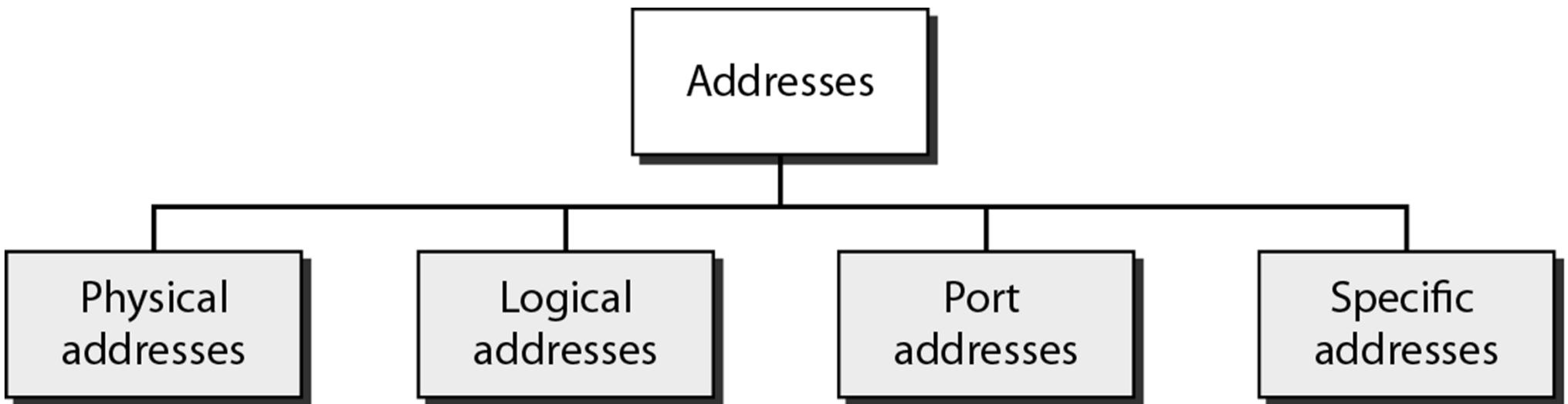


# ADDRESSING

- Physical Addresses      *MAC*
- Logical Addresses      *IP*
- 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. “Well known port”
  - Ports 1024 - 49,151 : registered port numbers (well register)
  - 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

port protocol application layer

port	Protocol	Service Application Layer
0	tcp Reserved	Maintenance
0	udp Reserved	52 tcp XNS Time Protocol
1	tcp TCP Port Service Multiplexer	52 udp XNS Time Protocol
2	tcp Management Utility	53 tcp Domain Name Server
3	tcp Compression Process	53 udp Domain Name Server
5	tcp Remote Job Entry	54 tcp XNS Clearinghouse
7	tcp Echo	54 udp XNS Clearinghouse
7	udp Echo	55 tcp ISI Graphics Language
9	tcp Discard	55 udp ISI Graphics Language
9	udp Discard	56 tcp XNS Authentication
11	tcp Active Users	56 udp XNS Authentication
11	udp Active Users	57 tcp any private terminal access
13	tcp Daytime	57 udp any private terminal access
13	udp Daytime	58 tcp XNS Mail
17	tcp Quote of the Day	58 udp XNS Mail
17	udp Quote of the Day	59 tcp any private file service
18	tcp RWP rwrite	59 udp any private file service
18	udp RWP rwrite	60 tcp Unsigned
18	tcp Message Send Protocol	60 udp Unsigned
18	udp Message Send Protocol	61 tcp KI MAIL
11	tcp Character Generator	61 udp KI MAIL
11	udp Character Generator	62 tcp ACA Services
20	tcp File Transfer [Default Data]	64-64 (C1) top Communications Integrator
21	tcp File Transfer [Control]	65 top TACACS-Database Service
22	tcp Telnet	66 top Oracle SQL .NET
24	tcp any private mail system	67 udp Bootstrap Protocol Server
24	udp any private mail system	68 udp Bootstrap Protocol Client
25	tcp Simple Mail Transfer	69 udp Trivial File Transfer
27	tcp NSW User System FE	70 top Copher
27	udp NSW User System FE	71 tcp Remote Job Service
29	tcp MSG ICP	71 udp Remote Job Service
29	udp MSG ICP	72 tcp Remote Job Service
31	tcp MSG Authentication	72 udp Remote Job Service
31	udp MSG Authentication	73 tcp Remote Job Service
33	tcp Display Support Protocol	73 udp Remote Job Service
33	udp Display Support Protocol	74 tcp Remote Job Service
35	tcp any private printer server	74 udp Remote Job Services
35	udp any private printer server	75 tcp any private dial out service
37	tcp Teln	75 udp any private dial out service
37	udp Teln	76 top Distributed External Object
38	tcp Route Access Protocol	76 udp Distributed External Object
38	udp Route Access Protocol	77 tcp any private RJT service
39	tcp Resource Location Protocol	77 udp any private RJT service
41	tcp Graphics	78 top vrtsp
41	udp Graphics	79 udp vrtsp
42	tcp Host Name Server	79 top Finger
43	tcp Who Is	80 top World Wide Web HTTP
44	tcp MPM FLAGS Protocol	80 tcp World Wide Web HTTP
45	tcp Message Processing Module	91 tcp HOSTS2 Name Server
[rec]		91 udp HOSTS2 Name Server
46	tcp MPM [default send]	92 top XFER Utility
47	tcp KI FTP	92 udp XFER Utility
47	udp KI FTP	93 top MIT ML Device
48	tcp Digital Audit Daemon	93 udp MIT ML Device
48	udp Digital Audit Daemon	94 top Common Trace Facility
49	tcp Login Host Protocol	94 udp Common Trace Facility
50	tcp Remote Mail Checking	95 top MIT ML Device
Protocol		95 udp MIT ML Device
50	udp Remote Mail Checking	96 top Micro Focus Cobol
Protocol		97 top any private terminal link
51	tcp AnyPort	97 udp any private terminal link
51	tcp Kerberos	98 top SU MIT Telnet Gateway
51	tcp DNSIX Secure Attribute Token	99 top Network News Transfer Protocol
51	tcp Network News Transfer	100 top CPDP/TKT
51	tcp Network News Transfer	101 top Encore Expedited Remote Pro/Cell
51	tcp Network News Transfer	101 udp Encore Expedited Remote Pro/Cell
51	tcp Network News Transfer	102 top SMAKYNET
51	tcp Network News Transfer	102 udp SMAKYNET
51	tcp Network Time Protocol	103 top Network Time Protocol
51	tcp Network Time Protocol	103 udp Network Time Protocol
51	tcp ANSA REX Trader	104 top ANSA REX Trader
51	tcp ANSA REX Trader	104 udp ANSA REX Trader
51	tcp Locus PC-Interface Net Map	105 top Locus PC-Interface Net Map
51	tcp Unisys Utility Login	106 top Unisys Utility Login
51	tcp Unisys Utility Login	106 udp Unisys Utility Login
51	tcp Locus PC-Interface Comm	107 top Locus PC-Interface Comm
51	tcp GSS X License Verification	108 top GSS X License Verification
51	udp GSS X License Verification	108 udp GSS X License Verification
51	tcp Password Generator Protocol	109 top Password Generator Protocol
51	udp Password Generator Protocol	109 udp Password Generator Protocol
51	tcp cisco PNATIVE	110 top cisco PNATIVE
51	udp cisco PNATIVE	110 udp cisco PNATIVE
51	tcp cisco TNATIVE	111 top cisco TNATIVE
51	udp cisco TNATIVE	111 udp cisco TNATIVE
51	tcp Cisco-Sys	112 top cisco SYSTEMINT
51	udp Cisco-Sys	112 udp cisco SYSTEMINT
51	tcp Statistics Service	113 top Statistics Service
51	udp Statistics Service	113 udp Statistics Service
51	tcp INGRES-NET Service	114 top INGRES-NET Service
51	tcp Location Service	115 top Location Service
51	tcp Location Service	115 udp Location Service
51	tcp PROFILE Naming System	116 top PROFILE Naming System
51	tcp NETBIOS Name Service	117 top NETBIOS Name Service
51	tcp NETBIOS Name Service	117 udp NETBIOS Name Service
51	tcp NETBIOS Datagram Service	118 top NETBIOS Datagram Service
51	tcp NETBIOS Datagram Service	118 udp NETBIOS Datagram Service
51	tcp NETBIOS Session Service	119 top NETBIOS Session Service
51	tcp NETBIOS Session Service	119 udp NETBIOS Session Service
51	tcp EMFIS Data Service	120 top EMFIS Data Service
51	tcp EMFIS Control Service	121 top EMFIS Control Service
51	tcp EMFIS Control Service	121 udp EMFIS Control Service
51	tcp Britton-Lee IDM	122 top Britton-Lee IDM
51	tcp Britton-Lee IDM	122 udp Britton-Lee IDM
51	tcp Interactive Mail Access Protocol v2	123 top Interactive Mail Access Protocol v2
51	tcp NovS	124 top NovS
51	tcp NovS	124 udp NovS
51	tcp UAAC Protocol	125 top UAAC Protocol
51	tcp UAAC Protocol	125 udp UAAC Protocol
51	tcp ISO-IP0	126 top ISO-IP0
51	tcp ISO-IP0	126 udp ISO-IP0
51	tcp ISO-IP	127 top ISO-IP
51	tcp ISO-IP	127 udp ISO-IP
51	tcp CRONUS-SUPPORT	128 top CRONUS-SUPPORT
51	tcp CRONUS-SUPPORT	128 udp CRONUS-SUPPORT
51	tcp AED 312 Evaluation Service	129 top AED 312 Evaluation Service
51	tcp SQL-NET	130 top SQL-NET
51	tcp SQL-NET	130 udp SQL-NET
51	tcp HEMS	131 top HEMS
51	tcp Background File Transfer	132 top Background File Transfer
51	tcp Background File Transfer	132 udp Background File Transfer
51	tcp SGMP	133 top SGMP
51	tcp SGMP	133 udp SGMP
51	tcp NETSC	134 top NETSC
51	tcp NETSC	134 udp NETSC
51	tcp NETSC	135 top NETSC
51	tcp NETSC	135 udp NETSC
51	tcp SQL Service	136 top SQL Service
51	tcp KNET VM	137 top KNET VM
51	Command Message Protocol	138 top PCMail Server
51		139 top NSS-Routing
51		139 udp NSS-Routing
51		140 top SCMP-TRAPS
51		140 udp SCMP-TRAPS
51		141 top SNMP
51		142 top SNMPTRAP
51		143 top CMIP TCP Manager
51		143 udp CMIP TCP Manager
51		144 top CMIP TCP Agent
51		144 udp CMIP TCP Agent
51		145 top Xerox
51		145 udp Xerox
51		146 top Shiva Systems
51		146 udp Shiva Systems
51		147 top KAMP
51		147 udp KAMP
51		148 top RSVD
51		148 udp RSVD 161 top SEND
51		149 top Network PostScript
51		149 udp Network PostScript
51		150 top Network Innovations Multiplex
51		150 udp Network Innovations Multiplex
51		151 top Network Innovations CL 1
51		151 udp Network Innovations
51		152 top Xplex
51		152 udp Xplex
51		153 top MAILQ
51		153 udp MAILQ
51		154 top VNET
51		154 udp VNET
51		155 top GENRAD-MUX
51		155 udp GENRAD-MUX
51		156 top X Display Manager Control Protocol
51		156 udp X Display Manager Control Protocol
51		157 top NextStep Window Server
51		157 udp NextStep Window Server
51		158 top Border Gateway Protocol
51		158 udp Border Gateway Protocol
51		159 top Intergraph
51		159 udp Intergraph

