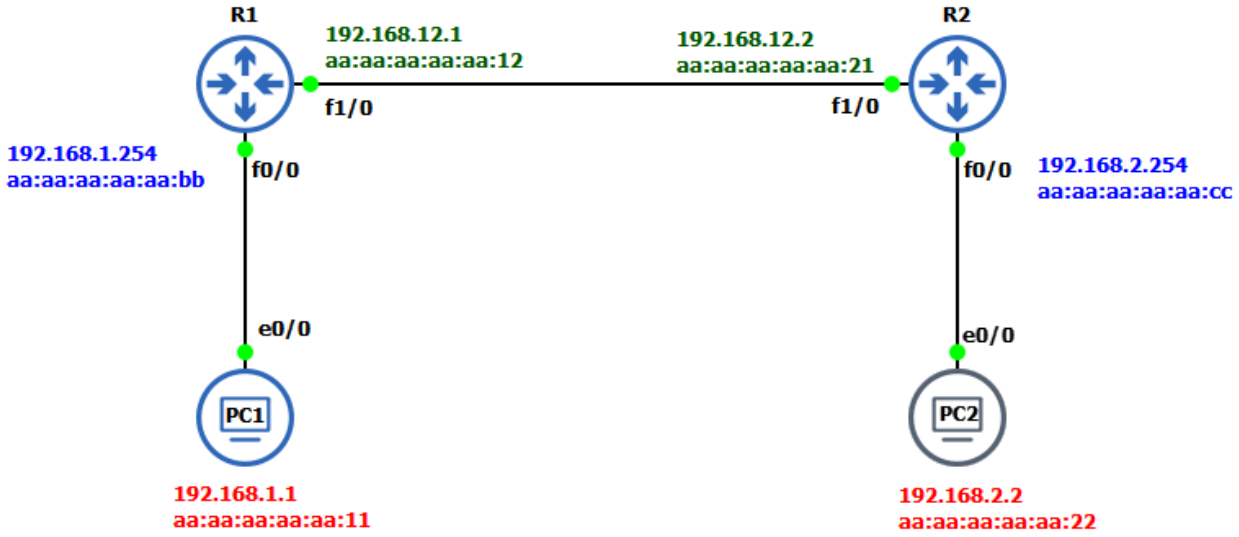
2- Proxy ARP

3- Gratuitous ARP

4- Reverse Address Resolution Protocol (RARP)

5- Inverse Address Resolution Protocol (InARP)

IP Routing:



The PC1 host has a Simple Steps to Make.

- Is the destination on the local subnet.
- Check ARP table for destination IP address, if empty, send an ARP request.
- Is the destination on a remote subnet.
- Check ARP table for default gateway IP address, if empty, send an ARP request.

Source: aaaa:aaaa:aa11	Destination: aaaa:aaaa:aabb	Source: 192.168.1.1	Destination: 192.168.2.2

The Router has to Perform a Number of Tasks:

- When it receives an Ethernet frame, check if the FCS is correct. If not, drop the frame.
- Check if the destination address of the frame is:
- Destined to our MAC address.
- Destined to a broadcast address of the subnet our interface is in.
- Destined to a multicast address that we listen to.
- De-encapsulate the IP packet from the frame, discard the Ethernet frame.
- Look for a match in the routing table for the destination IP address.
- Figure out what the Outgoing interface and optionally, the next hop IP address is.
- Decrease the TTL (Time to Live) field in the IP header, recalculate the header checksum.
- Encapsulate the IP packet in a new Ethernet frame.
- Check the ARP table for the destination IP address or next hop IP address.
- Transmit the frame.

Source: aaaa:aaaa:aa12	Destination: aaaa:aaaa:aa21	Source: 192.168.1.1	Destination: 192.168.2.2