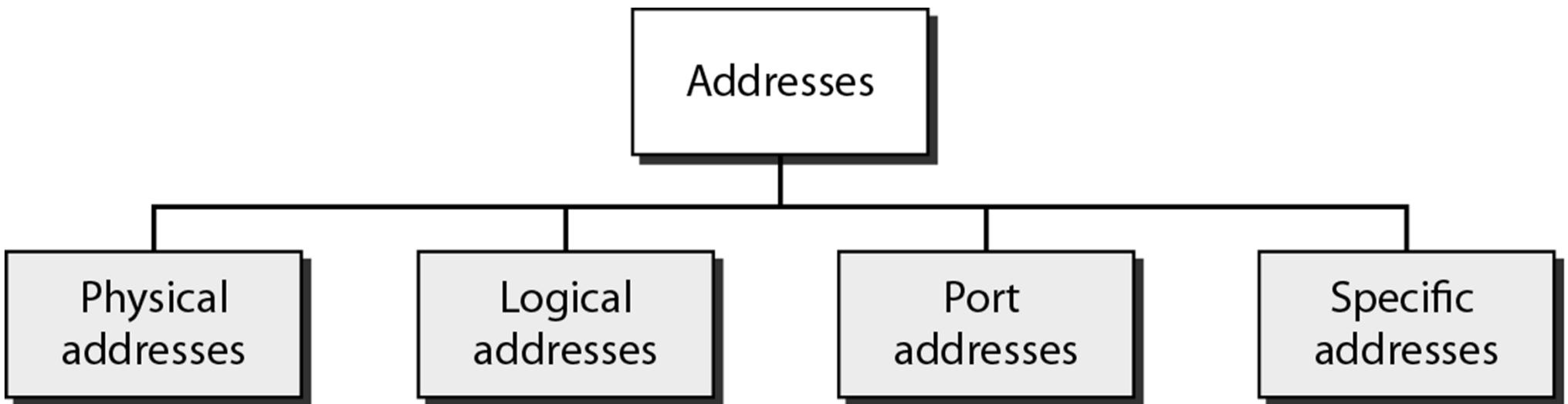


ADDRESSING

- Physical Addresses
- Logical Addresses
- Port Addresses
- Specific Addresses

Addresses in TCP/IP (Fig. 2.17)



Port Address

- Handy way for computers and users to keep track of which port belongs to what program
- Ports are numbered from 0 to 65,535
 - The Internet Assigned Numbers Authority (IANA) decided to reserve the first 1024 port numbers (i.e., 0 to 1023) for requesting entities.
 - Ports 1024 - 49,151 : registered port numbers
 - Ports 49,152 - 65,535: dynamic or private port numbers
- General ways to use port number for source and destination
 - Well-known port numbers -> usually for destination port
 - Randomly generate -> for source port

well known Ports

0	tcp Reserved	96	tcp Micro Focus Cobol	111	tcp Network News Transfer Protocol	141	tcp AED 312 Evaluation Service
0	udp Reserved	97	tcp any private terminal link	120	tcp CFDP/TKT	150	tcp SQL-NET
1	tcp TCP Port Service Multiplexer	97	udp any private terminal link	120	udp CFDP/TKT	150	udp SQL-NET
2	tcp Management Utility	98	tcp Kerberos	121	tcp Encore Expedited Remote Pro/Cell	151	tcp NEMS
3	tcp Compression Process	98	tcp SU MIT Telnet Gateway	121	udp Encore Expedited Remote Pro/Cell	152	tcp Background File Transfer Program
5	tcp Remote Job Entry	98	tcp DNSIX Secure Attribute Token	122	tcp SMAKYNET	153	tcp SCMP
7	tcp Echo	99	tcp MIT Dover Spoofer	122	udp SMAKYNET	153	udp SCMP
7	udp Echo	100	tcp Network Printing Protocol	123	tcp Network Ties Protocol	154	tcp NETSC
9	tcp Discard	100	udp Network Printing Protocol	123	udp Network Ties Protocol	154	udp NETSC
9	udp Discard	101	tcp Device Control Protocol	124	tcp ANSA REX Trader	155	tcp NETSC
11	tcp Active Users	101	udp Device Control Protocol	124	udp ANSA REX Trader	155	udp NETSC
11	udp Active Users	102	tcp Troll Object Dispatcher	125	tcp Locus PC-Interface Net Map	156	tcp SQL Service
13	tcp Daytime	102	udp Troll Object Dispatcher	126	tcp Unisys Utility Login	157	tcp KNET VM Command Message Protocol
13	udp Daytime	103	tcp SUPDUP	126	udp Unisys Utility Login	158	tcp PCMail Server
17	tcp Quotes of the Day	103	udp SUPDUP	127	tcp Locus PC-Interface Comm Server	159	tcp NSS-Routing
17	udp Quotes of the Day	104	tcp DIXIE Protocol Specification	128	tcp GSS X License Verification	160	tcp SCMP-TRAPS
18	tcp RWP rewrite	104	tcp Swift Remote Virtual File	128	udp GSS X License Verification	160	udp SCMP-TRAPS
18	udp RWP rewrite	105	Protocol	129	tcp Password Generator Protocol	161	tcp SNMP
18	tcp Message Send Protocol	105	tcp Swift Remote Virtual File	129	udp Password Generator Protocol	162	udp SNMPTRAP
18	udp Message Send Protocol	106	tcp TAC News	130	tcp cisco FNAITIVE	163	tcp CMIP TCP Manager
11	tcp Character Generator	106	udp TAC News	130	udp cisco FNAITIVE	163	udp CMIP TCP Manager
11	udp Character Generator	107	tcp Metagran Relay	131	tcp cisco TNATIVE	164	tcp CMIP TCP Agent
20	tcp File Transfer [Default Data]	107	udp Metagran Relay	131	udp cisco TNATIVE	164	udp CMIP TCP Agent
21	tcp File Transfer [Control]	108	tcp [unauthorized use]	132	tcp cisco SYSMAINT	165	tcp Xerox
22	tcp Telnet	108	tcp KIC Host Name Server	132	udp cisco SYSMAINT	165	udp Xerox
24	tcp any private mail system	109	tcp KIC Host Name Server	133	tcp Statistics Service	166	tcp Shiva Systems
24	udp any private mail system	109	tcp ISO-TSAP Class 0	133	udp Statistics Service	166	udp Shiva Systems
25	tcp Simple Mail Transfer	109	tcp ISO-TSAP Class 0	134	tcp INGRES-NET Service	167	tcp KAMP
27	tcp NSW User System FE	109	tcp Genesis Point-to-Point Trans	135	tcp Location Service	167	udp KAMP
27	udp NSW User System FE	109	Net	135	udp Location Service	168	tcp RSVD
29	tcp MSG ICP	109	tcp ACR-NEMA Digital Imag. 2	136	tcp PROFILE Naming System	168	udp RSVD 161 udp SEND
29	udp MSG ICP	109	Conn. 300	137	tcp NETBIOS Name Service	170	tcp Network PostScript
31	tcp MSG Authentication	109	tcp Mailbox Name Nsaserver	137	udp NETBIOS Name Service	170	udp Network PostScript
31	udp MSG Authentication	109	udp Mailbox Name Nsaserver	138	tcp NETBIOS Datagram Service	171	tcp Network Innovations Multiplex
33	tcp Display Support Protocol	109	tcp SCOM-TSMUX	138	udp NETBIOS Datagram Service	171	udp Network Innovations Multiplex
33	udp Display Support Protocol	109	tcp SCOM-TSMUX	139	tcp NETBIOS Session Service	172	tcp Network Innovations CL 1
35	tcp any private printer server	109	tcp Password Server	139	udp NETBIOS Session Service	172	udp Network Innovations
35	udp any private printer server	109	tcp Remote Telnet Service	140	tcp EMFIS Data Service	173	1
37	tcp Tme	109	tcp SNA Gateway Access Server	140	udp EMFIS Data Service	173	tcp Xplex
37	udp Tme	109	tcp Post Office Protocol - Version	141	tcp EMFIS Control Service	173	udp Xplex
38	tcp Route Access Protocol	109	2	141	udp EMFIS Control Service	174	tcp MAILQ
38	udp Route Access Protocol	109	tcp Post Office Protocol - Version	142	tcp Britton-Lee IDM	174	udp MAILQ
39	tcp Resource Location Protocol	109	3	142	udp Britton-Lee IDM	175	tcp VNET
41	tcp Graphics	110	tcp SUN Remote Procedure Call	143	tcp Interactive Mail Access	175	udp VNET
41	udp Graphics	110	tcp SUN Remote Procedure Call	144	tcp NewS	176	tcp GENRAD-MUX
42	tcp Host Name Server	110	Protocol	144	udp NewS	176	udp GENRAD-MUX
43	tcp Who Is	110	tcp McIDAS Data Transmission	145	tcp UAAC Protocol	177	tcp X Display Manager Control
44	tcp MPM FLAGS Protocol	110	Protocol	145	udp UAAC Protocol	178	tcp NextStep Window Server
45	tcp Message Processing Module	110	113	146	tcp ISO-IP0	178	tcp NextStep Window Server
[rec]		110	113	146	udp ISO-IP0	179	tcp Border Gateway Protocol
46	tcp MPM [default send]	110	114	147	tcp ISO-IP	180	tcp Intergraph
47	tcp KI FTP	110	114	147	udp ISO-IP	180	udp Intergraph
47	udp KI FTP	110	115	148	tcp CROWUS-SUPPORT	181	
48	tcp Digital Audit Daemon	110	115	148	udp CROWUS-SUPPORT	181	
48	udp Digital Audit Daemon	110	116	149	tcp AED 312 Evaluation Service	181	
49	tcp Login Host Protocol	110	116	149	udp AED 312 Evaluation Service	181	
50	tcp Remote Mail Checking	110	117	149	tcp CROWUS-SUPPORT	181	
Protocol		110	117	149	udp CROWUS-SUPPORT	181	
50	udp Remote Mail Checking	110	118	149	tcp AED 312 Evaluation Service	181	
Protocol		110	118	149	udp AED 312 Evaluation Service	181	
51	Bridging Logical Address, Data Communication and Networking	110	119	149	tcp AED 312 Evaluation Service	181	