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 10G
105	tcp	KIS
Protocol		
106	udp	KIS Protocol
107	tcp	Application Communication Interface
107	udp	Application Communication Interface
108	tcp	Plus Five's NUMPS
108	udp	Plus Five's NUMPS
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	udp	AppleTalk Zone Information
207	tcp	AppleTalk Unused
207	udp	AppleTalk Unused
208	tcp	AppleTalk Unused
208	udp	AppleTalk Unused
209	tcp	AppleTalk Unused
209	udp	AppleTalk Unused
210	tcp	Tivial Authenticated Mail Protocol
210	udp	Tivial Authenticated Mail Protocol
211	tcp	Texas Instruments 914C
211	udp	Texas Instruments 914C
212	tcp	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
248	tcp	Display Systems Protocol
249	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	Aruba Envoy Network Inquiry Proto
376	udp	Aruba 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	udp	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 Netware over IP
396	udp	Novell Netware 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 MT Protocol
411	udp	Remote MT 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	SMPT
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	731	tcp IBM NetView DM receive	775	tcp automb
456	udp nemo-udp	556	udp rts server	731	tcp IBM NetView DM receive	775	udp account_trusted
457	tcp sochelp	557	tcp openvms-sydisc	741	tcp netGW	776	tcp wpages
457	udp sochelp	557	udp openvms-sydisc	741	udp netGW	776	udp wpages
458	tcp apple quick time	558	tcp SDNSKMP	742	tcp Network based Rev. Cont.	780	tcp wpgs
458	udp apple quick time	558	udp SDNSKMP	742	udp Network based Rev. Cont.	780	udp wpgs
459	tcp empr-read	559	tcp TEEDTAP	Sys.	tcp Network based Rev. Cont.	786	tcp Concert
459	udp empr-read	559	udp TEEDTAP	Sys.	tcp Network based Rev. Cont.	786	udp Concert
460	tcp strok	560	tcp monitor	744	tcp Flexible License Manager	900	tcp nsls_demon
460	udp strok	560	udp monitor 561	744	udp Flexible License Manager	900	udp nsls_demon
512	tcp remote process execution	562	tcp chcmd-chshell	747	tcp Fujitsu Device Control	901	tcp device
512	udp used by nsl system to notify users	562	udp chcmd-chshell	747	udp Fujitsu Device Control	901	udp device
513	tcp remote login a la telnet;	564	tcp plan 9 file service	748	tcp Russell Info Sci Calendar Manager	902	tcp AccessBuilder
513	udp maintains data bases showing who's	564	udp plan 9 file service	748	udp Russell Info Sci Calendar Manager	902	udp AccessBuilder
514	tcp like exec, but automatic	565	tcp whoami	749	tcp kerberos administration	916	tcp Central Point Software-xtronic
514	udp syslog	565	udp whoami	750	tcp rfts	916	udp Central Point Software-xtronic
515	tcp spooler	570	tcp demon-ntester	750	udp loadav	917	tcp waitrd
517	tcp talk	570	udp demon-ntester	751	tcp pnpmp	917	udp waitrd
518	tcp talk	571	tcp daemon-ntester	751	tcp pnpmp 732	918	tcp busboy
518	udp talk	571	udp daemon-ntester	753	tcp rth	918	udp puparp
519	tcp unidns	600	tcp Sun IPC server	753	tcp rth	919	tcp garcon
519	udp unidns	600	udp Sun IPC server	754	tcp tel-send	919	udp Applic_ec
520	tcp extended file name server	607	tcp rps	754	tcp tel-send	919	tcp paprouter
520	udp local routing process (on site)	607	udp rps	756	tcp rlogin	1000	tcp cadlock
522	tcp flosserver	606	tcp Cray Unified Resource Manager	756	udp rlogin	1000	udp cadlock
522	udp flosserver	606	udp Cray Unified Resource Manager	751	tcp con		
526	tcp newdate	608	tcp Sender-Initiated Unsolicited File Transfer	751	udp con		
526	udp newdate	608	tcp SENDER-INITIATED Unsolicited File Transfer	760	tcp ns		
530	tcp rpc	609	tcp snmp-trap	760	tcp ns		
530	udp rpc	609	udp snmp-trap	761	tcp rxs		
531	tcp chat	610	tcp snmp-local	761	udp rxs		
531	udp chat	610	udp snmp-local	762	tcp quoted		
532	tcp readnews	611	tcp snmp-gui	762	udp quoted		
532	udp readnews	611	udp snmp-gui	763	tcp cycleserv		
533	tcp for emergency broadcasts	634	tcp gland	763	udp cycleserv		
533	udp for emergency broadcasts	634	udp gland	764	tcp osnerv		
539	tcp Aperthus Technologies Load Determination	636	tcp nslp	764	udp osnerv		
539	udp Aperthus Technologies Load Determination	636	udp nslp	765	tcp webster		
540	tcp uscpd	666	tcp doom Id Software	765	udp webster		
541	tcp uscp-logic	704	tcp errlog copy server	767	tcp phonebook		
541	udp uscp-logic	704	udp errlog copy server	767	udp phonebook		
		daemon		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

