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**TCP/IP**

- 
- ✍ **TCP/IP**
  - ✍ **TCP/IP**
  - ✍ **TCP/IP**
  - ✍ **TCP/IP**
  - ✍ **Internet Protocol \_ IP Address**
  - ✍ **Internet Protocol \_ Subnet Mask**
  - ✍ **Internet Protocol \_ ARP(Address Resolution Protocol)**
  - ✍ **Internet Protocol \_ RARP(Reverse Address Resolution Protocol)**
  - ✍ **Internet Protocol \_ Header**
  - ✍ **Internet Protocol \_ Routing**
  - ✍ **Transport Layer – TCP & UDP**
  - ✍ **Transport Layer – TCP**
  - ✍ **Transport Layer – UDP**

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## TCP/IP



1960          ARPA(Advanced Research Project Agency)

ARPANet

DARPA Internet protocol suite

## OPEN Protocol

TCP/IP          Berkeley UNIX

PC

LAN    WAN

, , ,

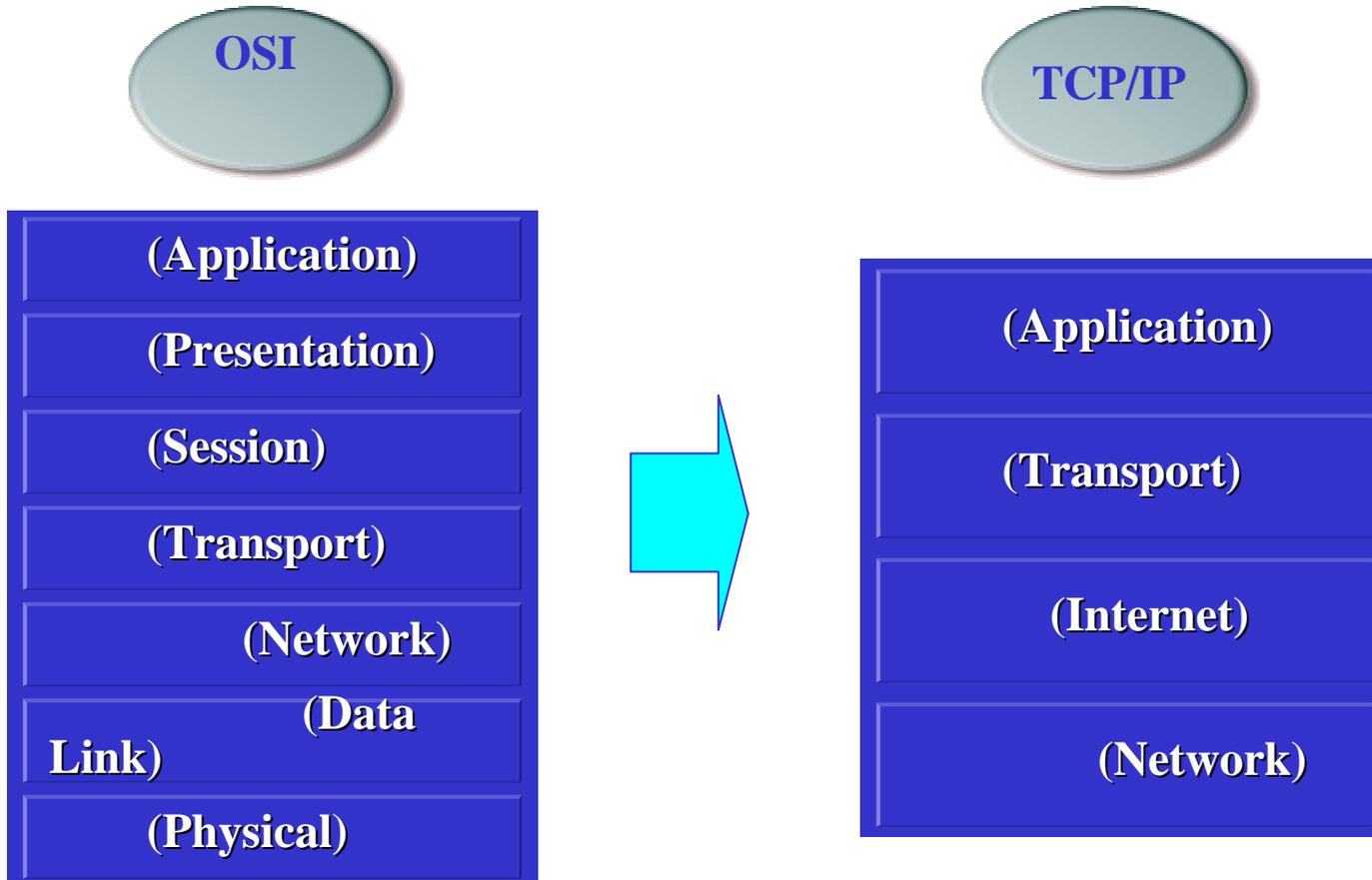
TCP & IP

# TCP/IP



IP

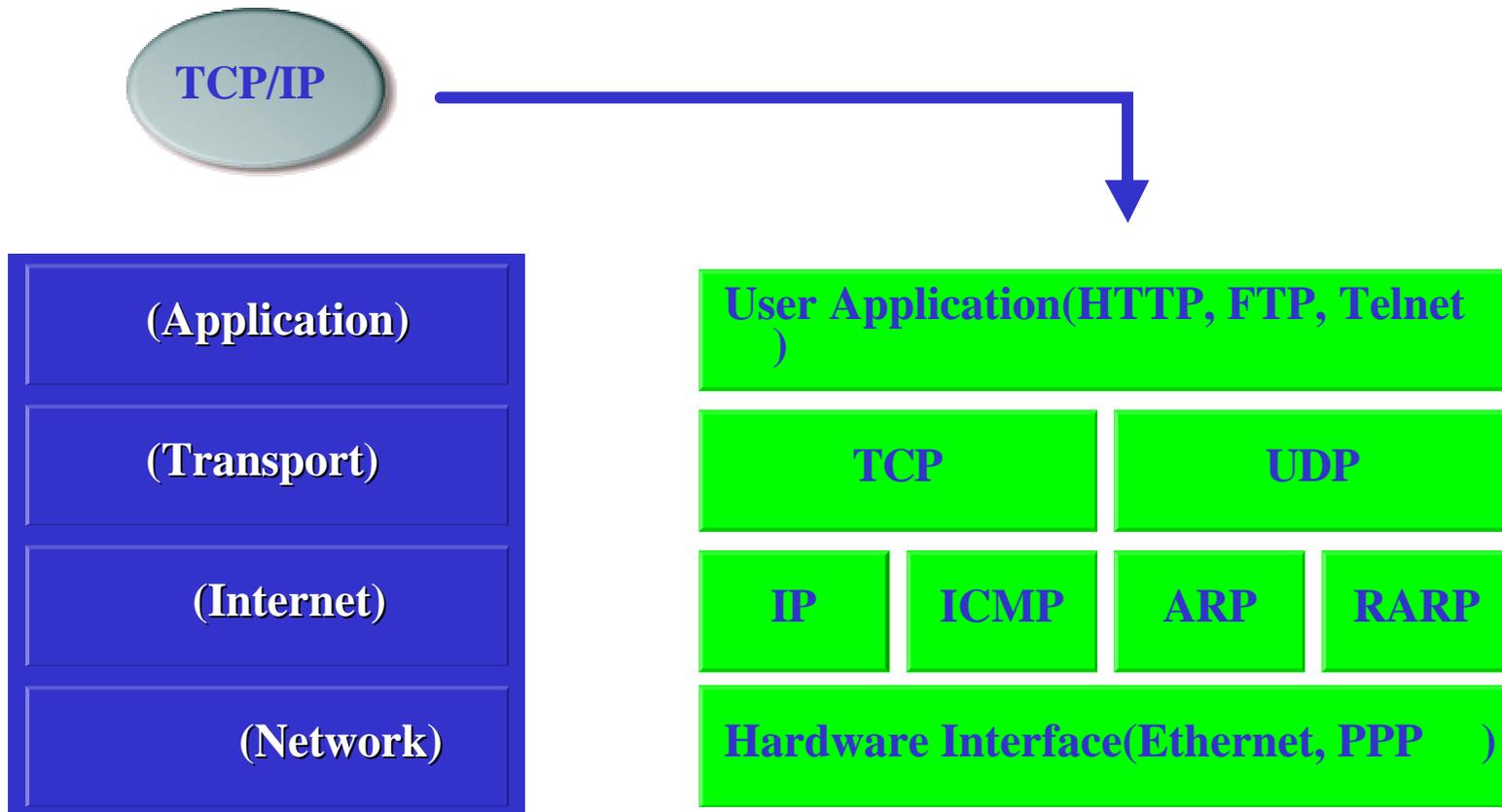
# OSI



# TCP/IP

✍ RFC 1180