101	tcp	Unify
101	udp	Unify
102	tcp	Unsys Audit SITP
102	udp	Unsys Audit SITP
103	tcp	OCBlader
103	udp	OCBlader
104	tcp	OCServer
104	udp	OCServer
105	tcp	Remote-KIS
105	udp	Remote-KIS 106
105	tcp	KIS
Protocol		
106	udp	KIS Protocol
107	tcp	Application Communication Interface
107	udp	Application Communication Interface
108	tcp	Plus Five's MUMPS
108	udp	Plus Five's MUMPS
109	tcp	Queued File Transport
109	tcp	Gateway Access Control Protocol
110	udp	Gateway Access Control Protocol
111	tcp	Prospero Directory Service
112	tcp	OSU Network Monitoring System
112	udp	OSU Network Monitoring System
113	tcp	Spider Remote Monitoring Protocol
113	udp	Spider Remote Monitoring Protocol
114	udp	Internet Relay Chat Protocol
115	tcp	DNSIX Network Level Module Audit
116	tcp	DNSIX Session Mgt Module Audit Raddr
117	tcp	Directory Location Service
117	udp	Directory Location Service
118	tcp	Directory Location Service Monitor
118	udp	Directory Location Service Monitor
119	tcp	SMUX
119	udp	SMUX
200	tcp	IBM System Resource Controller
200	udp	IBM System Resource Controller
201	tcp	AppleTalk Routing Maintenance
201	udp	AppleTalk Routing Maintenance
202	tcp	AppleTalk Name Binding
202	udp	AppleTalk Name Binding
203	tcp	AppleTalk Unused
203	udp	AppleTalk Unused
204	tcp	AppleTalk Echo
205	tcp	AppleTalk Unused
205	tcp	AppleTalk Unused
206	tcp	AppleTalk Zone Information
206	tcp	AppleTalk Zone Information
207	tcp	AppleTalk Unused
207	tcp	AppleTalk Unused
208	tcp	AppleTalk Unused
208	tcp	AppleTalk Unused
209	tcp	AppleTalk Unused
209	tcp	AppleTalk Unused
210	tcp	Telnet Authenticated Mail Protocol
210	tcp	ANSI Z39.50
210	udp	ANSI Z39.50
211	tcp	Texas Instruments 914C
211	udp	Texas Instruments 914C
211	tcp	Termed
212	udp	ATEXSSTR
213	tcp	IPX
213	udp	IPX
214	tcp	VM PWSCS
214	udp	VM PWSCS
215	tcp	Insigma Solutions
215	udp	Insigma Solutions
216	tcp	Access Technology License Server
217	tcp	dBASE Unix
217	udp	dBASE Unix
218	tcp	Netk Message Posting Protocol
218	udp	Netk Message Posting Protocol
219	tcp	Unsys ARP's
219	udp	Unsys ARP's
220	tcp	Interactive Mail Access Protocol v8
221	tcp	Berkley rlogin with SPX auth
221	udp	Berkley rlogin with SPX auth
222	tcp	Berkley rshd with SPX auth
222	udp	Berkley rshd with SPX auth
223	tcp	Certificate Distribution Center
223	udp	Certificate Distribution Center
243	tcp	Survey Measurement
243	udp	Survey Measurement
245	tcp	LINK
245	udp	LINK
246	tcp	Display Systems Protocol
247	tcp	Display Systems Protocol
247	tcp	Display Systems Protocol
248	tcp	Prospero Data Access Protocol
344	tcp	Prospero Data Access Protocol
345	tcp	Perf Analysis Workbench
345	udp	Perf Analysis Workbench
346	tcp	Zebra server
347	tcp	Fatman Server
348	tcp	Cabletron Management Protocol
348	udp	Cabletron Management Protocol
371	tcp	Clearcase
371	udp	Clearcase
372	tcp	Unix Lister
372	udp	Unix Lister
373	tcp	Legent Corporation
373	udp	Legent Corporation
374	tcp	Legent Corporation
374	udp	Legent Corporation
375	tcp	Harris
375	udp	Harris
376	tcp	Ardis Envoy Network Inquiry Proto
376	udp	Ardis Envoy Network Inquiry Proto
377	tcp	NEC Corporation
377	udp	NEC Corporation
378	tcp	NEC Corporation
378	udp	NEC Corporation
379	tcp	TIA EIA IS-99 modem client
380	tcp	TIA EIA IS-99 modem server
381	tcp	hp performance data collector
381	udp	hp performance data collector
382	tcp	hp performance data managed node
382	udp	hp performance data managed node
383	tcp	hp performance data alarm manager
383	udp	hp performance data alarm manager
384	tcp	A Remote Network Server System
384	udp	A Remote Network Server System
385	tcp	IBM Application
385	tcp	IBM Application
386	tcp	ASA Message Router Object Def.
386	udp	ASA Message Router Object Def.
387	tcp	AppleTalk Update-Based Routing Pro.
387	udp	AppleTalk Update-Based Routing Pro.
388	tcp	Unidata LDM Version 4
388	udp	Unidata LDM Version 4
389	tcp	Lightweight Directory Access Protocol
Protocol		
390	tcp	UIS
390	udp	UIS
391	tcp	SynOptics SNMP Relay Port
391	udp	SynOptics SNMP Relay Port
392	tcp	SynOptics Port Broker Port
392	udp	SynOptics Port Broker Port
393	tcp	Data Interpretation System
393	udp	Data Interpretation System
394	tcp	EMBL Nucleic Data Transfer
394	udp	EMBL Nucleic Data Transfer
395	tcp	NETcout Control Protocol
395	udp	NETcout Control Protocol
396	tcp	Novell Networks over IP
396	udp	Novell Networks over IP
397	tcp	Muli Protocol Trans. Net.
397	udp	Muli Protocol Trans. Net.
398	tcp	Kryptole
398	udp	Kryptole
399	tcp	ISO-TSAP Class 2
399	udp	ISO-TSAP Class 2
400	tcp	Workstation Solutions
400	udp	Workstation Solutions
401	tcp	Uninterruptible Power Supply
401	udp	Uninterruptible Power Supply
402	tcp	Genie Protocol
402	udp	Genie Protocol
403	tcp	decap
403	udp	decap
404	tcp	ncad
404	udp	ncad
405	tcp	ncid
405	udp	ncid
406	tcp	Interactive Mail Support Protocol
406	udp	Interactive Mail Support Protocol
407	tcp	Tributku
408	tcp	Prospero Resource Manager Sys. Mon.
409	tcp	Prospero Resource Manager Node Mon.
410	tcp	DECLedbug Remote Debug Protocol
411	tcp	Remote NT Protocol
411	udp	Remote NT Protocol
412	tcp	Trap Convention Port
412	udp	Trap Convention Port
413	tcp	SMSP
413	udp	SMSP
414	tcp	InfoSeek
414	udp	InfoSeek
415	tcp	Bllet
415	udp	Bllet
416	tcp	Silverplatter
416	udp	Silverplatter
417	tcp	Ormax
417	udp	Ormax
418	tcp	Hyper-G
Protocol		
419	tcp	Arrial
420	udp	SMPE
421	tcp	Arrial
422	tcp	Arrial
423	tcp	IBM Operations Planning and Control Start
424	tcp	IBM Operations Planning and Control Track
425	tcp	ICAD
426	tcp	smartdp
426	udp	smartdp
427	tcp	Server Location
427	udp	Server Location
428	tcp	OCS_CMU
428	udp	OCS_CMU
429	tcp	OCS_AMU
429	udp	OCS_AMU
430	tcp	UTMPSD
430	udp	UTMPSD
431	tcp	UTMPCD
431	udp	UTMPCD
432	tcp	IASD
432	udp	IASD
433	tcp	NNSP
433	udp	NNSP
434	tcp	MobileIP-Agent
434	udp	MobileIP-VN
435	tcp	DNA-CML
435	udp	DNA-CML
437	tcp	couch
437	udp	couch
438	tcp	dfgw
438	udp	dfgw
439	tcp	deep Thomas Obermar
439	udp	deep tommy@hicks.nemet.de
440	tcp	sgcp
440	udp	sgcp
441	tcp	decme-eyengt
442	tcp	cve_hostd
442	udp	cve_hostd
443	tcp	https MCos
444	tcp	Simple Network Paging Protocol
444	udp	Simple Network Paging Protocol
445	tcp	Microsoft-DS
446	tcp	DDM-RDB
446	udp	DDM-RDB
447	tcp	DDM-RFM
447	udp	DDM-RFM
448	tcp	DDM-BYTE
448	udp	DDM-BYTE
449	tcp	AS Server Mapper
449	udp	AS Server Mapper
450	tcp	TServer

