

Jaringan Komputer

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Outline

- Pengantar Jaringan Komputer
- Protokol TCP/IP
- Analisis transmisi data TCP/IP
- IP Subnetting
- Implementasi LAN
- Routing
- DNS
- Proxy Server
- Desain dan implementasi jaringan

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Pengantar Jaringan Komputer (1)

- Mengapa komputer dibentuk jaringan?
- Kerugian komputer dibentuk jaringan
- Evolusi jaringan Komputer
- *Requirement* jaringan komputer

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Pengantar Jaringan Komputer (2)

❑ Mengapa dibentuk jaringan?

- Sharing resources (printer, HD dll)
- Komunikasi (email, chatting dll)
- Integrasi data pada aplikasi
- Dan lain-lain

❑ Kerugian Jaringan komputer

- Ancaman keamanan data/informasi
- Ancaman virus
- Dan lain-lain

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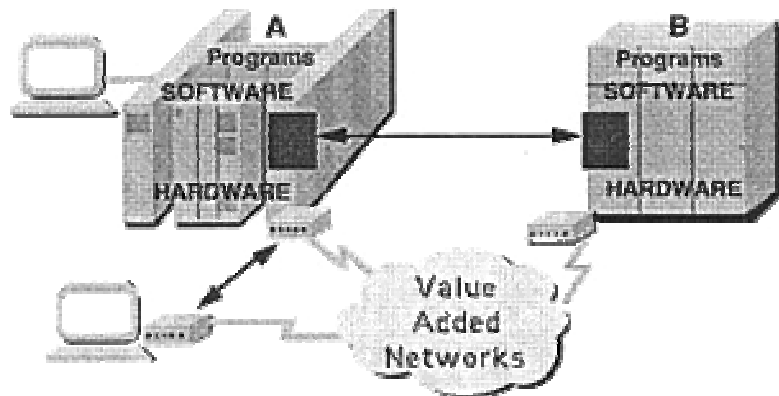
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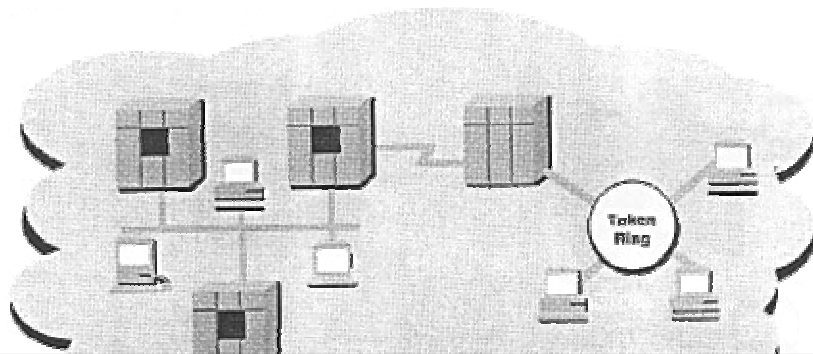
Pengantar Jaringan Komputer (3)

□ Evolusi jaringan komputer

- Mainframe pada era 1960-1970 an



- LAN (Local Area Network) pada era 1970-1980 an



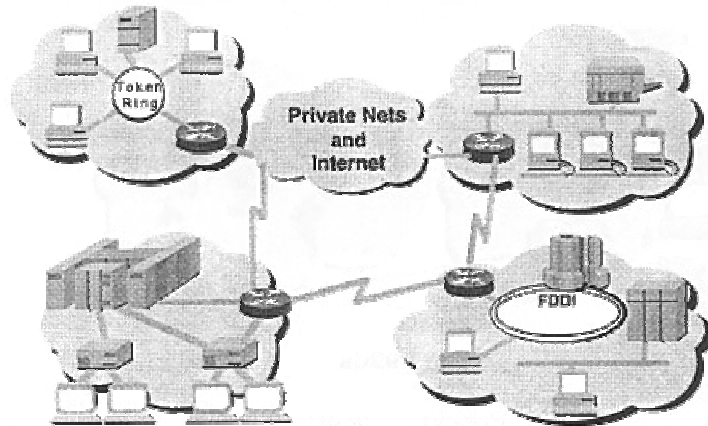
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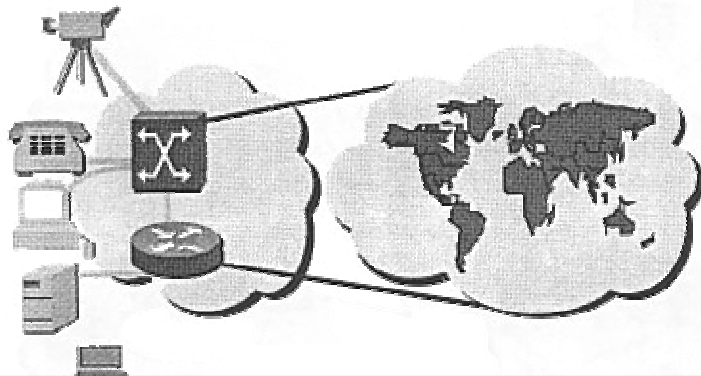
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Pengantar Jaringan Komputer (4)

- WAN (Wide Area Network) pada era 1980-1990 an



- Internet pada era 1990 an



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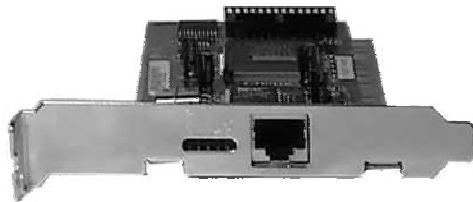
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Pengantar Jaringan Komputer (5)

□ Requirement jaringan komputer

▪ Hardware

- Network Interface Card
- Hub/Switch sebagai concentrator & repeater
- Router untuk menyeberangkan paket data ke jaringan yang berbeda
- Dan lain-lain



▪ Software

Protokol sebagai aturan yang digunakan bersama dalam proses transmisi data sehingga transmisi data dapat berjalan dengan semestinya

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Protokol TCP/IP (1)

- Protokol TCP/IP
- Perbandingan Model OSI dan implementasi TCP/IP
- Enkapsulasi dan *layering* pada TCP/IP
- Layer aplikasi pada TCP/IP
- Layer transport pada TCP/IP
- Layer network pada TCP/IP
- Layer physical pada TCP/IP

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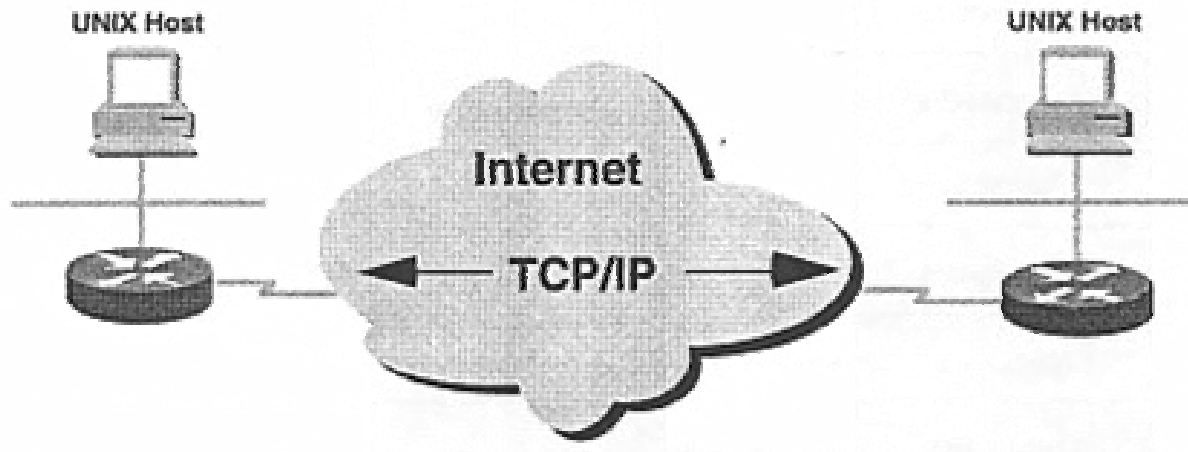
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Protokol TCP/IP (2)

□ Protokol TCP/IP

- Merupakan protokol yang secara *defacto* digunakan di internet (jaringan komputer global)
- Mengacu pada protokol OSI (Open sistem Interconnect)



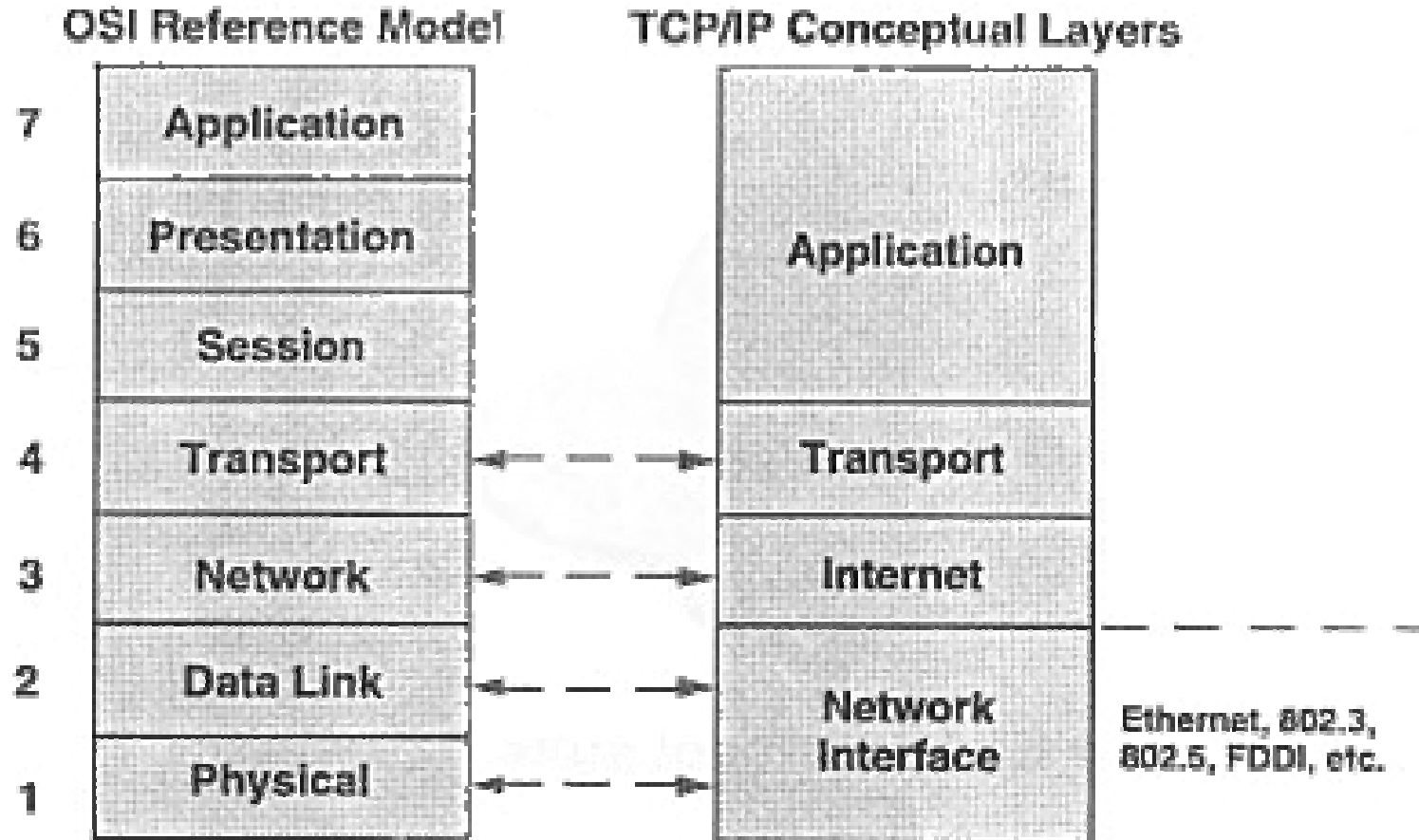
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Protokol TCP/IP (3)