✍



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## TCP/IP

### ✎ Network Layer( )

✎ OSI

✎ 48bit MAC(Media Access Control) Address

✎ IP ARP/RARP

### ✎ Internet Layer( )

✎ IP(Internet Protocol)

- TCP, UDP, ICMP

✎ ICMP(Internet Control Message Protocol)

-

✎ ARP(Address Resolution Protocol)

- IP Hardware

✎ RARP(Reverse ARP)

- Hardware IP

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## TCP/IP

### Transport Layer( )

#### TCP(Transmission Control Protocol)

- 
- full-duplex, byte stream
- TCP .

#### UDP(User Data Protocol)

- 
- UDP datagram

### Application Layer( )

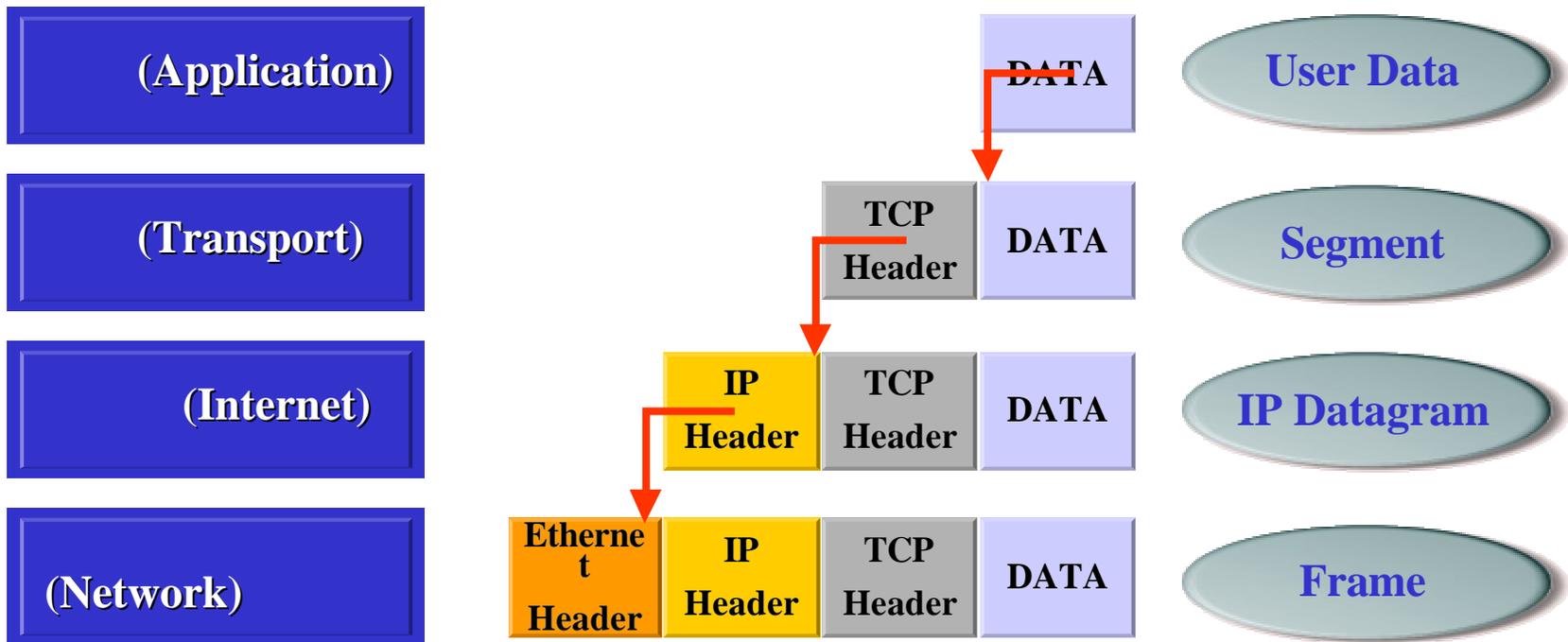


#### HTTP, Telnet, FTP, SMTP, POP3

# TCP/IP



Header 가



# Internet Protocol \_ IP Address

## ✍ IPv4

✍ Internet Address 32

- 2
- IP 4 10
- 

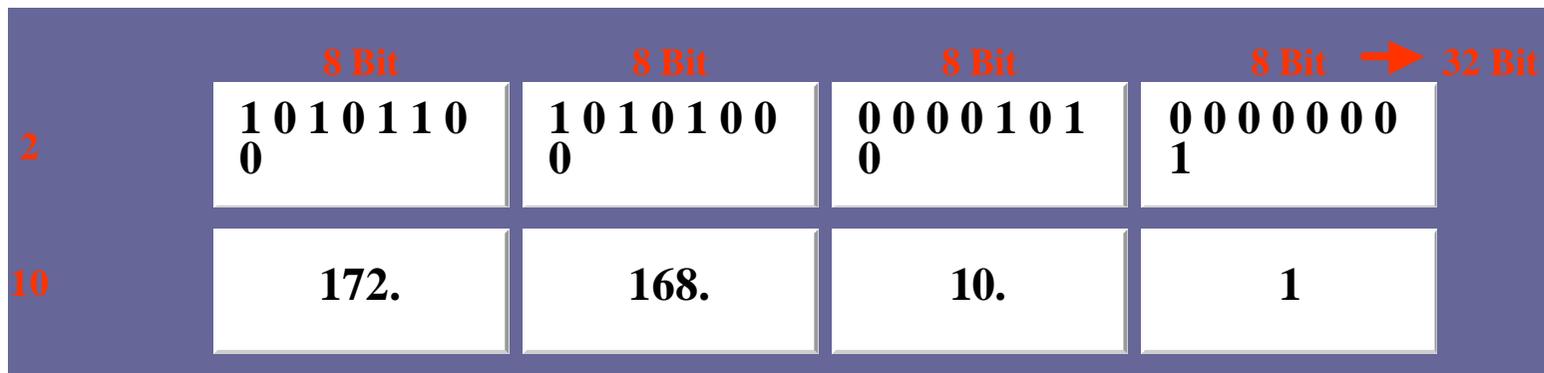
✍ Network ID Host ID

✍

IP

✍ IP NIC(Network Information Center)