451	tcp Cray Network Semaphore server	543	tcp klogd	704	udp errlog copy server	761	udp vid
451	udp Cray Network Semaphore server	543	udp klogd	704	tcp ErrtrustManager	770	tcp cadlock
452	tcp Cray SFS config server	544	tcp krcmd-kshell	721	tcp IBM NetView DM Server Client	770	udp cadlock
452	udp Cray SFS config server	544	udp krcmd-kshell	721	udp IBM NetView DM Server Client	771	tcp rip
453	tcp CreativeServer	545	tcp applepcsvr	721	tcp IBM NetView DM Server Client	772	tcp cycleserv2
453	udp CreativeServer	545	udp applepcsvr	730	tcp IBM NetView DM send	772	udp cycleserv2
454	tcp ContentServer	550	tcp nov-who	730	udp IBM NetView DM send	773	tcp subbit
454	udp ContentServer	550	udp nov-who	730	tcp IBM NetView DM receive	773	udp notify
455	tcp CreativePartner	555	tcp def	731	tcp IBM NetView DM receive	774	tcp password
455	udp CreativePartner	555	udp def	731	tcp IBM NetView DM receive	774	udp account_db
456	tcp nemo-tcp	556	tcp rts server	741	tcp netGW	775	tcp automb
456	udp nemo-udp	556	udp rts server	741	udp netGW	775	udp account_trusted
457	tcp sochelp	557	tcp openvms-sympc	742	tcp Network based Rev. Cont.	776	tcp wpages
457	udp sochelp	557	udp openvms-sympc	742	udp Network based Rev. Cont.	776	udp wpages
458	tcp apple quick time	558	tcp SDNSKMP	744	tcp Flexible License Manager	790	tcp wpage
458	udp apple quick time	558	udp SDNSKMP	744	udp Flexible License Manager	790	tcp Concert
459	tcp empr-read	559	tcp TEEDTAP	747	tcp Fujitsu Device Control	796	tcp Concert
459	udp empr-read	559	udp TEEDTAP	747	udp Fujitsu Device Control	796	udp nsls_demon
460	tcp strok	560	tcp monitor	748	tcp Russell Info Sci Calendar Manager	900	udp nsls_demon
460	udp strok	560	udp monitor 561	748	udp Russell Info Sci Calendar Manager	901	tcp device
512	tcp remote process execution	562	tcp chcmd-chshell	749	tcp kerberos administration	901	udp device
512	udp used by nsl system to notify users	562	udp chcmd-chshell	750	tcp rfts	902	tcp AccessBuilder
513	tcp remote login a la telnet;	564	tcp plan 9 file service	750	udp loader	903	udp AccessBuilder
513	udp maintains data bases showing who's	564	udp plan 9 file service	751	tcp pnp	916	tcp Central Point Software-xtronic
514	tcp like exec, but automatic	565	tcp whoami	751	udp pnp 732	916	udp Central Point Software-xtronic
514	udp sylog	565	udp whoami	753	tcp rth	917	tcp waitrd
515	tcp spooler	570	tcp demon-ntester	753	udp rth	917	udp waitrd
517	tcp talk	570	udp demon-ntester	754	tcp talk-send	918	tcp busboy
518	tcp talk	571	tcp daemon-ntester	754	udp talk-send	918	udp puparp
519	tcp unidns	571	udp daemon-ntester	756	tcp rlogin	919	tcp garcon
519	udp unidns	600	tcp Sun IPC server	756	udp rlogin	919	udp Applic_ec
520	tcp extended file name server	600	udp Sun IPC server	757	tcp con	919	tcp paprouter
520	udp local routing process (on site)	607	tcp rps	757	udp con	919	udp paprouter
522	tcp flosserver	607	udp rps	760	tcp rs	1000	tcp cadlock
522	udp flosserver	606	tcp Cray Unified Resource Manager	760	udp rs	1000	udp cadlock
526	tcp newdate	606	udp Cray Unified Resource Manager	761	tcp rse		
526	udp newdate	608	tcp Sender-Initiated Unsolicited File Transfer	761	udp rse		
530	tcp rpc	609	tcp snmp-trap	762	tcp quoted		
530	udp rpc	609	udp snmp-trap	762	udp quoted		
531	tcp chat	610	tcp snmp-local	763	tcp cycleserv		
531	udp chat	610	udp snmp-local	763	udp cycleserv		
532	tcp readnews	611	tcp snmp-gd	764	tcp osnews		
532	udp readnews	611	udp snmp-gd	764	udp osnews		
533	tcp for emergency broadcasts	634	tcp gload	765	tcp webster		
533	udp for emergency broadcasts	634	udp gload	765	udp webster		
539	tcp Aperthus Technologies Load Determination	636	tcp nslp	767	tcp phonebook		
539	udp Aperthus Technologies Load Determination	636	udp nslp	767	udp phonebook		
540	tcp uscpd	704	tcp errlog copy server	767	tcp vid		
541	tcp uscp-logic	704	tcp errlog copy server	767	udp vid		
541	udp uscp-logic	denominator		761	tcp vid		

