Data Communication (CE14773)

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ARP (Address Resolution Protocol)

- Why need ARP in LAN?
  - When an Ethernet frames is sent from one host on a LAN to another, it is the 48-bit Ethernet address that determines for which interface the frame is destined.
  - Mapping between the two different forms of address
    - 32-bit IP address and whatever type of address the data link uses.
  - Provides a dynamic mapping from an IP address to the corresponding hardware address.

Demultiplexing

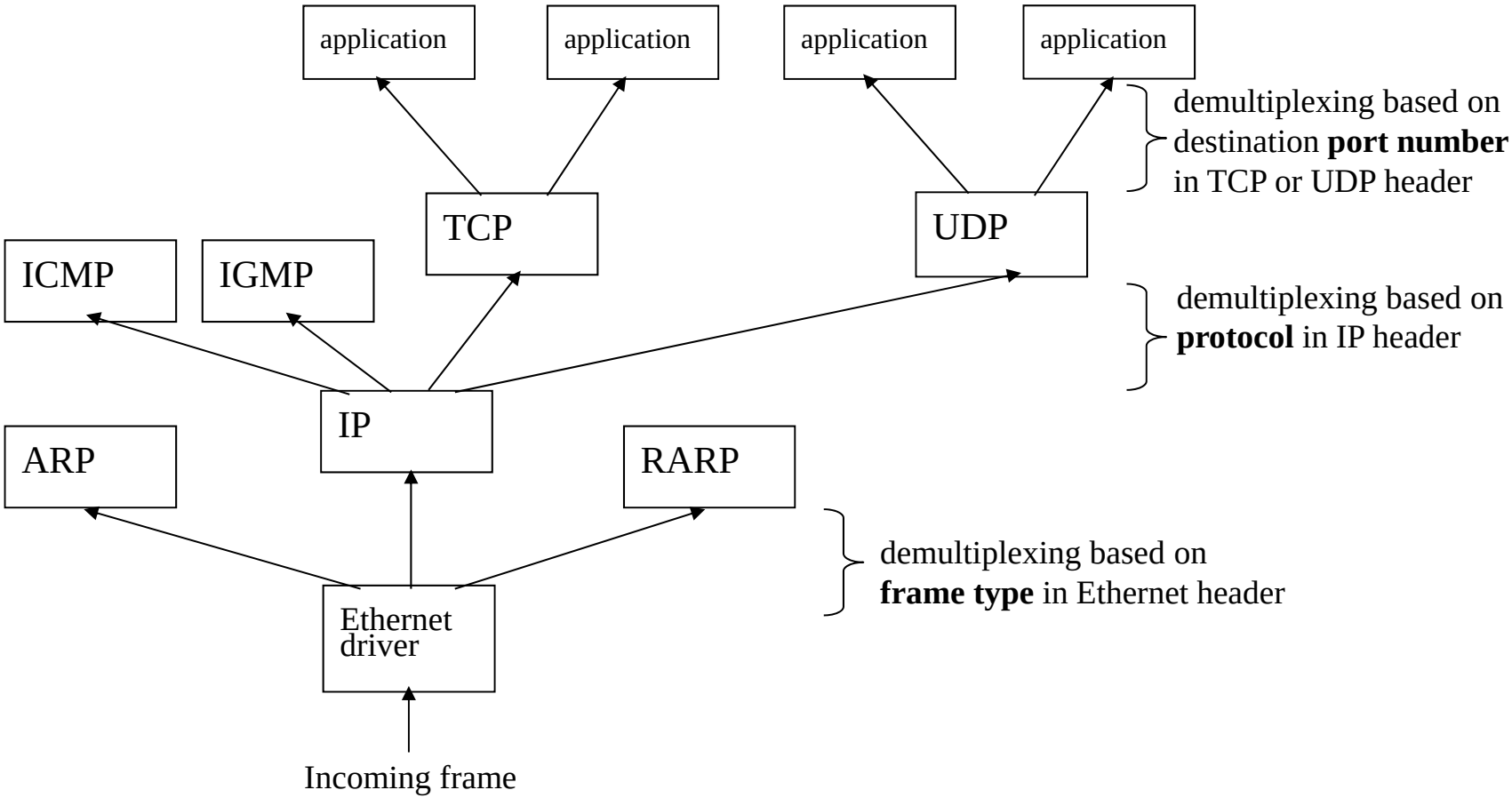
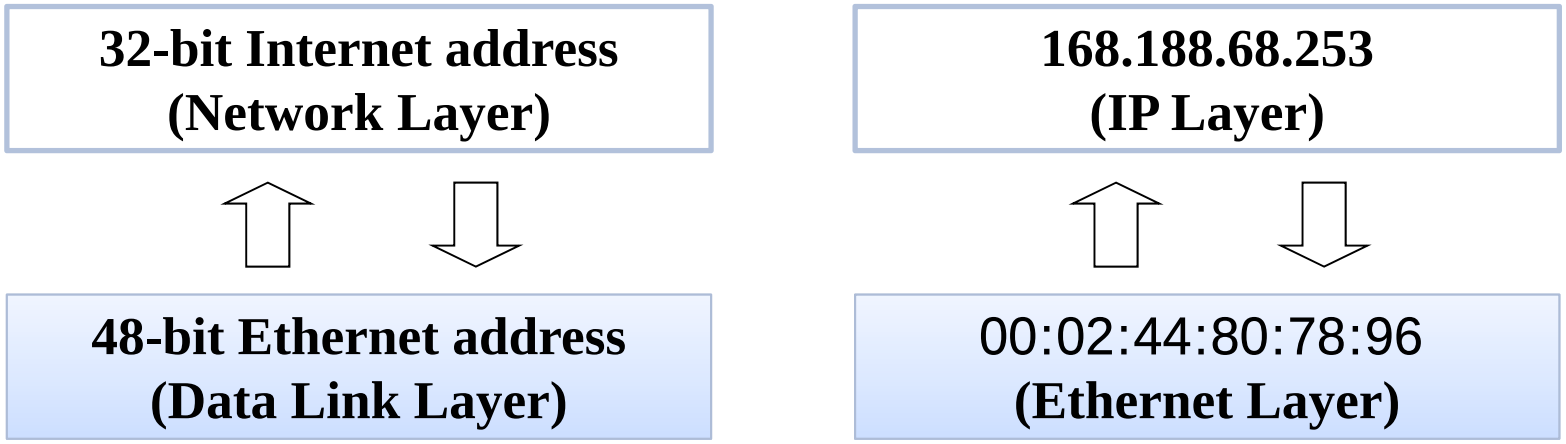