- Network ID NIC
- Host ID Local



# Internet Protocol \_ IP Address

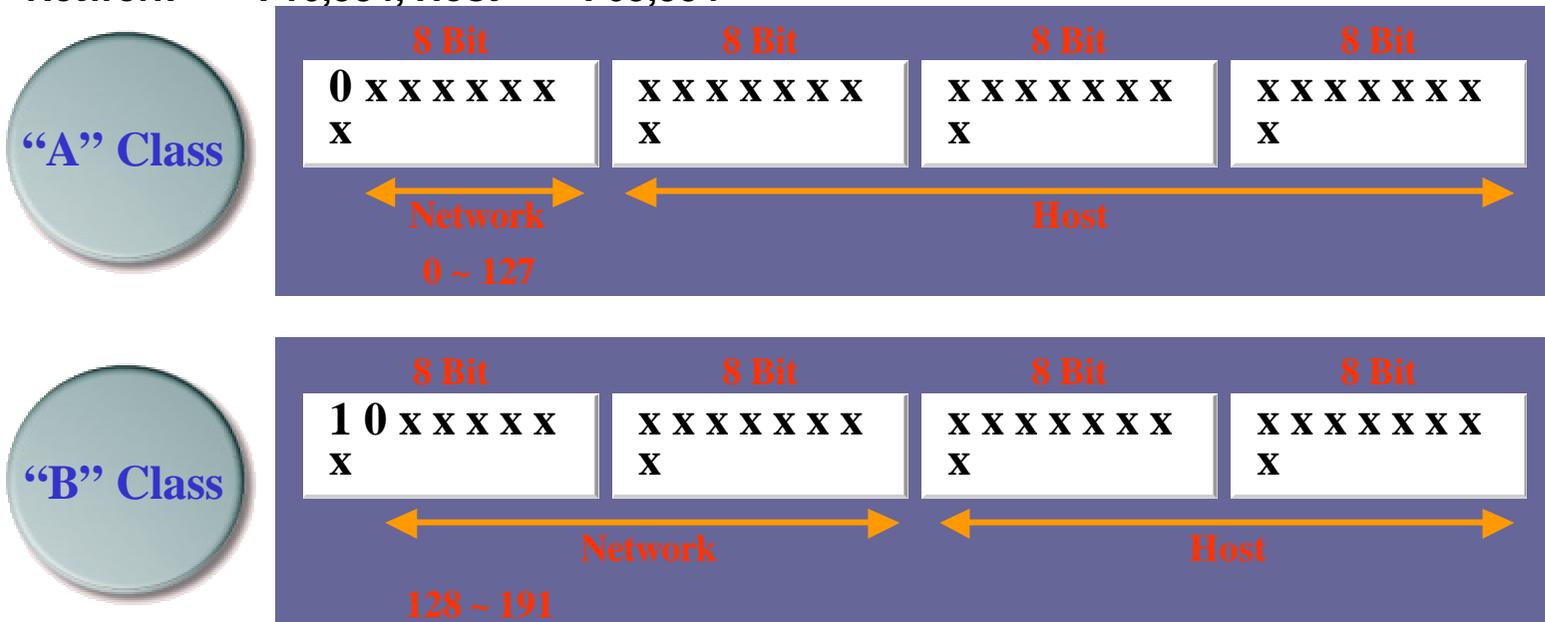
## ✍ IP

### ✍ “A” Class

- Bit가 “0”
- Network : 126, Host : 16,777,214

### ✍ “B” Class

- Bit가 “1 0”
- Network : 16,384, Host : 65,534



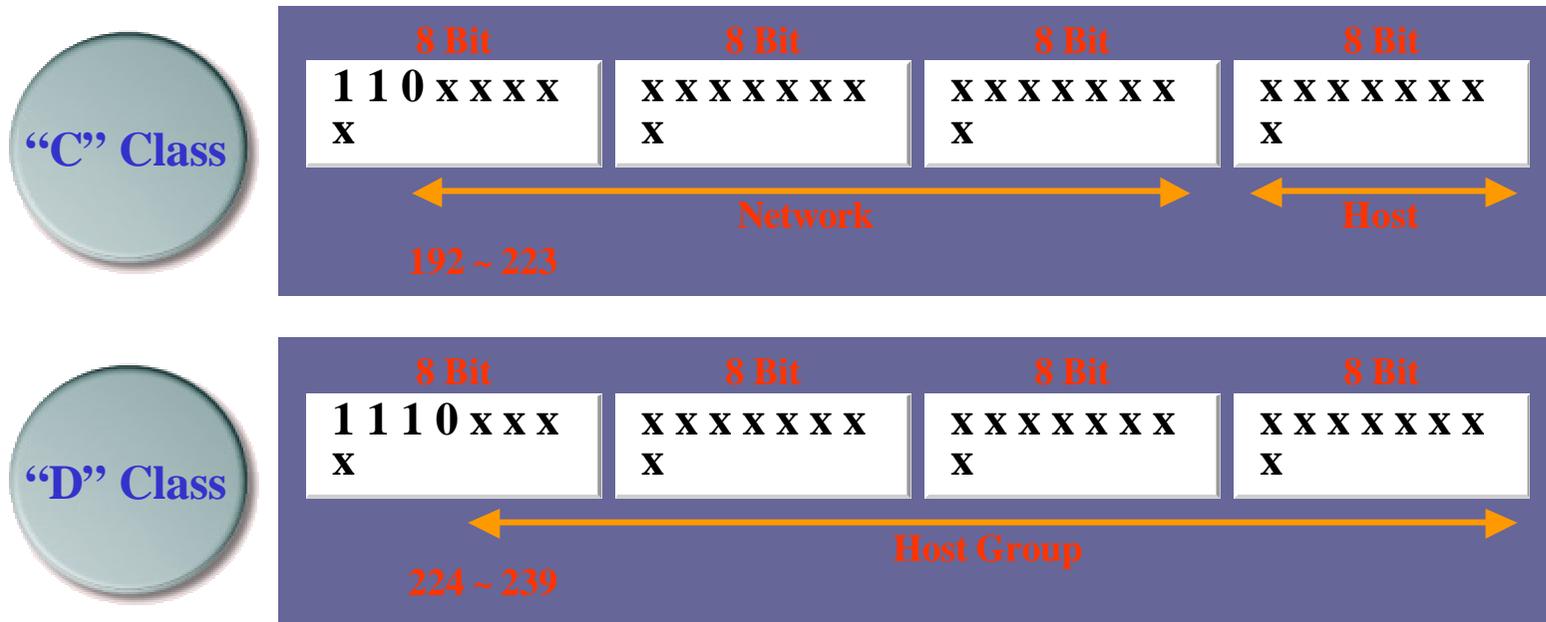
# Internet Protocol \_ IP Address

## ☞ “C” Class

- Bit가 “1 1 0”
- Network : 2,097,152, Host : 254

## ☞ “D” Class

- Bit가 “1 1 1 0”
- Multicast



# Internet Protocol \_ Subnet Mask

## ✍ Subnet Mask

✍ IP

✍ Network Host

✍ Major Class

	2		CIDR
A Class	11111111. 00000000. 00000000. 00000000	255. 0. 0. 0	/8
B Class	11111111. 11111111. 00000000. 00000000	255. 255. 0. 0	/16
C Class	11111111. 11111111. 11111111. 00000000	255. 255. 255. 0	/24

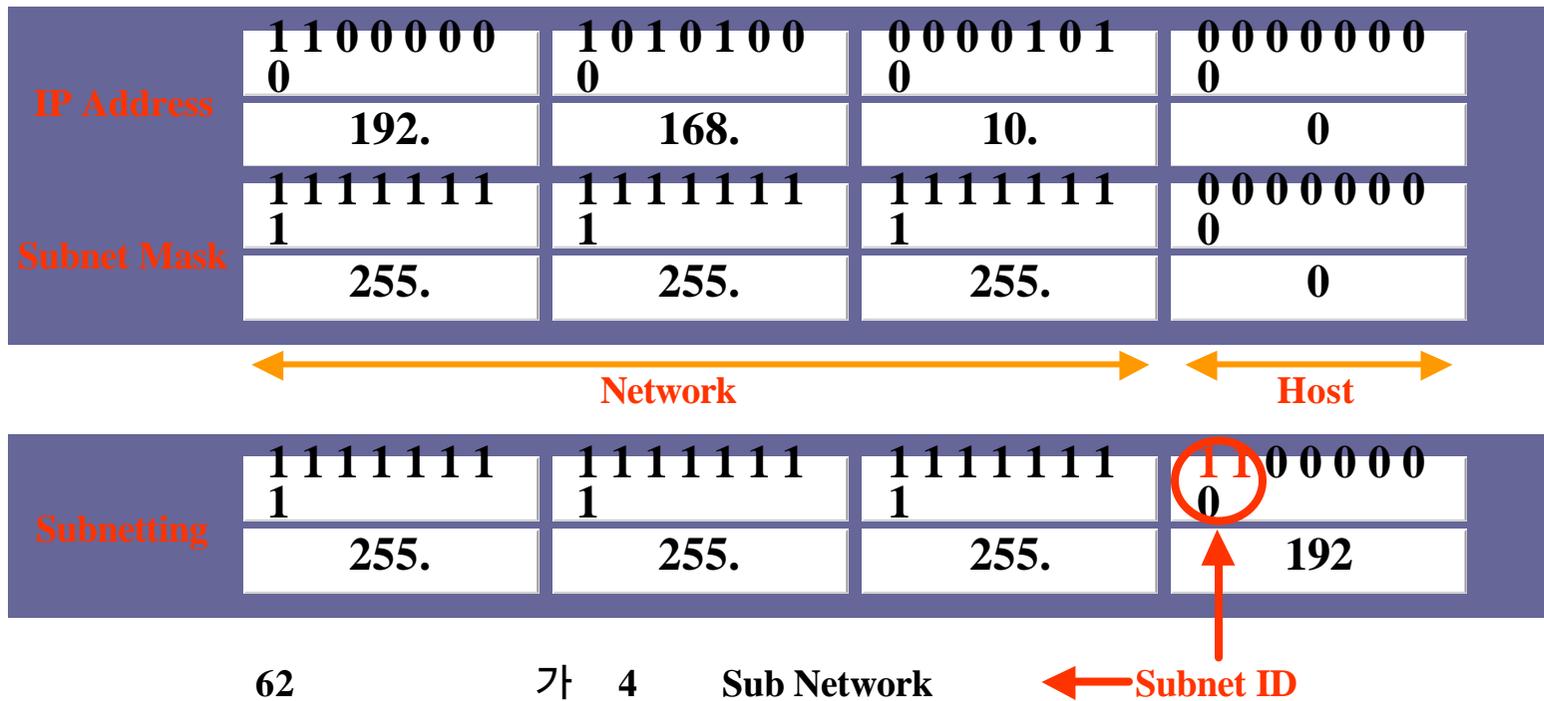
◆ CIDR(Classless Internet Domain Routing) : Subnet Mask

# Internet Protocol \_ Subnet Mask

## ✍ Subnetting

- ✍ Host ID                      Subnet ID
- ✍ Subnet ID    Host ID                      0    1
- ✍ Subnet ID    Net ID                      2 Bit

### ◆ ) “ C ” Class Subnetting



# Internet Protocol \_ Subnet Mask

## ✍ Subnetting Network & Host

### ✍ “ C ” Class Subnetting

- Network :  $2^n$
- Host :  $2^n - 2$

Subnet Bit(n)	Subnet Mask	Network	/Subnet
1	255. 255. 255. 128	2	126
2	255. 255. 255. 192	4	62
3	255. 255. 255. 224	8	30
4	255. 255. 255. 240	16	14
5	255. 255. 255. 248	32	6
6	255. 255. 255. 252	64	2

---

## Internet Protocol \_ Subnet Mask

### Broadcast and Multicast

#### Unicast

- 가

#### Broadcast

- 가

#### Multicast

- 가

(Group)

### Network broadcast

#### IP

 Host ID Bit가 “ 1 ” Broadcast

 Host ID Bit가 “ 0 ”

 0s "this" , 1s "all"

# Internet Protocol \_ ARP(Address Resolution Protocol)

(RFC 826)