# IPv4

↳ § 5 class A 0.0.0.0 → 127.255.255.255  
B 128.0.0.0 → 161.255.255.255  
C 192.0.0.0 → 239.255.255.255

} 69356974 public  
private

1110 D 224 →  
E multicast

୨୫୮୪୨୨୯

private { A → 10.0.0.0 → 10.255.255.255 } 95% is from 95% internet 5% is  
 D → 172.16.0.0 → 172.31.255.255 } 95% is public ip an  
 C → 192.168.0.0 → 192.168.255.255 } 5% is public ip an

ასე შეიძლოს იнтерნეტ გვიზო.

የኢንተርነት የpublic ip ማ

↳ aereo internet Yore isp

↳ မြန်မာစီမံချက် 4 မိန္ဒီမီတာ = 8 bit → အစွမ်း 32 bit

↳ ip අංක 00000000.00000000.00000000.00000000

ସ୍ଵର୍ଗଶର ପାଦରେ ପାଦରେ ପାଦରେ ପାଦରେ

บริการทั่วไป	1	1	1	1	1	1	1	1	1	$2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$	บริการ 130 - 196 - 230 . 02	
บริการพิเศษ	128	64	32	16	8	4	2	1	$128 + 2$	$192 + 4$	$224 + 6$	$(14+16+8+4)$
network area	198	142	924	240	248	932	254	255				

192.168.1.20) / 30 marker

① subnet mask: 255.255.255.252

② network IP: 192.168.1.200

③ Broadcast IP: 192.168.1. 203

④ IP host: 192.168.1.201-202

① main subnet mask

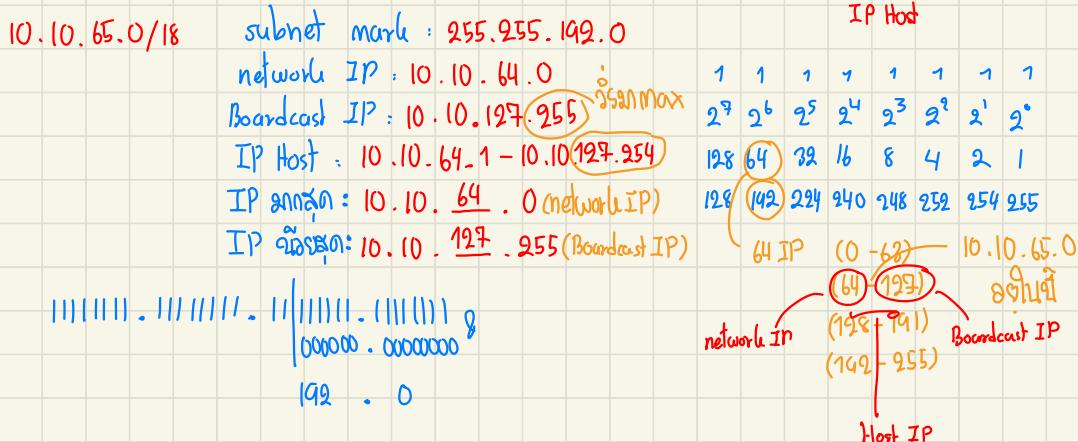
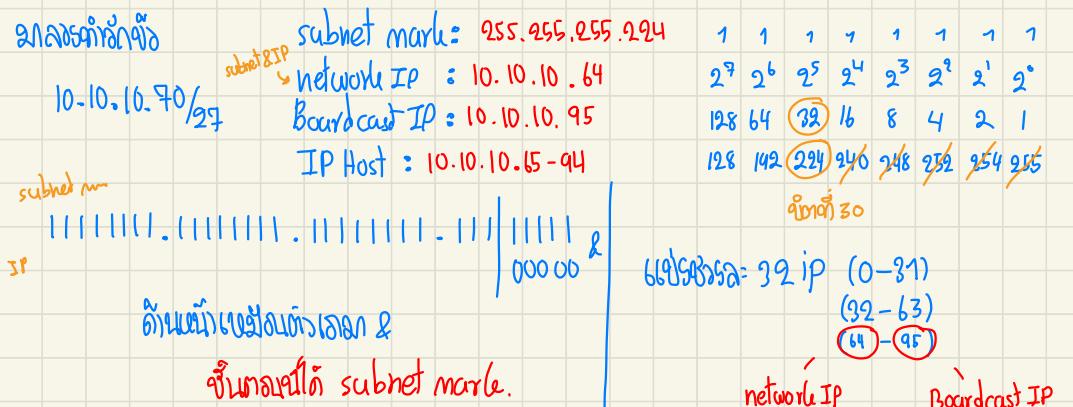
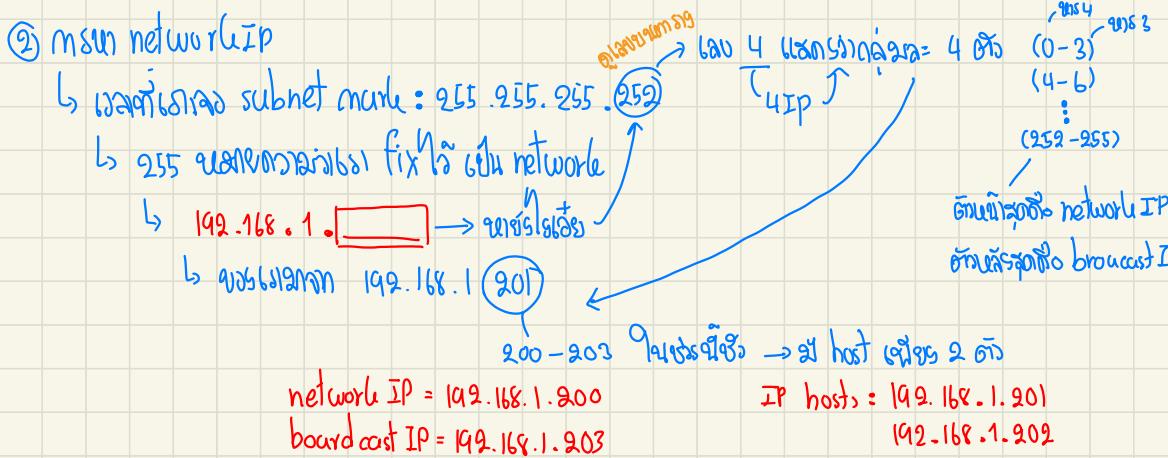
6) mark 30 → ଦିଗ୍ନତ୍ତ୍ଵ 30 → ଅନୁକରଣୀୟ 0

255 255 255 252

↗ Qualitative

9 subnet mask

= 955.955.955.952 We got this man!