IANA well-known reserved ports

Protocol Name	Port Number
FTP	20-data, 21
Telnet	23
SMTP	25
DNS	53
HTTP	80
POP3	110
NetBIOS	137-139

Sample port numbers for popular applications

Application	Port Number
MSN Messenger	1863
IRC	1863, 6666-6670, 7000
ICQ	4000-4001
ICQ	4000-4001
AOL Instant Messenger	5190, 6040
PCAnywhere	5631-5632
RealAudio	7070, 6970-7170
Napster	7777, 8875, 8888
Half-Life game	27,018

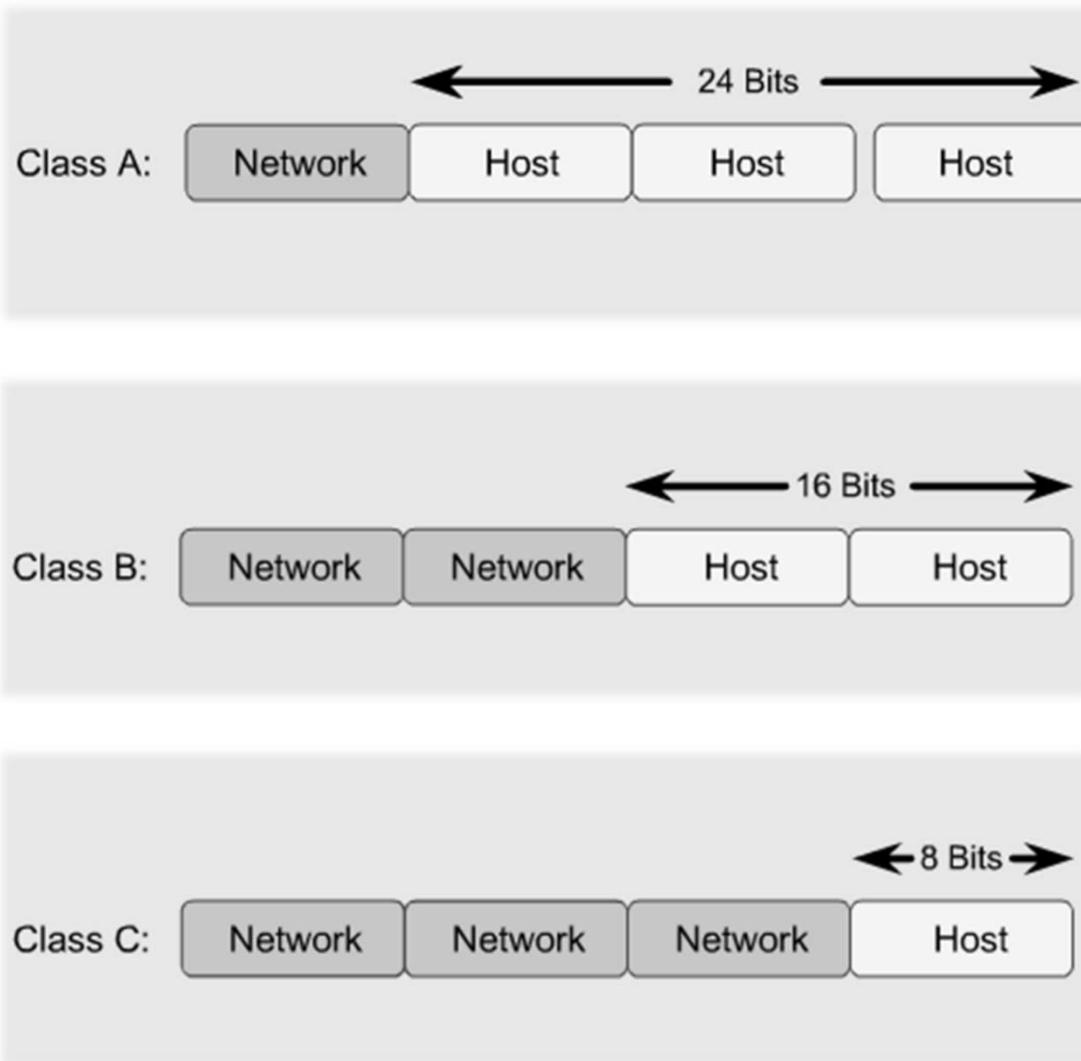
Common Windows port numbers

Protocol Name	Port Number
IE	80
POP3	110
RPC	135
NetBIOS	137-139
Server Message Block (SMB)	445
MSN Messenger	1863
Universal Plug and Play (UPnP)	5000

Logical Addresses : IP address (IPv4)

- IP Classes:
 - class A, B, C
- Class selection
 - Max. number of workstations required
- Each network
 - Must have a unique logical name (domain name)
 - Ex. www.ce.kmitl.ac.th is 161.246.4.119
- Each node or computer
 - Must have a unique host part of IP address

Logical Addresses : IP address (IPv4)



Logical Addresses : IP address (IPv4)

IP Address Class	High-Order Bits	First Octet Address Range	Number of Bits in the Network Address
Class A	0	0 - 127*	8
Class B	10	128 - 191	16
Class C	110	192 - 223	24
Class D	1110	224 - 239	28

Address Class	Number of Networks	Number of Hosts per Network
A	126*	16,777,216
B	16,384	65,535
C	2,097,152	254
D (Multicast)	N/A	N/A

Logical Addresses : IP address (IPv4)

IP Address Classes

Address Class	1st octet range (decimal)	1st octet bits (green bits do not change)	Network(N) and Host(H) parts of address	Default subnet mask (decimal and binary)	Number of possible networks and hosts per network
A	1-127**	00000000-01111111	N.H.H.H	255.0.0.0	128 nets (2^7) 16,777,214 hosts per net (2^{24-2})
B	128-191	10000000-10111111	N.N.H.H	255.255.0.0	16,384 nets (2^{14}) 65,534 hosts per net (2^{16-2})
C	192-223	11000000-11011111	N.N.N.H	255.255.255.0	2,097,150 nets (2^{21}) 254 hosts per net (2^{8-2})
D	224-239	11100000-11101111	NA (multicast)		
E	240-255	11110000-11111111	NA (experimental)		