IP Address

MAC Address



Broadcast



ARP



ARP



A가

D

가

ARP request

broadcast



가

broadcast



D

가

reply

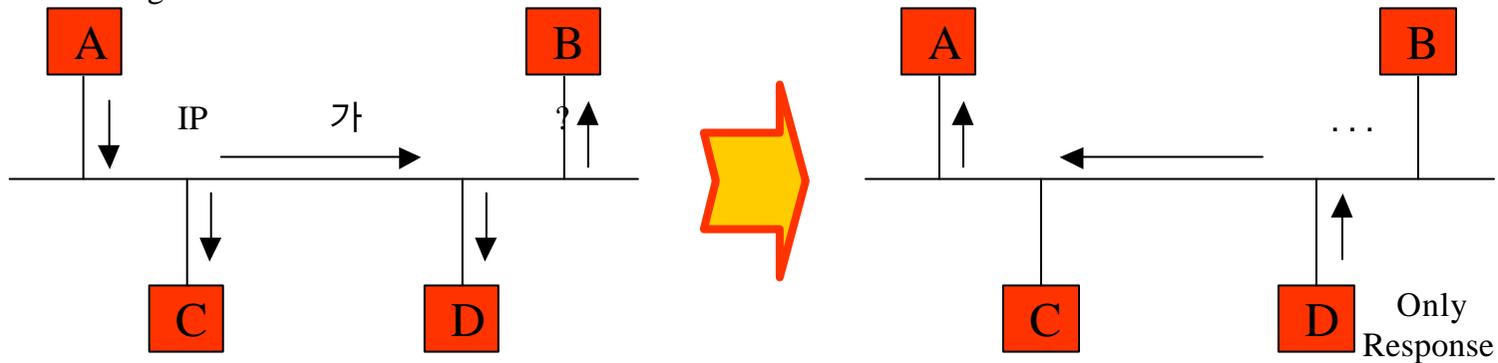


A

D

가

Broadcasting to All



# Internet Protocol \_ RARP(Reverse Address Resolution Protocol)

(RFC 826)



MAC Address IP Address

Broadcast

RARP

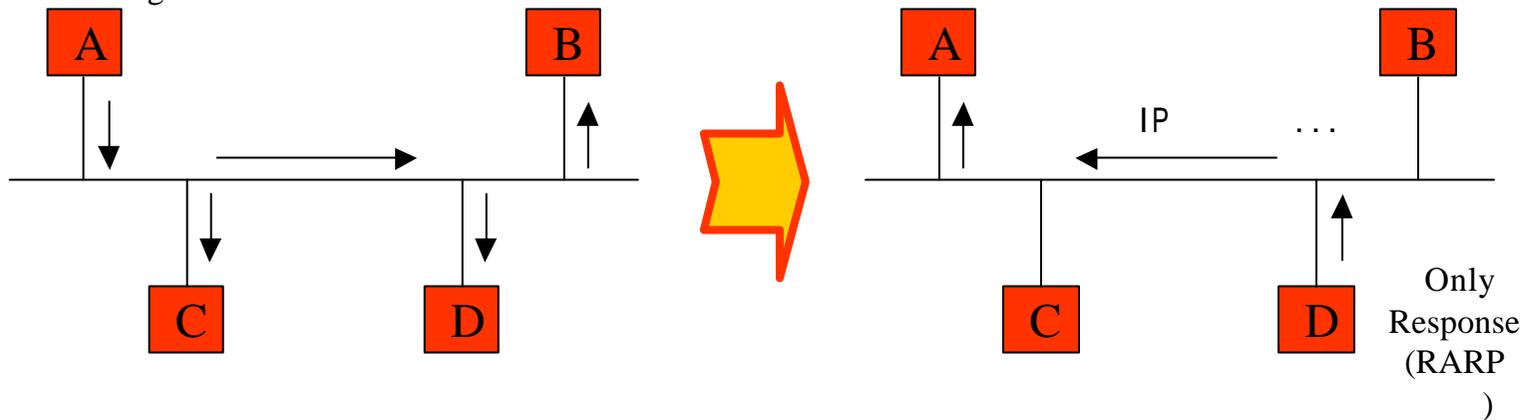
RARP

A가 MAC 가 RARP request broadcast

D(RARP )가 broadcast

D(RARP ) A IP 가 reply

Broadcasting to All



# Internet Protocol \_ Header

## Internet Layer(IP Layer)

✍ IP datagram

가

✍ IP datagram

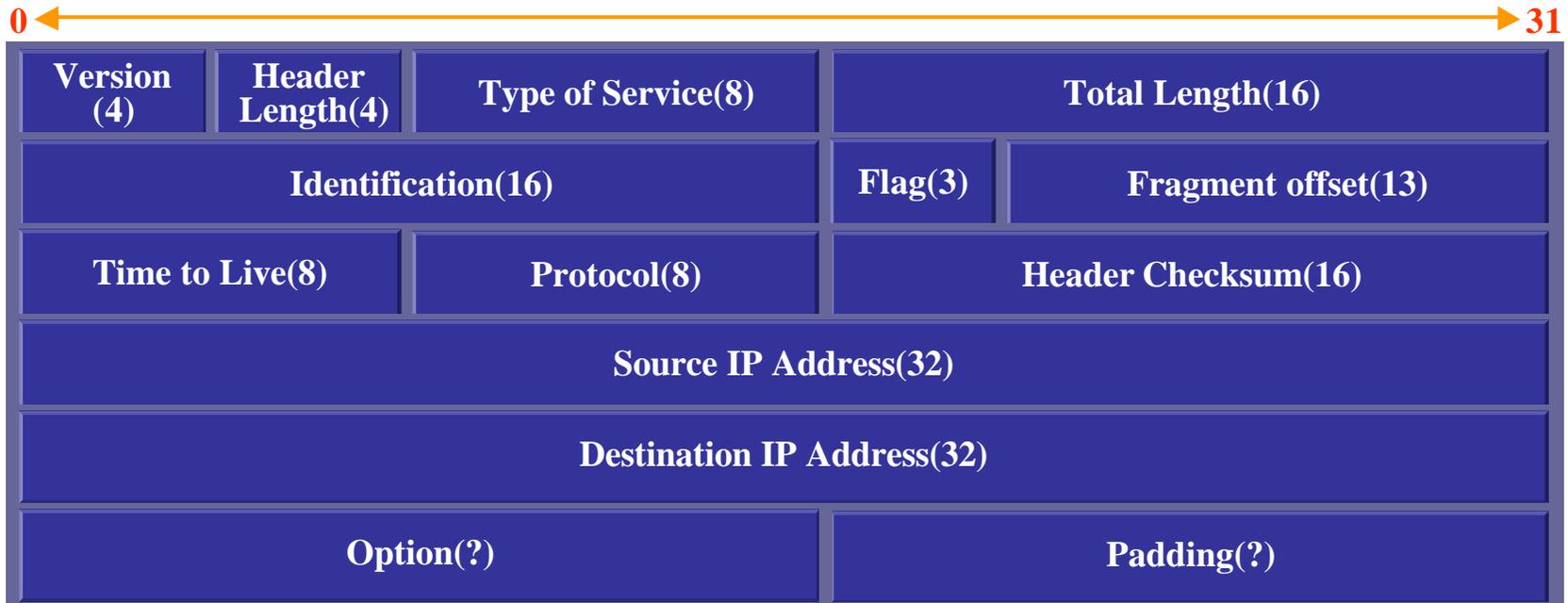
✍

(Association)

( )

✍ IP

## IP Header



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## Internet Protocol \_ Header

 **Version(4 Bit)**

 IP (IPv4)