# កំណត់លើ subnet mask ដូចណា?

↳ ផ្តល់ព័ត៌មានថា នីមួយៗមានអាជីវកម្មបន្ថែមទៀត ពេលចងចាំ (នៅពេលមិនការសមតាមលក្ខណៈរបស់ ip address)

↳ ដូចជាដឹកជញ្ជូន ០ ក្នុង ២៥៥ (ក្នុងបន្ទីបន្ទី)

↳ លាង A 255.0.0.0

B 255.255.0.0

C 255.255.255.0

} សារិកណាបាន មិនត្រូវ subnet ដើម្បីតារាង ip ទាំង

ឯកតាង  
ip: 

10	.	75	.	110	.	125
255	,	0	.	0	.	0

 (មានលក្ខណៈ)

subnet mask:

Network IP                      Host IP

↓  
subnet mask គេបានពារការ

និង Network IP ធ្វើឱ្យការបង្កើតឡាយ network អីមួយូរ

# Logical Addresses : IP address (IPv4)

- IP Classes:
  - class A, B, C /D,E
- 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)

192.168.0.0

សេវាអនុពលន៍ network ទាំង 1

(មិនមែនប្រព័ន្ធ)

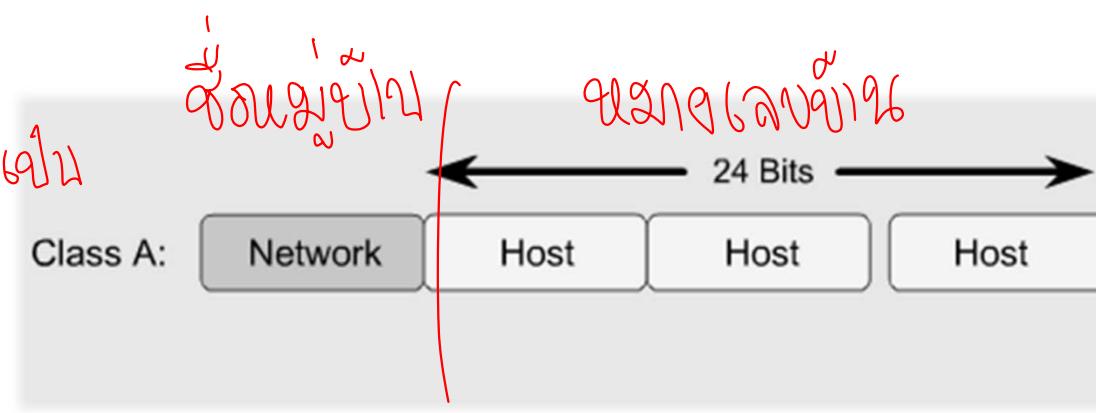
192.168.1.255

សេវាអនុពលន៍ network ទាំង 1

Broadcast IP

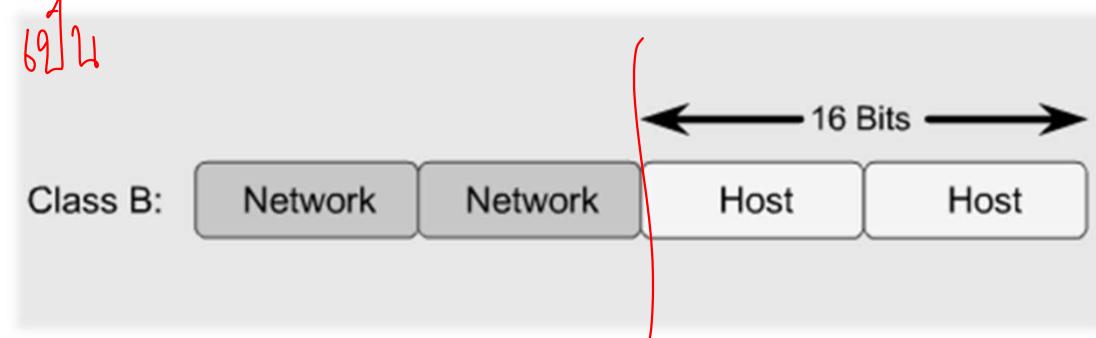
(ជួយសង្ឃគមន៍បណ្តាញ)

មិនមែនប្រព័ន្ធលើសម្រាប់ប្រព័ន្ធដែលមានចំណាំ



(32 bit)  
(24 bit)  
(8 bit)

គឺជានឹមិតខ្លួន



# 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
A $00000000 \rightarrow 0 \rightarrow 0.0.0.0$
B $10000000 \rightarrow 128 \rightarrow 128.0.0.0$
C $11000000 \rightarrow 192 \rightarrow 192.0.0.0$
D (Multicast) $11100000 \rightarrow 224 \rightarrow 224.0.0.0$

“ សេចក្តីថ្លែង ទៅ ”

0  
128  
192

128 | 192 | 224 |

65XXX — class B  
500 ip address = 500  
254 — class A  
60 ip address = 60

ពាណិជ្ជកម្ម subnet → ពាណិជ្ជកម្ម network របស់ខ្លួន

Trans. សំណង់ network ទៅអាជីវកម្ម  
subnet  
255.255.255.128  
subnet mask 255.255.255.128

192.168.1.126  
192.168.1.129  
192.168.1.200

ip net work លោកស្រី

លោកស្រី network address  
601 subnet & ip

ផ្សេងៗ & លើក

Number of Networks	Number of Hosts per Network	Subnet Mask	Number of Subnets
126*	255.255.255.128	2 <sup>8-2</sup>	16,777,216
16,384	255.255.255.0	2 <sup>16-2</sup>	65,535
2,097,152	255.255.0.0	2 <sup>8-2</sup>	254
D (Multicast)	N/A	N/A	N/A