□ Perbandingan Model OSI dan implementasi TCP/IP



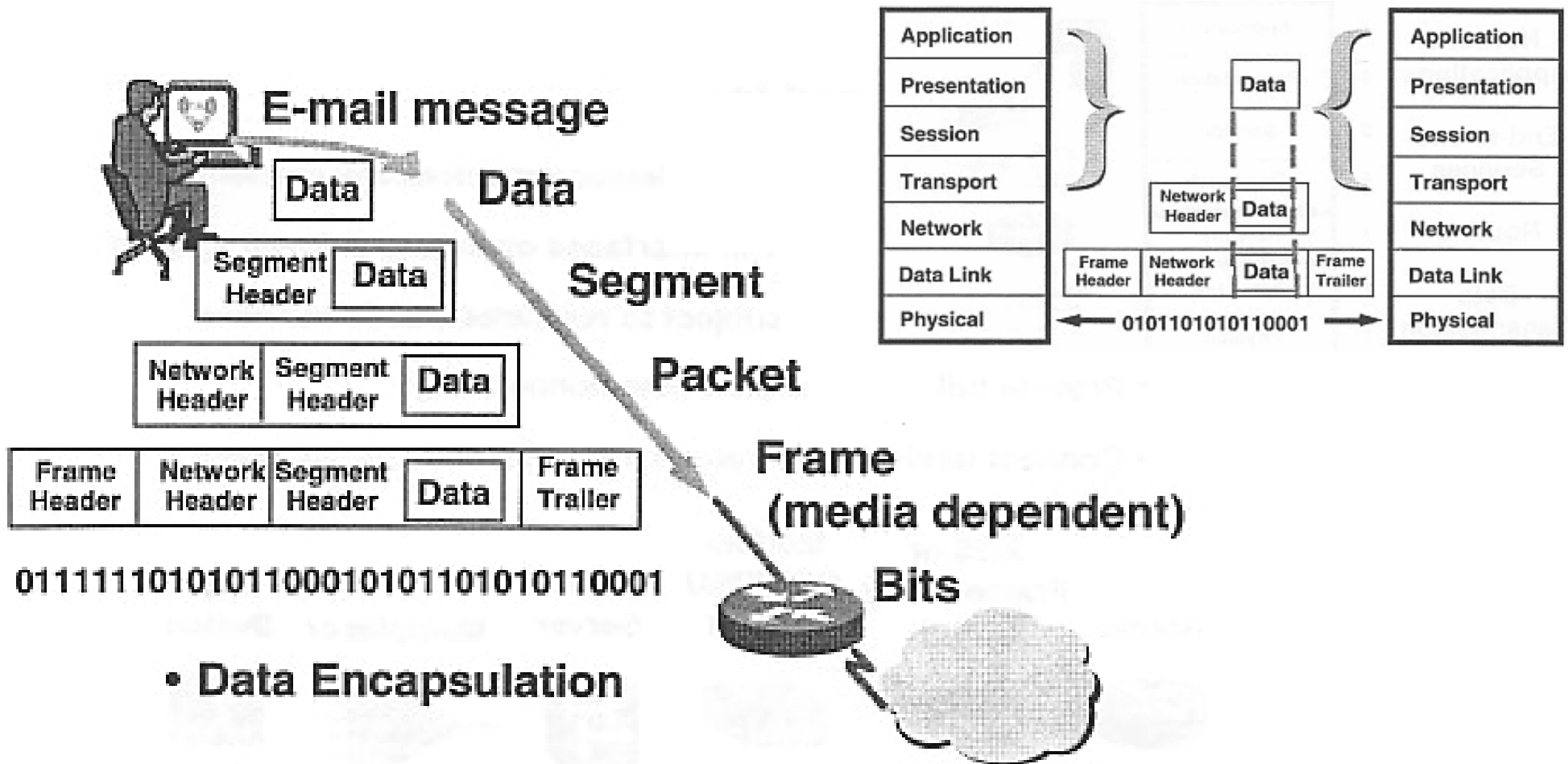
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Protokol TCP/IP (4)

□ Enkapsulasi dan *layering* pada TCP/IP



• Data Encapsulation

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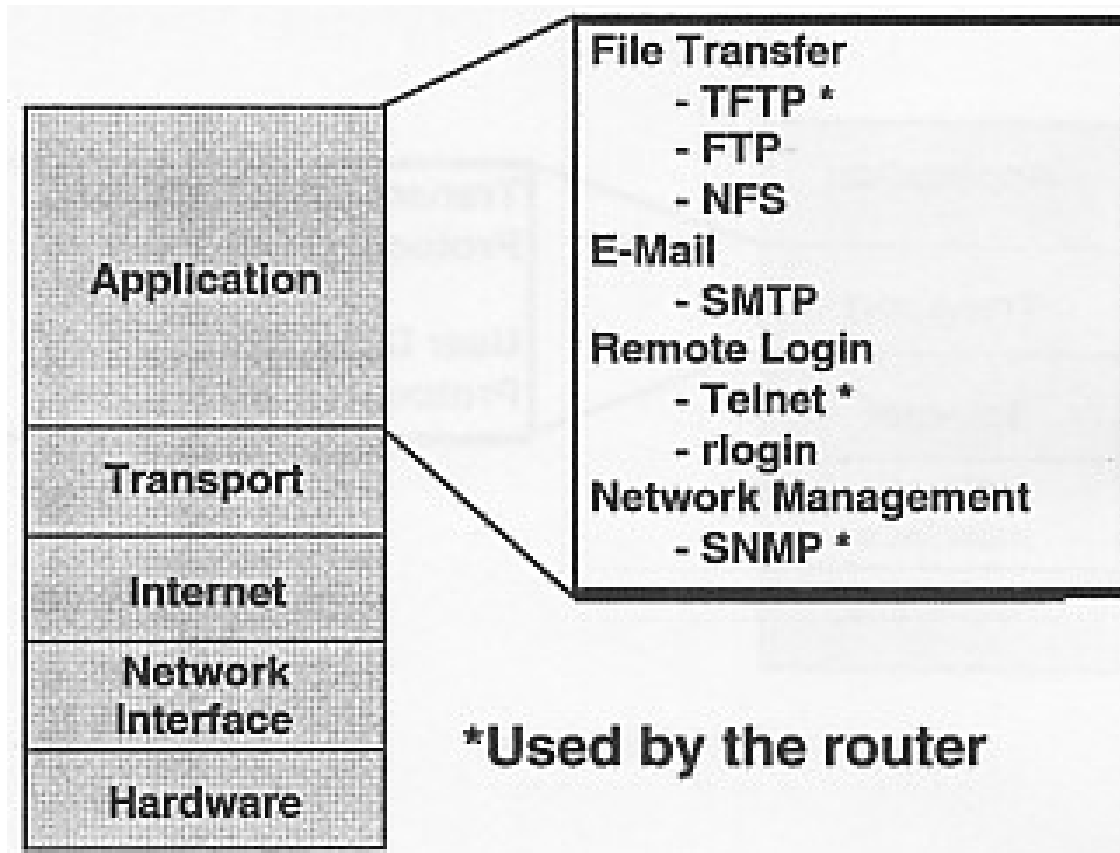
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Protokol TCP/IP (5)

□ Layer aplikasi

Aplikasi yang digunakan user seperti telnet,ftp, SSH



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Protokol TCP/IP (6)

□ Layer Transport

- Memastikan paket sampai ke servis yang benar (Port)
- Mengendalikan seluruh proses transmisi, kapan dimulai, dipercepat, diperlambat, diakhiri (Code Bit)
- Mengetahui apakah terjadi kerusakan data pada proses transmisi (Checksum)
- Penomoran paket data agar data dapat disusun ulang (Sequence number)

□ Jenis-jenis protokol di layer transport

- TCP (Transmission Control Protocol)
bersifat *connection* oriented
- Protokol UDP (User Datagram Protocol)
bersifat *connectionless* oriented

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Protokol TCP/IP (7)

□ Header-headers pada TCP

# Bits	16	16	32	32	4	6	6
	Source Port	Dest Port	Sequence #	Acknowledgment #	HLEN	Reserved	Code Bits

16	16	16	32	
Window	Check-sum	Urgent Pointer	Option	Data...

□ Header-headers pada UDP

# Bits	16	16	16	16	
	Source Port	Destination Port	Length	Check-sum	Data ...

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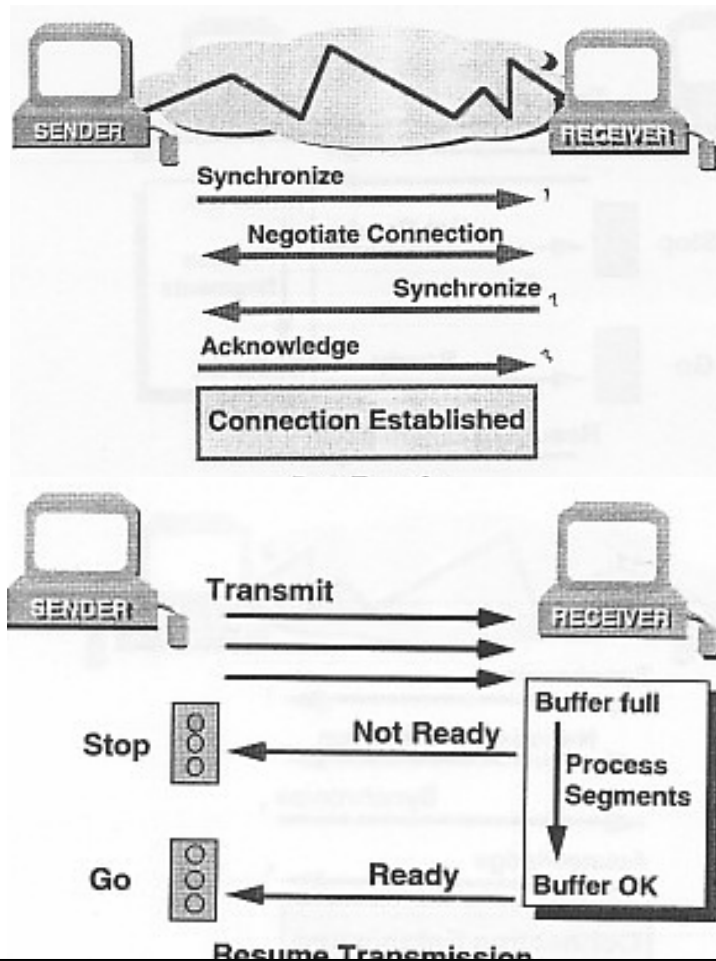
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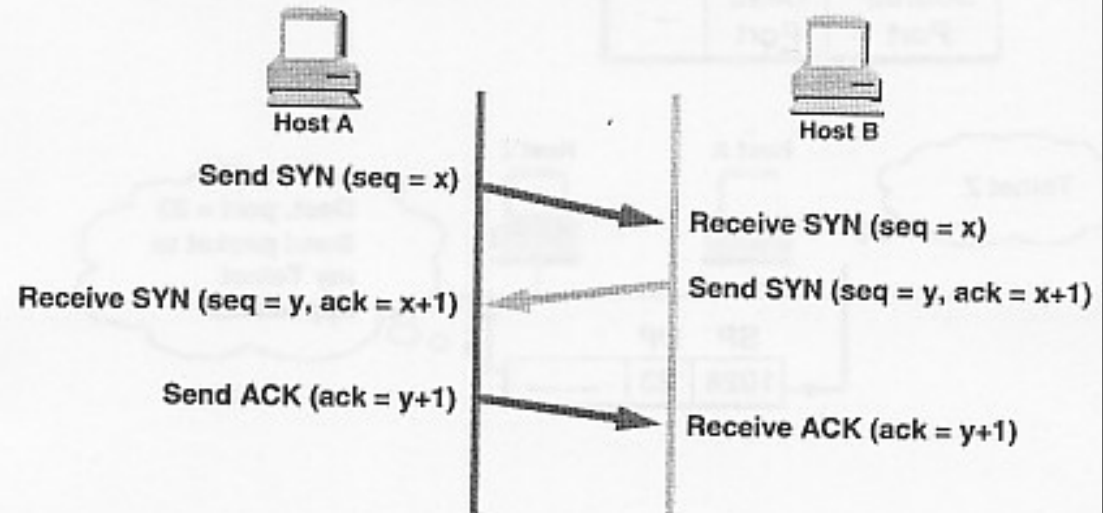
Protokol TCP/IP (8)

