Data Communication (CE14773)

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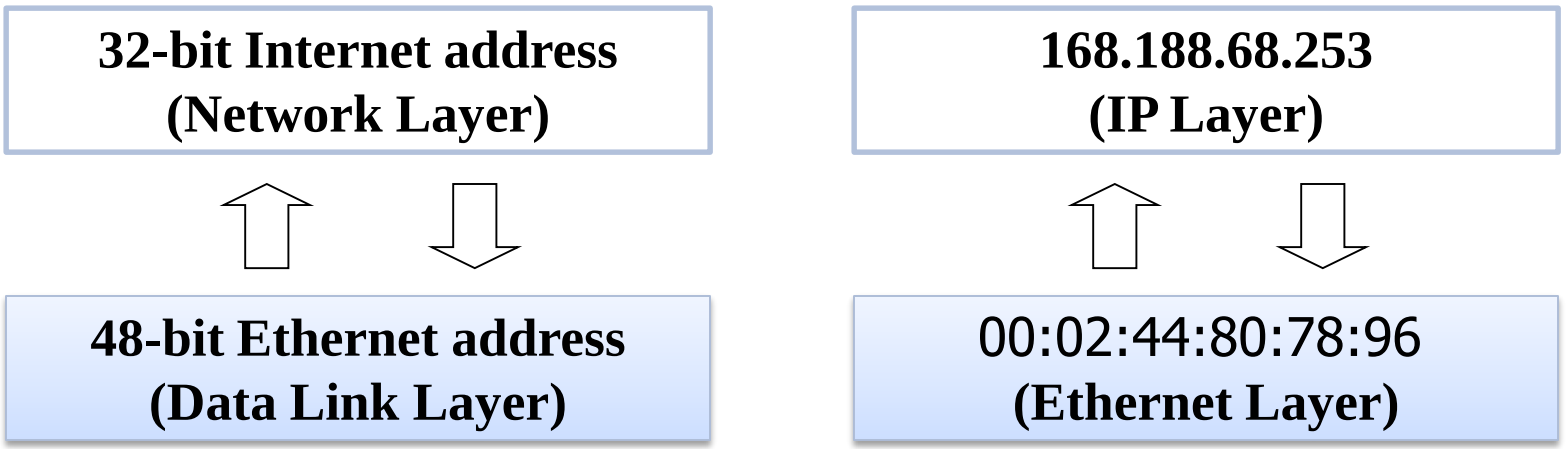
ARP (Address Resolution Protocol)

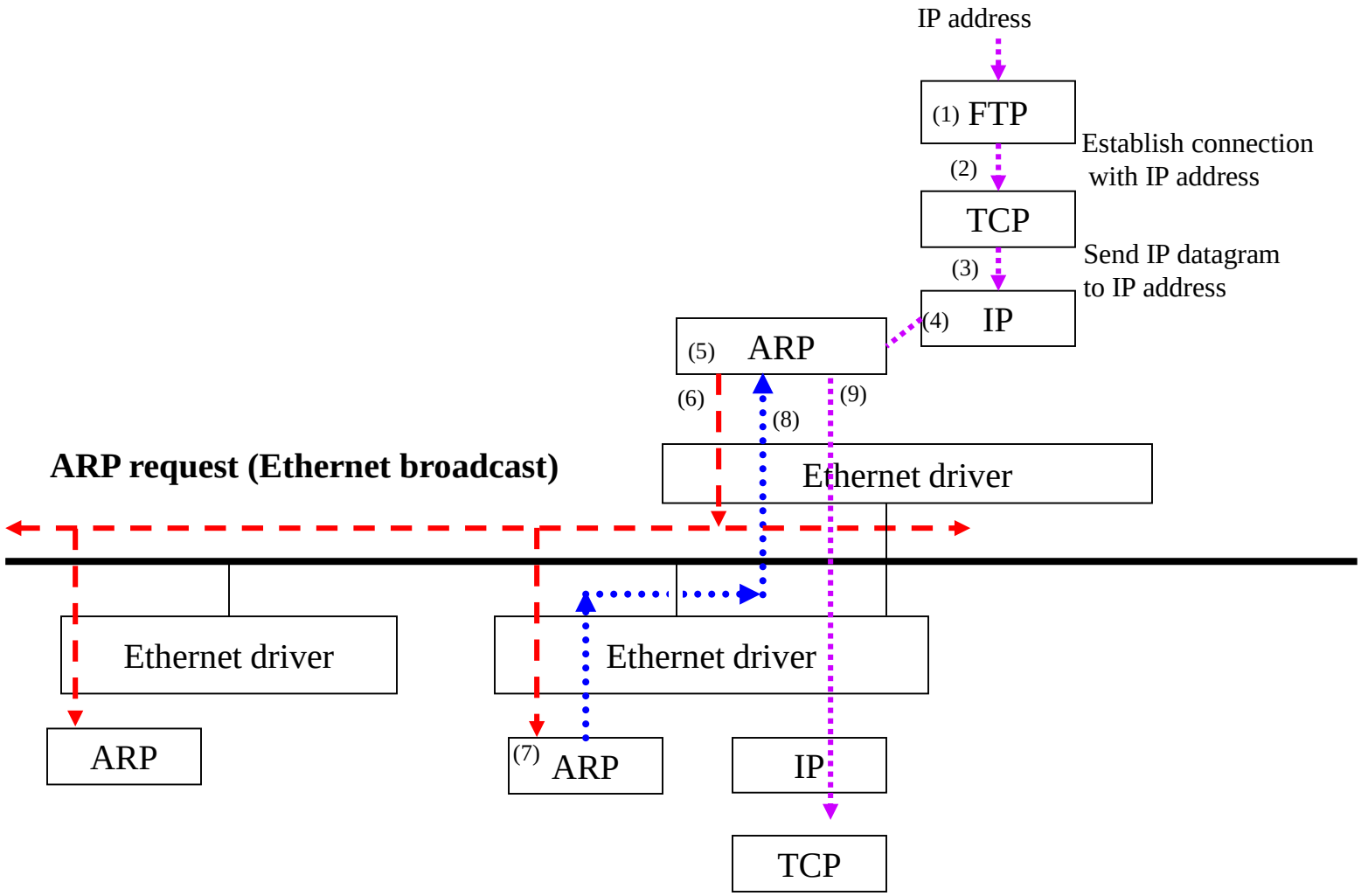
- Why need ARP in LAN?
  - When an Ethernet frames is sent from one host on a LAN to another, it is the 48-bit Ethernet address that determines for which interface the frame is destined.
  - Mapping between the two different forms of address
    - 32-bit IP address and whatever type of address the data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

