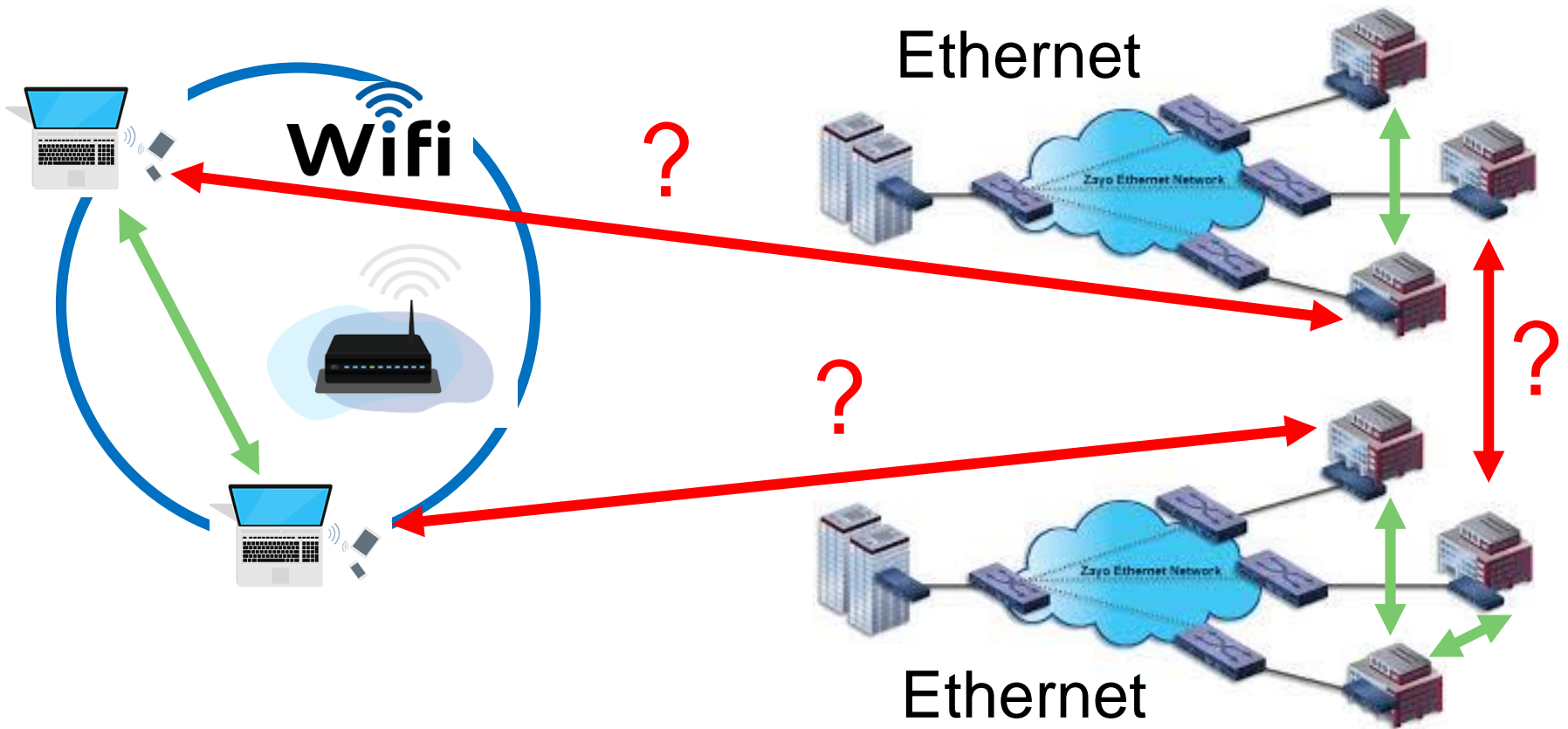

Introduction to Internet

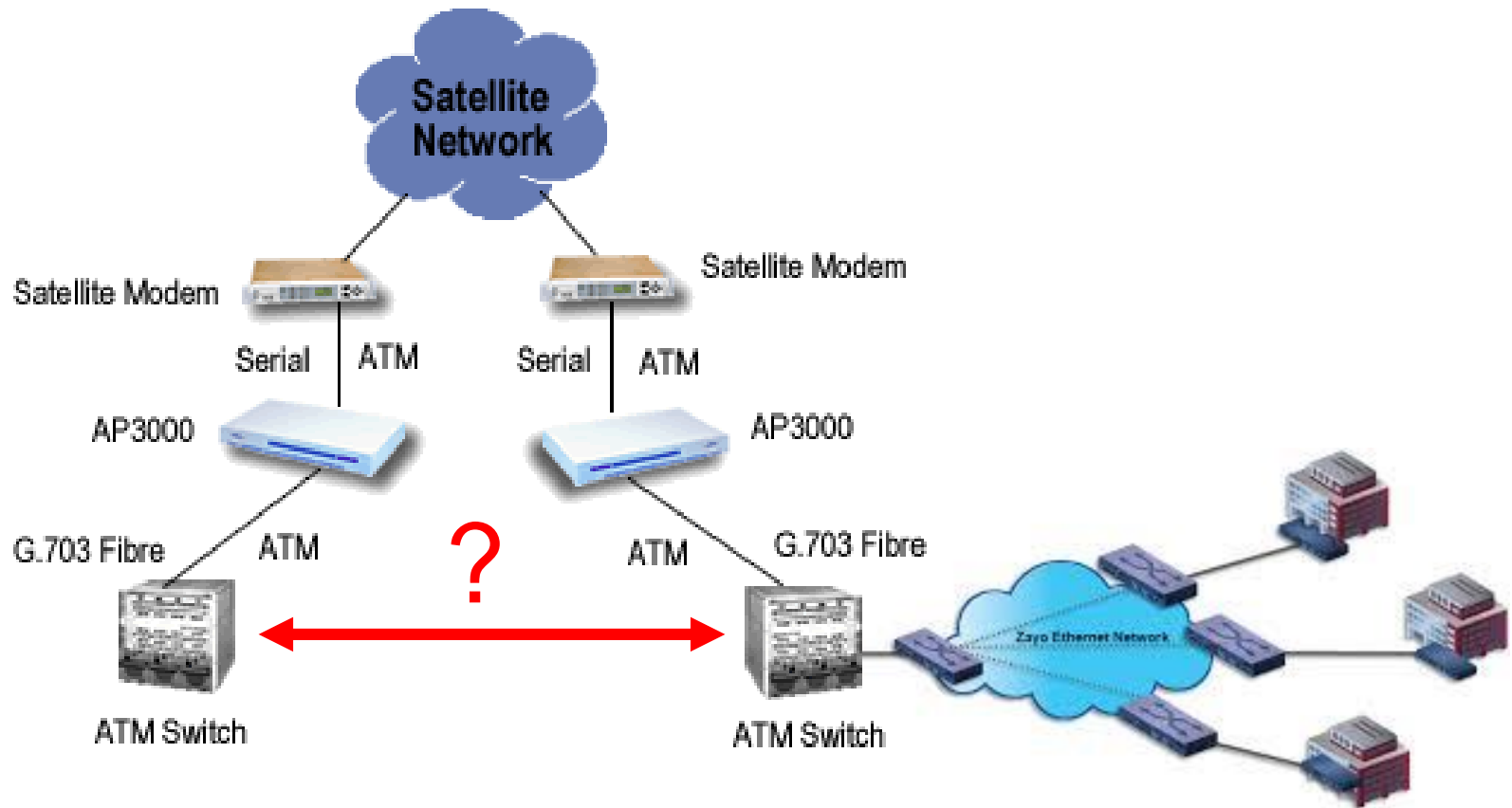
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What about inter-networks communications ? Between LANs ...