□ Feature-feature pada TCP

- Flow control, *handshake*



TCP Three-Way Handshake/ Open Connection



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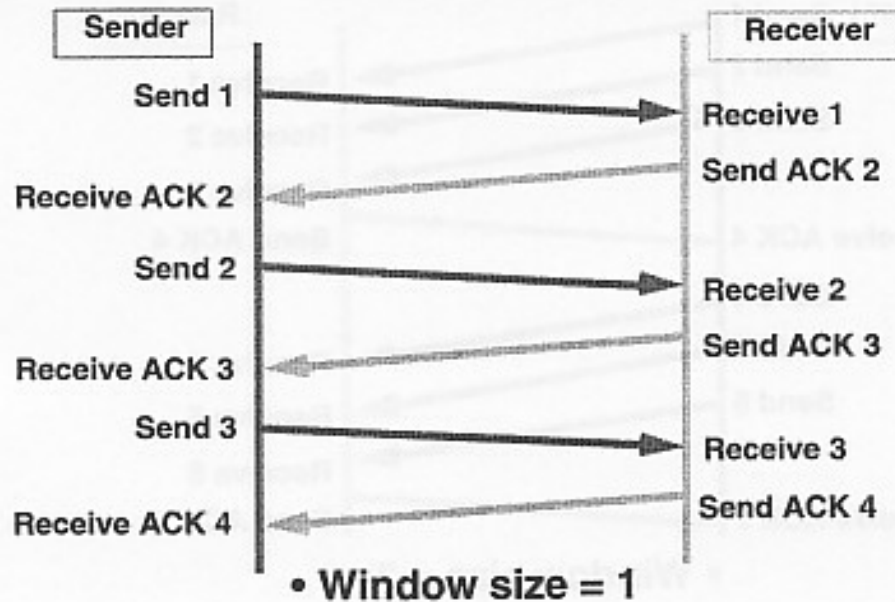
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Protokol TCP/IP (9)

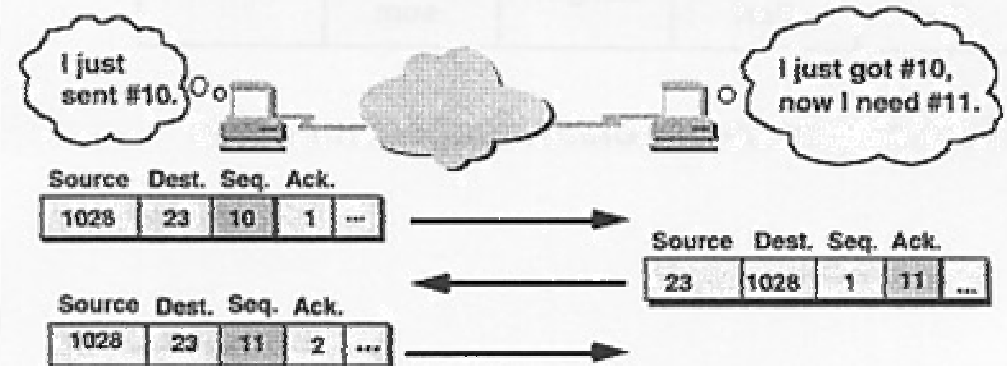
- *Sequence dan acknowledgment*

TCP Simple Acknowledgment



TCP Sequence and Acknowledgment Numbers

Source Port	Dest. Port	Sequence #	Acknowledgment #	...
				...



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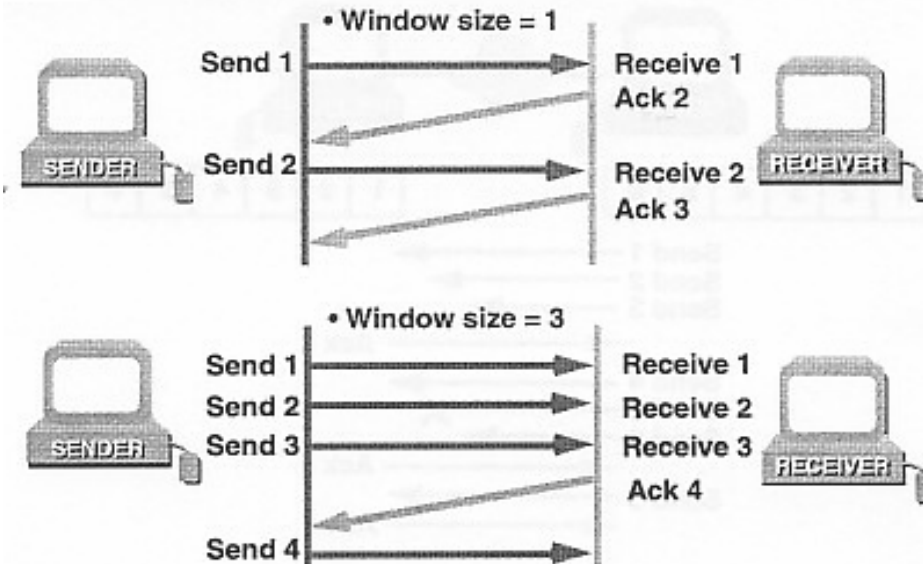
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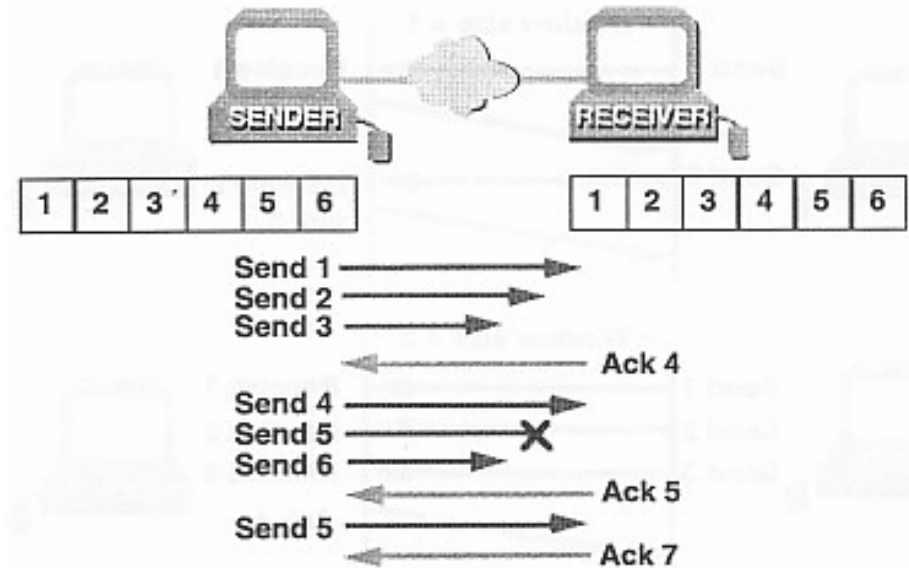
Protokol TCP/IP (10)

- *Reliability dan windowing*

Transport: Windowing



Reliability with Windowing



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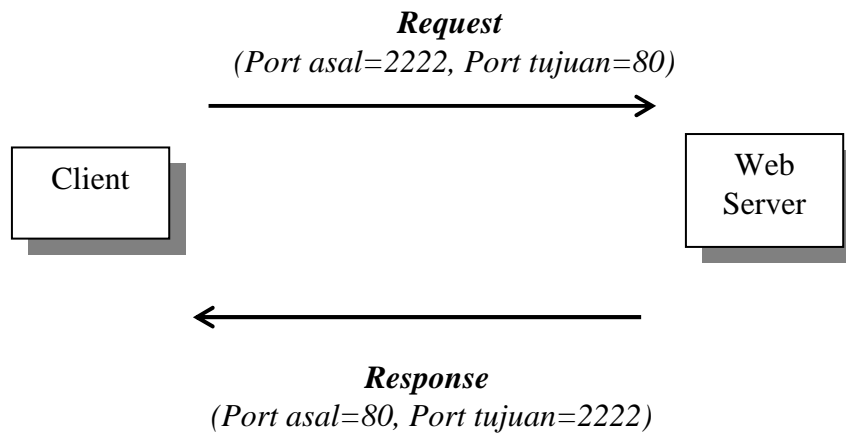
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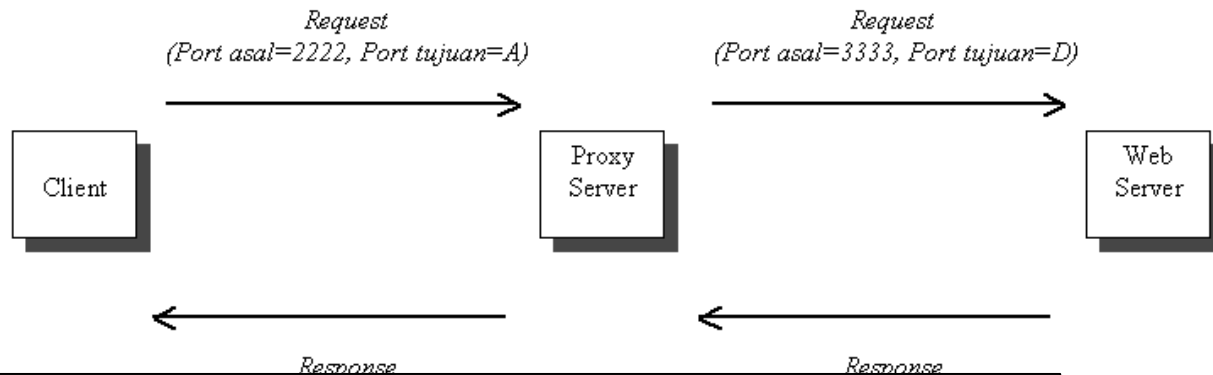
Protokol TCP/IP (11)

- **Port number**

- **Direct connection**



- **Via Proxy Connection**



Keterangan:

- **A=Port Proxy**
- **D=Port Web server**

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Protokol TCP/IP (12)

❑ Protokol pada layer Network

- **IP (Internet Protocol)**

Untuk transmisi paket data

- **ICMP (Internet Connection Message Protocol)**

Untuk informasi kondisi jaringan, contoh: ping, traceroute

- **ARP (Address Resolution Protocol)**

Mendapatkan informasi MAC Address dari IP yang diketahui

- **RARP (Reverse ARP)**

Mendapatkan informasi IP dari MAC Address yang diketahui

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Protokol TCP/IP (13)

□ Internet Protocol

- Memastikan paket data sampai ke komputer tujuan
- Protokol TCP di layer transport dan IP dilayer network menjadi tulang punggung protokol TCP/IP

# Bits	4	4	8	16	16	3	13	8
	VERS	HLEN	Type of Service	Total Length	Identification	Flags	Frag Offset	TTL

8	16	32	32	var	
Protocol	Header Checksum	Source IP Address	Destination IP Address	IP Options	Data ...

