ARP & RARP

Host & Routers recognized by logical address at N/w level.
Logical address named called so because usually implemented in software. Jurisdiction is universal.

Physical Address is local address. Jurisdiction is Local.
" " usually implemented in hardware.

Packet delievery to host or router requires 2 levels of addressing: logical & physical.

Mapping need from logical to physical & vice versa.

Static Mapping creating a table that associates logical address with physical address. Table present on each m/c of N/w.

Limitations: 1. M/c's NIC could be changed, leading to new physical addr.
2. In some LANs, such as LocalTalk, physical address changes every time the computer is turned on.

To implement these changes static table must be updated periodically, which could affect N/w performance.

Dynamic Mapping each time a m/c knows one of the 2 address (logical or physical), it can use a protocol to find other one.

Two protocols for dynamic mapping are:
(a) Address Resolution Protocol (ARP)
(b) Reverse " " " (RARP)

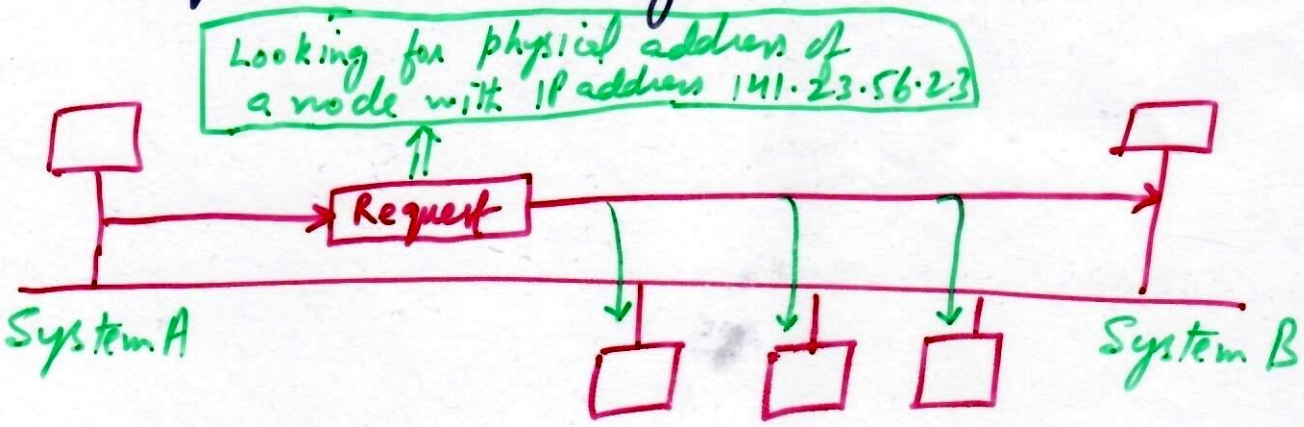
ARP maps logical address ⟶ physical address
RARP " physical " ⟶ logical "

ARP & RARP use unicast & broadcast physical address.

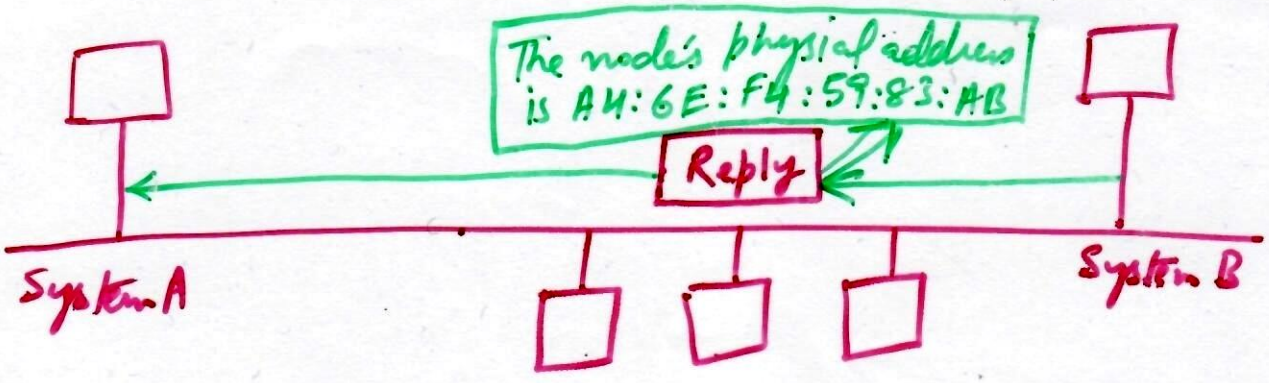
ARP Anytime host or router has IP datagram to send to another host or router, it has IP address of receiver.

But IP datagram must be encapsulated in a frame to pass thro' the physical N/w. ∴ sender needs physical address of receiver.