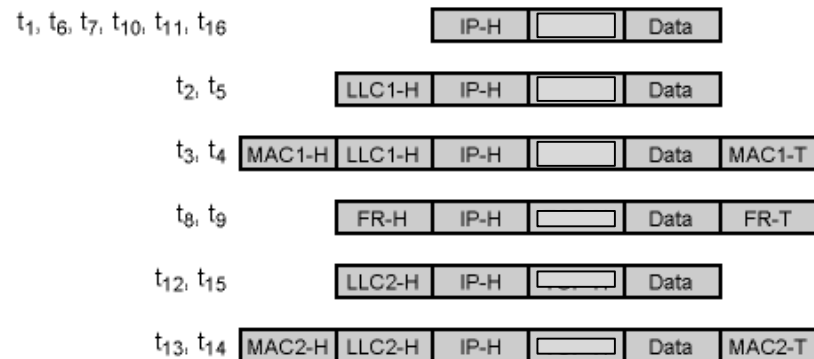
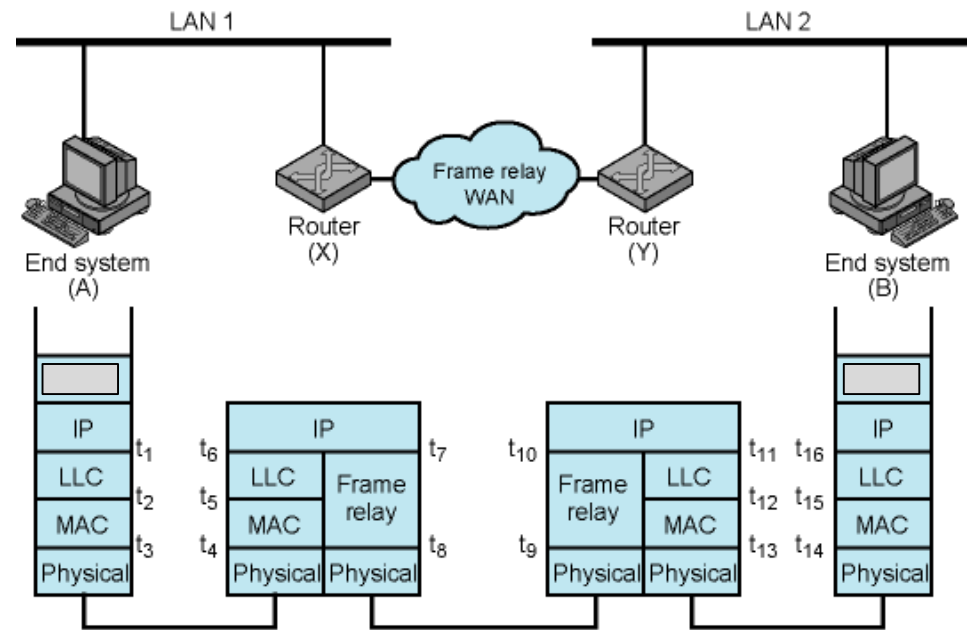


What about inter-networks communications ? Between WANs ...



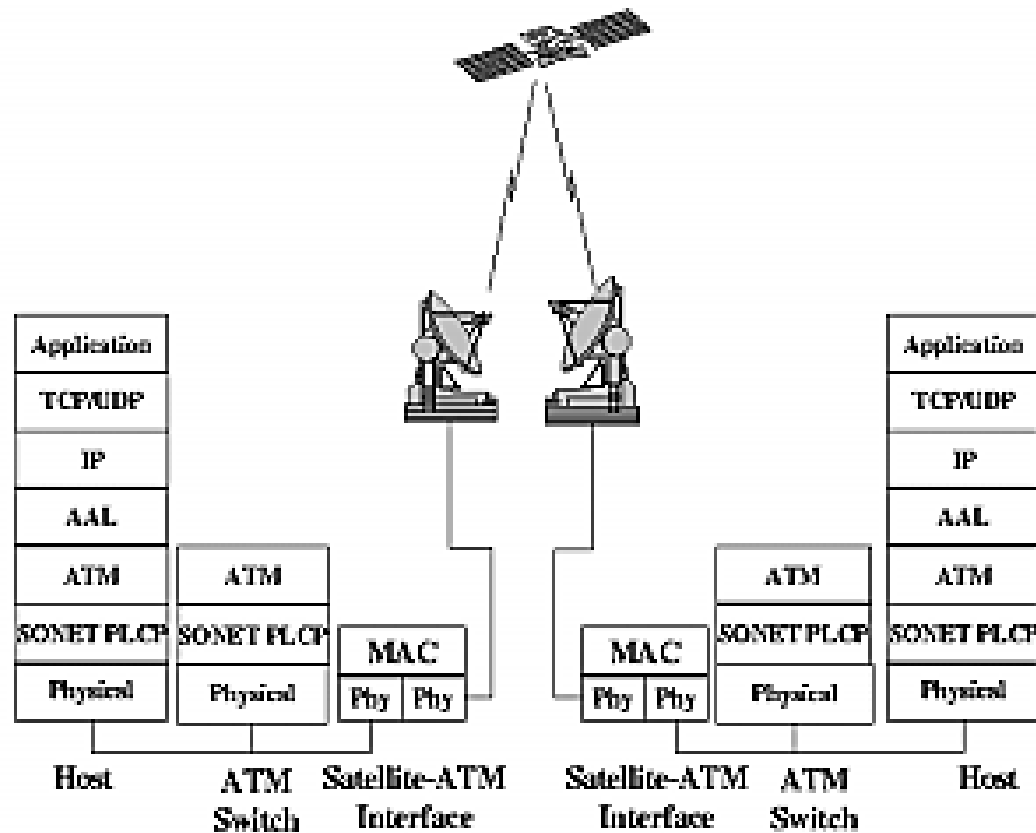
Internet Protocol Operation

- IP packet is encapsulated as Data in intermediary networks
- From intermediary network to another IP packet is carried



