

# **Chapter 15: Address Resolution Protocol**

Raj Jain

The Ohio State University

Columbus, OH 43210

Jain@CIS.Ohio-State.Edu

<http://www.cis.ohio-state.edu/~jain/>



- ❑ Address resolution problem
- ❑ Address resolution techniques
- ❑ ARP protocol
- ❑ Proxy ARP, Reverse ARP, and Inverse ARP

# Address Resolution Protocol (ARP)



- ❑ Problem: Given an IP address find the MAC address
- ❑ Solution 1. Table Lookup:  
Searching or indexing to get MAC addresses

<b>IP Address</b>	<b>MAC Address</b>
197.15.3.1	0A:4B:00:00:07:08
197.15.3.2	0B:4B:00:00:07:00
197.15.3.3	0A:5B:00:01:01:03
197.15.3.4	04:06:07:08:09:10
197.15.3.5	06:07:09:08:03:01

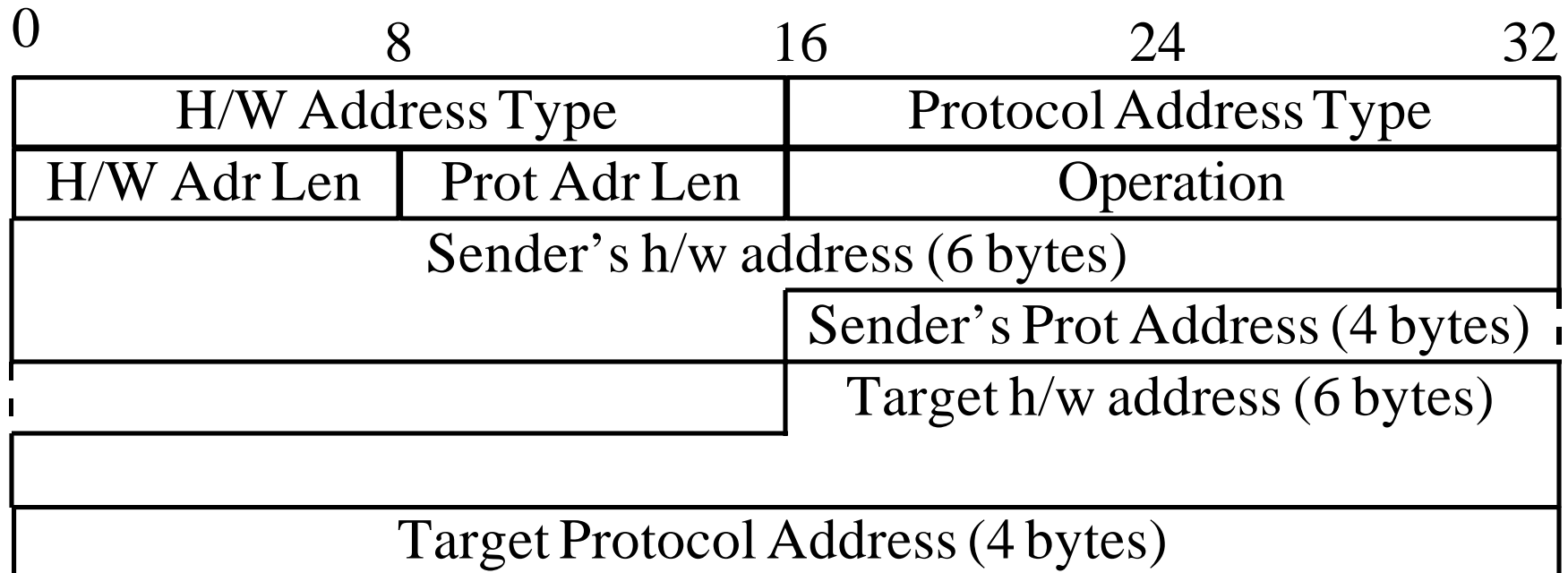
## ARP (Cont)

- ❑ 2. Closed-Form Computation: Using local IEEE 802 addresses, e.g., Hardware Address  
= (IP\_address & 0xFF)!40:00:00:00:00:00
- ❑ 3. Message Exchange: ARP
  - ❑ The host broadcasts a request:  
“What is the MAC address of 127.123.115.08?”
  - ❑ The host whose IP address is 127.123.115.08 replies back: “The MAC address for 127.123.115.08 is 8A-5F-3C-23-45-56<sub>16</sub>”
- ❑ All three methods are allowed in TCP/IP networks.

# Comparison of ARP Techniques

Issue	Method
Address change does not affect other hosts	Message, Computation
Protocol address independent of h/w address	Table , Message
H/w address independent of protocol address	Table, Message
Uses broadcast	Message
Adds traffic to a network	Message
Resolves with min delay	Table, Computation
Easy to implement	Computation, Table, Message

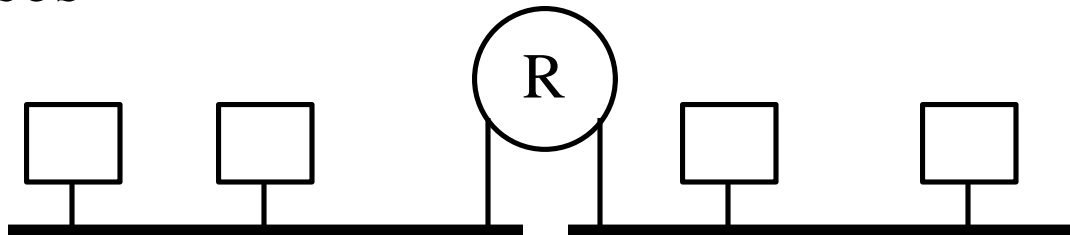
# ARP Message Format



- ❑ H/W Address type:
- ❑ Protocol Address type: 0x0800 = IP
- ❑ Operation: 1=Request, 2=Response
- ❑ ARP messages are sent directly to MAC layer

