TCP & Threads, Glue Protocols

11 January 2026
Lecture 11

Some slides adapted from Kurose and Ross

Topics for Today

- TCP and Threads
- Glue Protocols: ARP

Source:

  - ARP: PD 3.2.6

TCP and Threads

- We'll write the Sentence Server tool in class.

ARP - Address Resolution Protocol

Problem

- Need mapping between IP and link layer addresses.
- `10.0.10.10` → `ab:cd:ef:12:34:56`

Solution

- ARP
- Every host maintains IP–Link layer mapping table (cache)
- Timeout associated with cached info (15 min.)

Imagine a mail room

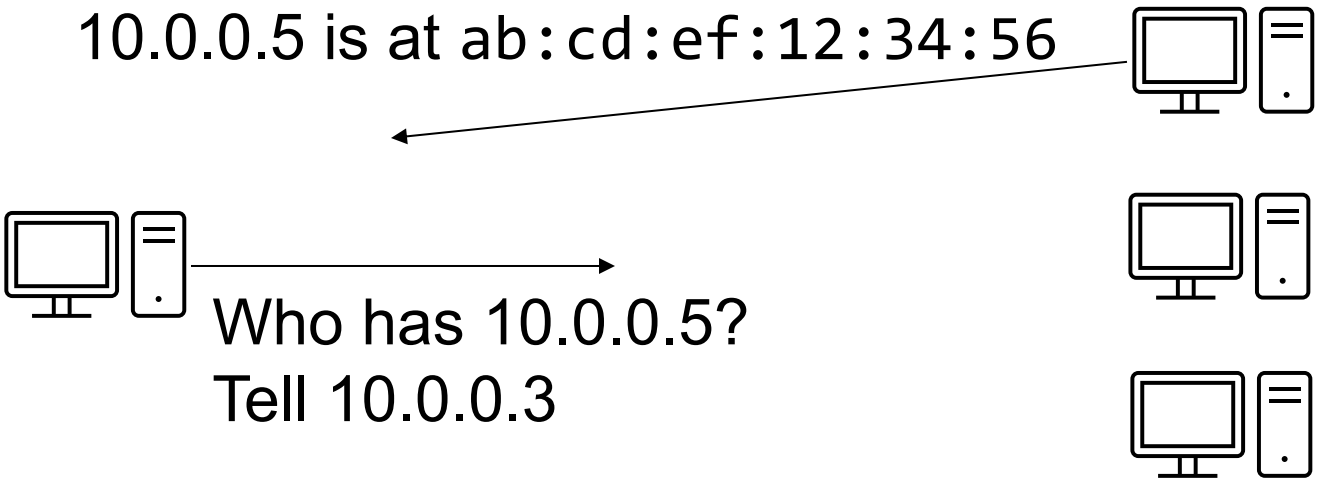
ARP - Address Resolution Protocol

Sender

- Broadcasts "Who is IP address X?"
- Broadcast message includes sender's IP & Link Layer address

Receivers

- Any host with sender in cache "refreshes" time-out
- Host with IP address X replies "IP X is Link Layer Y"
- Target host adds sender (if not already in cache)



ARP Sample Trace

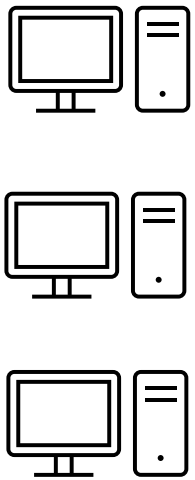
No.	Time	Source	Destination	Protocol	Length	Info
12896	272.707828000	QuantaCo_	Broadcast	ARP	60	Who has 10.0.0.5? Tell 0.0.0.0
12916	273.706199000	QuantaCo_	Broadcast	ARP	60	Gratuitous ARP for 10.0.0.5 (Request)
12956	277.144084000	QuantaCo_	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.5
12958	277.144101000	Dell_	QuantaCo_	ARP	42	10.0.0.3 is at 44:

```
⊞ Frame 12956: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
⊞ Ethernet II, Src: QuantaCo_         (60:              ), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
⊟ Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: QuantaCo_          (60:              )
    Sender IP address: 10.0.0.5 (10.0.0.5)
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 10.0.0.3 (10.0.0.3)
```

ARP - Address Resolution Protocol

- Gratuitous ARP: Check if someone else has your IP address

```
> Frame 2213: 90 bytes on wire (720 bits), 90 bytes captured (720 bits)
> Radiotap Header v0, Length 24
> 802.11 radio information
> IEEE 802.11 QoS Data, Flags: .......TC
> Logical-Link Control
v Address Resolution Protocol (ARP Announcement)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    [Is gratuitous: True]
    [Is announcement: True]
    Sender MAC address: Intel_d1:b6:4f (00:13:02:d1:b6:4f)
    Sender IP address: 192.168.1.109
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.1.109
```



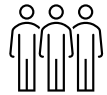
ARP - Address Resolution Protocol

- Gratuitous ARP: Check if someone else has your IP address
- Why?

Tell everyone your MAC address

Detect computers with identical IP addresses

- If there's an answer, there's a problem



Conclusion

- TCP and Threads
- Glue Protocols: ARP