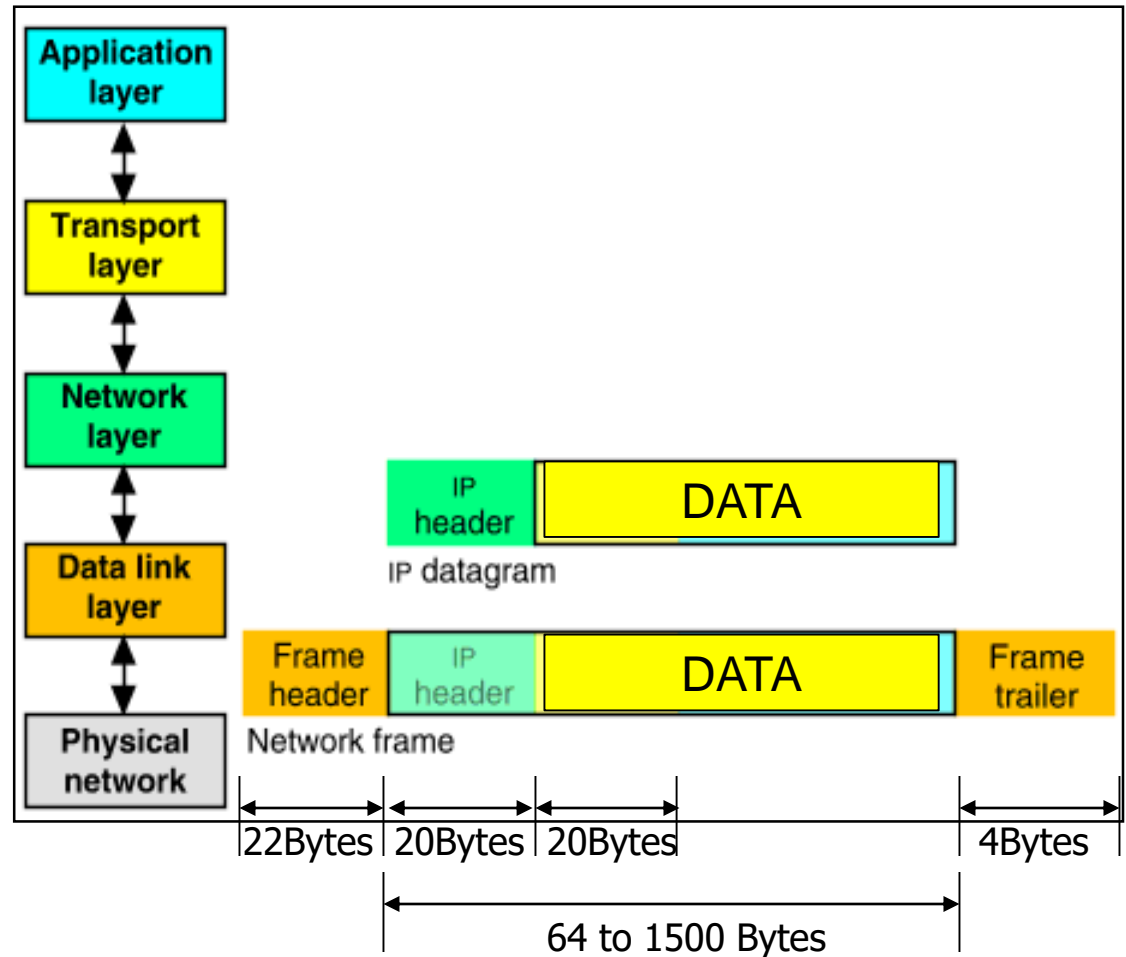
TCP-H = TCP header
 IP-H = IP header
 LLC-H = LLC header
 MAC-H = MAC header
 MAC-T = MAC trailer
 FR-H = Frame relay header
 FR-T = Frame relay trailer