# ARP Processing

- ❑ ARP responses are cached.
- ❑ Entry replaced when
  - ❑ Cache table fills up (oldest removed)
  - ❑ After some time, e.g., 20 minutes
- ❑ Sender's address binding is stored in the cache of the target
- ❑ Proxy ARP: A router may act as a proxy for many IP addresses

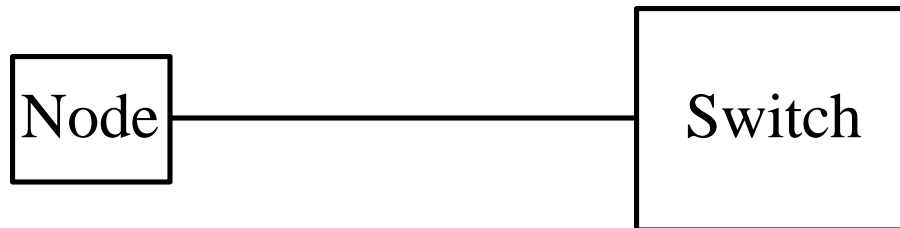


## Reverse ARP (RARP)

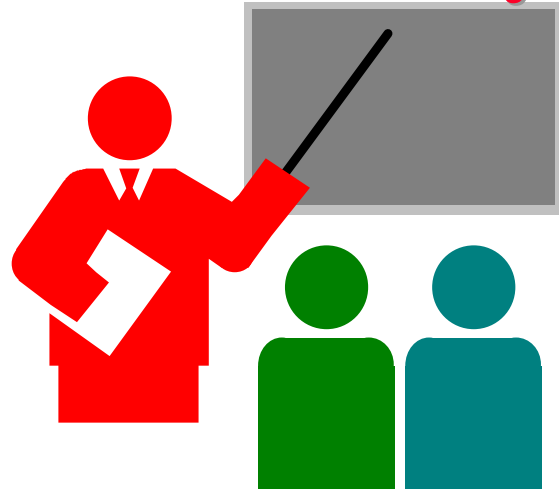
- ❑ What is the IP address of a given hardware address?
- ❑ Used by diskless systems to find their own IP address.
- ❑ Need RARP server to respond.
- ❑ Ref: RFC 903 and Comer's "Internetworking with TCP/IP, Vol 1, 3rd Ed

# Inverse ARP

- ❑ Used on point to point links
- ❑ Find IP address of the host on the other end
- ❑ Used in frame relay and ATM
- ❑ Ref: RFC 1293



# Summary



- ❑ ARP allows converting IP address to MAC addresses
- ❑ Proxy ARP, RARP, Inverse ARP

# Homework

- ❑ Read Chapter 15, RFC 826
- ❑ Submit answers to 15.6

## References

[RFC1931] D. Brownell, "Dynamic RARP Extensions and Administrative Support for Automatic Network Address Allocation", 04/03/1996, 11 pages.

[RFC1868] G. Malkin, "ARP Extension - UNARP", 11/06/1995, 4 pages.

[RFC1735] J. Heinanen, R. Govindan, "NBMA Address Resolution Protocol (NARP)", 12/15/1994, 11 pages.

[RFC1577] M. Laubach, "Classical IP and ARP over ATM", 01/20/1994, 17 pages.

- ❑ [RFC1433] J. Garrett, J. Hagan, J. Wong, "Directed ARP", 03/05/1993, 17 pages.
- ❑ [RFC1390] D. Katz, "Transmission of IP and ARP over FDDI Networks", 01/05/1993, 12 pages. (STD 36)
- ❑ [RFC1374] J. Renwick, A. Nicholson, "IP and ARP on HIPPI", 11/02/1992, 43 pages.
- ❑ [RFC1329] P. Kuehn, "Thoughts on Address Resolution for Dual MAC FDDI Networks", 05/19/1992, 28 pages.

- ❑ [RFC1293] T. Bradley, C. Brown, "Inverse Address Resolution Protocol", 01/17/1992, 6 pages.
- ❑ [RFC1201] H D. Provan, "Transmitting IP Traffic over ARCNET Networks", 02/01/1991, 7 pages.
- ❑ [RFC1029] G. Parr, "More fault tolerant approach to address resolution for a Multi-LAN system of Ethernets", 05/01/1988, 17 pages.
- ❑ [RFC1027] S. Carl-Mitchell, J. Quarterman, "Using ARP to implement transparent subnet gateways", 10/01/1987, 8 pages.

- ❑ [RFC0925] J. Postel, "Multi-LAN address resolution", 10/01/1984, 15 pages.
- ❑ [RFC0903] R. Finlayson, T. Mann, J. Mogul, M. Theimer, "Reverse Address Resolution Protocol", 06/01/1984, 4 pages.
- ❑ [RFC0826] D. Plummer, "Ethernet Address Resolution Protocol: Or converting network protocol addresses to 48.bit Ethernet address for transmission on Ethernet hardware", 11/01/1982, 10 pages.