 **Header Length(4 Bit)**

 IP 32 Bit

 20 Byte(32 Bit x 5)

 **Type of Service(8 Bit)**



 (QoS)

 8 0 ~ 2

 3 ~ 6 ToS

 7 0

 **Total Length(16 Bit)**

 IP

 IP

 16 65,535 가 8192

---

## Internet Protocol \_ Header

### Identification(16 Bit)

-  Datagram
-  Datagram
-  Datagram Packet 가

### Flag(3 Bit)

-  "more fragment"
-  fragment fragment
-  3 Bit
  - Bit " 0 " : " 0 " Setting
  - Bit " 1 " : " 0 " , " 1 "
  - Bit " 2 " : " 0 " , " 1 "

### Fragment offset(13 Bit)

-  Datagram fragment가

# Internet Protocol \_ Header

## Fragmentation and Reassembly

Unit) 가 - MTU(Maximum Transfer

Ethernet MTU 1,500 bytes

### Fragmentation

가 IP datagram , IP IP datagram Fragment

Fragment Reassemble 가

, IP Fragmentation

## Time to Live(8 Bit)

TTL Datagram

Datagram (0 ~ 255),

" (0)" datagram , 가

---

## Internet Protocol \_ Header

### ✍ Protocol(8 Bit)

✍ IP

✍ ICMP(1), TCP(6), UDP(17)

### ✍ Header Checksum

✍ IP checksum

✍ TTL, Fragment

✍ ICMP, IGMP, TCP, UDP 가 checksum

### ✍ IP Address( 32 Bit)

✍ IP Datagram Source IP

✍ IP Datagram Destination IP

### ✍ Option(?)

✍ 가 Optional Information

✍ IP datagram ( 가)

- Security, Record Route, Timestamp

- Strict Source Routing

### ✍ Padding(?)

✍ Option Field 가(IP Header 32 Bit )

# Internet Protocol \_ Routing



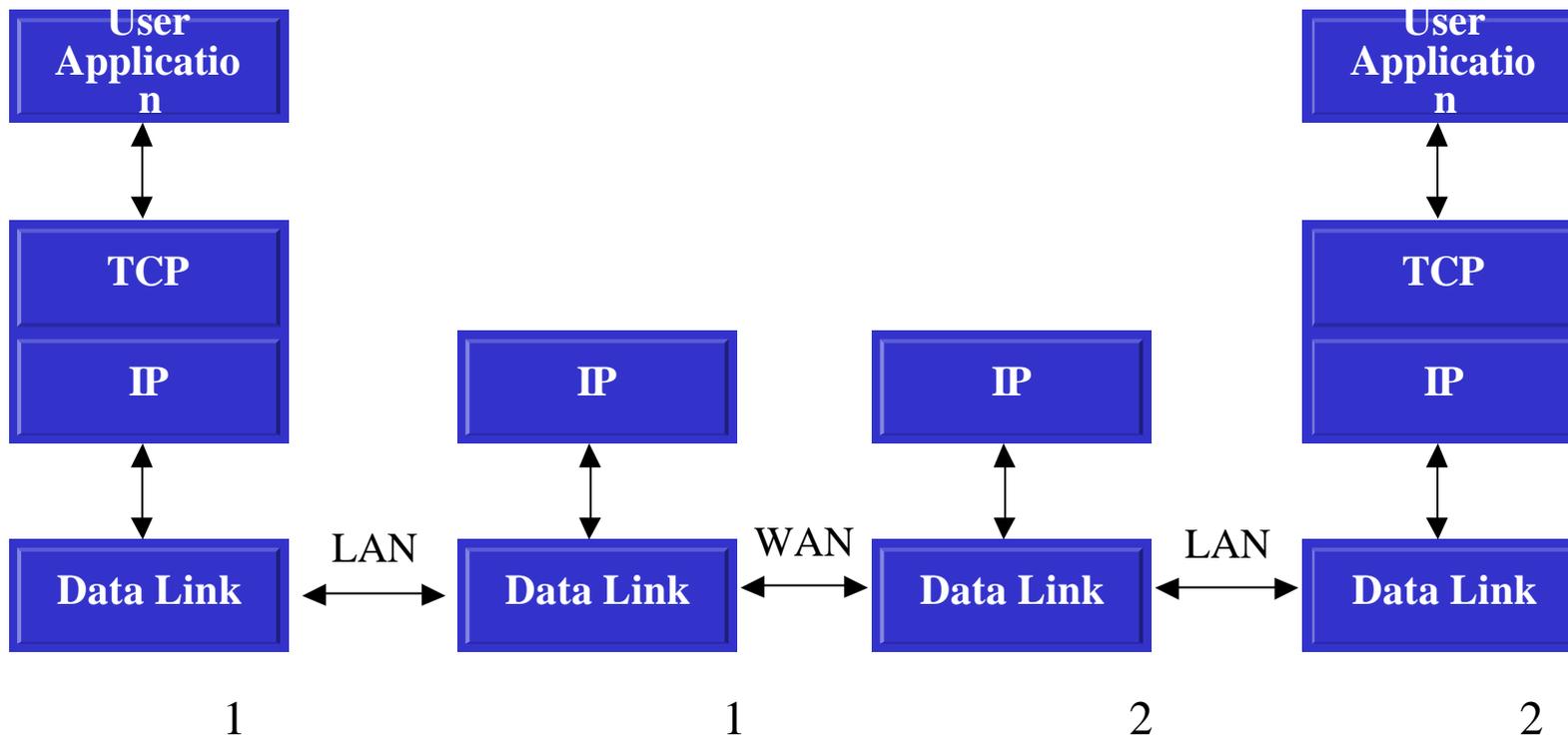
Network

IP



IP

IP



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# Internet Protocol \_ Routing

## IP Datagram



- 가 ,
- 가 ,가 가



- 가 가 ,
- 가 ,

## IP



-

 RIP, OSPF, IGRP, EIGRP

-

 EGP, BGP



**Default**

---

# Internet Protocol \_ Routing



- ✍ ( )
- ✍ 가 , 가
- ✍



- ✍ 가
- ✍ Routing Metric
- ✍ Routing Metric
- ✍ Interior Routing Protocol
  - , (same AS)
- ✍ Exterior Routing Protocol
  - Backbone , (different AS)

---

## Internet Protocol \_ Routing

### Interior Routing Protocol



- RIP(Routing Information Protocol)
- OSPF(Open Shortest Path First)



- IGRP(Interior Gateway Routing Protocol)
- EIGRP(Enhanced IGRP)

### Exterior Routing Protocol



Inter-domain routing protocol



EGP(Exterior Gateway Protocol)



BGP(Border Gateway Protocol)

---

## Transport Layer – TCP & UDP



**IP**

**6 가**

- Connection-Oriented or Connectionless**
- Sequencing**
- Error Control**
- Flow Control**
- Byte stream or Message**
- Full-Duplex or Half-Duplex**

---

## Transport Layer – TCP & UDP

### Connection-Oriented

 TCP





 Virtual Circuit(가 )

 가

 Connection-Oriented

-

-

-

### connectionless

 UDP

 (Datagram)