Example : TCP over Satellite-ATM Protocol Stack

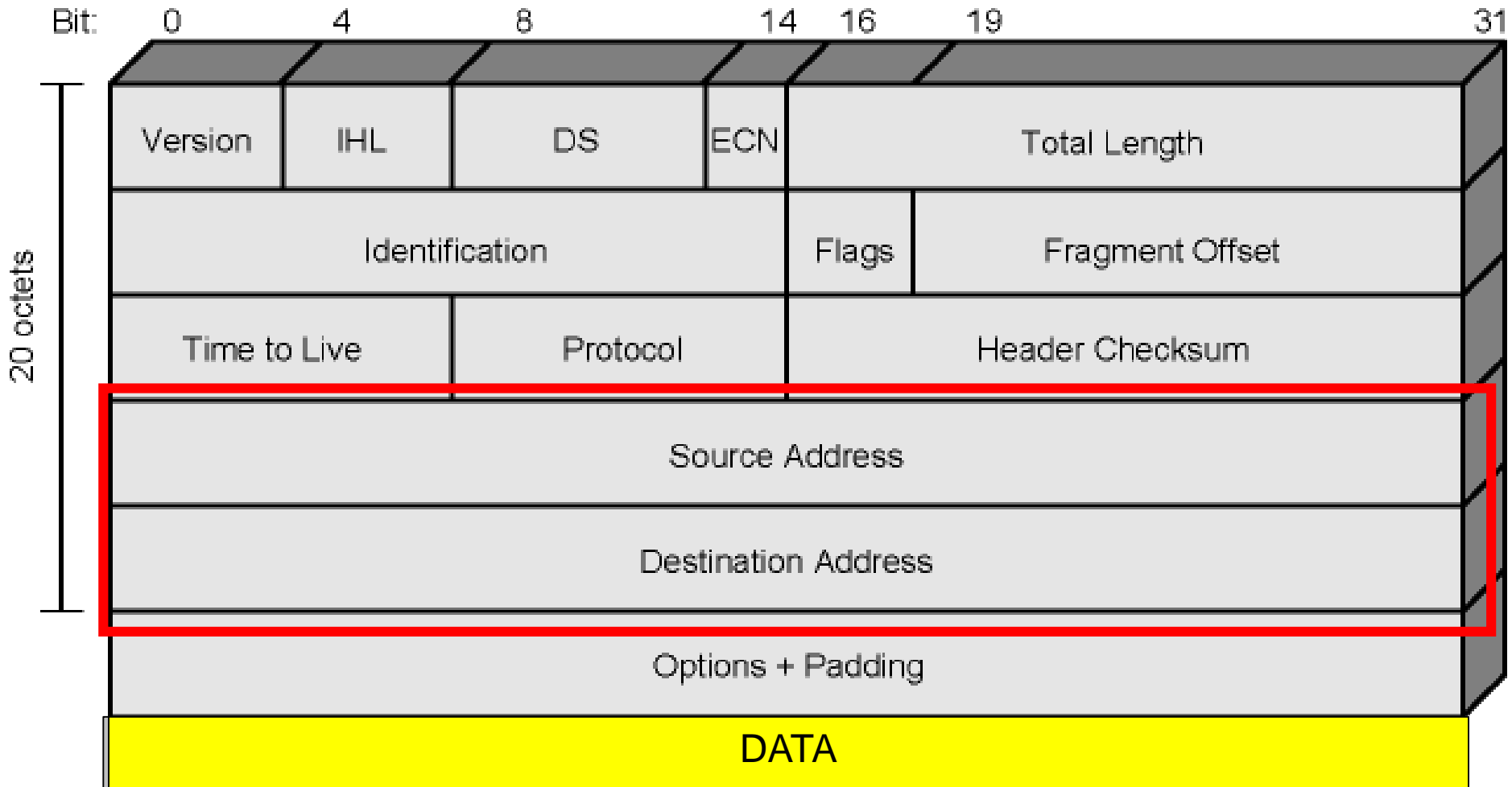


Packet Encapsulation in OSI/ISO model

- The data is sent down the protocol stack
- Each layer adds to the data by prepending headers

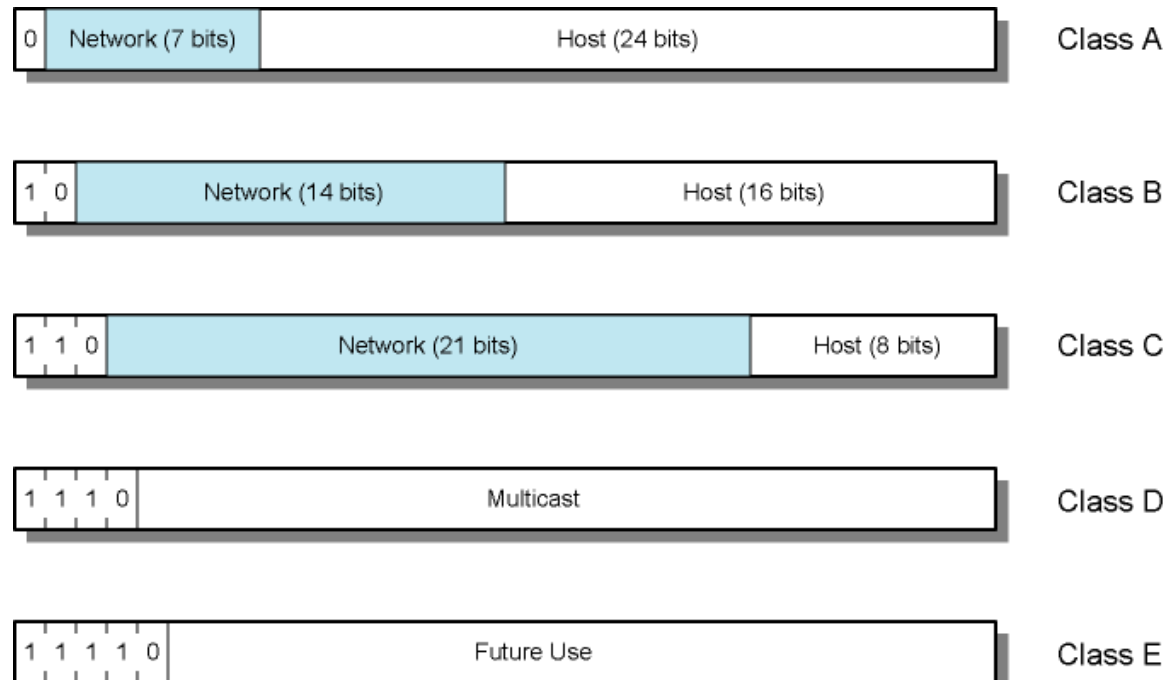


IPv4 Header



IPv4 Address Formats

- 32 bit global Internet address
- Network part and host part
- **All-zero host part identifies the network**
- **All-one host part means broadcast (limited to current network)**



IP Addresses - Class A

- Start with binary 0
 - 7-bit network - 24-bit host
 - All zero
 - Special meaning (means “this computer”)
 - 01111111 (127) (network part) reserved for loopback
 - Generally 127.0.0.1 is used
 - Range 1.x.x.x to 126.x.x.x
 - 10.x.x.x is for private networks
 - Few networks - many hosts
 - All networks have been allocated
-

IP Addresses - Class B

- Starts with binary 10
 - Range **128.x.x.x** to **191.x.x.x**
 - **Second octet** is also part of the network id.
 - 14-bit network, 16-bit host number
 - $2^{14} = 16,384$ class B addresses
 - $2^{16} = 65,536$ hosts per network
 - Actually minus 2 due to network and broadcast addresses
 - All networks have been allocated
-

IP Addresses - Class C

- Start binary 110
 - Range 192.x.x.x to 223.x.x.x
 - **Second** and **third** octets are also part of network address
 - $2^{21} = 2,097,152$ addresses (networks)
 - $256 - 2 = 254$ hosts per network
 - Nearly all allocated
-