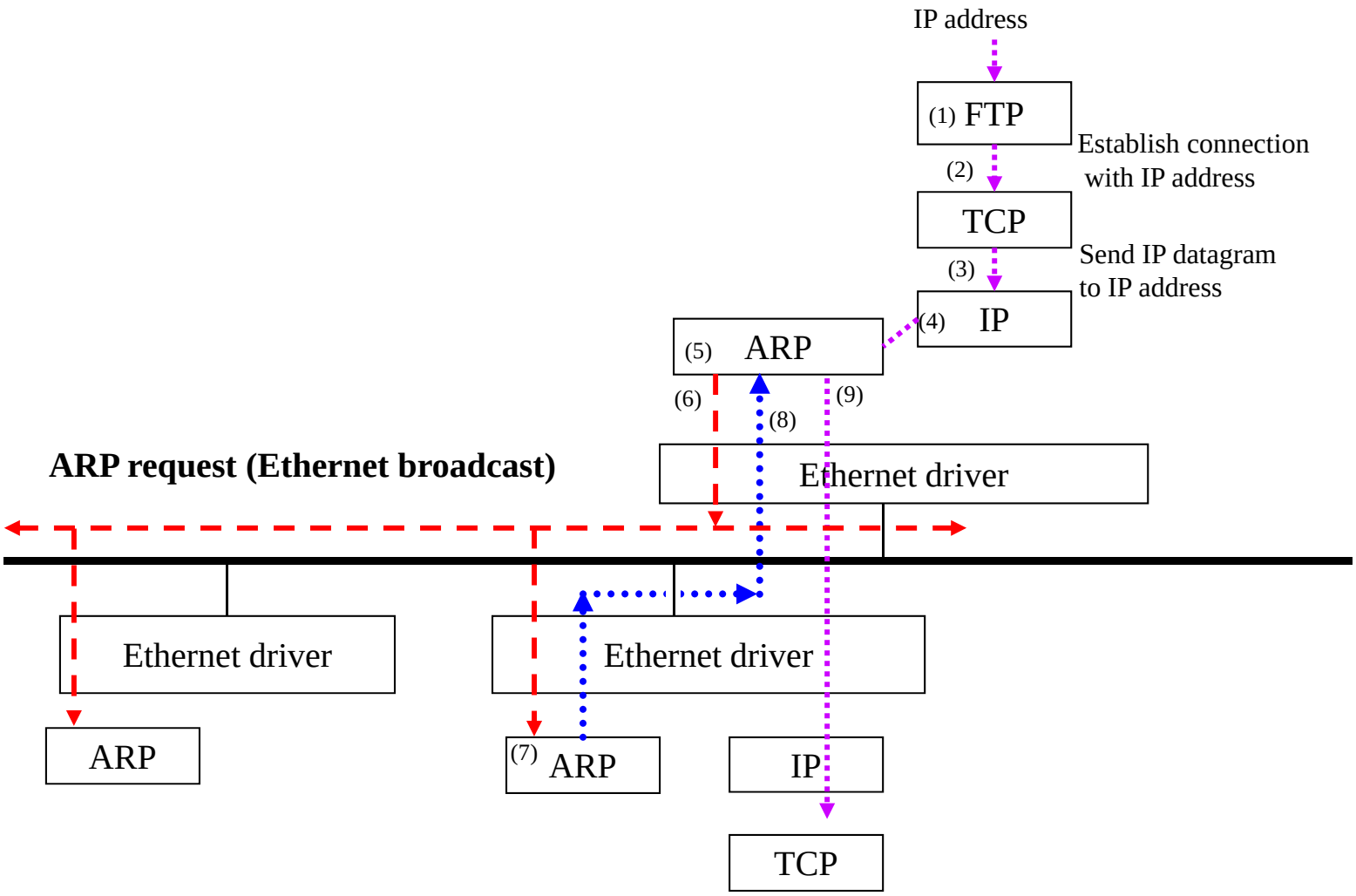
Figure 3. The demultiplexing of a received Ethernet frame