ចន្ទន់

# Logical Addresses : IP address (IPv4)

ກົມທີ່ default ໂຮງລາຍການ  
subnet  
ກົມໃຫຍ່  
ກົມໃຫຍ່  
network  
ເປົ້າສັນ

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

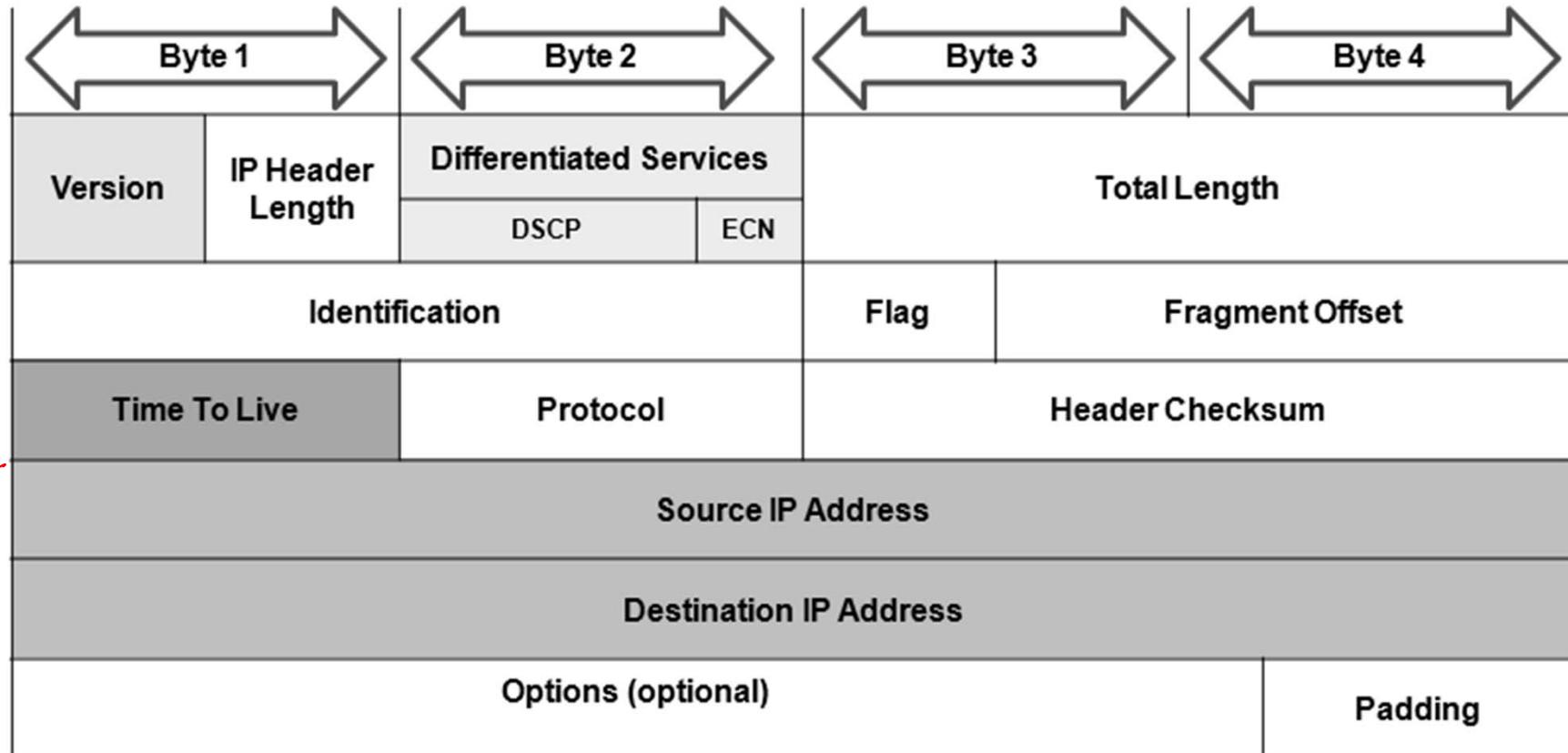
Class	RFC 1918 Internal Address Range	CIDR Prefix
A	10.0.0.0 - 10.255.255.255	10.0.0.0/8
B	172.16.0.0 - 172.31.255.255	172.16.0.0/12
C	192.168.0.0 - 192.168.255.255	192.168.0.0/16

Handwritten notes in red:

- Brackets above the first two rows: "የኢትዮጵያ" (Ethiopia)
- Brackets below the last two rows: "የኢትዮጵያ ከተማ" (Ethiopian National)

# Logical Addresses : IP address (IPv4)

IP Header fields to focus (highlighted)



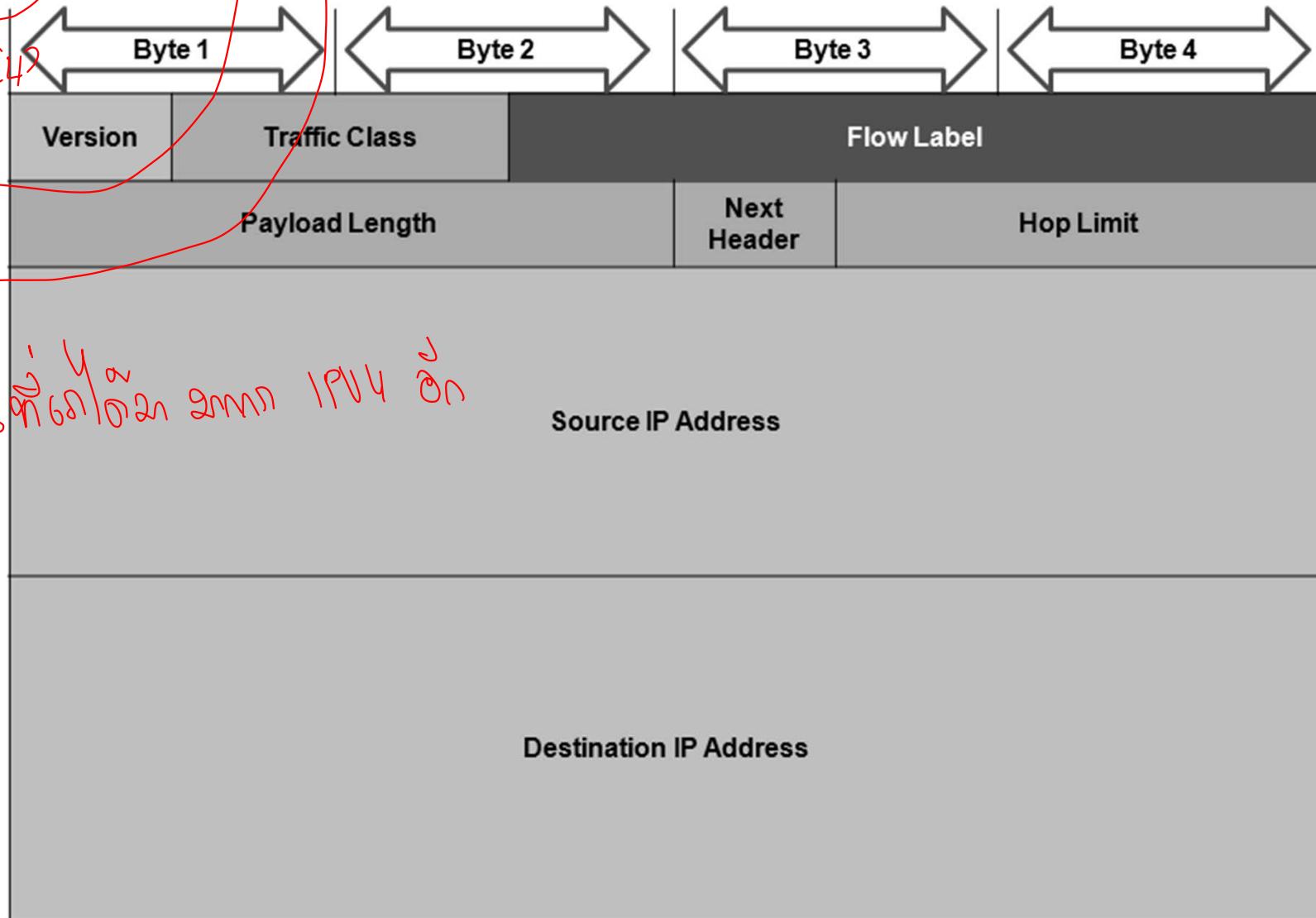
# Logical Addresses : IP address (IPv6)

128 bit

IPv4

until C1?