Anytime a host or router needs to find physical address of another host or router on its N/w, it sends ARP query packet. Packet has physical & IP address of sender & IP address of receiver. Query is broadcast over the N/w.



a. ARP request is broadcast



b. ARP reply is unicast

Only intended recepient recognizes its IP address & sends back ARP response packet containing recepient's IP & physical address. Packet unicast directly to the inquirer using physical address received in query packet.

PACKET FORMAT (ARP)

HARDWARE TYPE		PROTOCOL TYPE
HARDWARE LENGTH	PROTOCOL LENGTH	OPERATION Request 1, Reply 2
SENDER HARDWARE ADDRESS (For e.g 6 bytes for Ethernet)		
SENDER PROTOCOL ADDRESS (For e.g 4 bytes for IP)		
TARGET HARDWARE ADDRESS (For e.g 6 bytes for Ethernet) (It is not filled in a request)		
TARGET PROTOCOL ADDRESS (For e.g 4 bytes for IP)		

Hardware Type 16 bit field defining type of N/W on which ARP is running. Each LAN has been assigned an integer based on its type. For e.g Ethernet is given type 1. ARP can be used on any physical N/w.

Protocol Type 16 bit field. For e.g for IPv4 protocol is 0800_{16}. ARP can be used with any higher level protocol.

Hardware Length 8 bit field defining length of physical address in bytes. For e.g for Ethernet the value is 6.

Protocol Length 8 bit field. Gives length of logical address in bytes. For e.g for IPv4 protocol the value is 4

Operation 16 bit field defining type of packet. Two packet types are defined: ARP request (1), ARP reply (2).

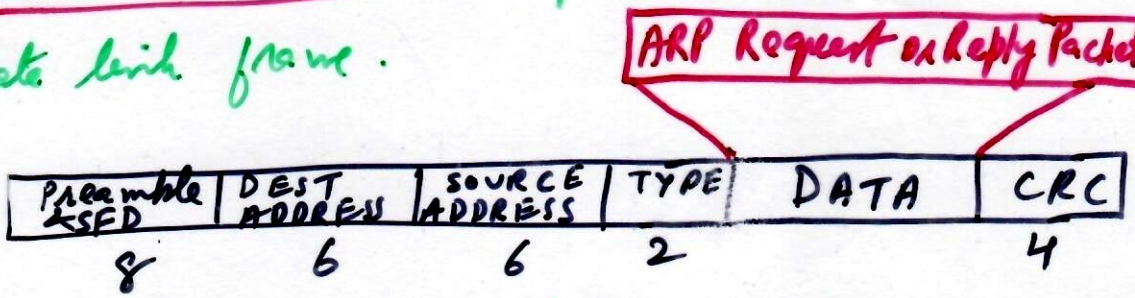
Sender hardware Address: variable length field defining physical address of sender. For e.g for Ethernet it is 6 bytes long.

Sender protocol address: variable length field defining logical address of sender. For IP protocol, field is 4 bytes long.

Target Hardware Address variable length field defining physical address of target. For e.g. for Ethernet this field is 6 bytes long. For an ARP request message, this field is all 0s because the sender doesn't know the physical address of the target.

Target Protocol Address: variable length field defining the logical address of target.

ENCAPSULATION ARP packet is encapsulated directly into data link frame.



Type field → indicates that data carried by frame is an ARP packet.

4 Cases in which ARP can be used

1. A host has a packet to send to another host on same N/W.
2. Host wants to send packet to another host on another N/W. It must be delivered to a router first.
3. A router receives a packet to be sent to a host on another N/W
4. A router receives a packet to be sent to a host on the same N/W.

RARP (Reverse Address Resolution Protocol)

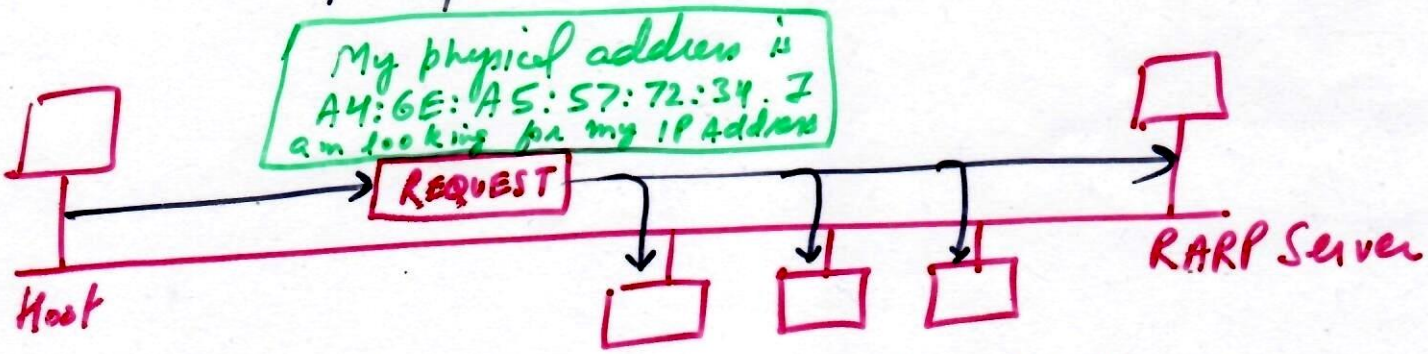
Finds logical address for a m/c that only knows its physical address. To create an IP datagram, a host or a router needs to know its own IP address or addresses. The IP address of a m/c is usually read from its configuration file stored on a disk file.