ARP (Address Resolution Protocol)



Device	IP Address	Ethernet Address
hme0	168.188.129.72	00:60:08:a7:43:9a
hme0	rtislab.cs.chungnam.ac.kr	08:00:20:7a:91:f6
hme0	java.cs.chungnam.ac.kr	00:60:08:a7:48:7d
hme0	multimedia.cs.chungnam.ac.kr	00:60:08:a7:47:78
hme0	168.188.128.126	00:60:08:a7:48:62
hme0	168.188.129.126	00:01:02:57:8b:ae
hme0	168.188.129.123	00:60:08:a7:47:7a
hme0	parfait.cs.chungnam.ac.kr	00:60:08:a7:4b:72
hme0	168.188.128.96	00:c0:26:5c:01:42
hme0	168.188.128.97	00:c0:26:5b:89:13
hme0	cyberman.cs.chungnam.ac.kr	00:60:08:a7:48:1c

Operation of ARP



ARP Cache Table

- Maintains the recent mappings from Internet address to hardware address.

- Timeout
  - Completed Entry
    - The normal expiration time of an entry in the cache is 20 minutes from the time the entry was created.
  - Incomplete Entry
    - The network ID and subnet ID are that of local Ethernet, but there is no host with the specified host ID.
    - Down or nonexistent?
    - The incomplete expiration time of an entry in the cache is 3 minutes from the time the entry was created.

Protocol Format - ARP

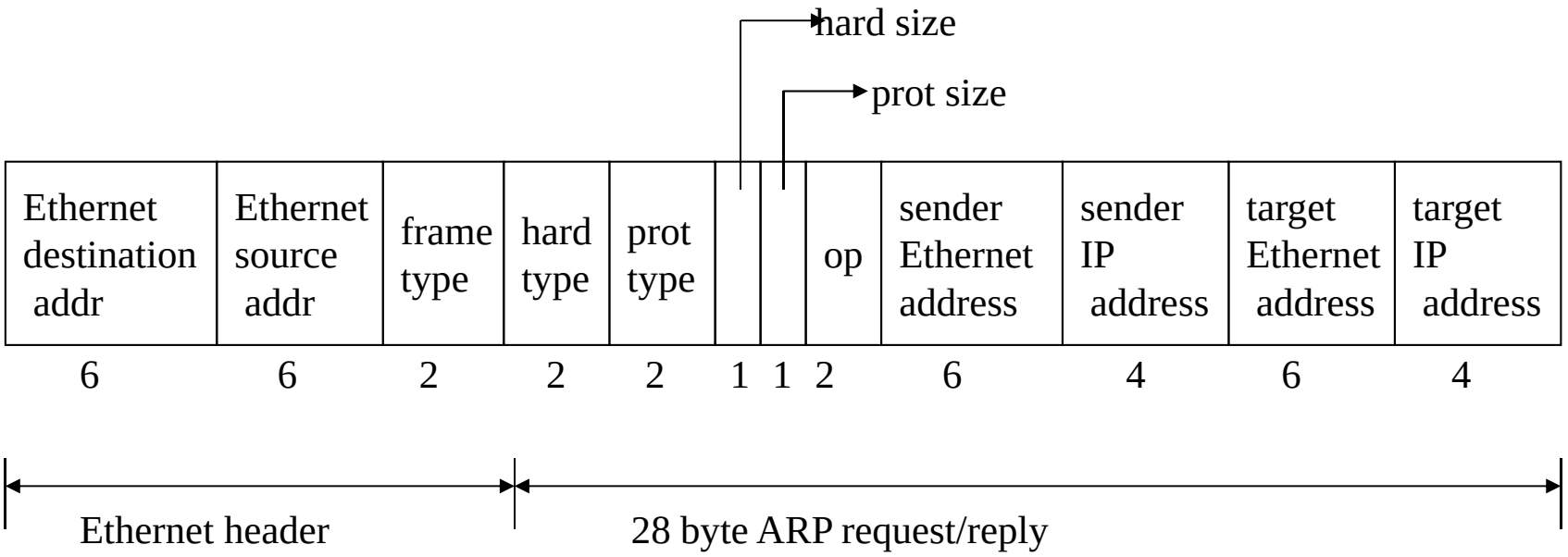


Figure 5. Format of ARP request or reply packet when used on an IP over Ethernet

Description of ARP Field

- Ethernet Destination address Field
  - Broadcast address
    - All Ethernet interfaces on the cable receive these frames.
- Ethernet Source address Field
  - Ethernet Address of Sender
- Frame type Field
  - For an ARP request or an ARP reply, this field is 0x0806
- Hard type Field
  - Type of hardware address.
  - In case Ethernet - this field is 1
- Prot type Field
  - Type of protocol address being mapped
  - In case IP - this field is 0x0800