IPv6 64 bits 1024 2000 IPv4 32



(128)  
9  
32  
2  
2<sup>96</sup> (96)  
2<sup>64</sup>

# 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

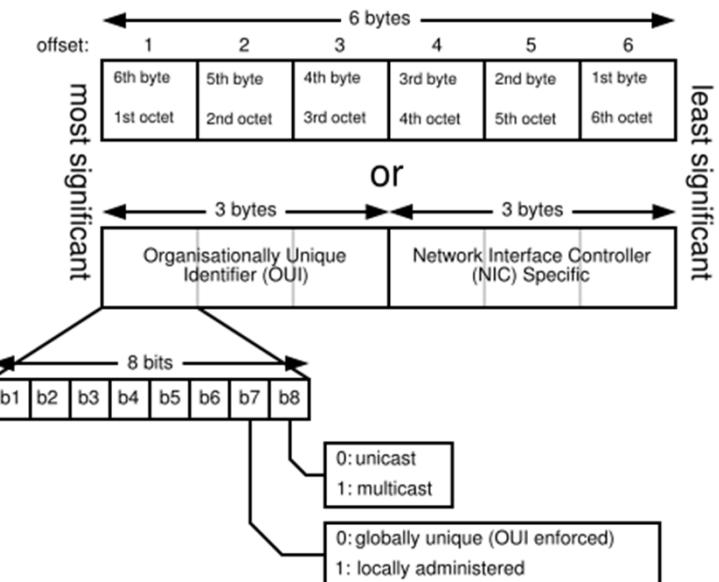
- ใน OSI Model นอกจาก IP Address ที่ต้องตั้งค่าเพื่อทำให้อุปกรณ์สามารถเชื่อมต่อผ่านเครือข่ายคอมพิวเตอร์แล้วยังมี Address อีกประเภทที่ใช้งานในเครือข่ายได้แก่ Media Access Control Address
- MAC Address เป็น Address ที่อยู่ในลำดับชั้นการสื่อสารชั้นที่ 2 (Data Link Layer) ของ OSI Model
- สำหรับ MAC Address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

ifconfig wlan0 down  
iwconfig wlan0 ether 69:69:69:69:69:69  
ifconfig wlan0 up.

# 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**

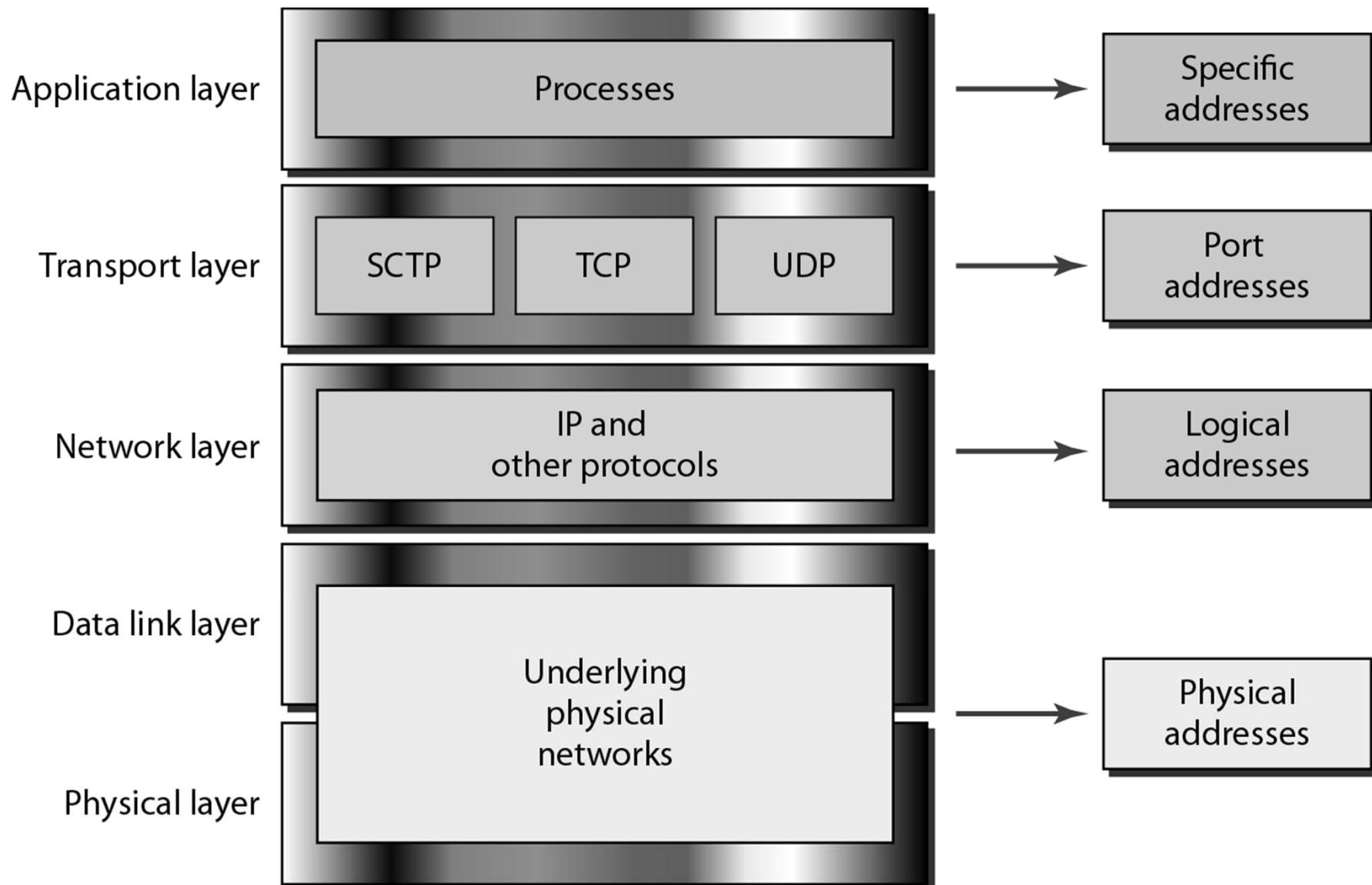
(เลขฐาน 16 → จุดต่อไปนี้เป็น 0-15 ทั้งหมด 16 ตัว)  
 $\frac{2^4}{2^4}$  (డॅट(.) 4 bit)  
= 1 (เลขฐาน 16)



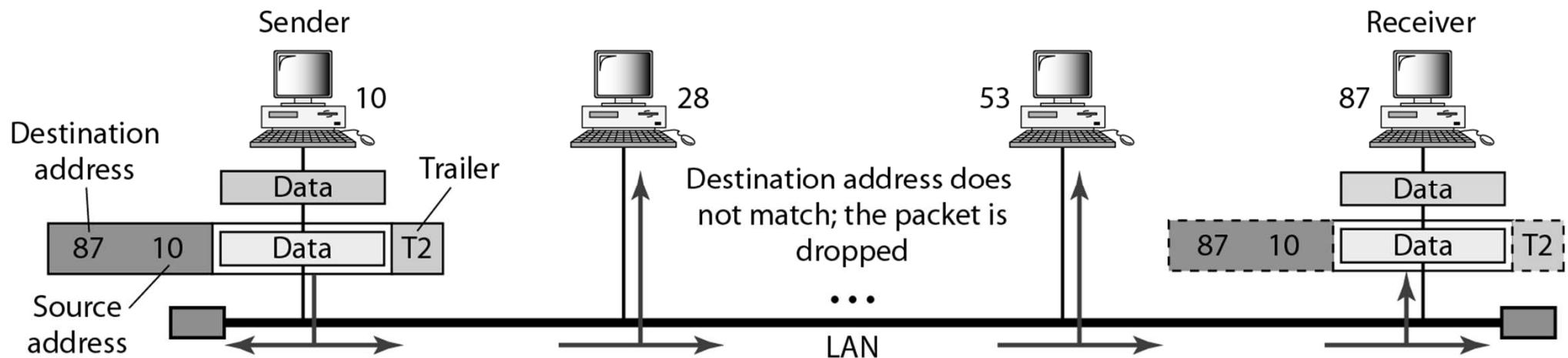
## Example 2.1

- 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.