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



Protocol Format - ARP

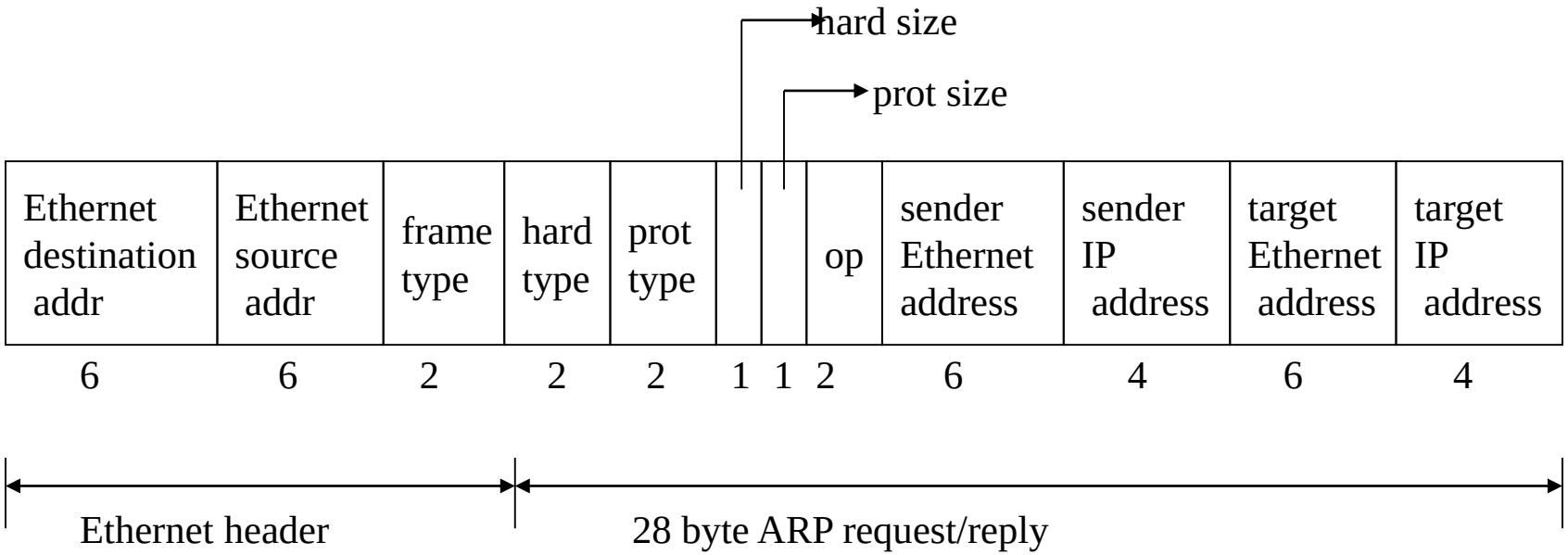


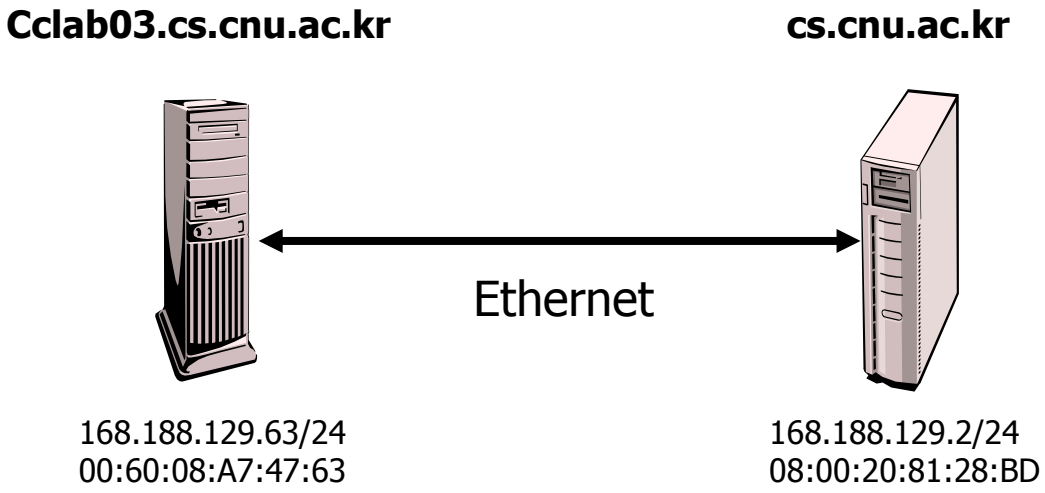
Figure 5. Format of ARP request or reply packet when used on an IP over Ethernet