Description of ARP Field

- Hard size & Prot size Field
  - Specify the sizes in bytes of the hardware addresses and the protocol addresses
- Op(operation) Field
  - ARP request (a value of 1)
  - ARP reply (a value of 2)
  - RARP request (a value of 3)
  - RARP reply (a value of 4)
- Sender’s hardware address & Sender’s Protocol address
- Target hardware address & target Protocol address

Process of ARP Operation

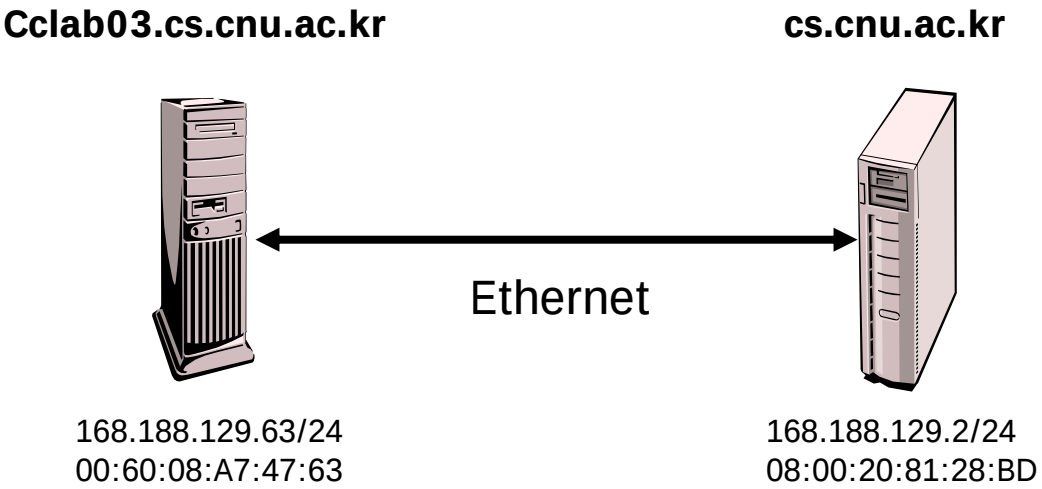
- For an ARP request, all the fields are filled in except the target hardware address.
- When a system receives an ARP request directed to it, fills in its hardware address.
- Swaps the two sender address with the two target addresses, sets the op field to reply(value is 2).
- Sends the reply to Sender.

Process of ARP Operation

In case of execute “telnet 168.188.129.2” in cclab03 computer.

Question?

- What is the Ethernet Address of Host that have IP Address 168.188.129.2 ?



Process of ARP Operation (1)

1. Searching ARP Cache in 168.188.129.63

Interface	IP Address	Ethernet Address	Status
hme0	java.cs.chungnam.ac.kr	00:60:08:a7:48:7d	Complete
hme0	168.188.129.126	00:60:08:a7:48:62	Complete
hme0	parfait.cs.chungnam.ac.kr	?	Incomplete
hme0	168.188.129.123	00:60:08:a7:47:7a	Complete
hme0	168.188.129.1	00:00:A2:CB:2A:F1	Complete

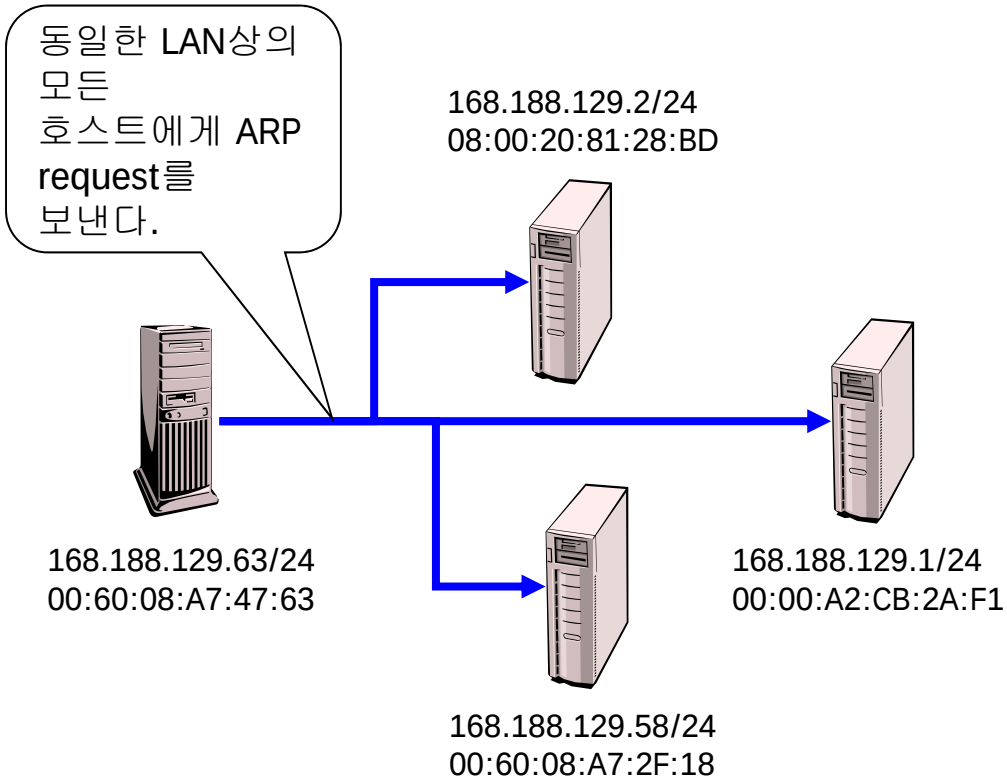
If not found Ethernet Address matching with IP Address in Cache, then Execute ARP Request / Reply Operation