Some Special IP address forms

Prefix (network)	Suffix (host)	Type & Meaning
all zeros	all zeros	this computer (used during bootstrap)
network address	all zeros	identifies network
network address	all ones	broadcast on the specified network
all ones	all ones	broadcast on local network
127	any	loopback (for testing purposes)

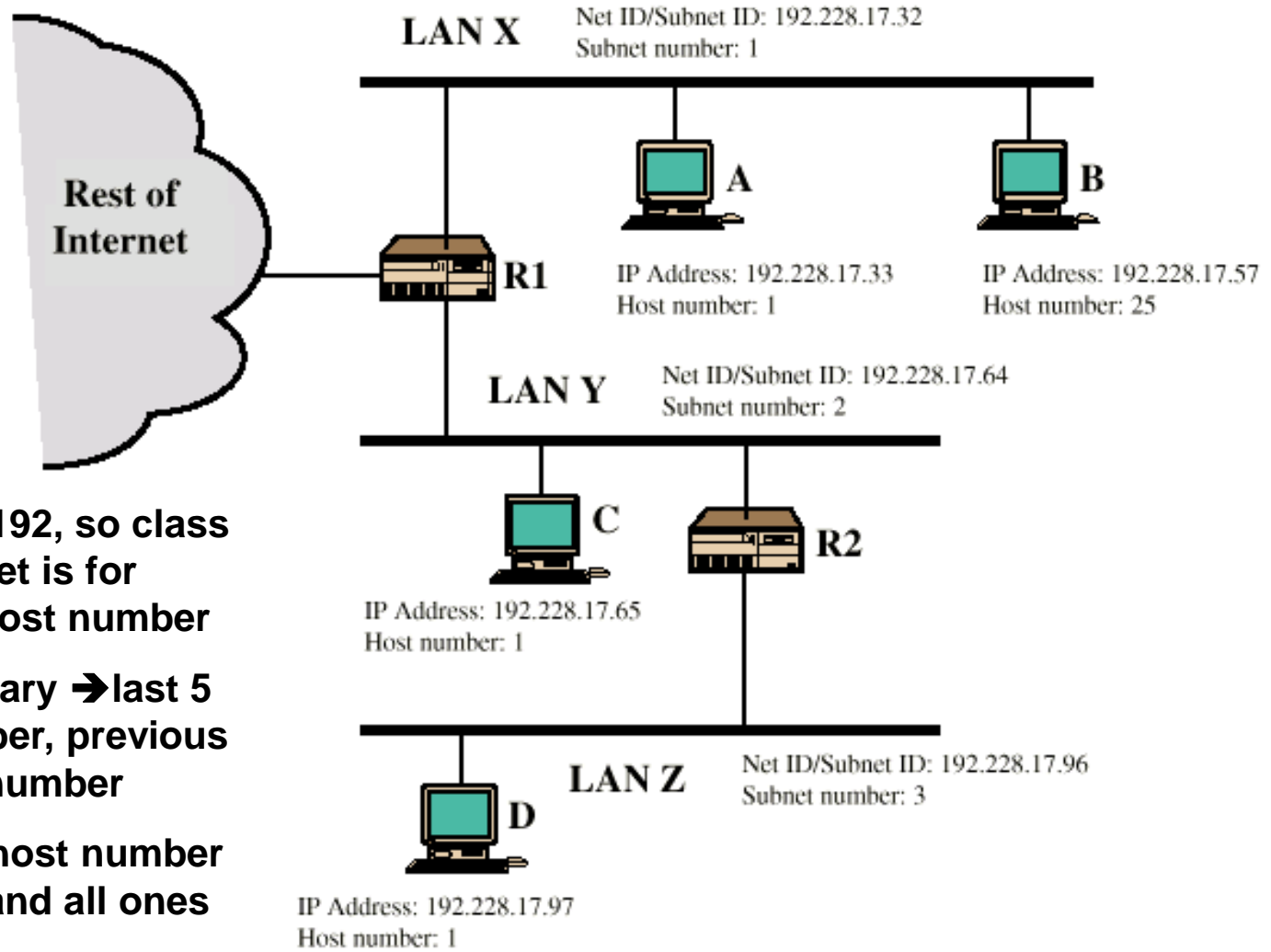
Routing Using Subnets (Example)

Subnet Mask:
255.255.255.224

Addresses start with 192, so class C addresses. Last octet is for Subnet number and Host number

224 -> 11100000 in binary → last 5 bits are for Host number, previous 3 bits are for Subnet number

Don't forget! All zero host number identifies the subnet and all ones is used for broadcast