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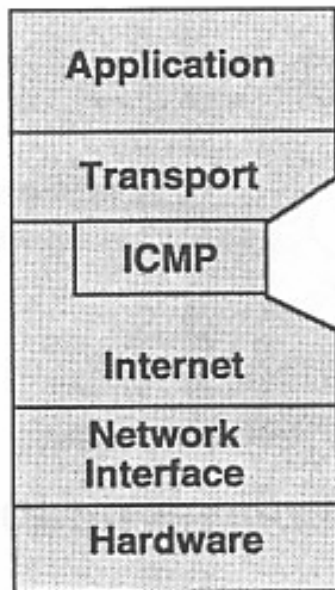
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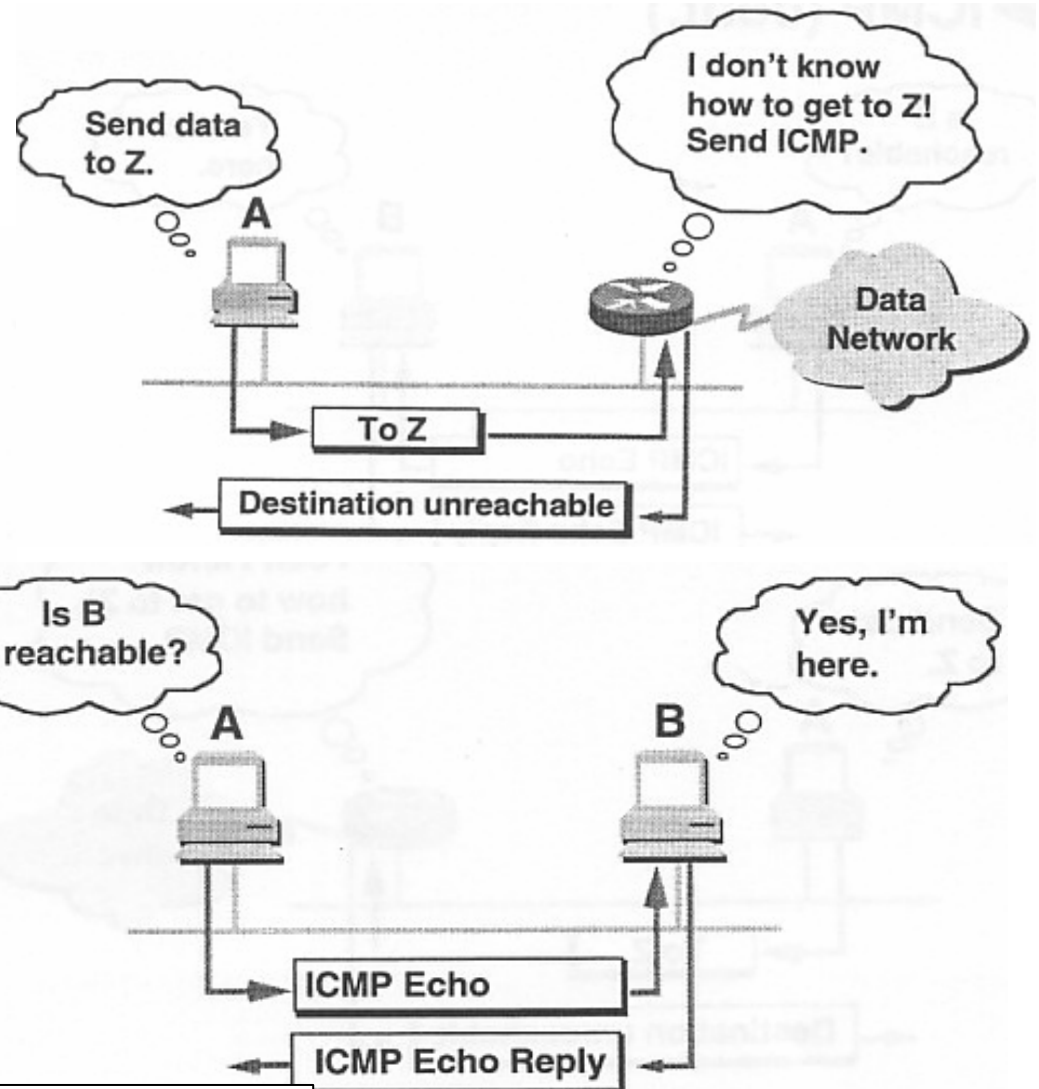
Protokol TCP/IP (14)

❑ ICMP

Digunakan untuk diagnosa kondisi jaringan



Destination Unreachable
Echo (Ping)
Other



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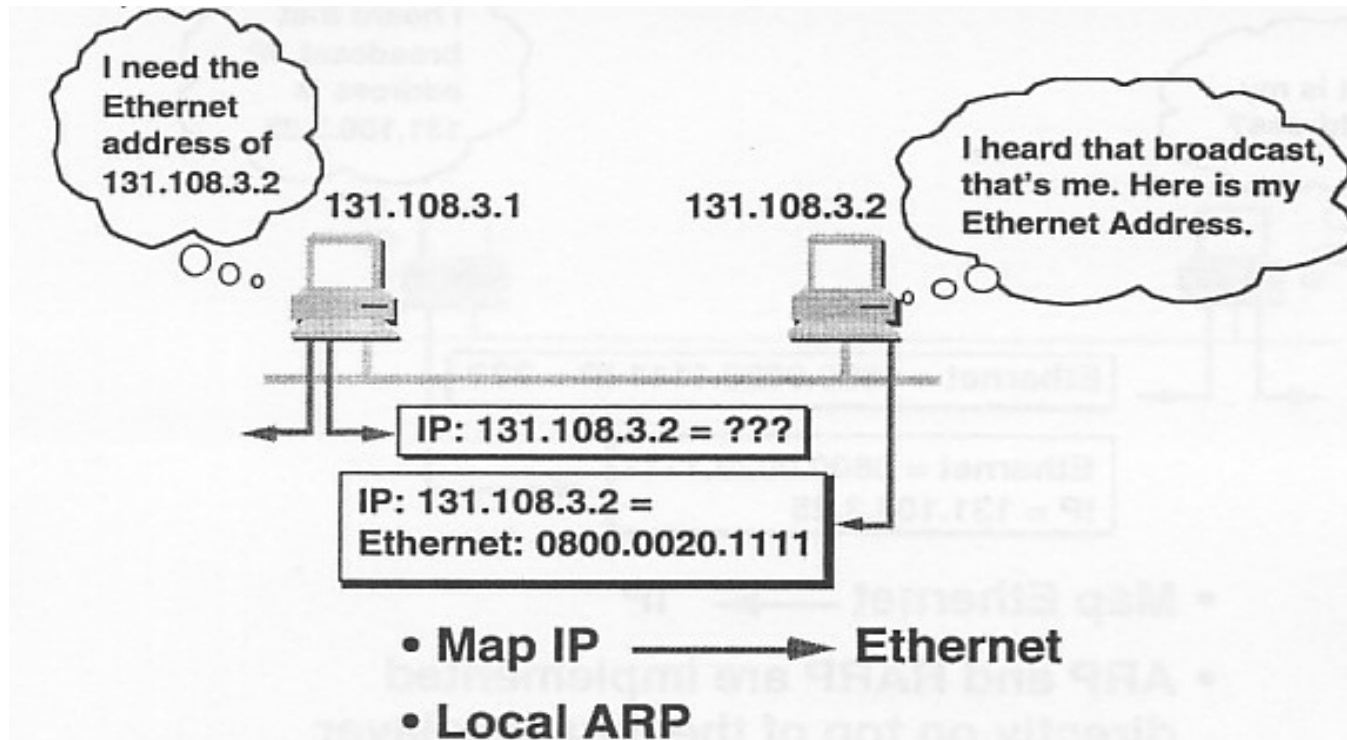
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Protokol TCP/IP (15)

□ ARP

Memetakan IP ke MAC Address



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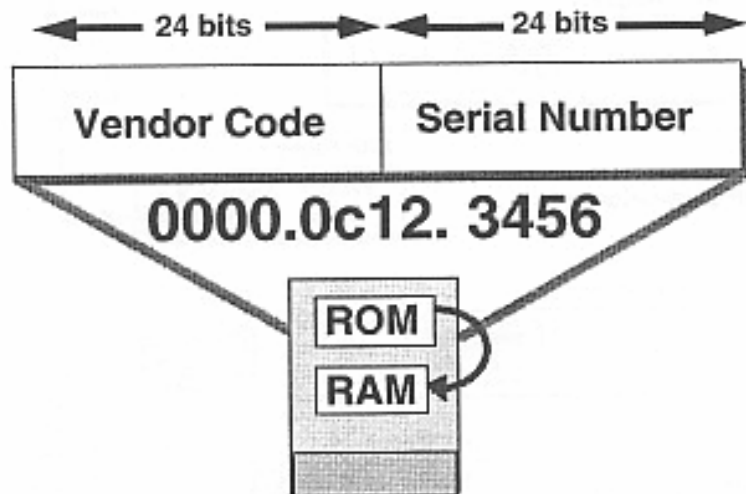
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Protokol TCP/IP (16)

❑ Layer Network Interface/Data link dan Physical

- Mentransmisikan datagram dari layer network ke host tujuan
- Teknologi: Ethernet, Point to Point Protocol (PPP), dll
- Teknologi ethernet merupakan teknologi yang banyak dipakai
- Alamat ethernet disebut MAC (Media Access Control) Address



- **MAC address is burned into ROM on a network interface card**

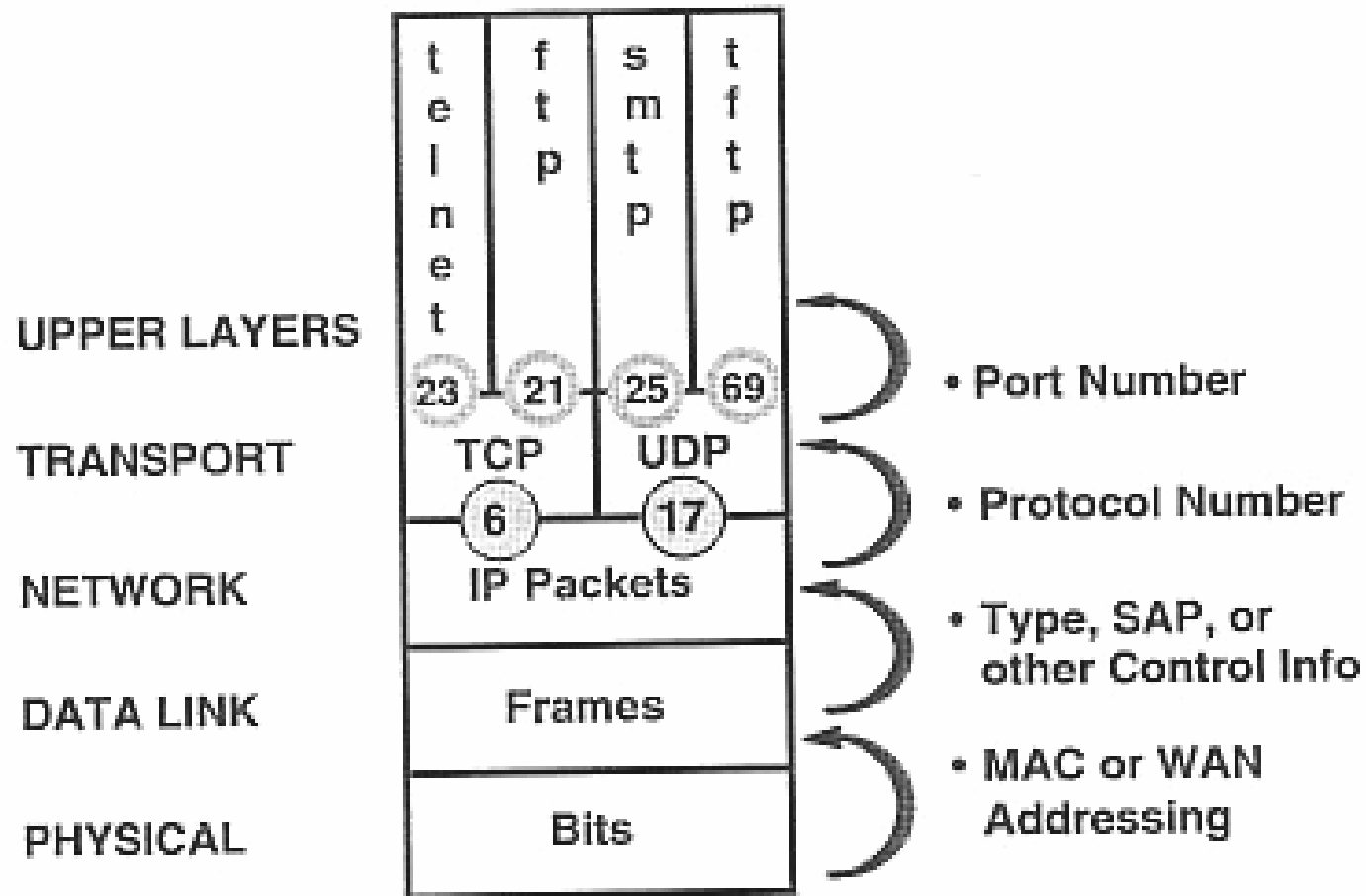
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Protokol TCP/IP (17)