(datagram)



---

## Transport Layer – TCP & UDP

### Sequencing



#### TCP

- sequencing

#### UDP

- sequencing

### Error control



가

- checksum( 가) & positive acknowledgment

-

-

---

## Transport Layer – TCP & UDP

### Port Number

 UDP TCP 가



 TCP UDP 16 Port Number

### Well-Known Ports

- Client가 Server
- HTTP : 80, FTP: 21, TFTP: 69, SMTP : 25, DNS : 53

### TCP

 Connections Between Processes

 Sequencing of Data

 End-to-End Reliability

 End-to-End Flow Control

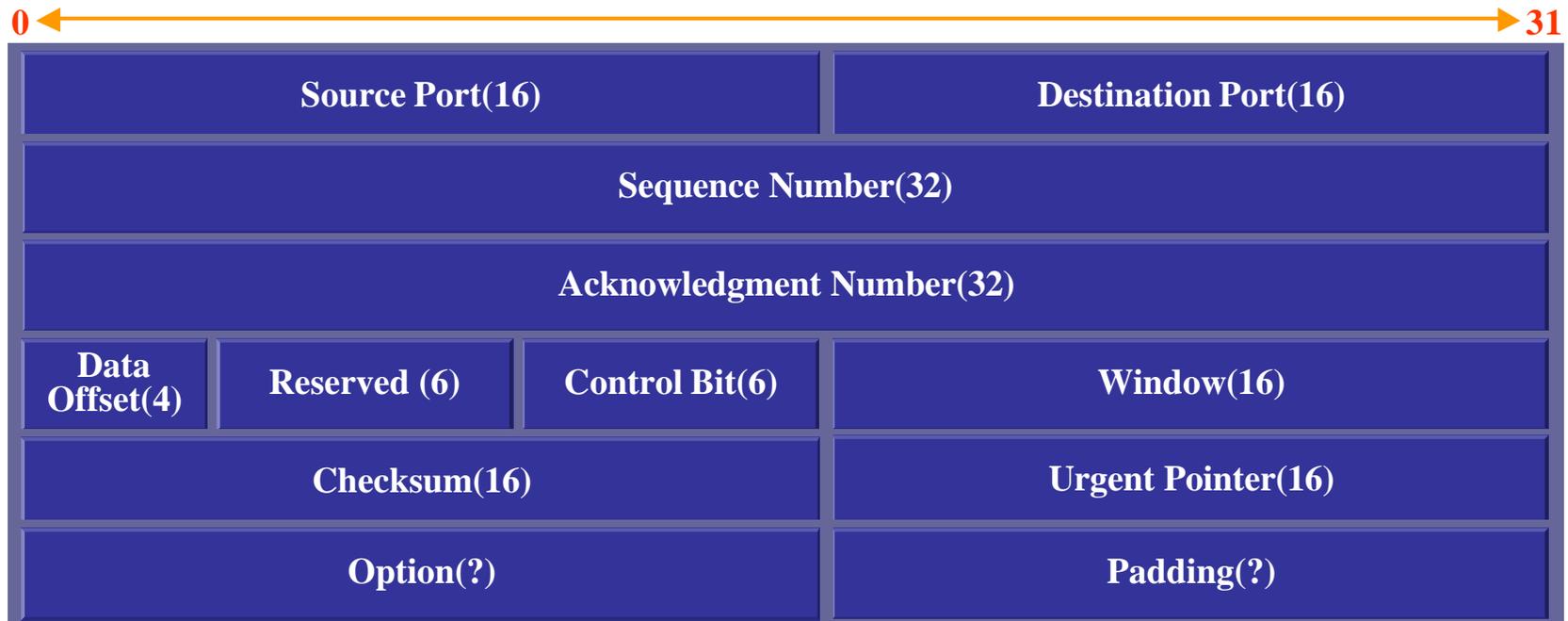
### UDP

 Port Numbers

 Optional Checksum

# Transport Layer – TCP

## TCP Segment



✍ Source Port(16 Bit) :

✍ Destination Port(16 Bit) :



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## Transport Layer – TCP

✍ **Window**

-

✍ **Checksum**

- TCP

✍ **Urgent Pointer**

-

✍ **Options**

- TCP 8

✍ **Padding**

- 가 32 TCP "0" padding

# Transport Layer – TCP

✍ Transport

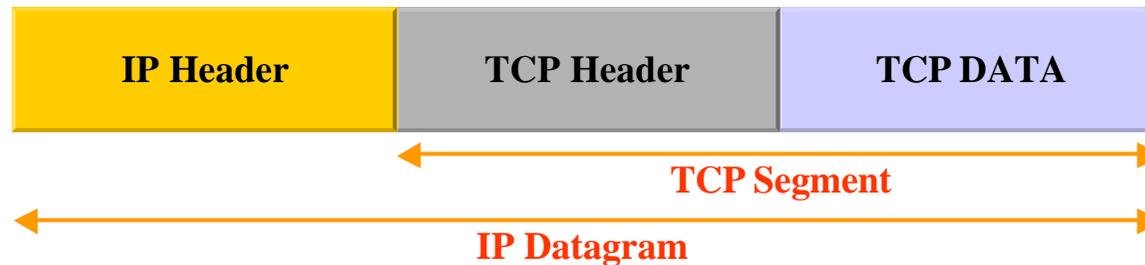
✍ Stream Service

✍ , 가  
✍ , (IP)

✍ TCP End-to-End Segment

✍ , Maximum Segment Size(MSS)

✍ IP datagram TCP



# Transport Layer – TCP

## TCP Flow Control - Sliding Windows

TCP

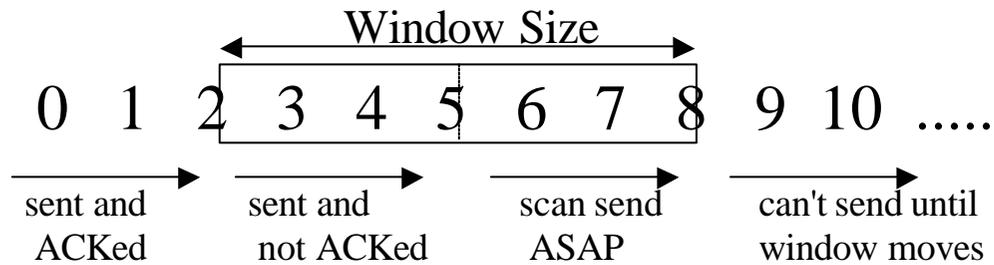
Sliding Window

TCP

-

-

Sliding Window



Window Size

Acknowledgment

가

,

가

“ 0 ”