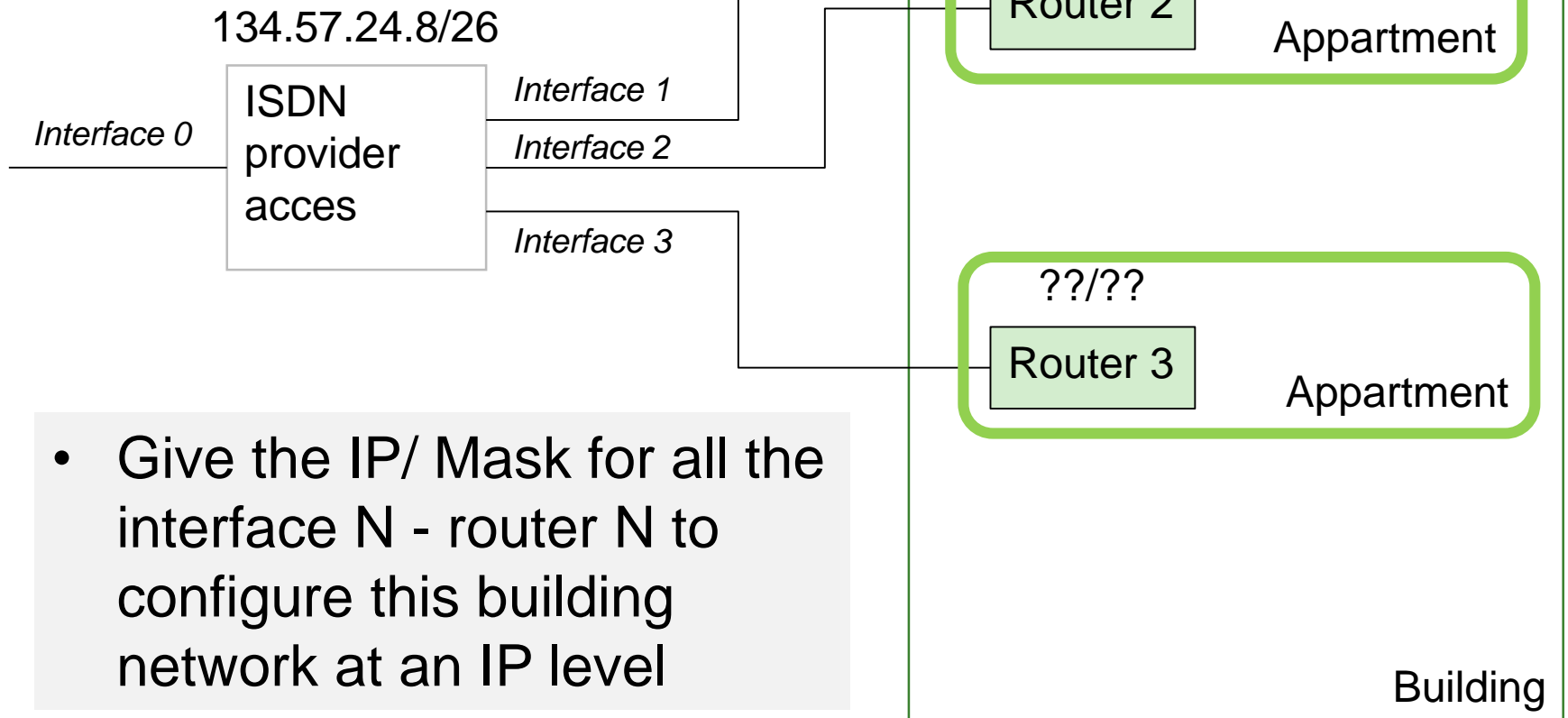


Addr
Source

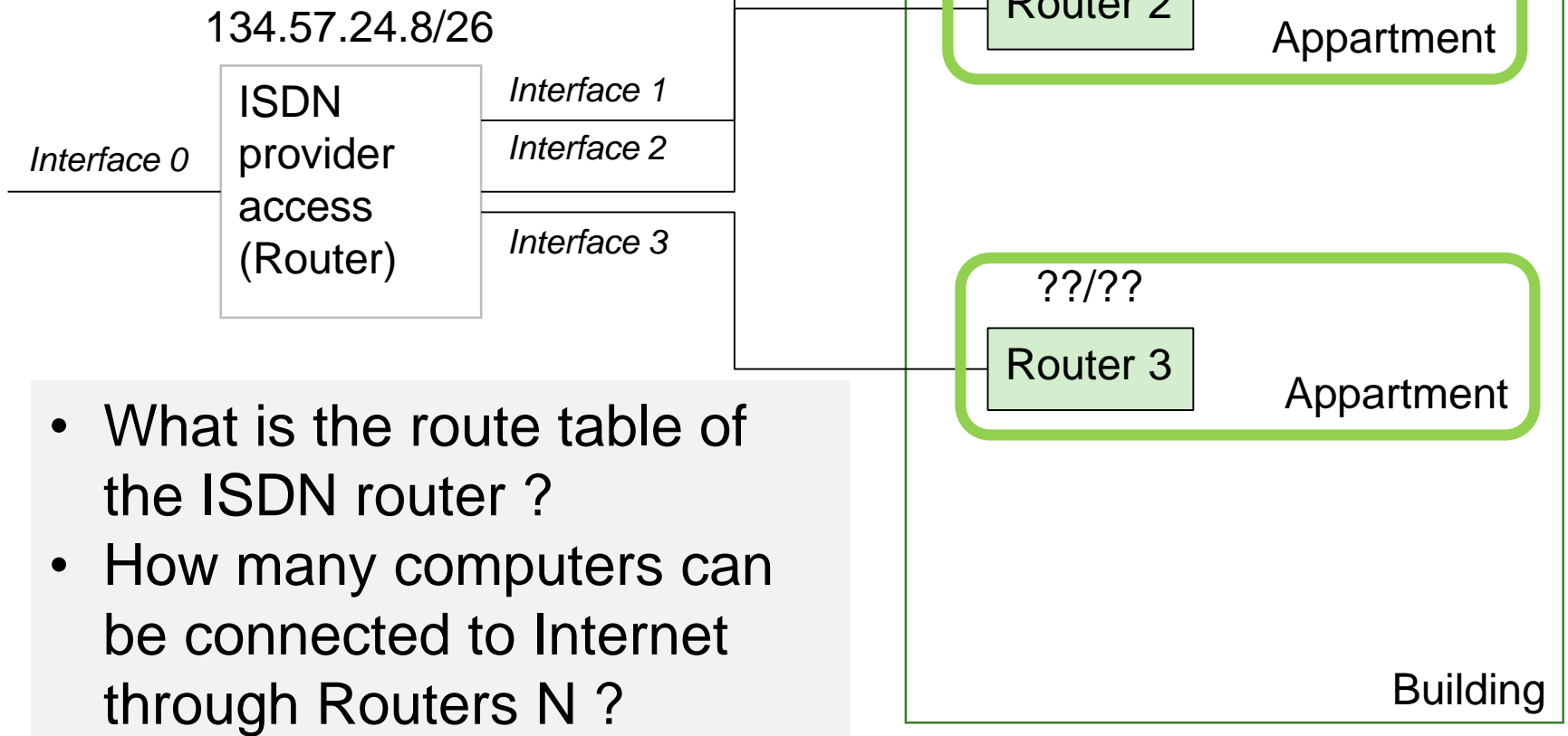
Addr
Dest

DATA

Exercise 1

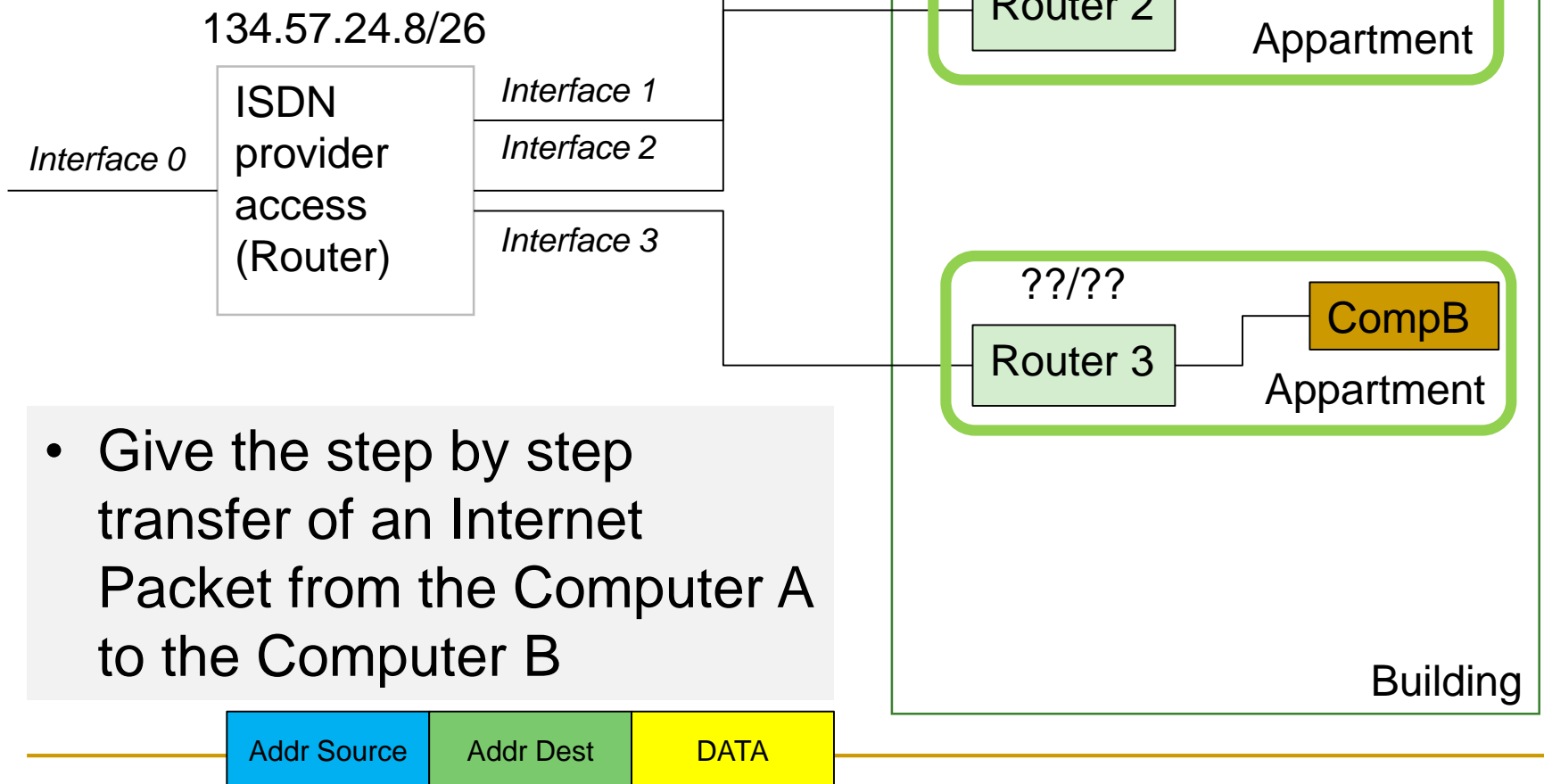


Exercise 2



- What is the route table of the ISDN router ?
- How many computers can be connected to Internet through Routers N ?

Exercise 3



IPv6 Enhancements

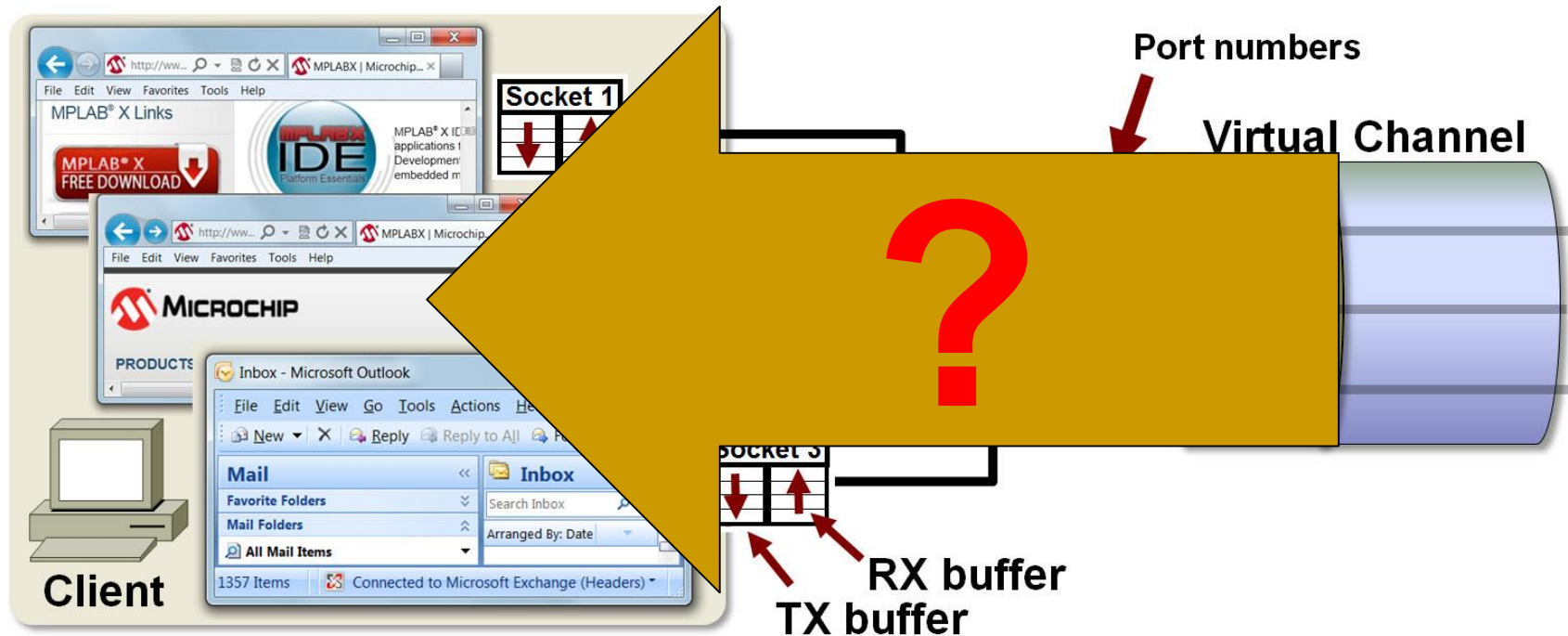
- Expanded address space
 - 128 bit
 - $6 \cdot 10^{23}$ addresses per square meter on earth!
 - Improved option mechanism
 - Separate optional headers between IPv6 header and transport layer PDU
 - Some are not examined by intermediate routers
 - Improved speed and simplified router processing
 - Easier to extend with new options
 - Flexible protocol
-