Process of ARP Operation (2)

2. Processing of ARP Request in 168.188.129.63

Broadcast type

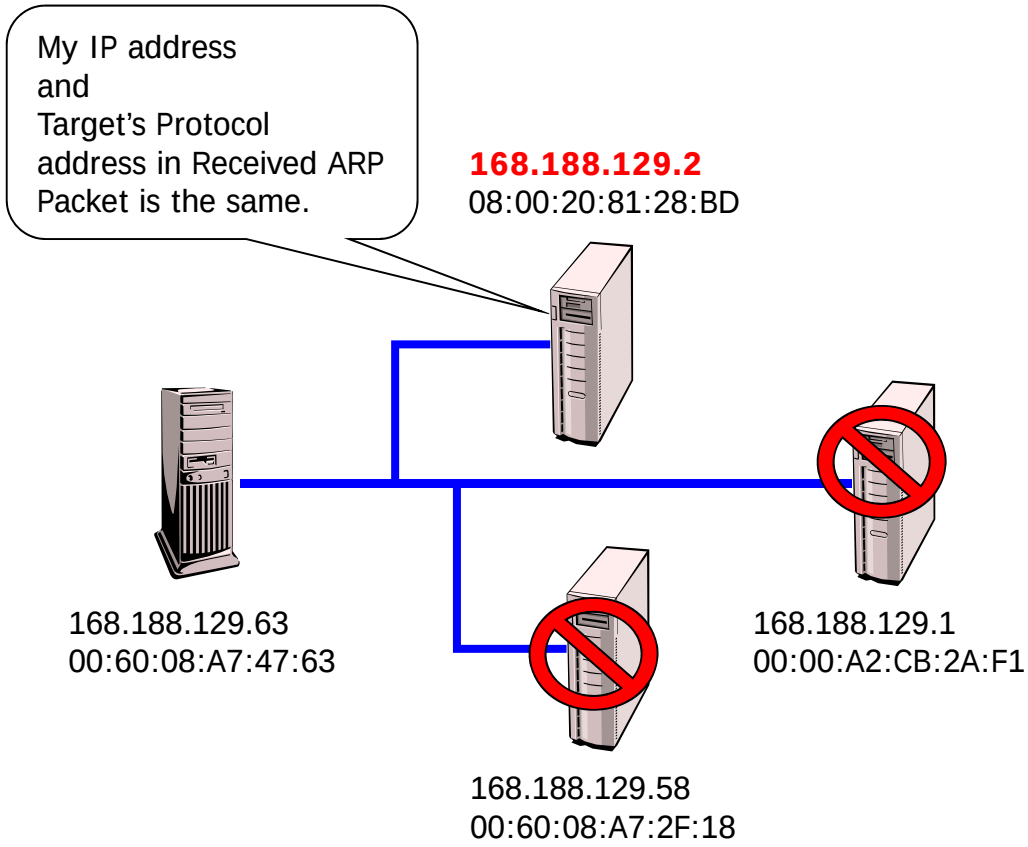
	ff:ff:ff:ff:ff:ff
	00:60:08:A7:47:63
	0x0806
Hardware type	1
Protocol type	0x0800
Length of hardware address	6
Length of protocol address	4
Opcode (ARP Request)	1
Sender's hardware address	00:60:08:A7:47:63
Sender's protocol address	168.188.129.63
Target's hardware address	???????
Target's protocol address	168.188.129.2



Process of ARP Operation (3)