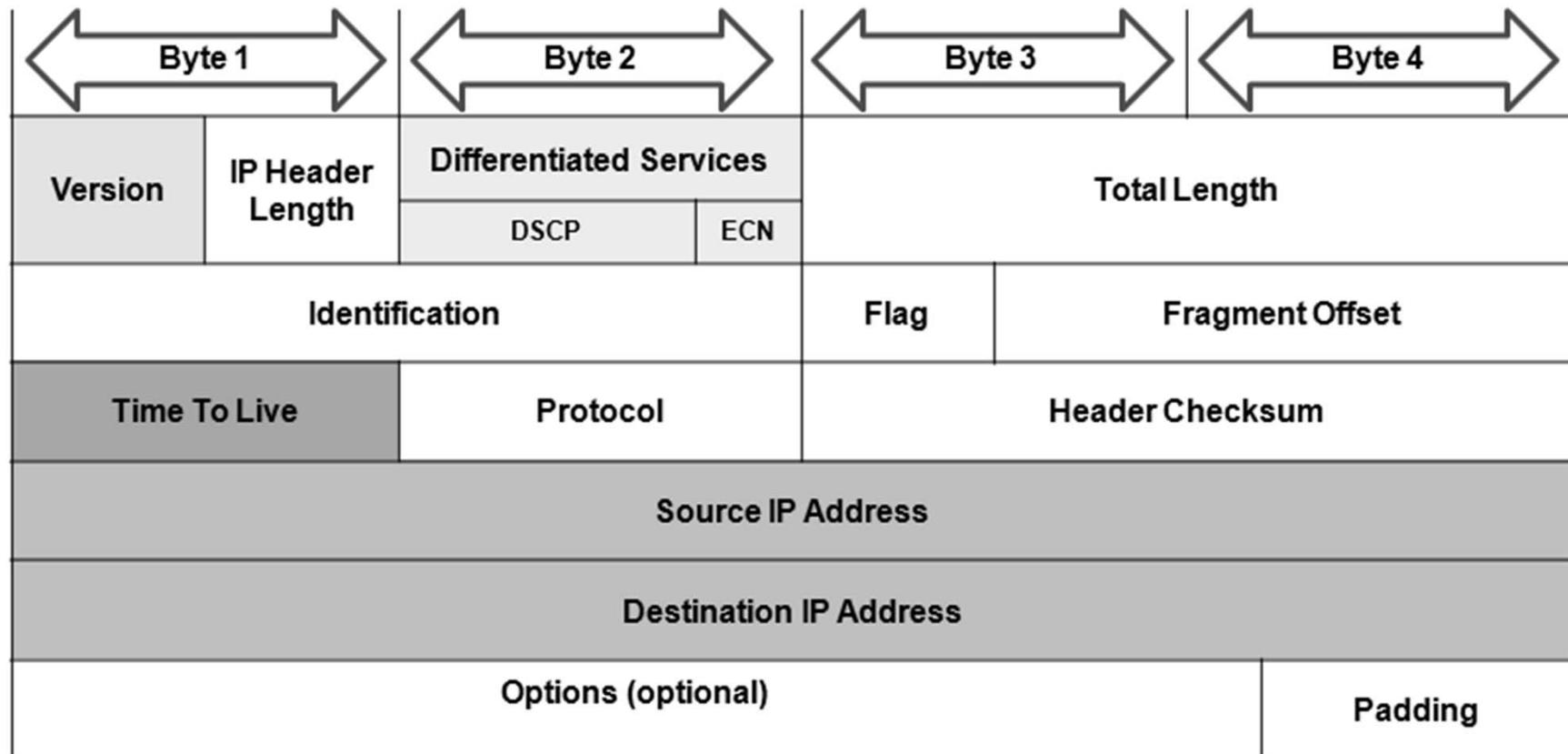
** All zeros (0) and all ones (1) are invalid hosts addresses.

Logical Addresses : IP address (IPv4)

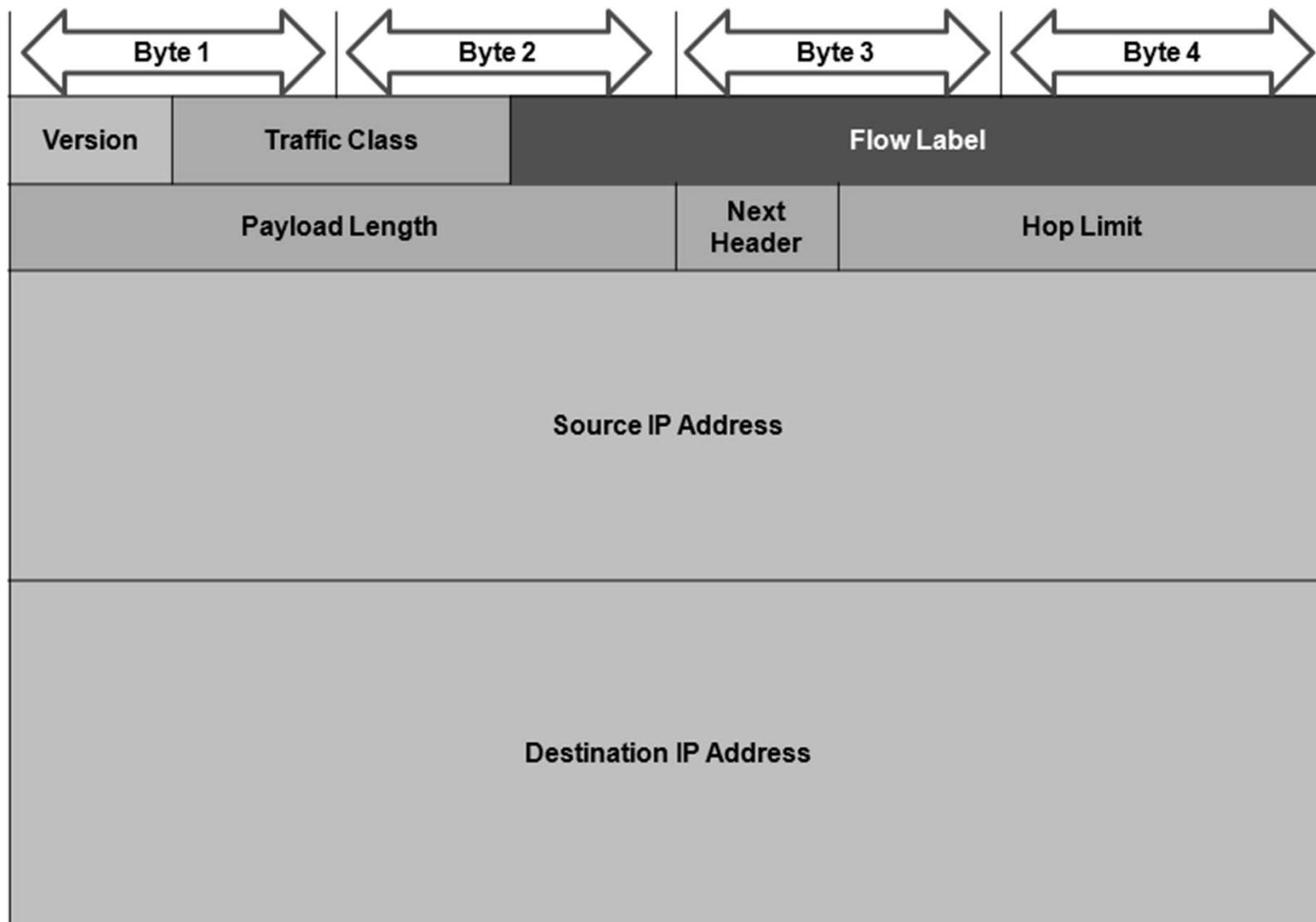
- Private addressing

Class	RFC 1918 Internal Address Range	CIDR Prefix
A	10.0.0.0 - 10.255.255.255	10.0.0.0/8
B	172.16.0.0 - 172.31.255.255	172.16.0.0/12
C	192.168.0.0 - 192.168.255.255	192.168.0.0/16

Logical Addresses : IP address (IPv4)



Logical Addresses : IP address (IPv6)



Logical Addresses : IP address

IPv4 and IPv6 Headers

IPv4 Header

Version	IHL	Type of Service	Total Length					
Identification		Flags		Fragment Offset				
Time to Live	Protocol		Header Checksum					
Source Address								
Destination Address								
Options		Padding						

IPv6 Header

Version	Traffic Class	Flow Label
Payload Length		Next Header
Source Address		Hop Limit
Destination Address		