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

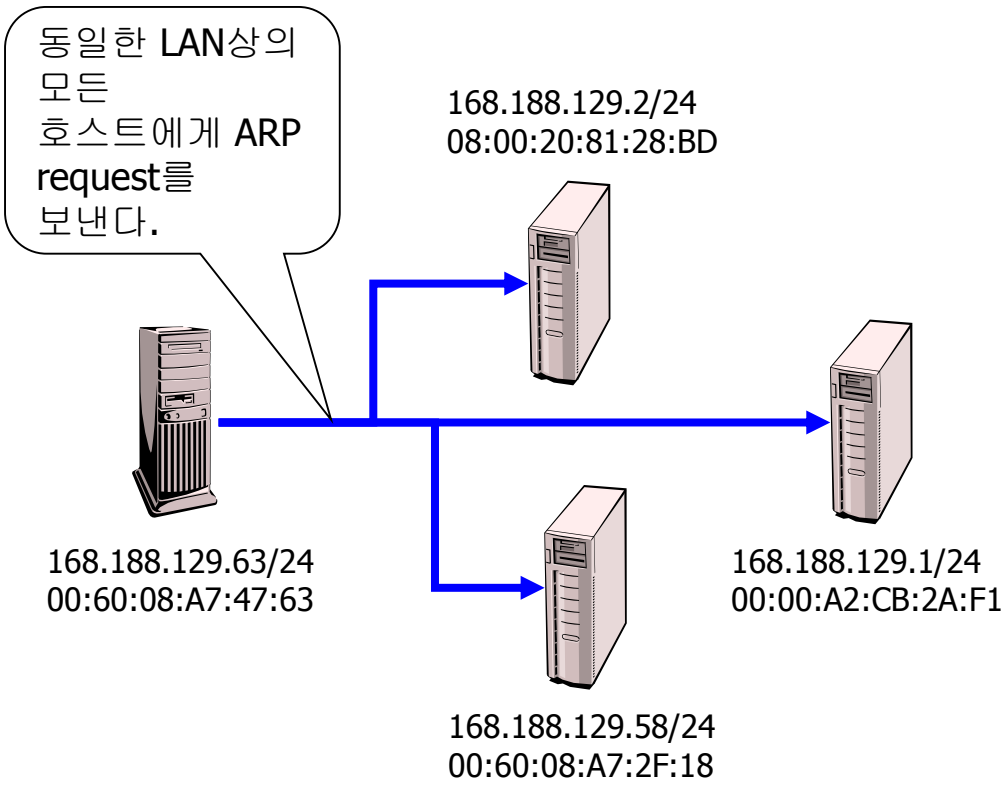
If not found Ethernet Address matching with IP Address in Cache, then Execute ARP Request/Reply Operation

Process of ARP Operation (2)

2. Processing of ARP Request in 168.188.129.63

Broadcast type

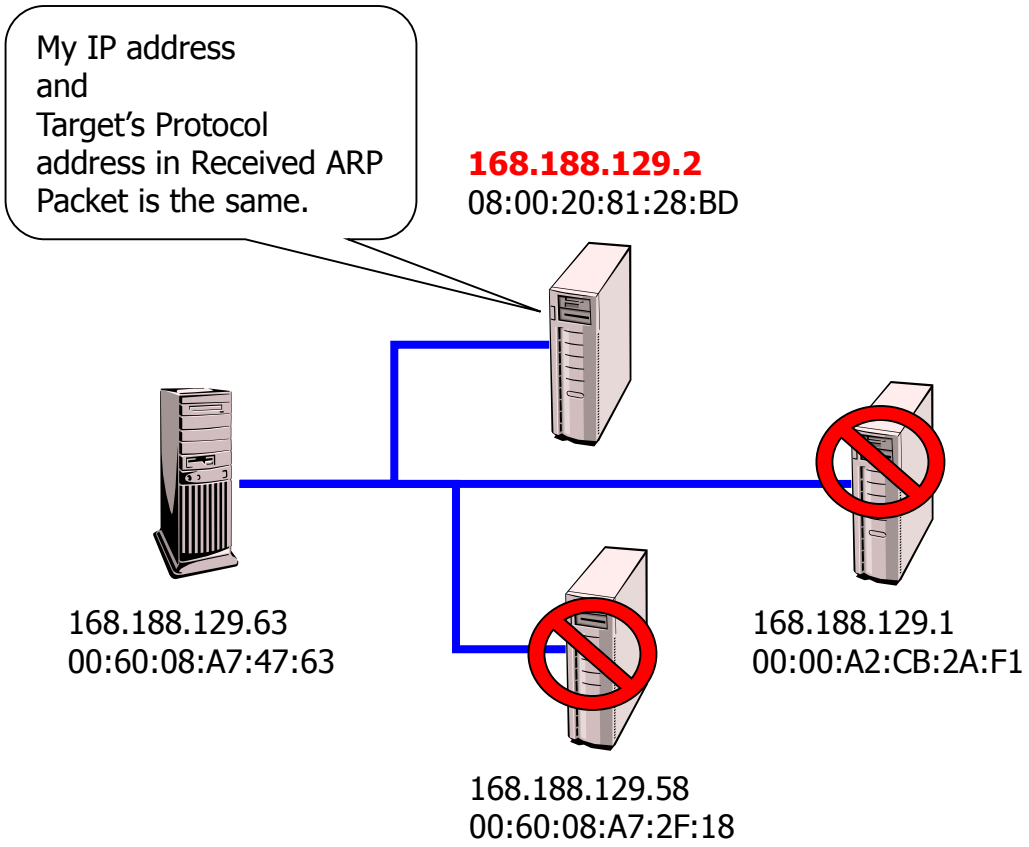
	ff:ff:ff:ff:ff:ff
	00:60:08:A7:47:63
	0x0806
Hardware type	1
Protocol type	0x0800
Length of hardware address	6
Length of protocol address	4
Opcode (ARP Request)	1
Sender's hardware address	00:60:08:A7:47:63
Sender's protocol address	168.188.129.63
Target's hardware address	???????
Target's protocol address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