,

# Transport Layer – TCP

## ✍ Connection

### ✍ TCP

- TCP 3-way handshake

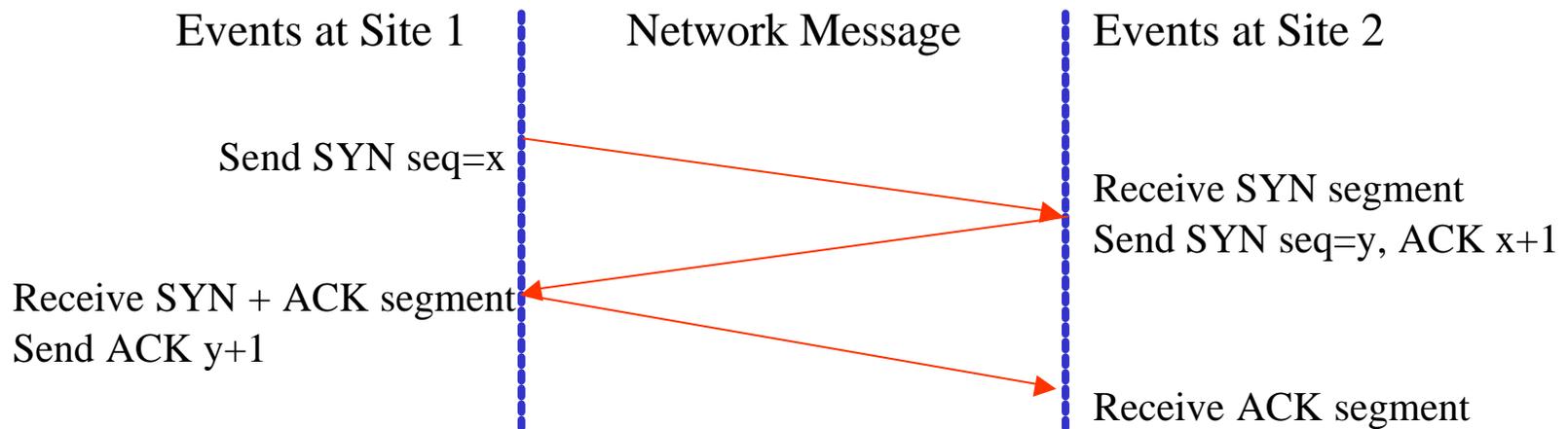
### ✍ TCP가

✍ Lost, Delayed, Duplicated, Delivered out of Order가

- Site 1 SYN Control bits

- Site 2 ACK SYN Control bits

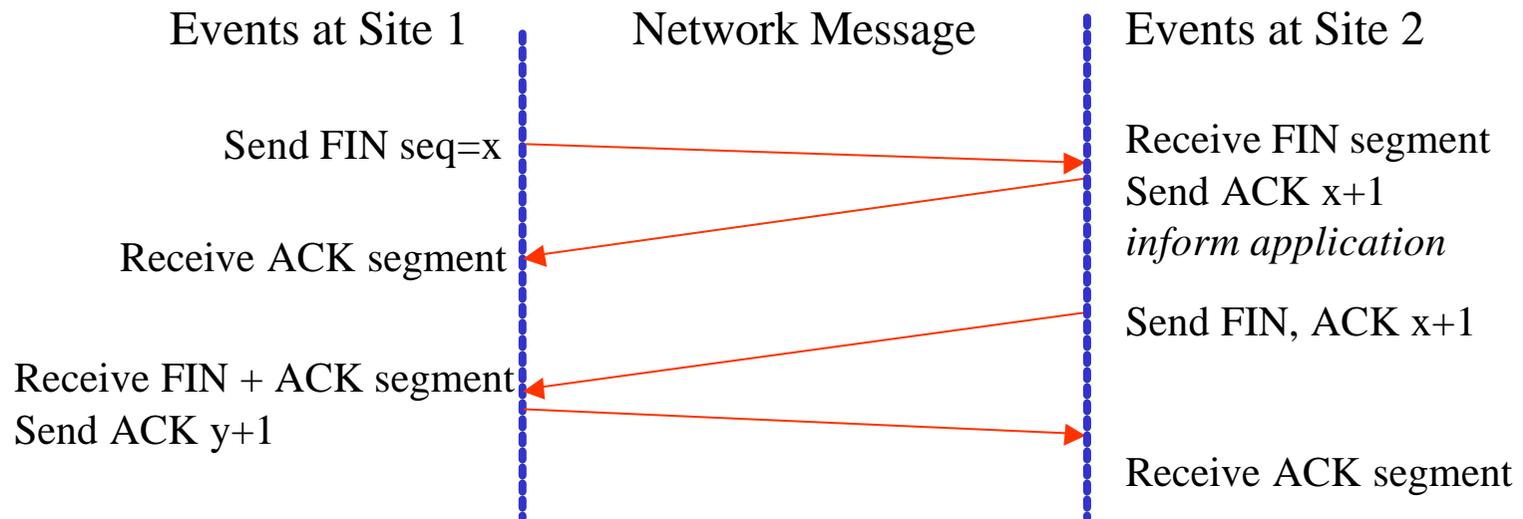
- Site 1 SYN ACK



# Transport Layer – TCP

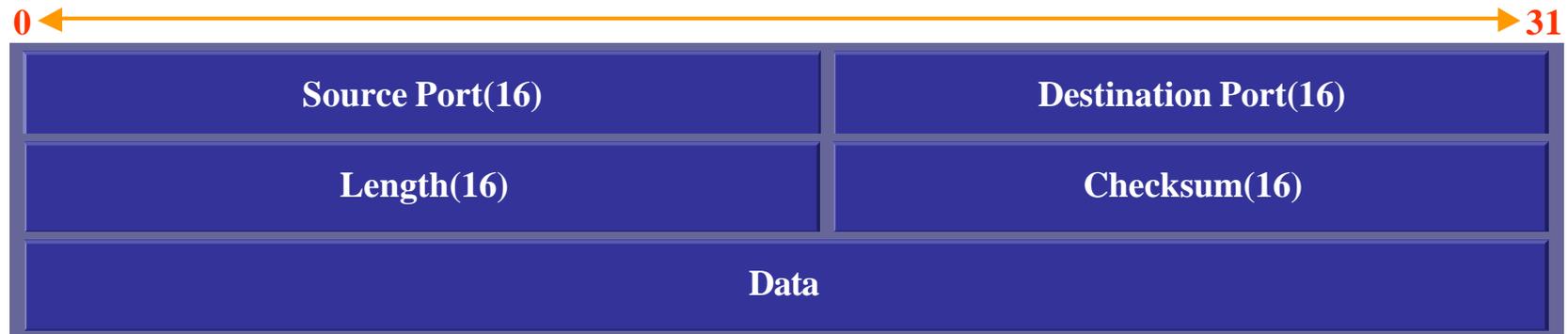
✍ TCP

- TCP 3-way handshake
- FIN , FIN ACK
- TCP
- TCP 2 FIN
- ACK



## Transport Layer – UDP

### ✎ UDP datagram



✎ Source Port(16 Bit) :

✎ Destination Port(16 Bit) :

✎ UDP Length(16 Bit) : UDP header + Data

✎ UDP Checksum: UDP header + Data      Checksum

# Transport Layer – UDP

- ✍ Transport
- ✍ Simple, Datagram-Oriented
- ✍ IP datagram      UDP datagram