□ Contoh stack TCP/IP



- A TCP/IP Example

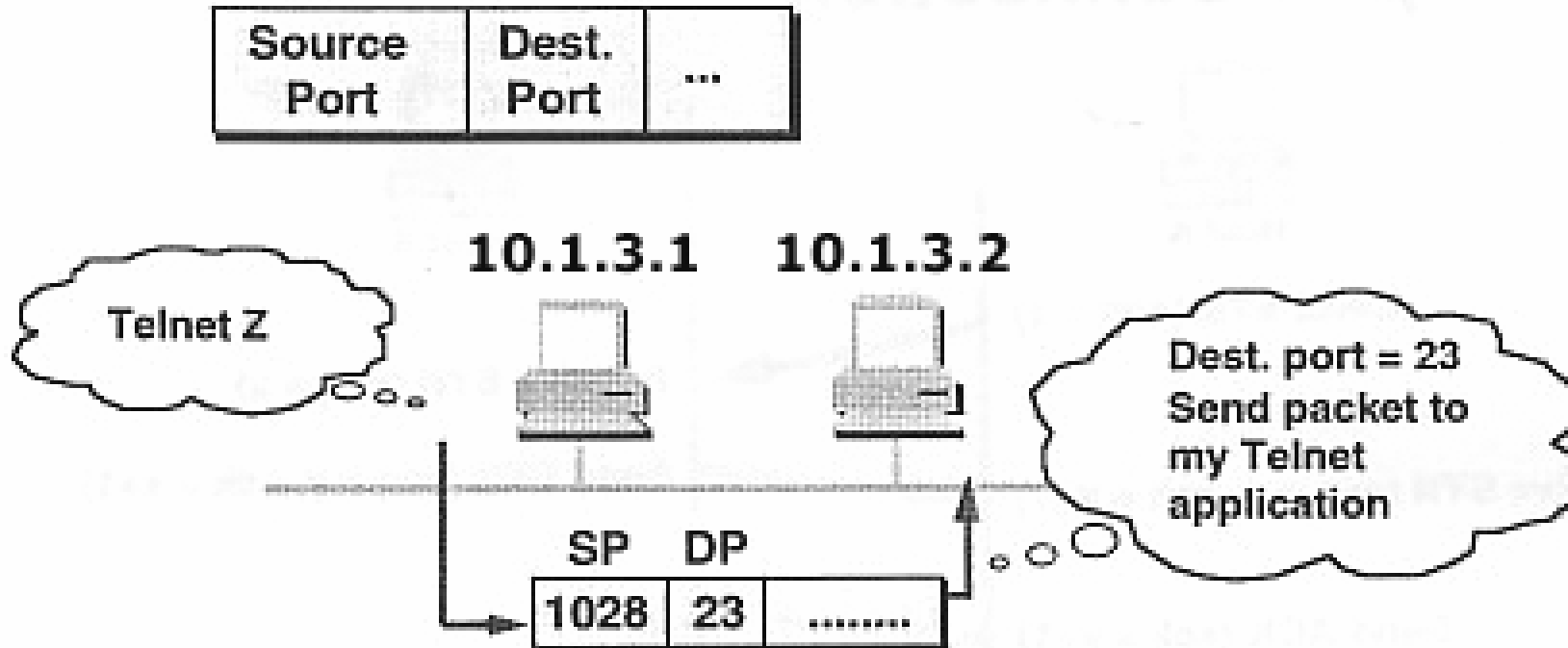
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Analisa transmisi data TCP/IP (1)

□ Contoh kasus telnet



Aplikasi	Transport		Network		Phisycal
	Port Asal	Port tujuan	IP asal	IP tujuan	
telnet	1028	23	10.1.3.1	10.1.3.2	Ethernet 802.3

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Analisa transmisi data TCP/IP (2)

❑ Analisa dengan Netstat di server

```
# netstat -na
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	0.0.0.0:23	0.0.0.0:0	LISTENING
TCP	10.1.3.2:23	10.1.3.1:1028	ESTABLISHED

❑ Analisa dengan Netstat di client

```
# netstat -na
```

Active Connections

Proto	Local Address	Foreign Address	State
TCP	10.1.3.1:1028	10.1.3.2:23	ESTABLISHED

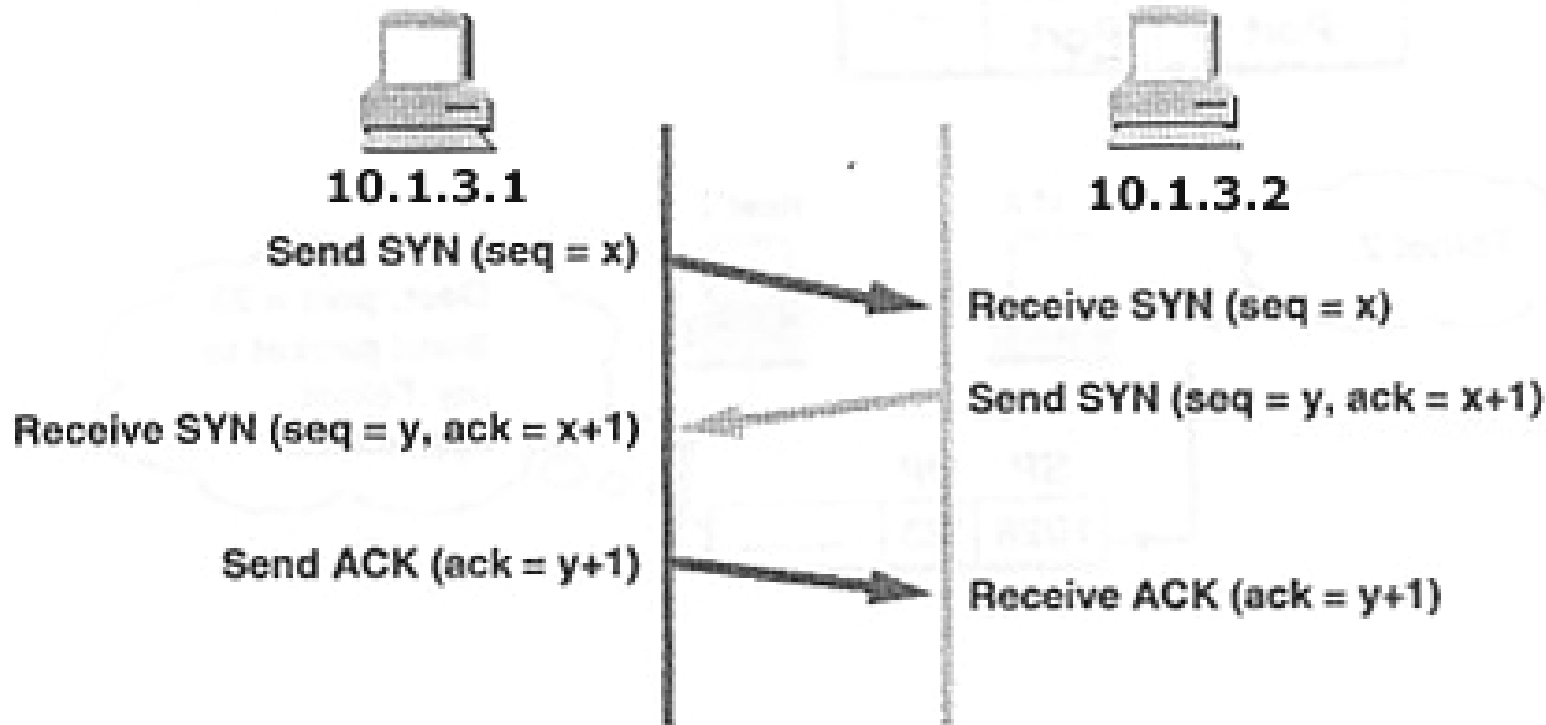
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Analisa transmisi data TCP/IP (3)

□ Analisa paket data lebih detail dengan TCPDump



- Host pengirim mengirimkan paket SYN
- Penerima merespon dengan mengirimkan paket SYN dan ACK
- Pengirim membalas dengan ACK yang berarti transmisi data ala TCP/IP siap

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Analisa transmisi data TCP/IP (4)

```
02:07:01.031065 10.1.3.1.1028 > 10.1.3.2.telnet:  
S 748156130:748156130(0) win 16384 <mss  
1460,nop,nop,sackOK> (DF)
```

```
02:07:01.031531 10.1.3.2.telnet > 10.1.3.1.1028:  
S 719564333:719564333(0) ack 748156131 win 5840  
<mss 1460,nop,nop,sackOK> (DF)
```