Legend

- Field names kept from IPv4 to IPv6

- Fields not kept in IPv6

- Name & position changed in IPv6

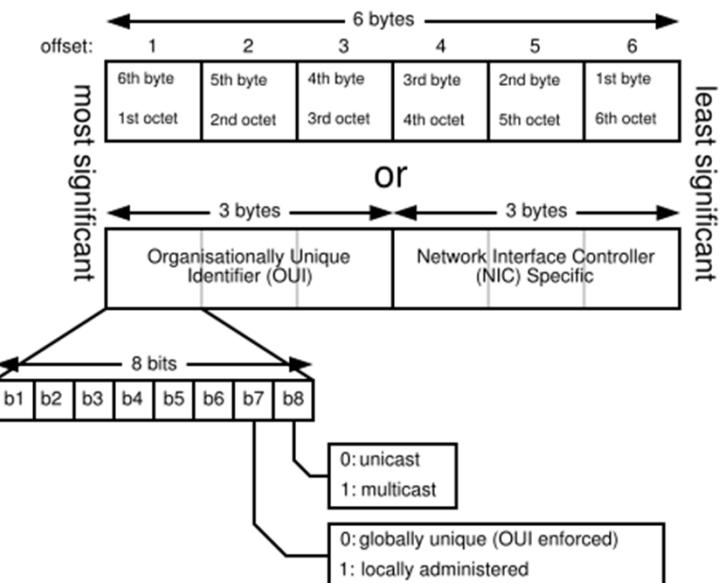
- New field in IPv6

Physical Addresses : MAC Address

- ใน OSI Model นอกจาก IP Address ที่ต้องตั้งค่าเพื่อทำให้อุปกรณ์สามารถเชื่อมต่อผ่านเครือข่ายคอมพิวเตอร์แล้วยังมี Address อีกประเภทที่ใช้งานในเครือข่ายได้แก่ Media Access Control Address
- MAC Address เป็น Address ที่อยู่ในลำดับชั้นการสื่อสารชั้นที่ 2 (Data Link Layer) ของ OSI Model
- สำหรับ MAC Address นั้นเป็น Address ที่ถูกกำหนดมาในตัว NIC ซึ่งมาจากโรงงานที่ผลิตออกมาก ดังนั้นจึงไม่สามารถเปลี่ยนหมายเลข MAC Address ได้

Physical Addresses : MAC Address

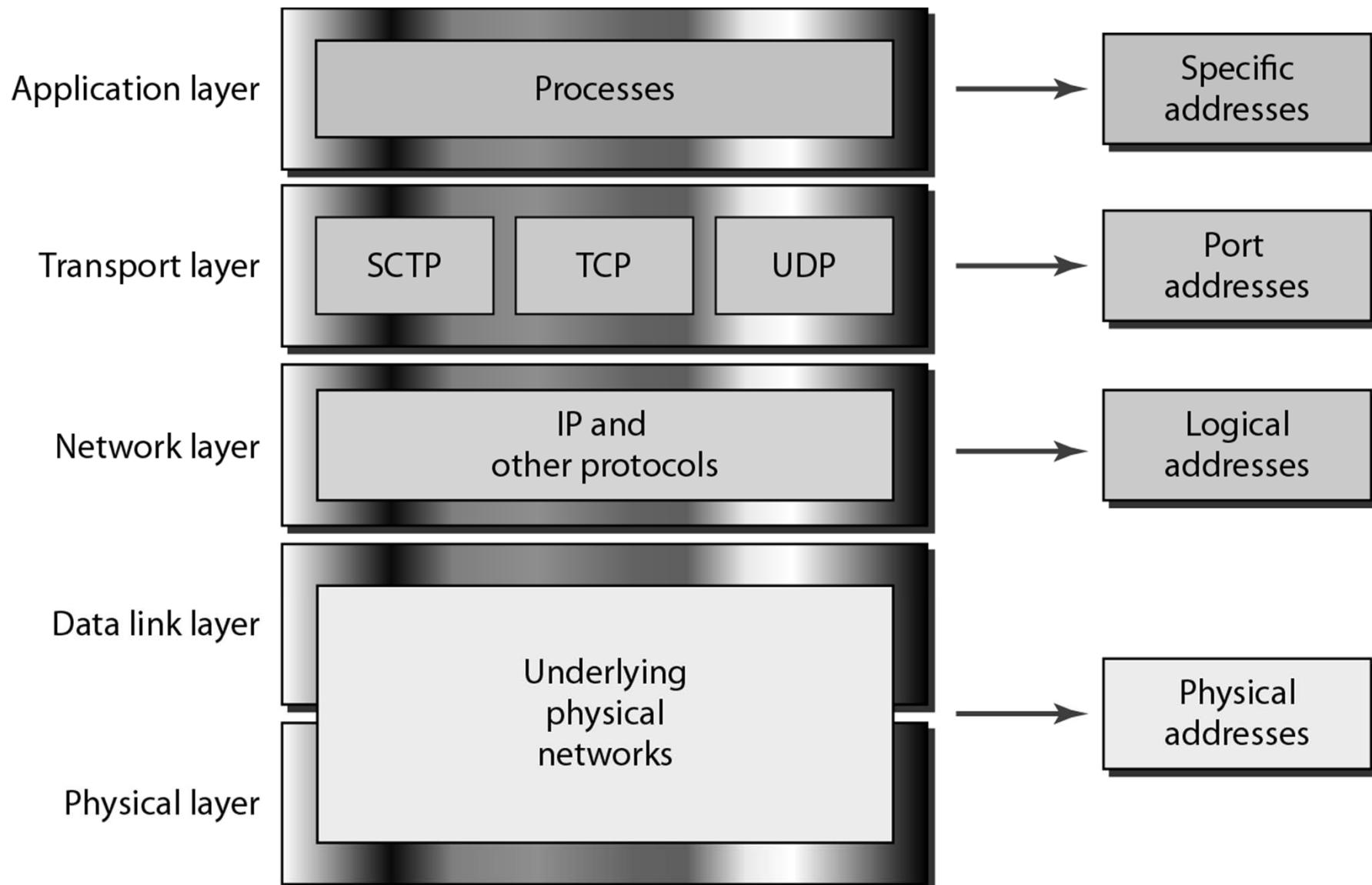
- ลักษณะของ MAC Address จะประกอบด้วยเลขฐานสองจำนวน 48 bit (6 byte) โดยแบ่งออกเป็น 6 ส่วน คั่นด้วย -
- การแสดงผล MAC Address จะแสดงเป็นเลขฐานสิบหก ดังนี้จะเห็นเป็นเลขฐานสิบหกจำนวน 12 ตัว (เลขฐานสิบหก 6 คู่)
 - ตัวอย่างหนึ่ง : 00-11-25-99-AF-44



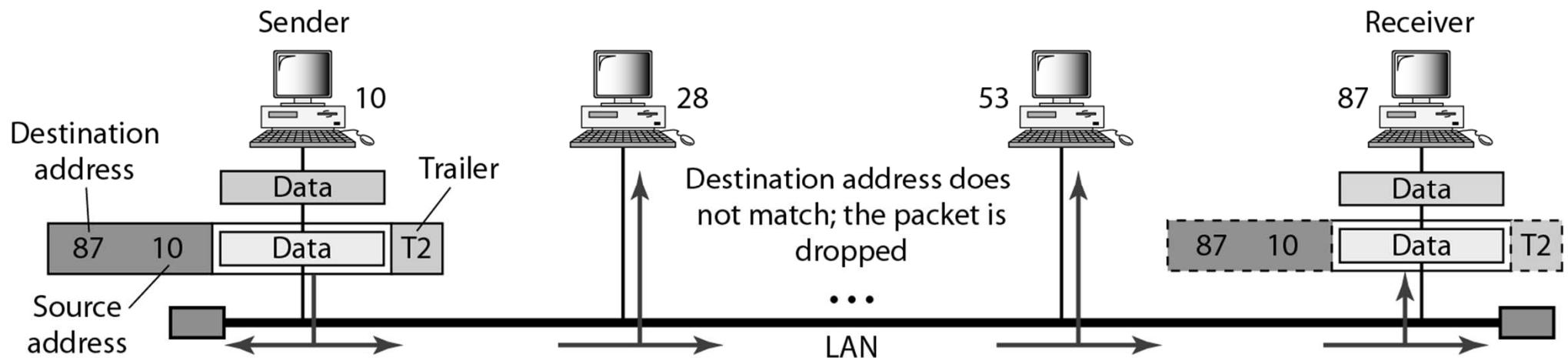
Example 2.1

- In Figure 2.19 a node with physical address 10 sends a frame to a node with physical address 87. The two nodes are connected by a link (bus topology LAN). As the figure shows, the computer with physical address 10 is the sender, and the computer with physical address 87 is the receiver.