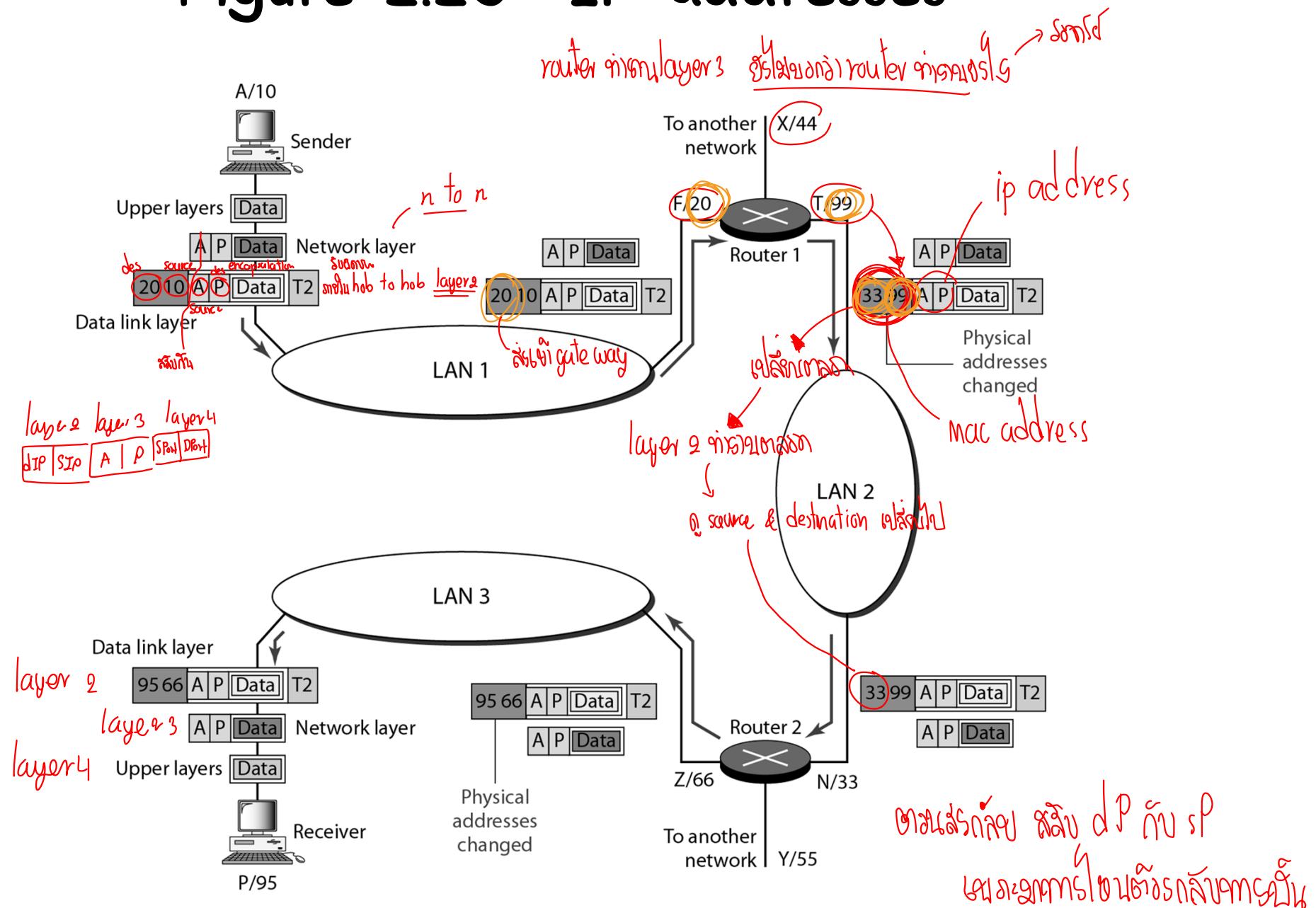
## Example 2.3

- 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.**

layer 2 ມາດໄລຍ່

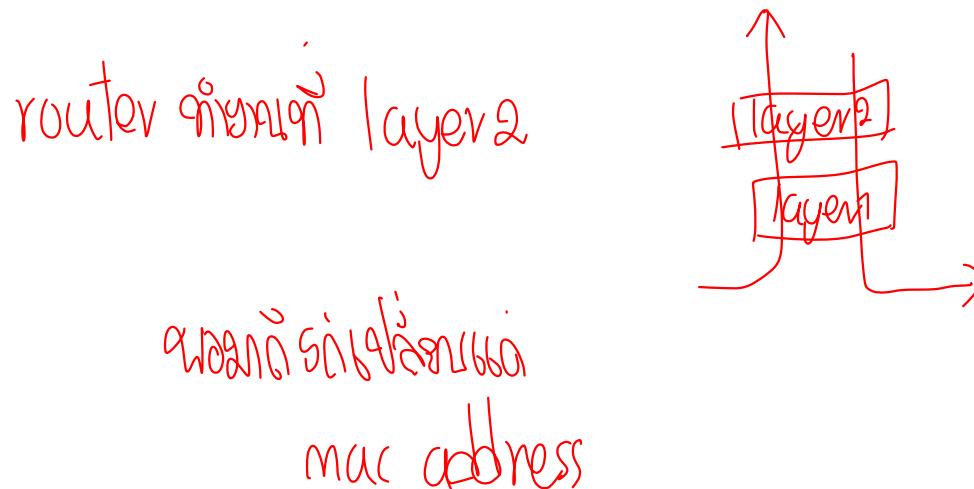
ds sd

## Figure 2.20 IP addresses



# Note

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

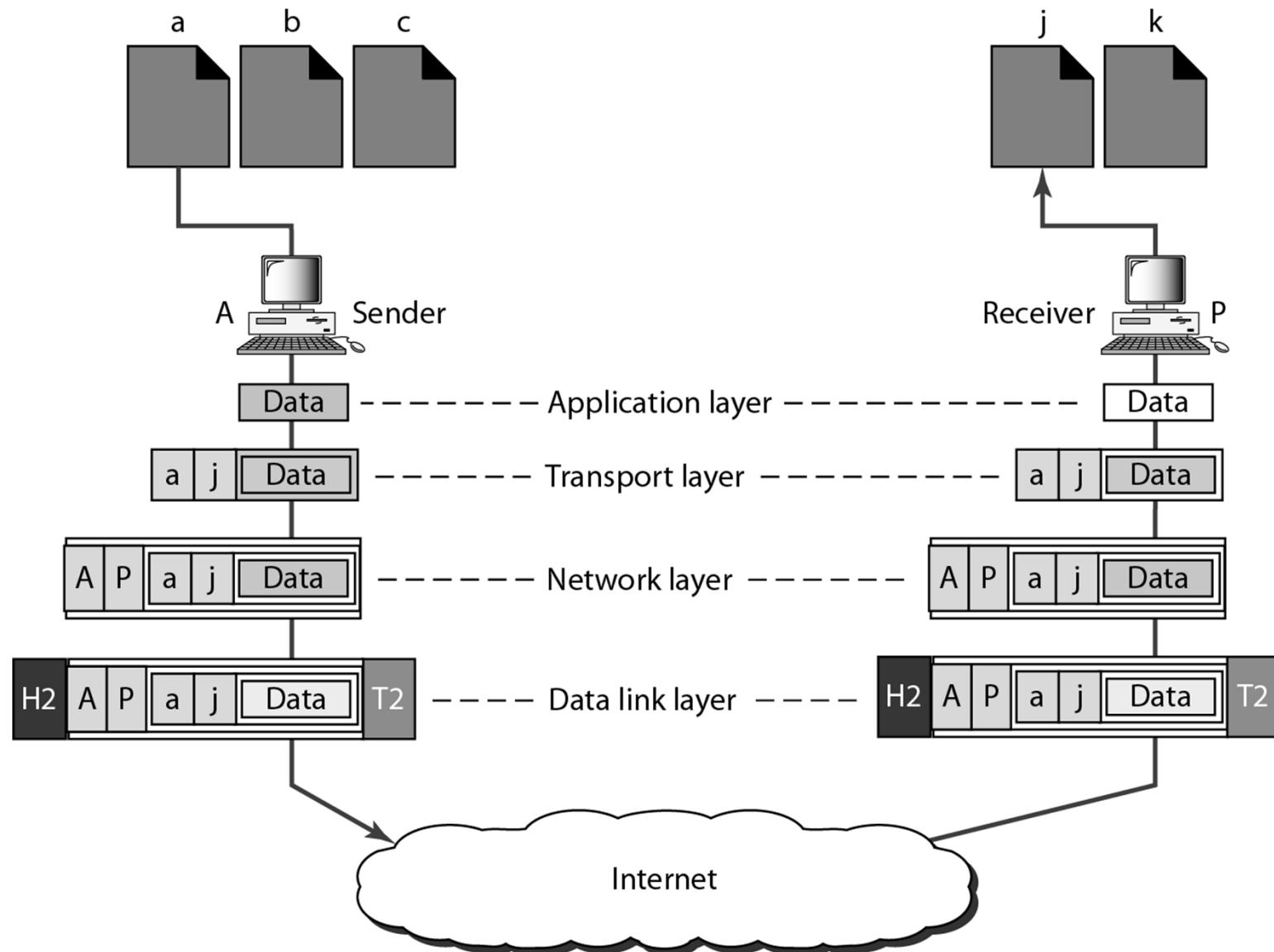


## Example 2.4

- 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

WTF.



## 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.

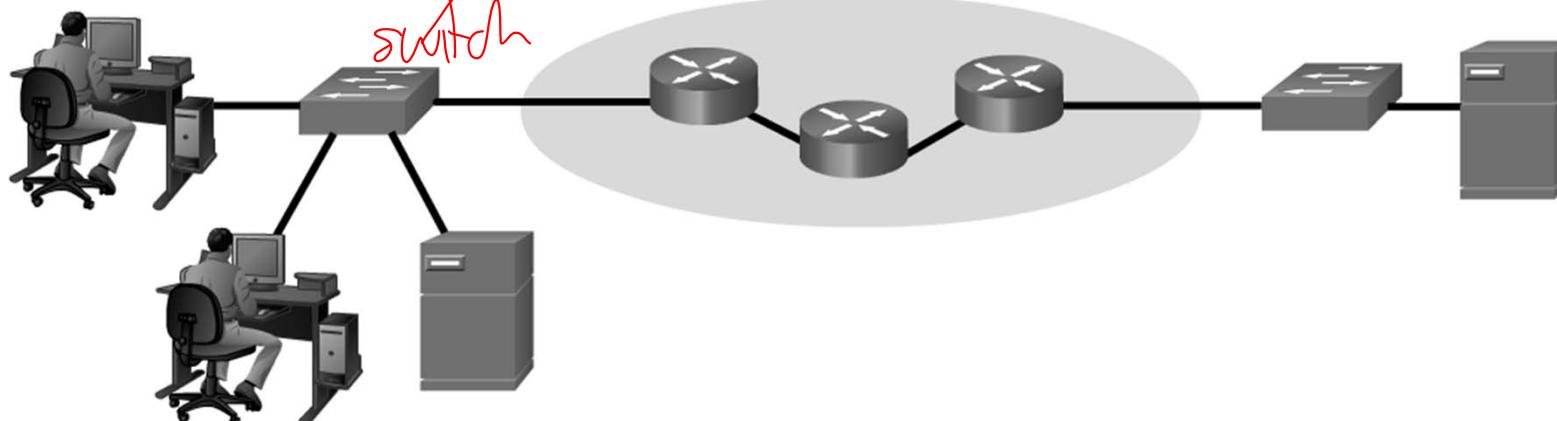
# Note

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