```
02:07:01.038584 10.1.3.1.1028 > 10.1.3.2.telnet:  
. ack 1 win 17520 (DF)
```

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Analisa transmisi data TCP/IP (5)

02:07:01.155457 10.1.3.2.telnet > 10.1.3.1.1028:
P 1:13(12) ack 1 win 5840 (DF) [tos 0x10]

02:07:01.159498 10.1.3.1.1028 > 10.1.3.2.telnet:
P 1:7(6) ack 13 win 17508 (DF)

02:07:01.159634 10.1.3.2.telnet > 10.1.3.1.1028:
. ack 7 win 5840 (DF) [tos 0x10]

02:07:01.159903 10.1.3.1.1028 > 10.1.3.2.telnet:
P 7:16(9) ack 13 win 17508 (DF)

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Analisa transmisi data TCP/IP (6)

□ Analisa paket data dengan Ethereal

The screenshot displays the Ethereal (Wireshark) interface. The main window shows a list of captured packets. The first packet is selected, and its details are expanded to show the Transmission Control Protocol (TCP) header information.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.3.101	10.1.3.126	TCP	32777 > telnet [SYN] Seq=0 Ack=0 Win=5840 Len=0
3	0.000260	10.1.3.101	10.1.3.126	TCP	32777 > telnet [ACK] Seq=1 Ack=1 Win=5840 Len=0
4	0.149570	10.1.3.101	10.1.3.126	TELNET	Telnet Data ...
7	3.605512	10.1.3.101	10.1.3.126	TCP	32777 > telnet [ACK] Seq=34 Ack=13 Win=5840 Len=0
9	3.605886	10.1.3.101	10.1.3.126	TCP	32777 > telnet [ACK] Seq=34 Ack=58 Win=5840 Len=0
10	3.757061	10.1.3.101	10.1.3.126	TELNET	Telnet Data ...
13	3.758450	10.1.3.101	10.1.3.126	TCP	32777 > telnet [ACK] Seq=142 Ack=61 Win=5840 Len=0
14	3.758713	10.1.3.101	10.1.3.126	TELNET	Telnet Data ...
17	3.813604	10.1.3.101	10.1.3.126	TELNET	Telnet Data ...

Frame 1 (74 bytes on wire, 74 bytes captured)
Ethernet II, Src: 00:07:95:35:2c:00, Dst: 00:50:fc:71:f1:35
Internet Protocol, Src Addr: 10.1.3.101 (10.1.3.101), Dst Addr: 10.1.3.126 (10.1.3.126)
Transmission Control Protocol, Src Port: 32777 (32777), Dst Port: telnet (23), Seq: 0, Ack: 0, Len: 0

- Source port: 32777 (32777)
- Destination port: telnet (23)
- Sequence number: 0 (relative sequence number)
- Header length: 40 bytes
- Flags: 0x0002 (SYN)
- Window size: 5840
- Checksum: 0xd97f (correct)
- Options: (20 bytes)

0010 00 3c d1 b1 40 00 40 06 4e b6 0a 01 03 b5 0a 01 .K.a@. NF...e..
0020 03 7e 80 09 00 17 a7 2e b2 29 00 00 00 00 a0 02 .~.....).....
0030 16 d0 d9 7f 00 00 02 04 05 b4 04 02 08 0a 00 10
0040 63 48 00 00 00 00 01 03 03 02 cH.....

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IP Address (1)

- IP Address
- Jenis-jenis IP address
- Format IP address versi 4
- Alamat-alamat khusus
- Kelas-kelas IP Address

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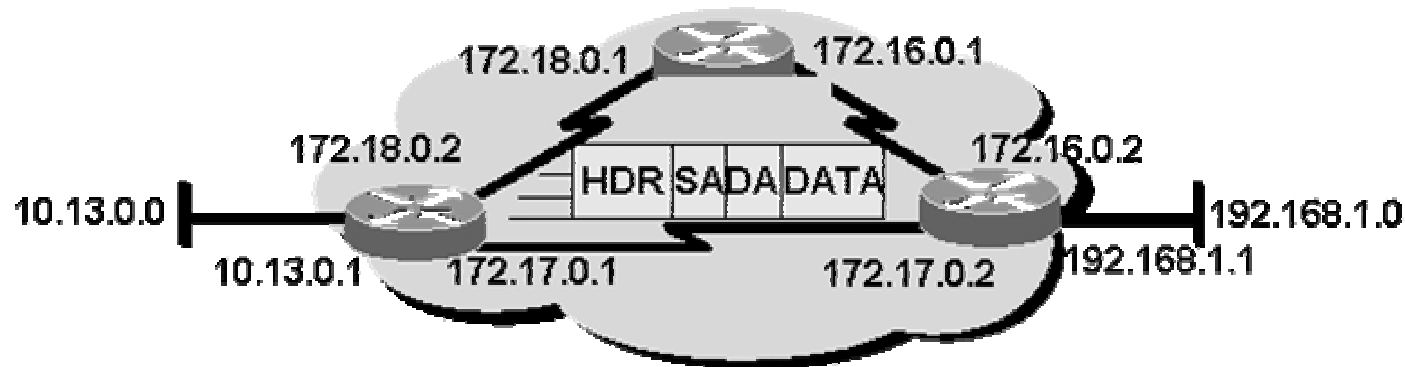
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IP Address (2)

□ IP Address

Menentukan alamat host, lokasi host dalam jaringan, routing untuk mencapainya



□ Jenis-jenis IP address

- IP Public (Static), unique di internet
- IP Local/Private, unique hanya dalam 1 jaringan. Menurut ARIN (American for Registry Internet Number), rentang IP local :
 - 10.0.0.0 -10.255.255.255;
 - 172.16.0.0-172.31.255.255;
 - 192.168.0.0.-192.168.255.255

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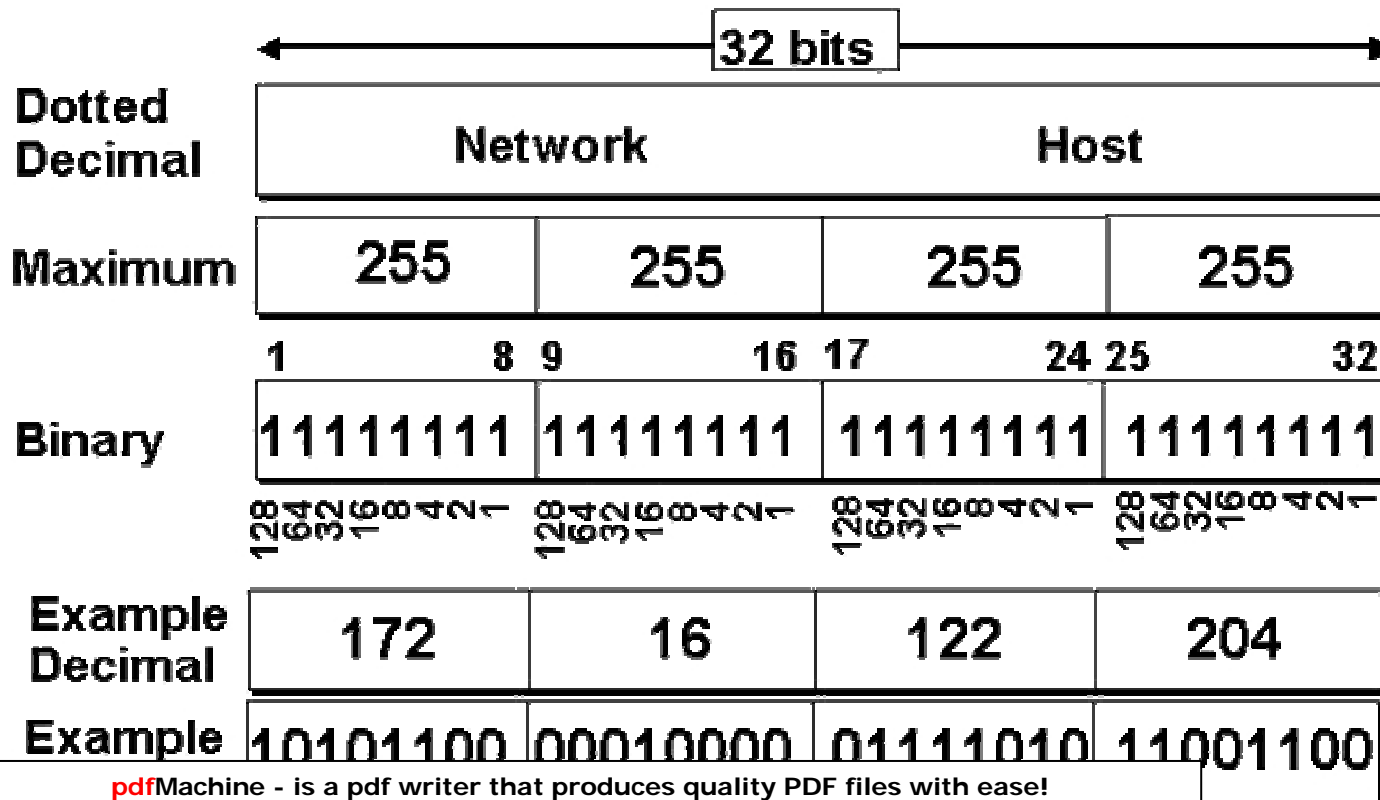
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IP Address (3)

□ Format IP address Versi 4

- 32 Bit
- 4 segment
- Terdiri dari network ID dan host ID



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IP Address (4)

□ Alamat-alamat khusus

■ Network Address

- Menunjukkan alamat suatu jaringan
- IP Address dalam jaringan tersebut yang paling kecil

■ Broadcast Address

- Digunakan untuk mengirimkan paket ke seluruh host di dalam jaringan
- IP Address dalam jaringan tersebut yang paling kecil

■ Loopback

Alamat lokal tiap komputer yang bernilai 127.0.0.1

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IP Address (5)

□ Kelas-kelas IP Address

	8 bits	8 bits	8 bits	8 bits
Class A:	Network	Host	Host	Host
Class B:	Network	Network	Host	Host
Class C:	Network	Network	Network	Host
Class D:	Multicast			
Class E:	Research			

□ Range Kelas-Kelas IP:

- Kelas A : 1.0.0.0 s.d 126.255.255.255 = 16.777.214 IP
- Kelas B : 128.0.0.0 s.d 191.155.255.255 = 65.534 IP
- Kelas C : 192.0.0.0 s.d 223.255.255.255 = 254 IP

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IP Subnetting (1)

- IP tanpa subnetting
- Masalah-masalah pada IP tanpa subnetting
- IP dengan subnetting
- IP subnetting dengan VLSM
- Notasi jaringan

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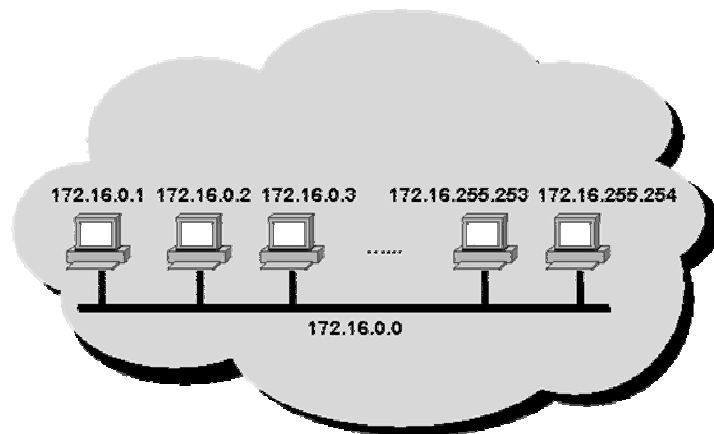
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IP Subnetting (2)

❑ IP tanpa subnetting

Jumlah host maksimal dalam 1 jaringan berdasarkan kelas IP



Network 172.16.0.0

Contoh IP kelas B

1 jaringan dengan host 65.534

❑ Masalah yang muncul pada jaringan tanpa subnetting

- Topologi/hardware harus sama
- Collision (tabrakan paket data antar host) makin sering
- Kesulitan mengatur jaringan

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IP Subnetting (3)

❑ IP dengan Subnetting,

Jaringan dibuat subnet-subnet dengan mengkonfigurasi subnet mask

Contoh 1

Bandingkan IP address 10.10.1.1 tanpa subnetting (subnetmask Default =255.0.0.0) dengan jika subnetting dengan subnet mask = 255.255.255.248 !

Jawaban

Network address dihitung dengan mengoperasikan logika AND antara IP address dengan subnetmasknya

IP address	00001010	00001010	00000001	00000001	
Subnetmask	11111111	11111111	11111111	11111000	AND
Network ID	00001010	00001010	00000001	00000000	

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IP Subnetting (4)

1. Network ID 10.10.1.0
2. Jumlah IP dalam 1 jaringan

IP-IP Address yang bersubnetmask dan bernetwork ID sama

IP address 00001010.00001010.00000001.00000000 = 10.10.1.0

IP address 00001010.00001010.00000001.00000001 = 10.10.1.1

IP address 00001010.00001010.00000001.00000010 = 10.10.1.2

IP address 00001010.00001010.00000001.00000011 = 10.10.1.3

IP address 00001010.00001010.00000001.00000100 = 10.10.1.4

IP address 00001010.00001010.00000001.00000101 = 10.10.1.5

IP address 00001010.00001010.00000001.00000110 = 10.10.1.6

IP address 00001010.00001010.00000001.00000111 = 10.10.1.7

SM 11111111.11111111.11111111.11111000 AND

Net ID 00001010.00001010.00000001.00000000

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IP Subnetting (5)

3. Jumlah total IP=8
4. Jumlah IP yang bisa dipakai host= $8-2=6$
5. Rentang IP host =10.10.1.1-10.10.1.6

	Tanpa subneting	Dengan Subneting
Jumlah host	16.777.214	6
Network address	10.0.0.0	10.10.1.0
Broadcast address	10.255.255.255	10.10.1.7
Rentang IP yang dipakai host	10.0.0.1 s.d 10.255.255.255	10.10.1.1 s.d 10.10.1.6

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IP Subnetting (6)

Contoh 2

Anda mempunyai stok IP 202.10.1.0 – 202.20.1.255. Anda ingin membuat subnet dengan jumlah host maksimal 30 komputer. Tentukan subnetmask yang digunakan, dan seluruh subnet yang terbentuk

Jawab:

1. Jumlah host maksimal =30 sehingga diperlukan 32 IP (1 buah untuk network ID dan 1 buah untuk broadcast ID)
2. Subnetmask (segmen terakhir) yang digunakan adalah $256-32 = 224$, sehingga subnetmasknya adalah 255.255.255.224

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IP Subnetting (7)

3. Subnet yang terbentuk terdapat $256/32 = 8$ buah subnet

Subnet	Subnetmask	Net ID	Broadcast ID	Rentang IP host