Relationship of layers and addresses in TCP/IP (Fig. 2.18)



Physical addresses (Fig. 2.19)



Example 2.2

- As we will see in Chapter 13, most local-area networks use a 48-bit (6-byte) physical address written as 12 hexadecimal digits; every byte (2 hexadecimal digits) is separated by a colon, as shown below:

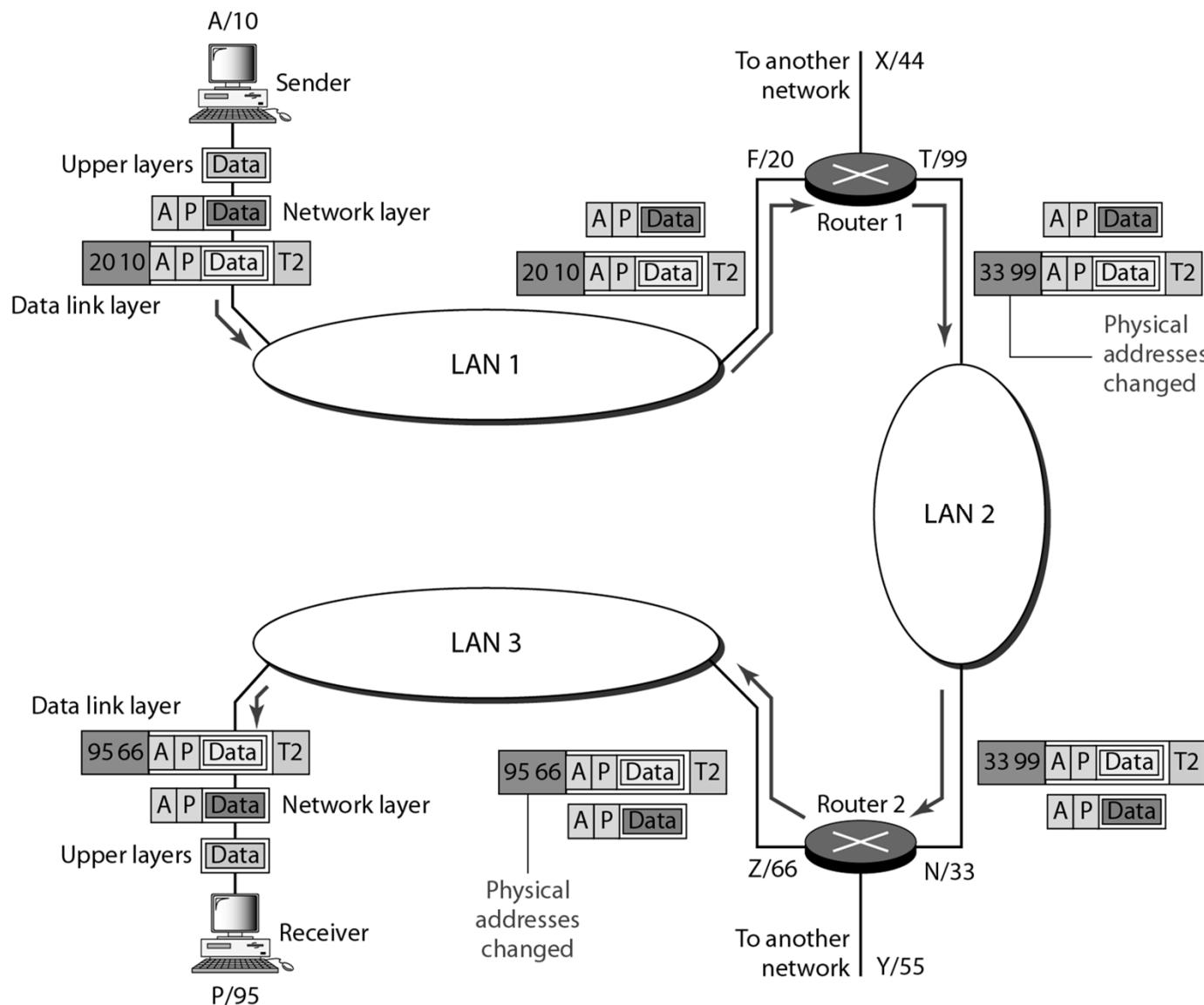
07:01:02:01:2C:4B

A 6-byte (12 hexadecimal digits) physical address.

Example 2.3

- Figure 2.20 shows a part of an internet with two routers connecting three LANs. Each device (computer or router) has a pair of addresses (logical and physical) for each connection. In this case, each computer is connected to only one link and therefore has only one pair of addresses. Each router, however, is connected to three networks (only two are shown in the figure). So each router has three pairs of addresses, one for each connection.

Figure 2.20 IP addresses



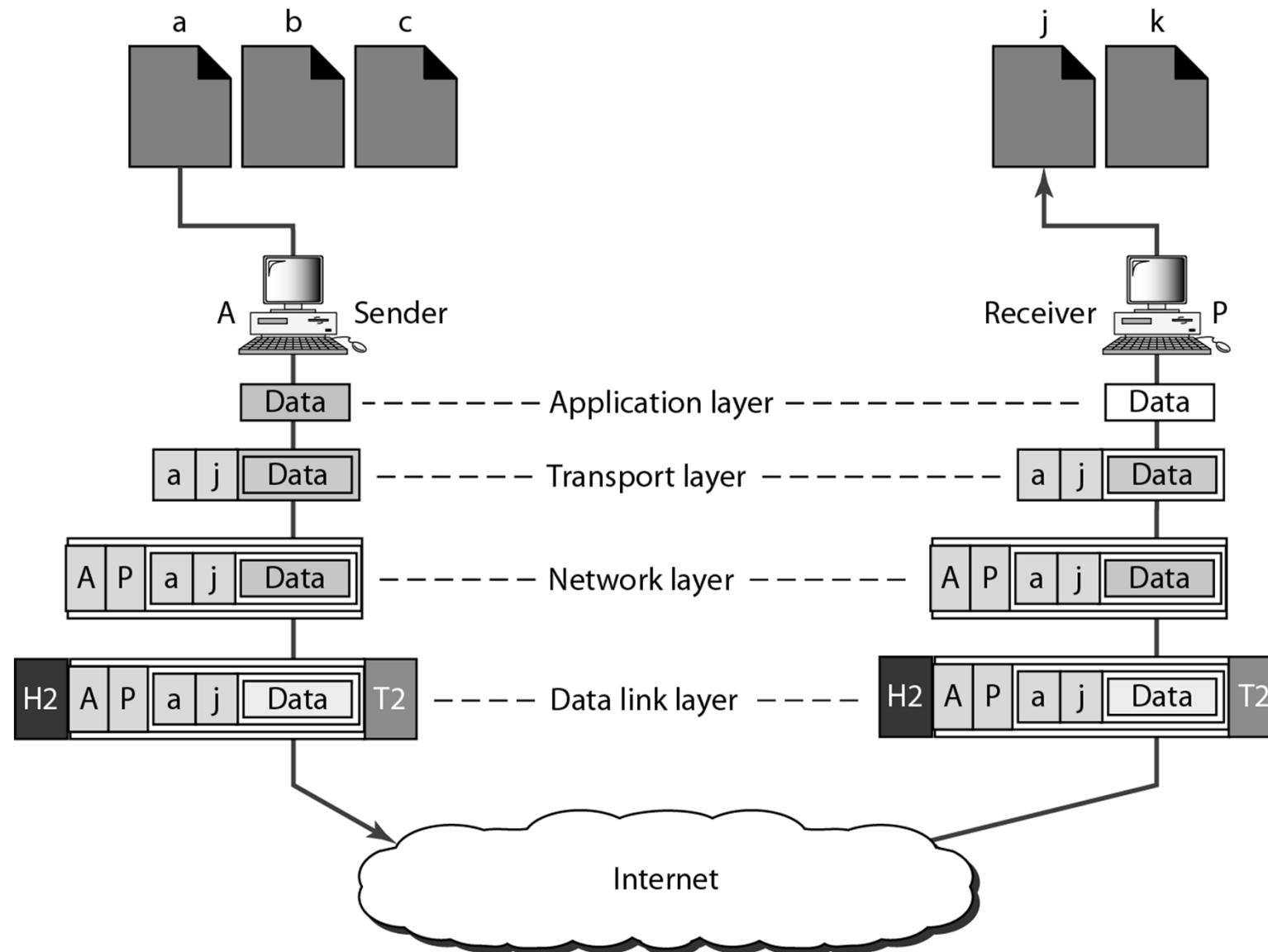
Note

- The physical addresses will change from hop to hop, but the logical addresses usually remain the same.