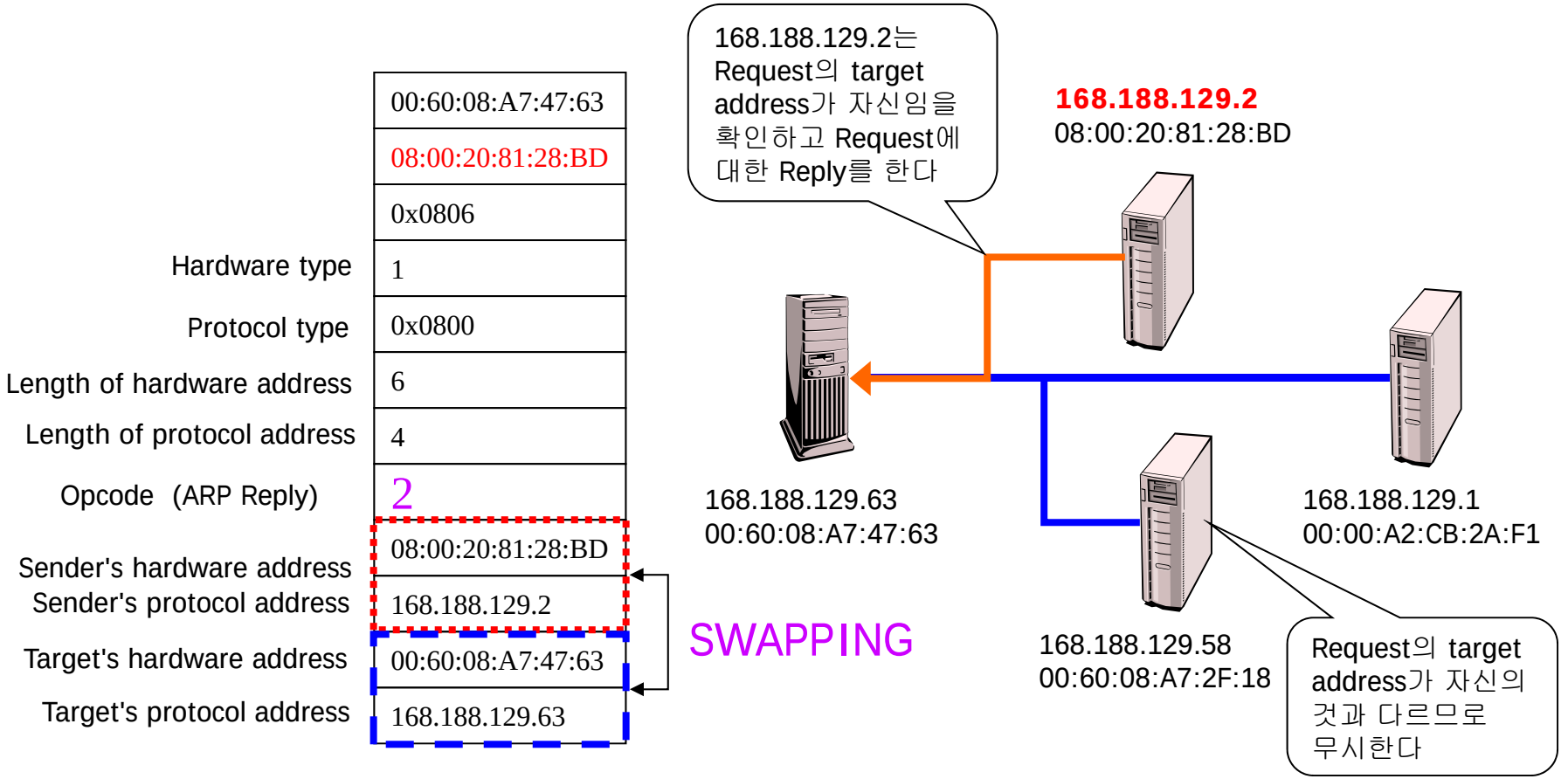
3. Processing of ARP Request in 168.188.129.2

	ff:ff:ff:ff:ff:ff
	00:60:08:A7:47:63
	0x0806
Hardware type	1
Protocol type	0x0800
Length of hardware address	6
Length of protocol address	4
Opcode (ARP Request)	1
Sender's hardware address	00:60:08:A7:47:63
Sender's protocol address	168.188.129.63
Target's hardware address	???????
Target's protocol address	168.188.129.2



Process of ARP Operation (4)

4. Processing of ARP Reply in 168.188.129.2



Process of ARP Operation (5)

5. Append Entry to ARP Cache in 168.188.129.63

Interface	IP Address	Ethernet Address	Status
hme0	java.cs.chungnam.ac.kr	00:60:08:a7:48:7d	Complete
hme0	168.188.129.126	00:60:08:a7:48:62	Complete
hme0	parfait.cs.chungnam.ac.kr	00:60:08:a7:4b:72	Incomplete
hme0	168.188.129.123	00:60:08:a7:47:7a	Complete
hme0	168.188.129.1	00:00:A2:CB:2A:F1	Complete
hme0	168.188.129.2	08:00:20:81:28:BD	Complete

ARP Request/reply를 통해 알아온 168.188.129.2의 Ethernet address를 테이블에 저장하고 정해진 시간 동안 이 주소를 사용하여 메시지를 전송