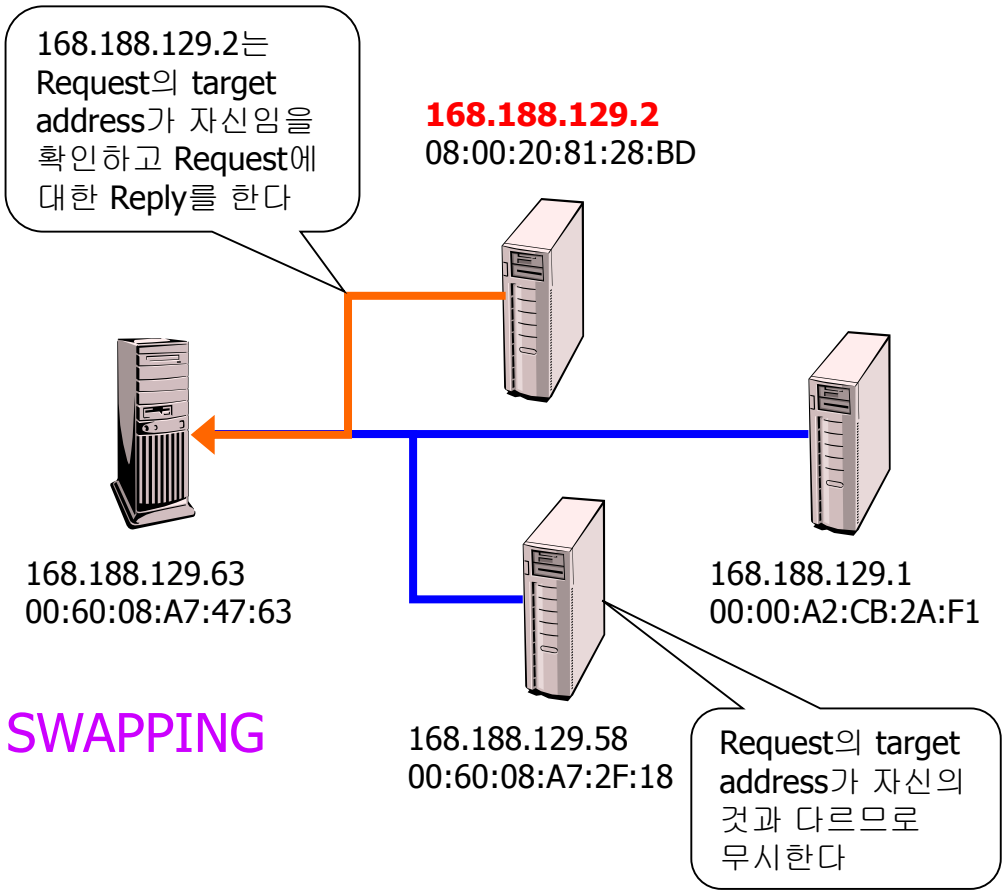


Process of ARP Operation (4)

4. Processing of ARP Reply in 168.188.129.2

	00:60:08:A7:47:63
	08:00:20:81:28:BD
	0x0806
Hardware type	1
Protocol type	0x0800
Length of hardware address	6
Length of protocol address	4
Opcode (ARP Reply)	2
Sender's hardware address	08:00:20:81:28:BD
Sender's protocol address	168.188.129.2
Target's hardware address	00:60:08:A7:47:63
Target's protocol address	168.188.129.63

SWAPPING



Process of ARP Operation (5)