1	255.255.255.224	202.10.1.0	202.10.1.31	202.10.1.1 - 202.10.1.30
2	255.255.255.224	202.10.1.32	202.10.1.63	202.10.1.33 - 202.10.1.62
3	255.255.255.224	202.10.1.64	202.10.1.95	202.10.1.65 - 202.10.1.94
4	255.255.255.224	202.10.1.96	202.10.1.127	202.10.1.97 - 202.10.1.126
5	255.255.255.224	202.10.1.128	202.10.1.159	202.10.1.129 - 202.10.1.158
6	255.255.255.224	202.10.1.160	202.10.1.191	202.10.1.161 - 202.10.1.190
7	255.255.255.224	202.10.1.192	202.10.1.223	202.10.1.193 - 202.10.1.222
8	255.255.255.224	202.10.1.224	202.10.1.255	202.10.1.225 - 202.10.1.254

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IP Subnetting (8)

Contoh 3.

Anda penanggung jawab jaringan komputer disebuah institusi yang mempunyai stok IP 202.10.1.0 s.d 202.10.1.255. Untuk mempersempit ruang gerak aktivitas penyadapan/sniffing (penyadapan hanya bisa dilakukan pada jaringan yang sama), Anda membuat agar tiap departement menjadi jaringan tersendiri. Departement A terdiri dari 50 Komputer, B terdiri 13 komputer, dan C 50 komputer, departement D 30, departement E 13 dan departement F 49. Tentukan (Tiap komputer diberi IP 202.10.1.xxx):

- Network Address tiap departement
- Broadcast Address tiap departement
- Subnetmask yang digunakan tiap departement
- Rentang IP yang bisa digunakan tiap departement dengan teknik VLSM

IP Subnetting (9)

Langkah-langkah alokasi IP

- Departemen A, C dan F sama-sama membutuhkan alokasi 64 IP (2 pangkat n yang ke atas terdekat adalah 64) sehingga subnetmask segmen terakhir adalah $256-64=192$. Jadi subnetmask yang digunakan adalah 255.255.255.192
- Departemen D 30 komputer sehingga dibutuhkan 32 IP sehingga subnetmask segmen terakhir adalah $256-32=224$. Jadi subnetmask yang digunakan adalah 255.255.255.224
- Departemen B dan E sama-sama membutuhkan 16 IP sehingga subnetmask segmen terakhir adalah $256-16=240$. Jadi subnetmask yang digunakan adalah 255.255.255.240
- Urutkan dari Jumlah alokasi terbesar ke yang terkecil kemudian alokasikan IP

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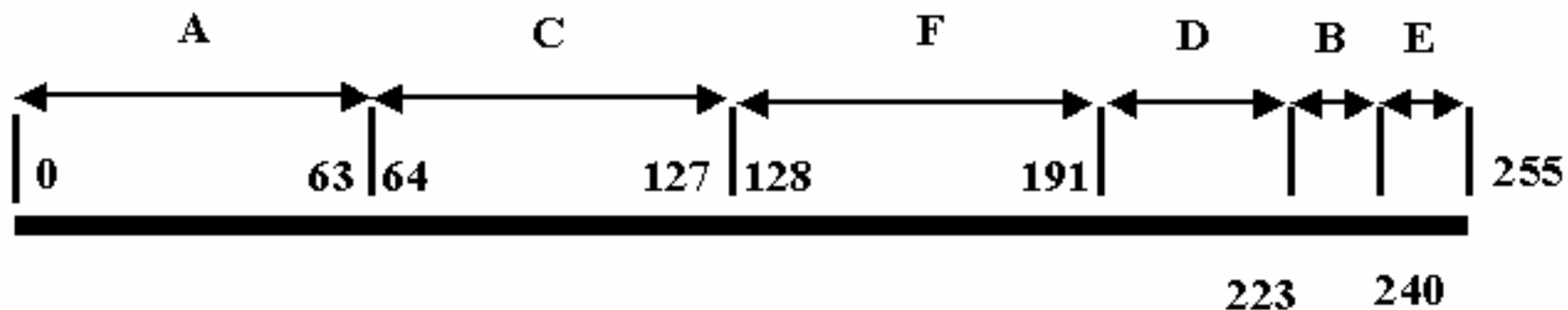
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IP Subnetting (10)

Jadi tabel alokasi IP yang terbentuk

Departemen	Subnetmask	Net ID	Broadcast ID	Rentang IP host
A	255.255.255.192	202.10.1.0	202.10.1.63	202.10.1.1 - 202.10.1.62
C	255.255.255.192	202.10.1.64	202.10.1.127	202.10.1.65 - 202.10.1.126
F	255.255.255.192	202.10.1.128	202.10.1.191	202.10.1.129 - 202.10.1.190
D	255.255.255.224	202.10.1.192	202.10.1.223	202.10.1.193 - 202.10.1.222
B	255.255.255.240	202.10.1.224	202.10.1.239	202.10.1.225 - 202.10.1.238
E	255.255.255.240	202.10.1.240	202.10.1.255	202.10.1.241 - 202.10.1.254



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IP Subnetting (11)

- Pengalokasian IP address dengan beberapa subnetting yang sering digunakan dapat dilihat dalam tabel berikut:

Subnetmask	Jumlah host	Kelas IP
255.255.255.0	254	Sebarang
255.255.255.128	126	Sebarang
255.255.255.192	62	Sebarang
255.255.255.224	30	Sebarang
255.255.255.240	14	Sebarang
255.255.255.248	6	Sebarang
255.255.255.252	2	Sebarang

- Notasi jaringan= Net.ID/jumlah bit SM diset 1

Contoh:

- 10.10.1.0/24=Net ID=10.10.1.0 SM=255.255.255.0

- 10.10.1.0/25=Net ID=10.10.1.0 SM=255.255.255.128

Implementasi LAN (1)

- LAN
- Karakteristik LAN
- Jenis-jenis topologi LAN
- Kebutuhan hardware LAN pada topologi star
- Pengkabelan
- Jaringan dengan wireless
- Konfigurasi TCP/IP

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Implementasi LAN (2)

□ LAN

Kumpulan perangkat komputer (komputer, printer dan perangkat lainnya) yang saling berhubungan dan dapat saling berkomunikasi

□ Karakteristik LAN

- Keterbatasan area/lokasi geografi
- Transfer data kecepatan tinggi
- Koneksi terus-menerus ke servis lokal
- Umumnya digunakan media kabel

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Implementasi LAN (3)

□ Topologi LAN

- Bus
- Ring
- Star

□ Kebutuhan hardware [topologi star]

- Network Interface, seperti Ethernet
- Hub/Switch(concentrator)
- Kabel dan konektor RJ45

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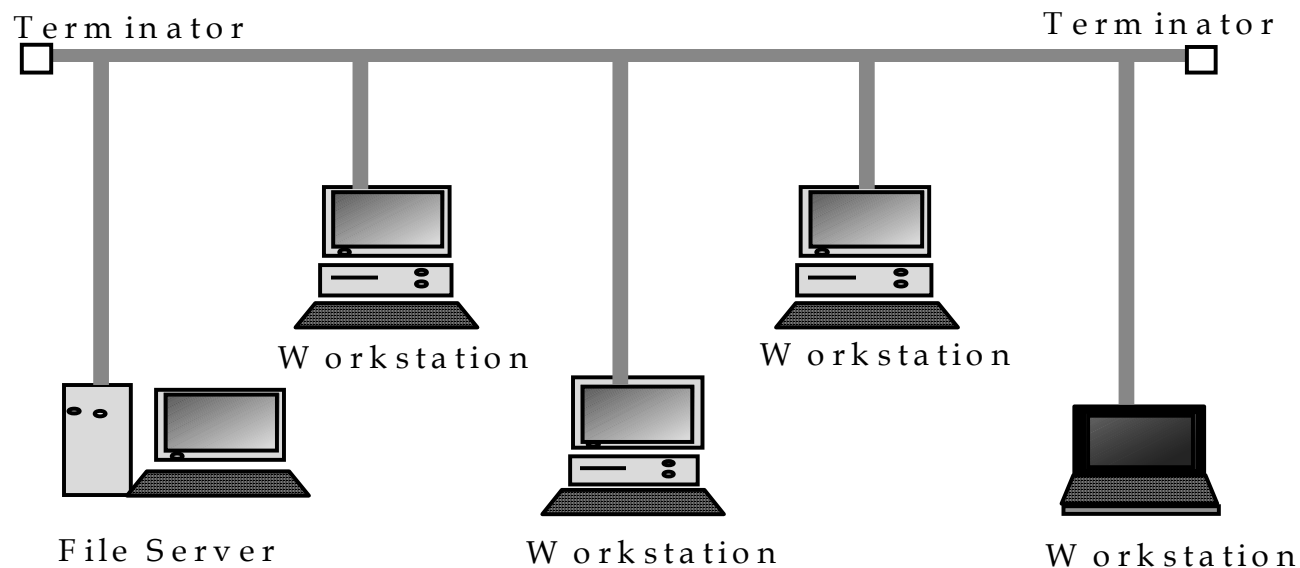
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Implementasi LAN (4)

□ Topologi Bus

- Sederhana, kabel coaxial dengan penutup 50 ohm
- Salah satu segment putus akan mengganggu seluruh jaringan
- Kemungkinan collision lebih besar
- Kabel coaxial lebih sulit dibentuk



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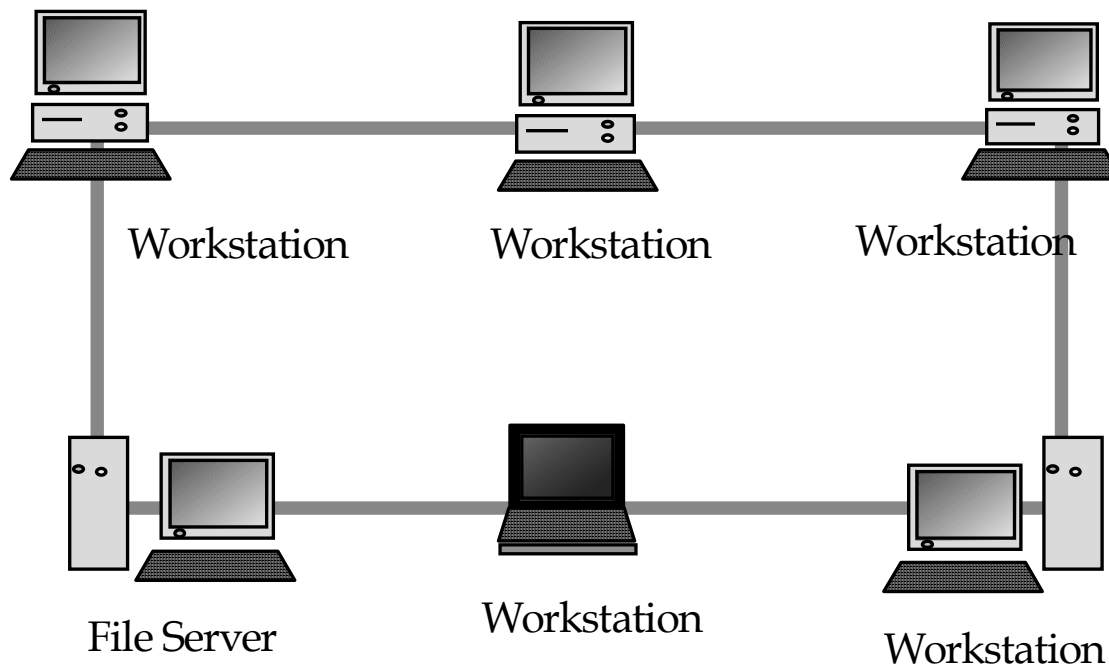
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Implementasi LAN (5)

□ Topologi Ring

- Lingkaran tertutup yang berisi node-node
- Salah satu segment putus akan mengganggu seluruh jaringan
- Aliran 1 arah, kemungkinan collision kecil
- Implementasi dengan *concentrator* terlihat seperti topologi star



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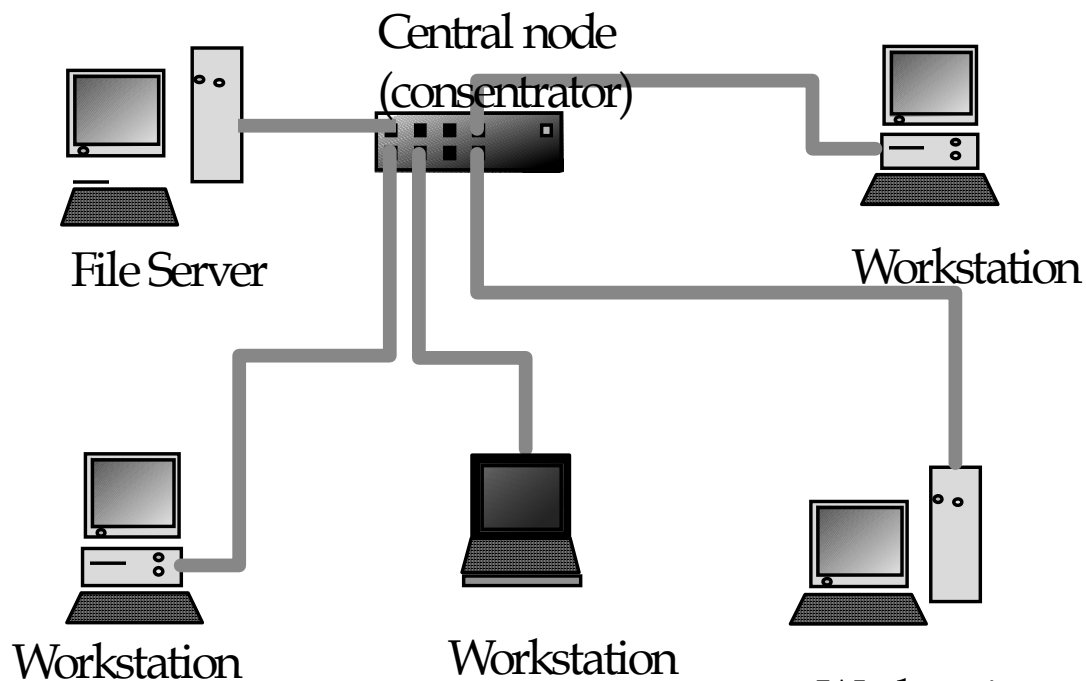
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Implementasi LAN (6)

□ Topologi Star

- Setiap node berkomunikasi langsung dengan *central node*,
- Setiap node berkomunikasi langsung dengan *central node*,
- Salah satu segment putus tidak mengganggu seluruh jaringan
- Biasanya digunakan kabel UTP



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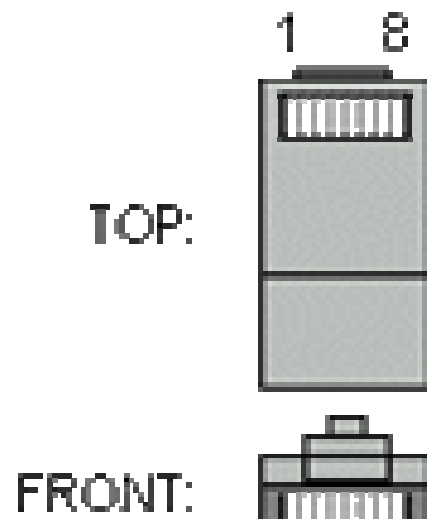
Implementasi LAN (7)

□ Jenis-jenis pengkabelan

- Straight
- Cross Category 5
- Dan lain-lain

□ Kabel UTP

- 8 kabel terdiri dari 4 pasang kabel terpilin
- Bentuk fisik RJ-45



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Implementasi LAN (8)

□ Pengkabelan straight

- Menghubungkan PC-Hub/switch, Hub-Hub
- Half duplex
- Panjang maksimal kabel 100 m
- Ethernet 10/100/1000Base-T

Name	Pin	Cable Color	Pin	Name
TX+	1	White/Orange	1	TX+
TX-	2	Orange	2	TX-
RX+	3	White/Green	3	RX+
	4	Blue	4	
	5	White/Blue	5	
RX-	6	Green	6	RX-
	7	White/Brown	7	
	8	Brown	8	

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Implementasi LAN (9)

- **Pengkabelan Crossover category 5**
 - Switch-Switch, PC-PC, PC-Hub/Switch
 - Full duplex
 - Panjang maksimal kabel 100 m
 - Ethernet 10/100/1000Base-T

Terminal A	Color	Terminal B
1	White/Orange	3
2	Orange	6
3	White/Green	1
4	Blue	4
5	White/Blue	5
6	Green	2
7	White/Brown	7
8	Brown	8

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Implementasi LAN (10)

□ Jaringan dengan Wireless



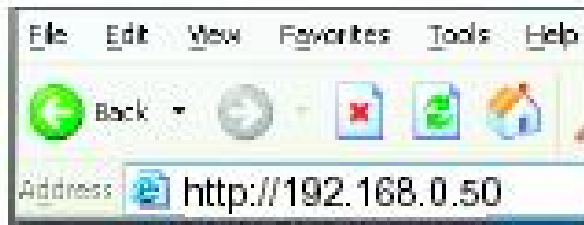
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Implementasi LAN (11)

- Jaringan dengan Wireless
 - Konfigurasi via web browser



- Panel Konfigurasi Akses Point



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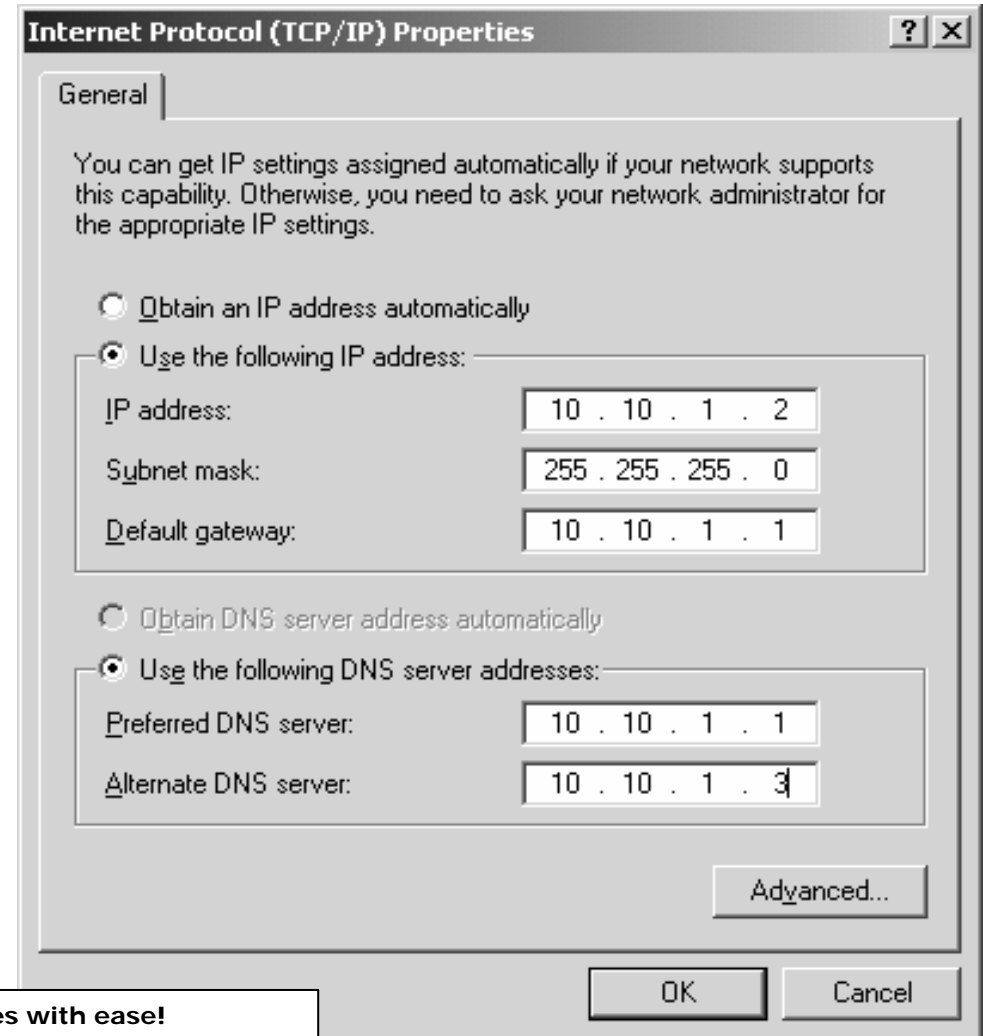
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Implementasi LAN (12)

□ Konfigurasi TCP/IP

■ Pada sistem operasi Windows

- IP address
- Subnetmask
- Gateway
- DNS server



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Implementasi LAN (13)

- Pada sistem operasi Linux

- IP address
- Subnetmask
- Gateway

Di file `/etc/sysconfig/network-scripts/ifcfg-eth0`

DEVICE=eth0

ONBOOT=yes

BOOTPROTO=static

BROADCAST=10.10.1.255

IPADDR=10.10.1.2

NETMASK=255.255.255.0

NETWORK=10.10.1.0

GATEWAY=10.10.1.1

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Implementasi LAN (14)

- DNS server

Di file `/etc/resolve.conf`