Homework #3

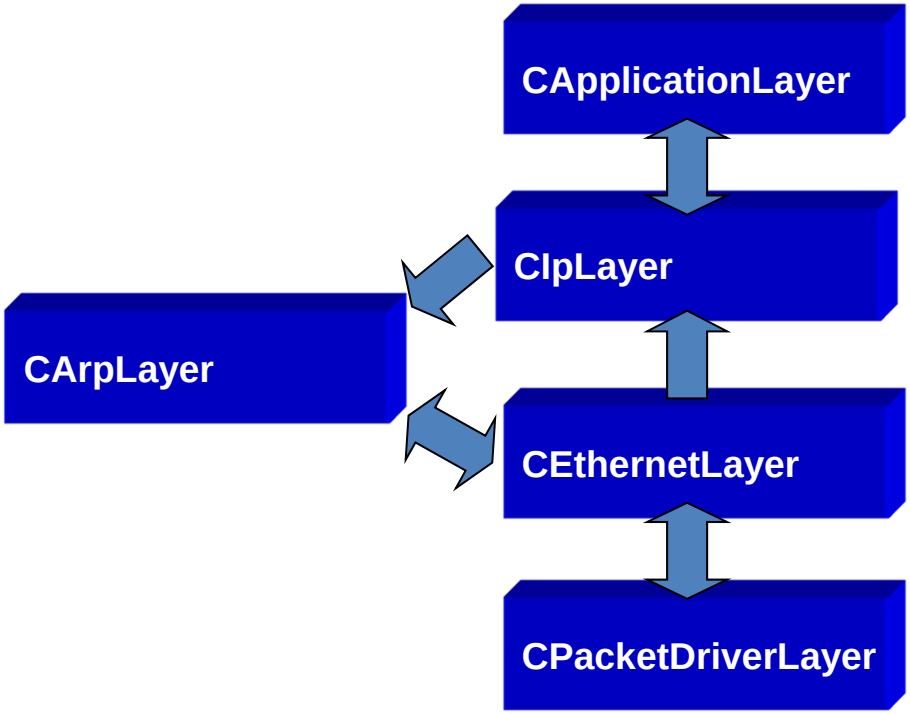
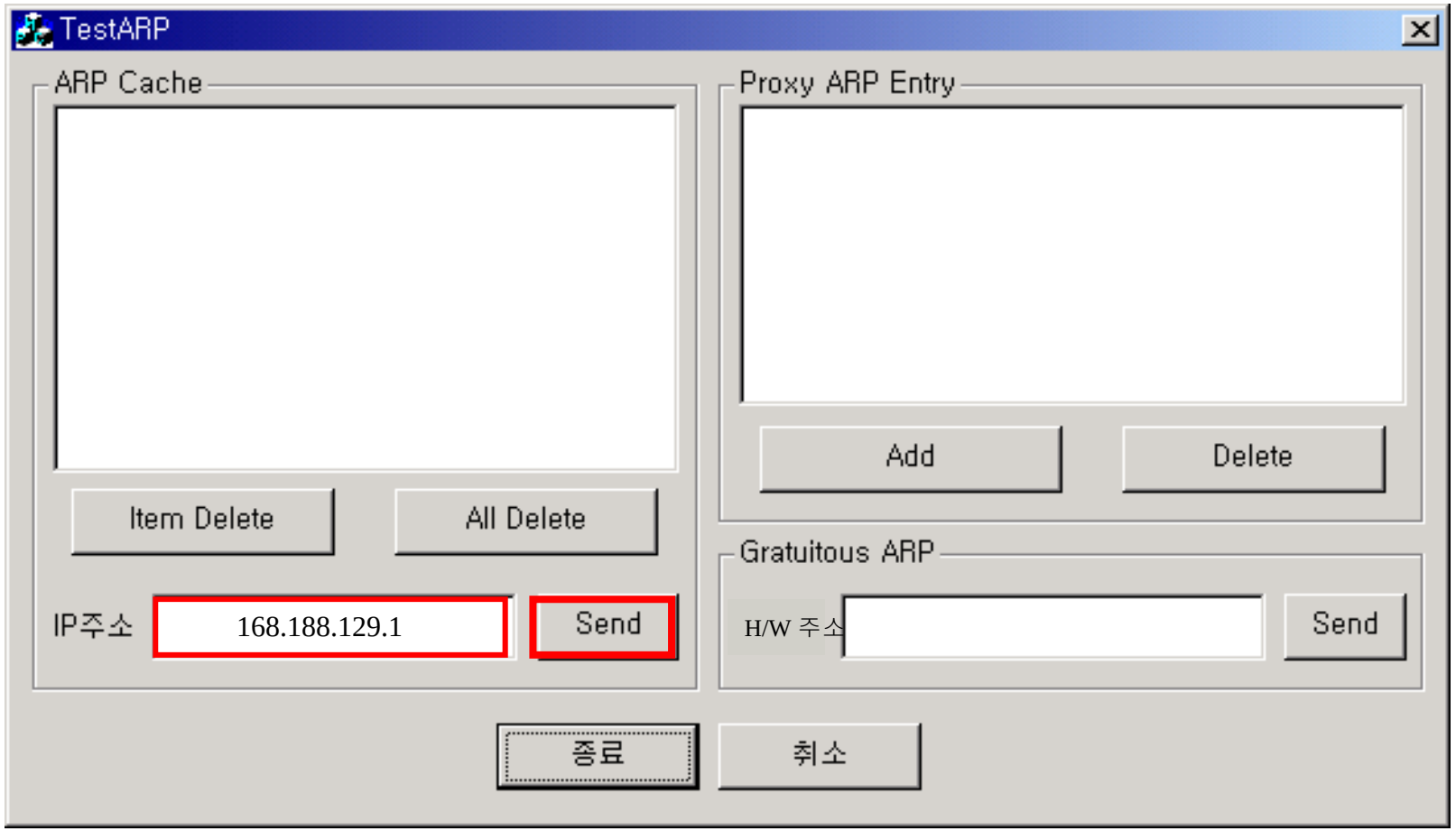


Figure 3. Layered Architecture for Homework #3

ARP Request Operation(1)

- Basic ARP Operation
  - ARP Request Operation by User.
    - Input Target's IP Address from User.
    - Send ARP Request Packet to Hosts on the LAN
      - Send to Packet using Broadcasting (ff:ff:ff:ff:ff:ff)
    - Wait for ARP Reply Packet that correspond to request.
  - ARP Requested Operation By Other Host
    - Wait for ARP Request Packet to arrive at My Host.
    - Append/Update a Entry to Cache.
    - Send to Reply Packet.