5. Append Entry to ARP Cache in 168.188.129.63

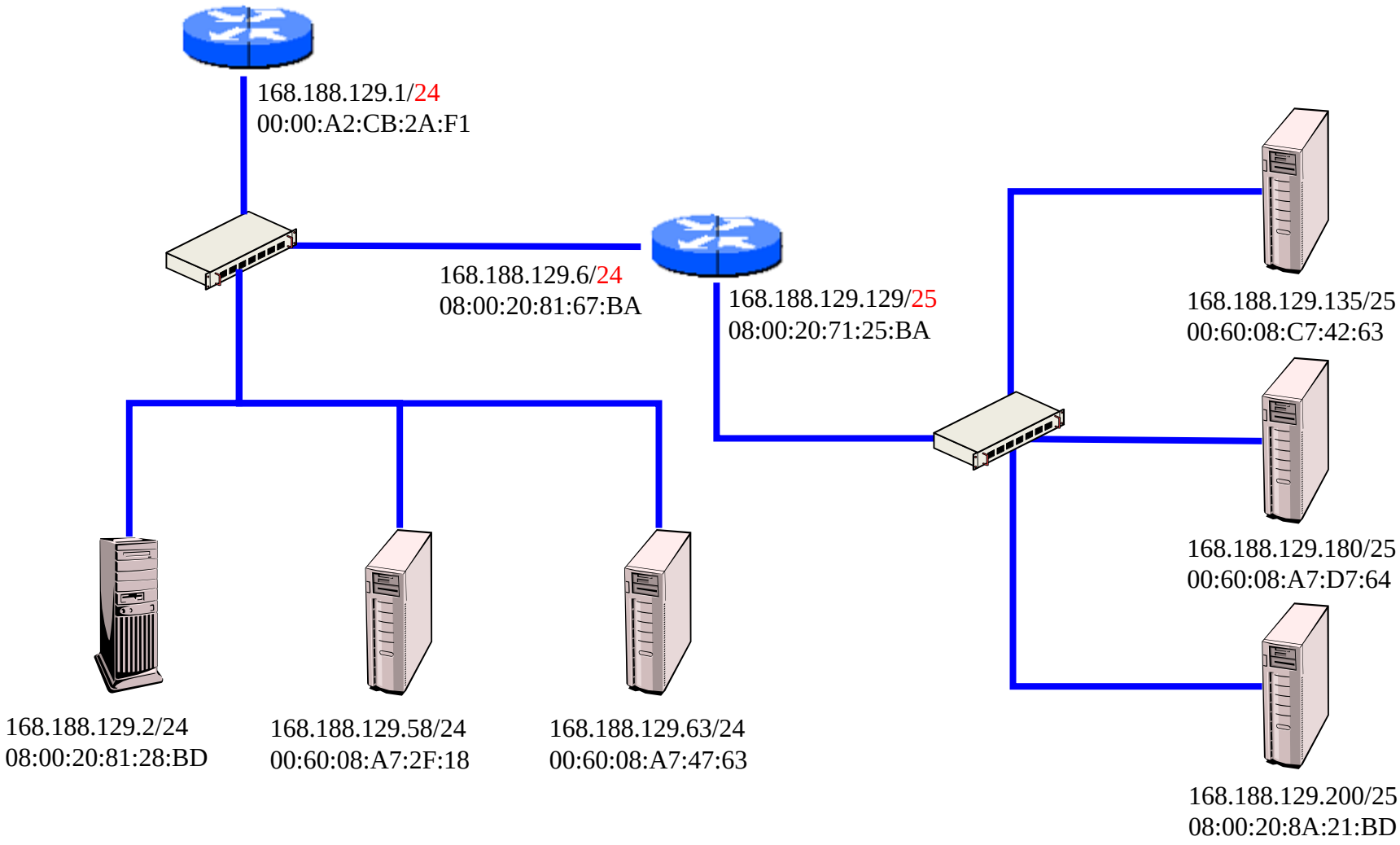
Interface	IP Address	Ethernet Address	Status
hme0	java.cs.chungnam.ac.kr	00:60:08:a7:48:7d	Complete
hme0	168.188.129.126	00:60:08:a7:48:62	Complete
hme0	parfait.cs.chungnam.ac.kr	00:60:08:a7:4b:72	Incomplete
hme0	168.188.129.123	00:60:08:a7:47:7a	Complete
hme0	168.188.129.1	00:00:A2:CB:2A:F1	Complete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