# Communicating with Device / Same Network

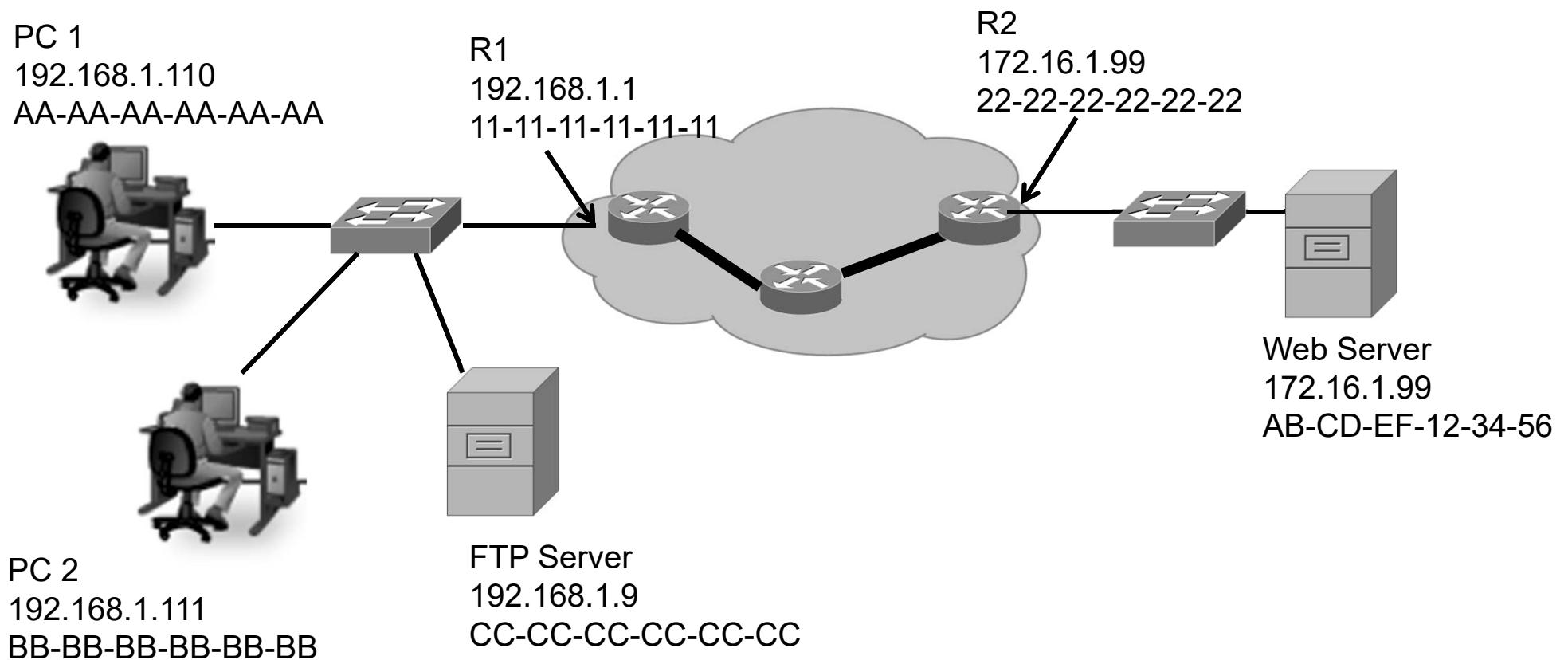
Data Link Ethernet Frame Header <i>layer 2</i>		Network Layer IP Packet Header <i>layer 3</i> <i>as network layer</i>					
Destination	Source	Source	Destination	Source	Dest.		
CC-CC-CC-CC-CC-CC	AA-AA-AA-AA-AA-AA	ip & subnet Network 192.168.1.110	Host 192.168.1.9	Network 192.168.1.9	Host 9	???	21

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 Ethernet Frame Header		Network Layer 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