Example 2.4

- Figure 2.21 shows two computers communicating via the Internet. The sending computer is running three processes at this time with port addresses a, b, and c. The receiving computer is running two processes at this time with port addresses j and k. Process a in the sending computer needs to communicate with process j in the receiving computer. Note that although physical addresses change from hop to hop, logical and port addresses remain the same from the source to destination.

Figure 2.21 Port addresses



Example 2.5

- As we will see in Chapter 23, a port address is a 16-bit address represented by one decimal number as shown.

753

A 16-bit port address represented as one single number.

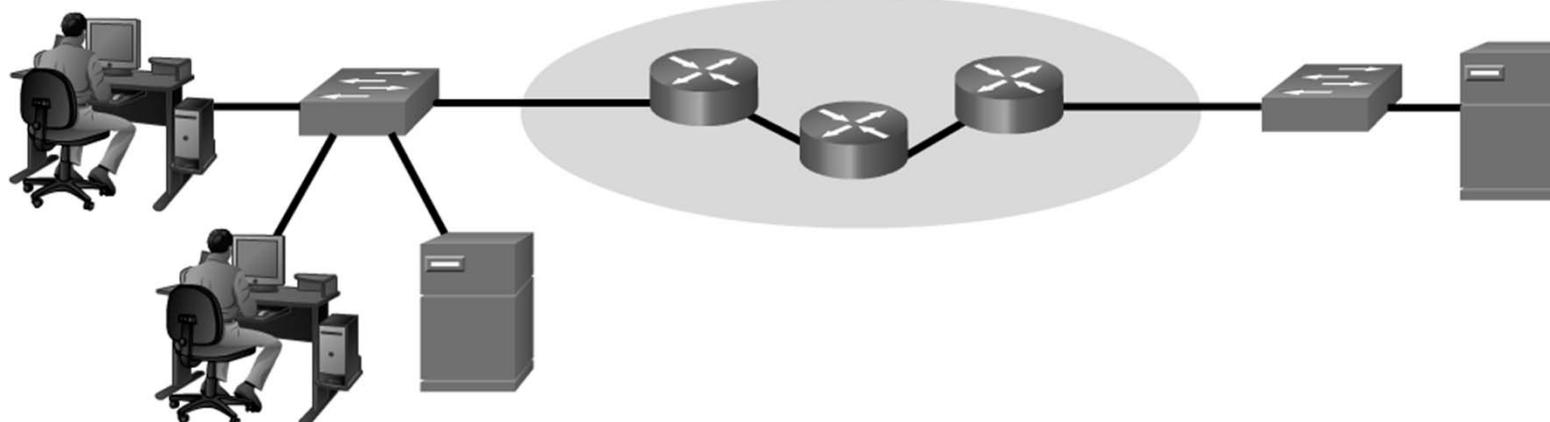
Note

- The physical addresses change from hop to hop, but the logical and port addresses usually remain the same.

Communicating with Device / Same Network

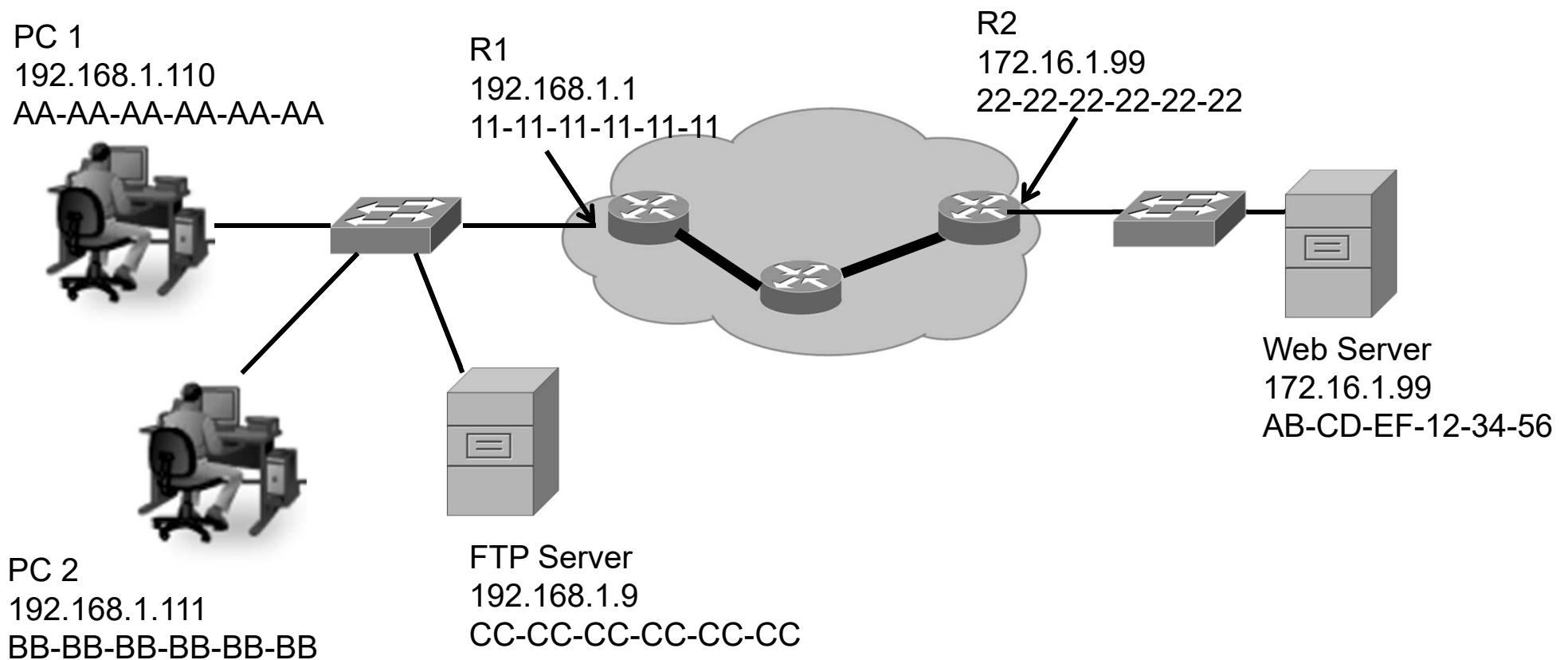
Data Link Ethernet Frame Header		Network Layer IP Packet Header					
Destination	Source	Source	Destination	Source	Dest.	Data	
CC-CC-CC-CC- CC-CC	AA-AA-AA-AA- AA-AA	Network 192.168.1.	Host 110	Network 192.168.1.	Host 9	???	21

PC1
192.168.1.110
AA-AA-AA-AA-AA-AA



FTP Server
192.168.1.9
CC-CC-CC-CC-CC-CC

Default Gateway



Communicating Device / Remote Network

Data Link		Network Layer					
Ethernet Frame Header		IP Packet Header					
Destination	Source	Source	Destination	Source	Dest.	Data	
11-11-11-11-11-11	AA-AA-AA-AA-AA-AA	Network 192.168.1.	Device 110	Network 172.16.1.	Device 99	???	80

PC1
 192.168.1.110
 AA-AA-AA-AA-AA-AA

R1
 192.168.1.1
 11-11-11-11-11-11

R2
 172.16.1.99
 22-22-22-22-22-22

Web Server
 172.16.1.99
 AB-CD-EF-12-34-56