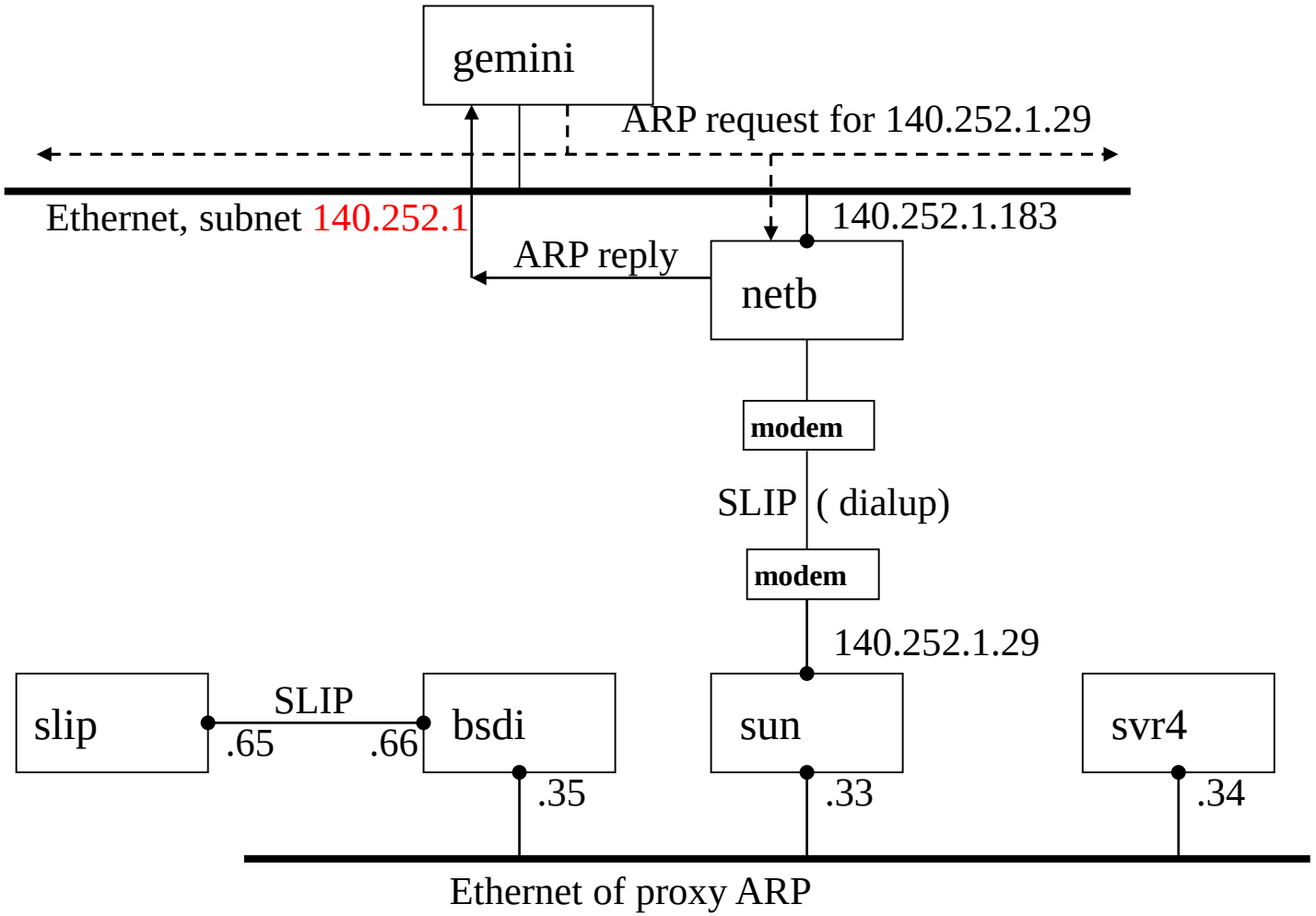
Proxy ARP

- Proxy ARP lets a router answer ARP requests on one of its networks for a host on another of its networks.
- This fools the sender of the ARP request into thinking that the router is the destination host, when in fact the destination host is “on the other side” of the router.
- This router is acting as a proxy agent for the destination host, relaying packets to it from other hosts.

Example of proxy ARP



Example of proxy ARP



Homework #3

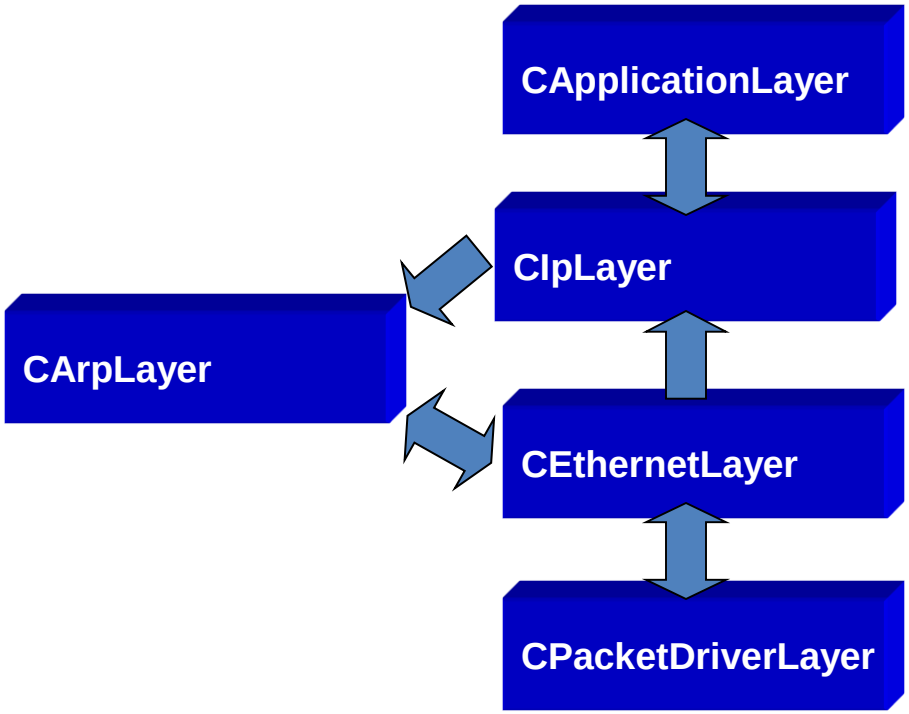
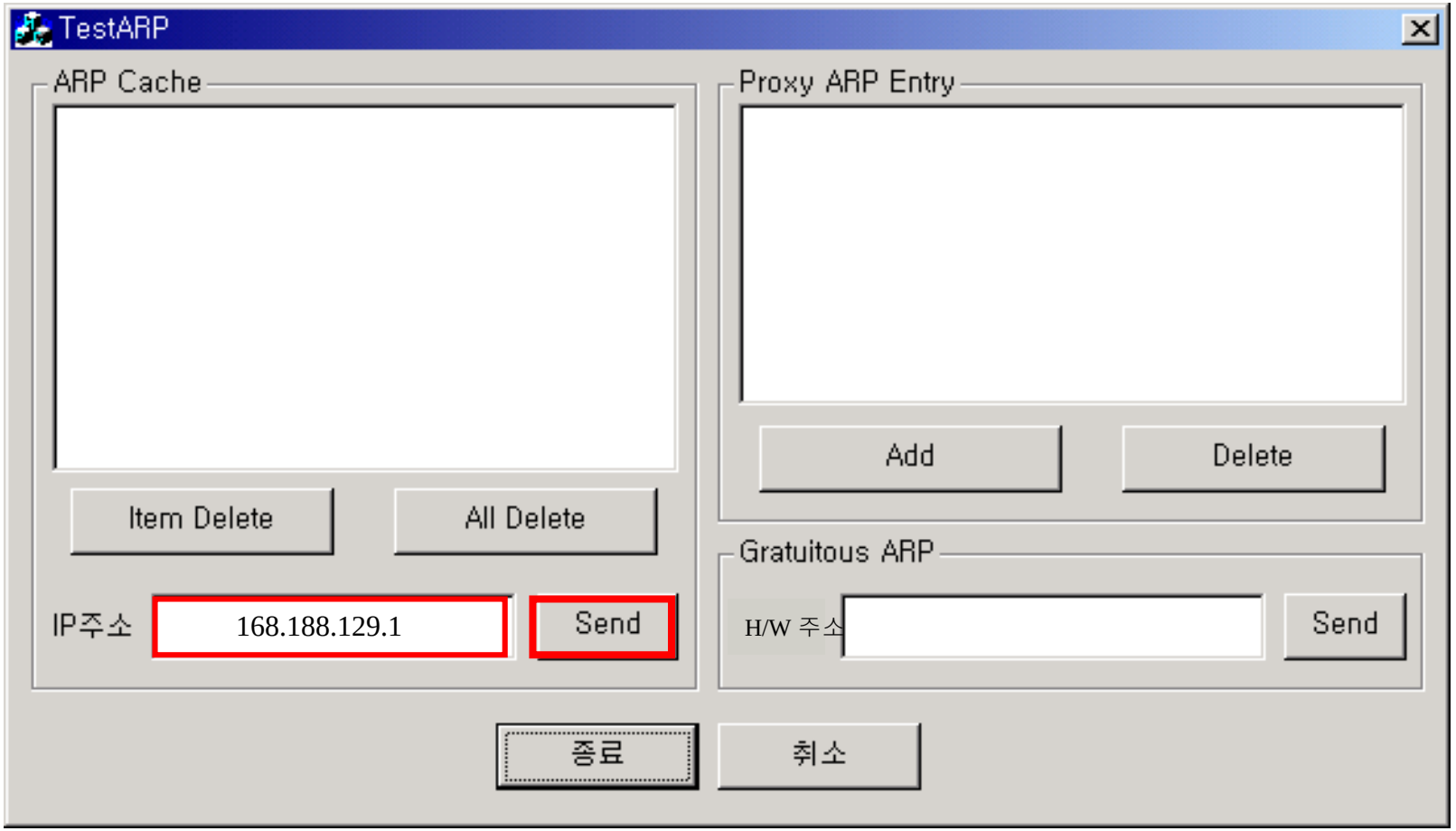