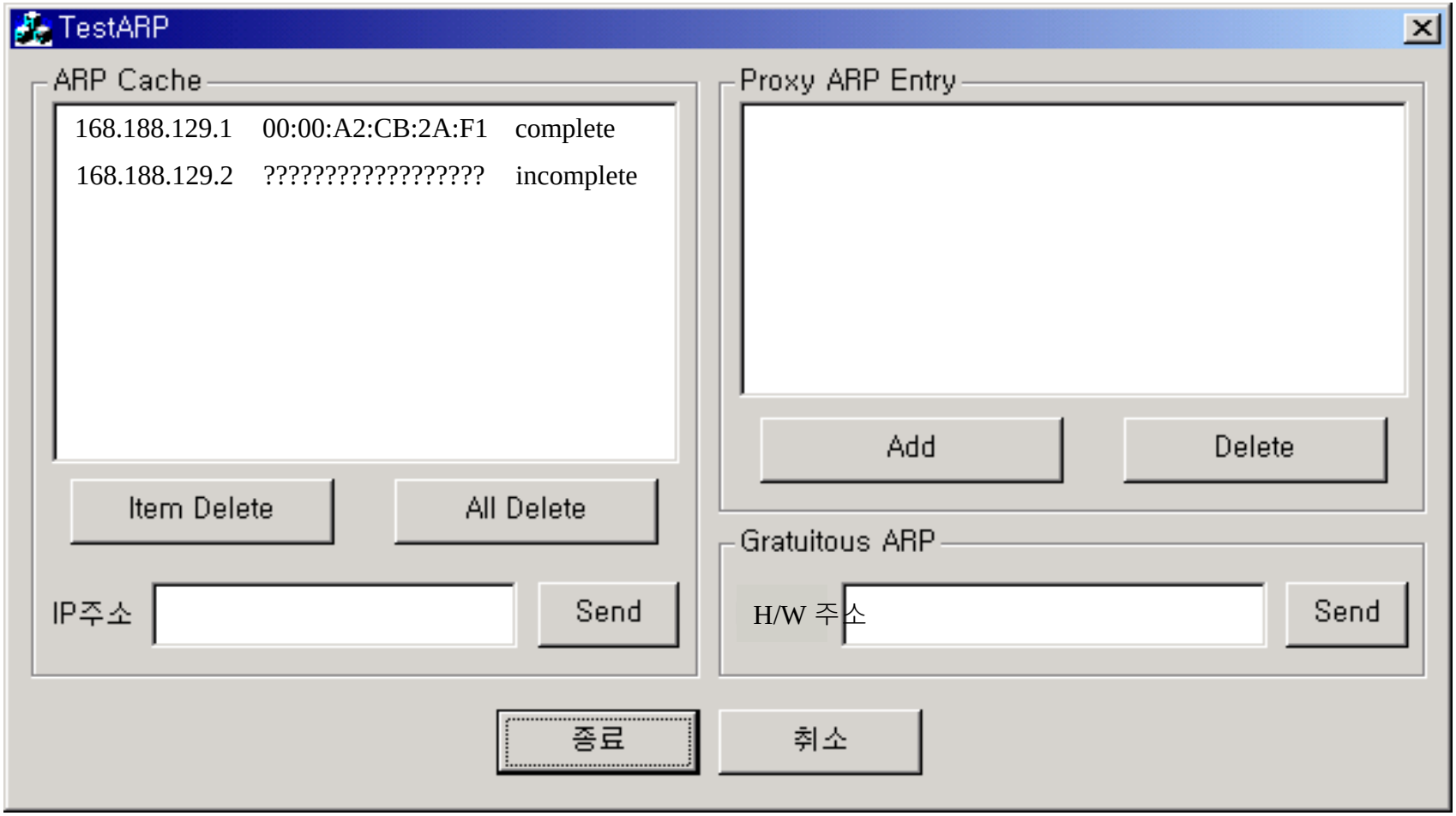
ARP Request Operation(2)



ARP Reply Operation(1)

- Basic ARP Operation
  - ARP Reply Operation
    - Wait for ARP Reply Packet.
    - Add/Update Cache Entry by Received ARP Reply Packet.
  - Return ARP Reply to Sender that response to Received ARP Requested Packet.
    - Add/Update Cache Entry by Received ARP Reply Packet.

ARP Reply Operation



일정

날짜	내용
7주차(4월 15/16일)	ARP 기본 동작과정
8주차(4월 22/23일)	중간고사 (휴강)
9주차(4월 29/30일)	Proxy ARP 동작과정
10주차 (5월 6/7일)	Gratuitous ARP 동작과정
11주차 (5월 16일)	ARP 데모

◈ 과제 제출일

❖ 5월 12일/13일 24:00시까지

◈ 매주 강의 내용에 따라 과제의 추가 요구사항 설명