However a diskless m/c is usually booted from ROM, which has minimum booting info. ROM is installed by manufacturer It can't include IP address ∴ the IP addresses on a N/W are assigned by N/W Administrator.

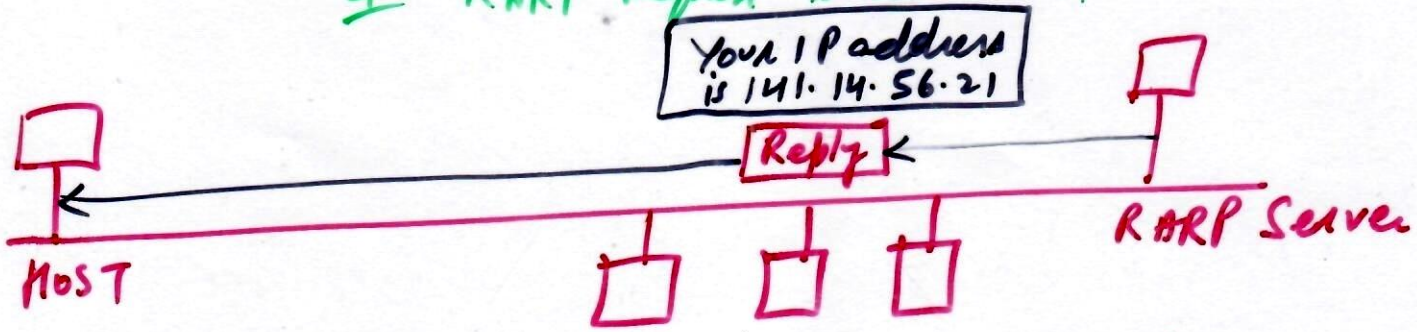
M/c gets its physical address (by reading its NIC) which is unique locally. Then physical address can be used to get logical address using RARP protocol.

RARP request is created & broadcast on the local N/W. Another m/c on the local N/W that knows all the IP addresses will respond with RARP reply.

Requesting M/c → RARP client program
Responding M/c → RARP Server "



a. RARP Request is broadcast



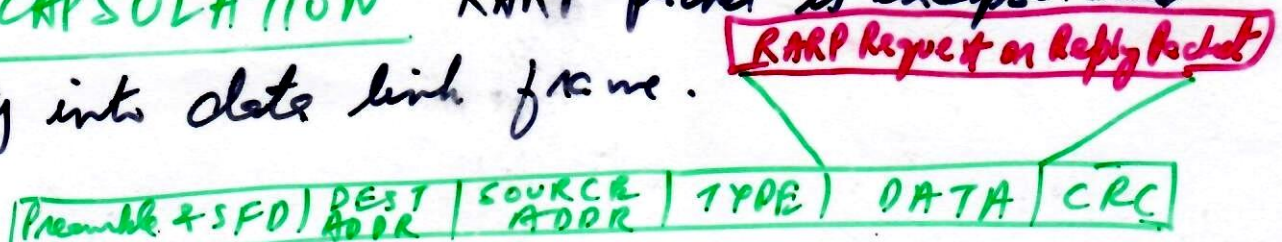
b. RARP reply is unicast

In above fig diskless host on left is booted. To get its IP address, request is broadcast. Packet recd by hosts or routers on physical N/W. Only RARP server on the right responds with answer, containing IP address of requester.

PACKET FORMAT Format of RARP packet is exactly same as ARP packet except values of Operation field is either 3 (RARP request) or 4 (RARP reply).

HARDWARE TYPE		PROTOCOL TYPE
HARDWARE LENGTH	PROTOCOL LENGTH	OPERATION REQUEST 3, REPLY 4
SENDER HARDWARE ADDRESS		
SENDER PROTOCOL ADDRESS (It is not filled for Request)		
TARGET HARDWARE ADDRESS (Not filled for request)		
TARGET PROTOCOL ADDRESS (Not filled for request)		

ENCAPSULATION RARP packet is encapsulated directly into data link frame.



RARP Server provides mapping from physical to logical address. Mapping stored on disk file. RARP server is implemented at data link layer. To access a file, RARP server needs the help of the underlying operating system such as UNIX. Administrator provides more than one server, in case one RARP server goes down. If all servers are running, several RARP replies will be travelling on the N/W at the same time, & that may create heavy traffic.

Alternative Solutions to RARP Diskless computer needs subnet mask, IP address of router etc. RARP doesn't provide this extra info. New protocols have been developed to provide this info. DHCP & BOOTP can be used instead of RARP