Figure 3. Layered Architecture for Homework #3

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.

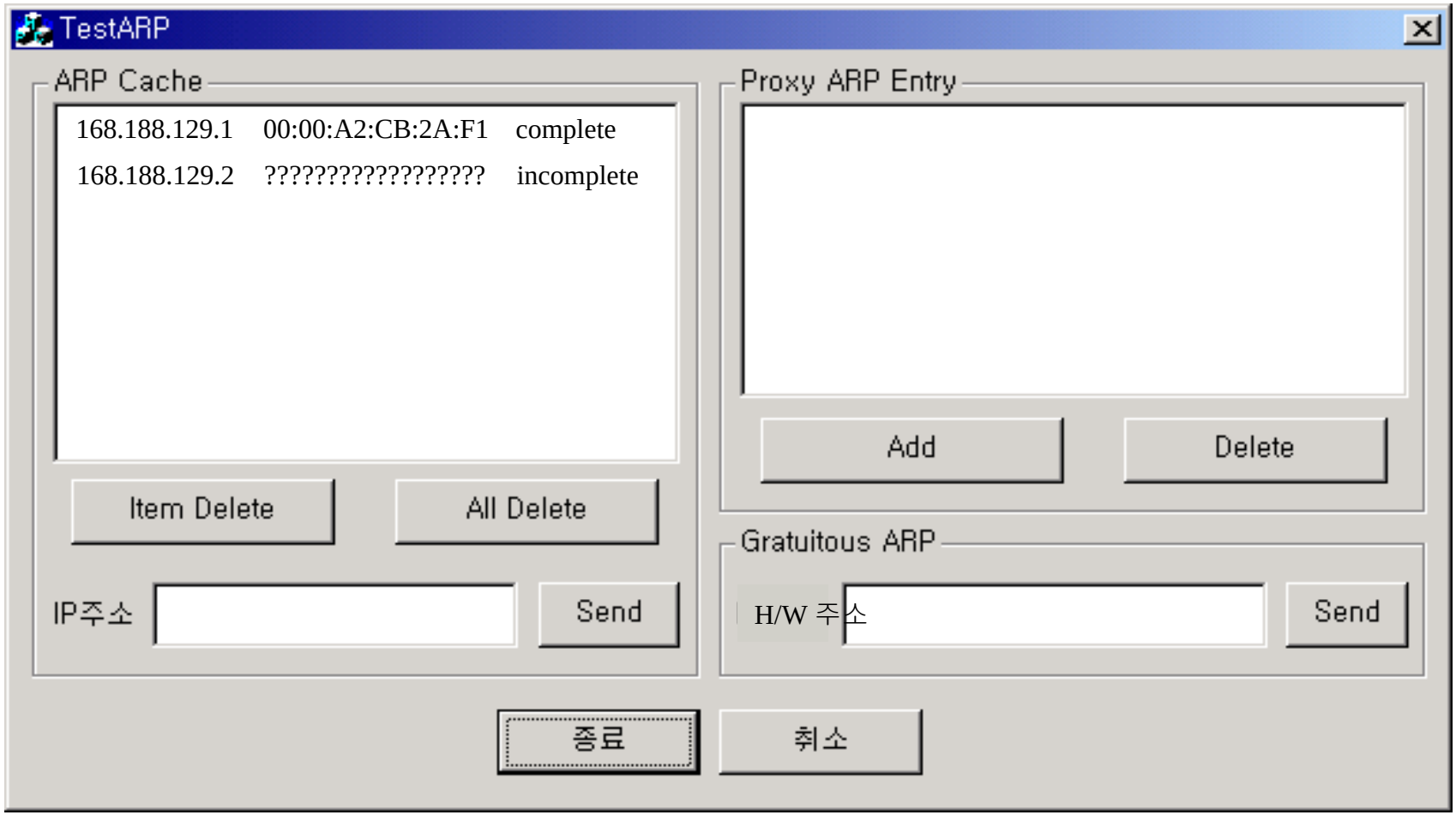
ARP Request Operation(2)