Introduction to Transport Protocols over IP : UDP / TCP

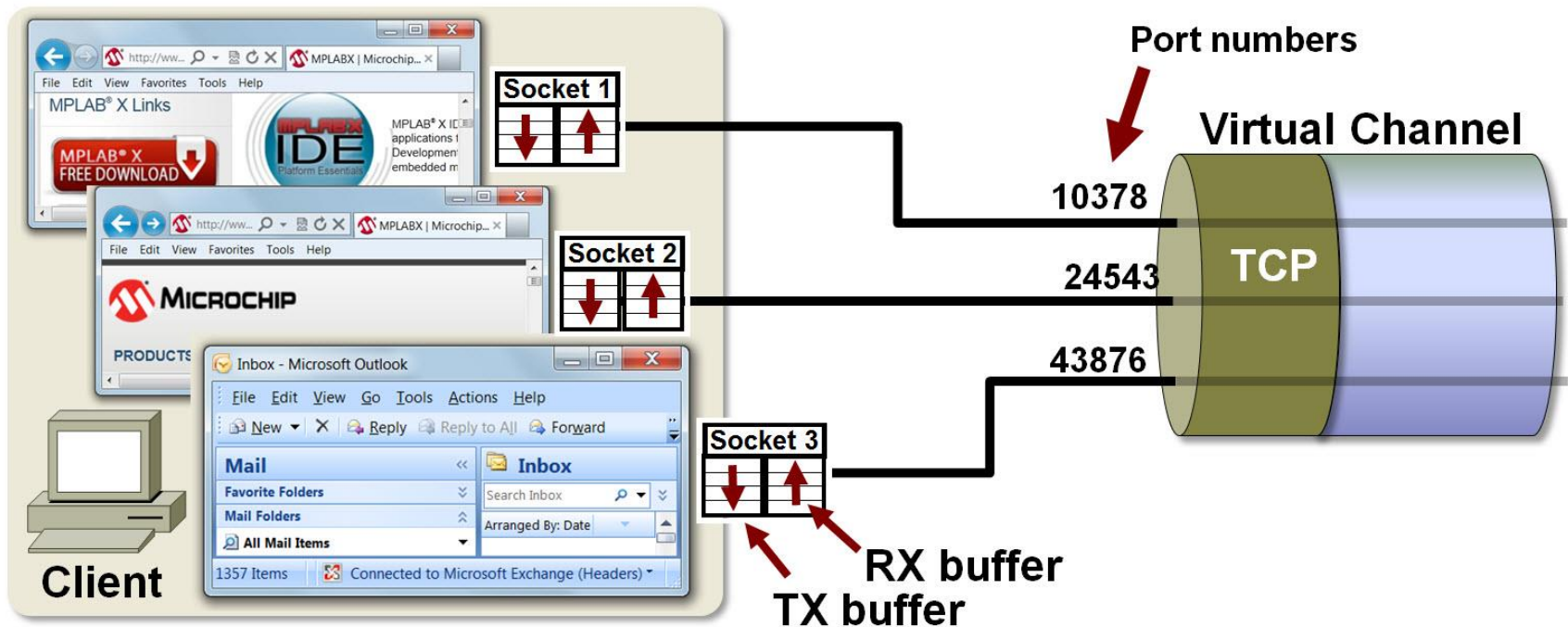
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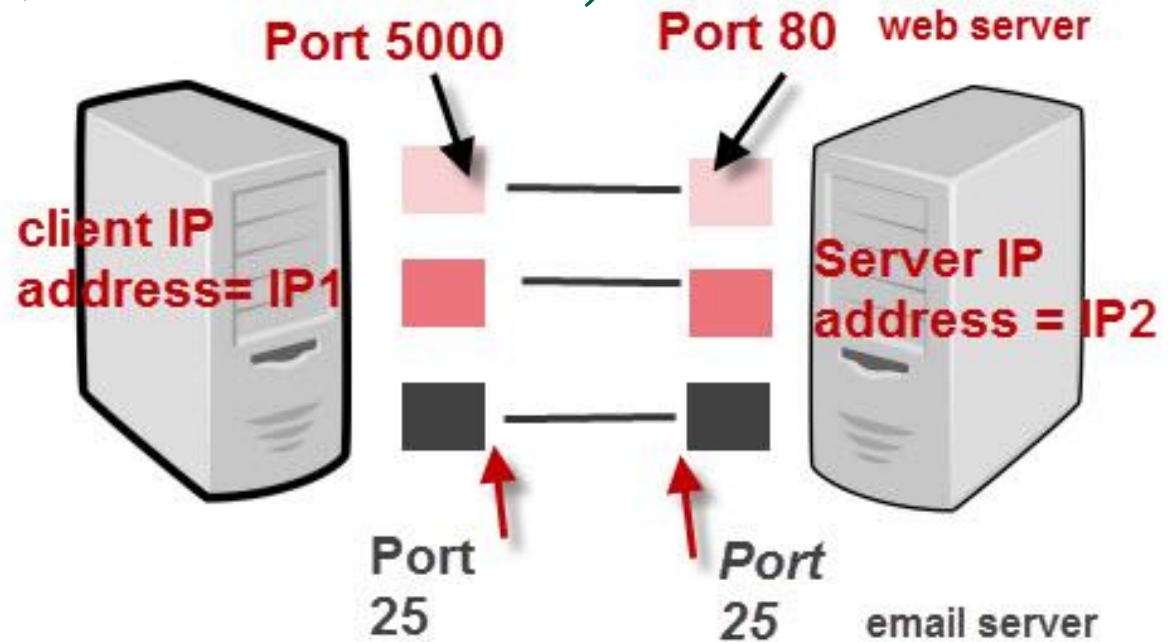
How multiple programs can communicate over internet ?



Adding Port number to IP Address



Communication Channels are (IP/Port Src, IP/Port Dest)



IP Address + Port number = Socket

TCP/IP Ports And Sockets