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.

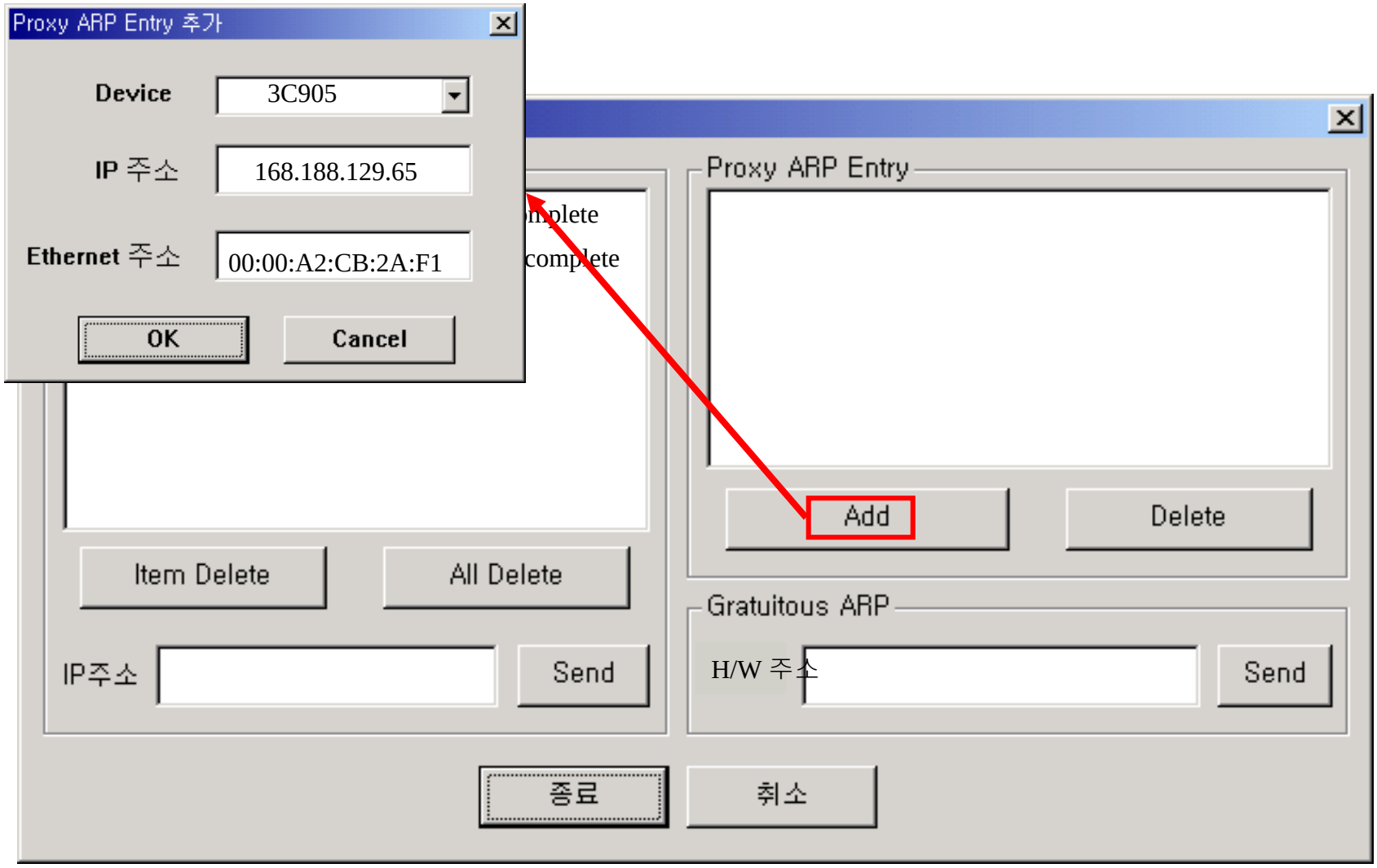
ARP Reply Operation



Proxy ARP Operation

- Proxy ARP Operation
  - Executed ARP Requested Operation By Other Host
  - Proxy ARP Table
    - Entry Field
      - Device Name
      - IP Address
      - Ethernet Address
  - Wait for ARP Request Packet to arrive at My Host.
    - My Host address is not Target Protocol address in ARP Request Packet.
    - Search Proxy ARP Table.
      - If exists result entry? Then, Use those Entry to ARP Reply.
    - Append/Update a Entry to Cache.
    - Send to Reply Packet.

Proxy ARP Operation



Proxy ARP Operation