```
nameserver 10.10.1.1
```

```
nameserver 10.10.1.3
```

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Routing (1)

- Apa itu routing
- Jenis-jenis routing dilihat dari cara update tabel routingnya
- Routing protocol dan jenis-jenis algoritmanya
- Variabel-variabel penting dalam routing
- Contoh Routing Static
- Routing dinamik dengan RIP
- NAT (network address translation)

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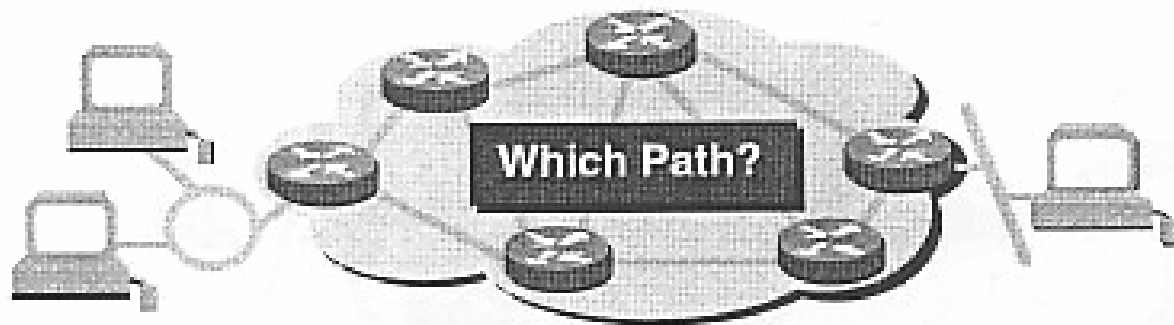
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Routing (2)

□ Apa itu routing?

Mekanisme penentuan rute tercepat ke host tujuan yang berbeda jaringan



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Routing (3)

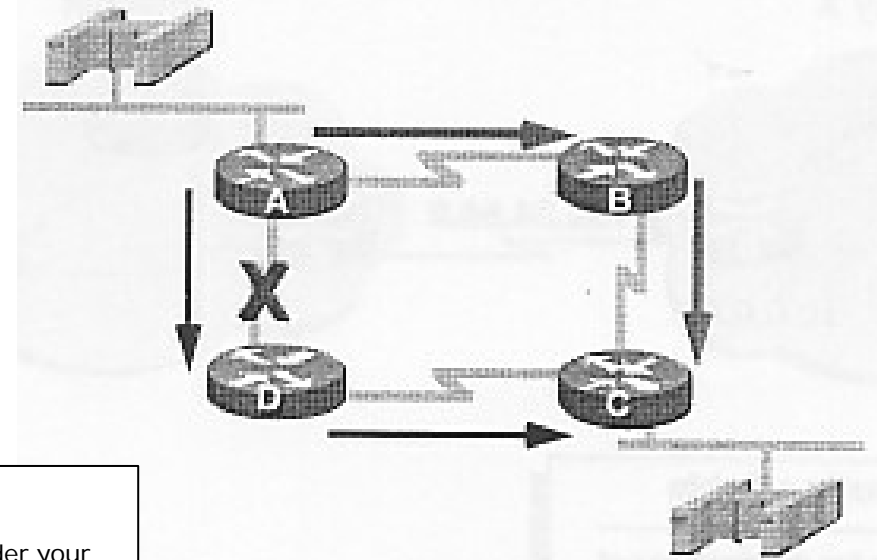
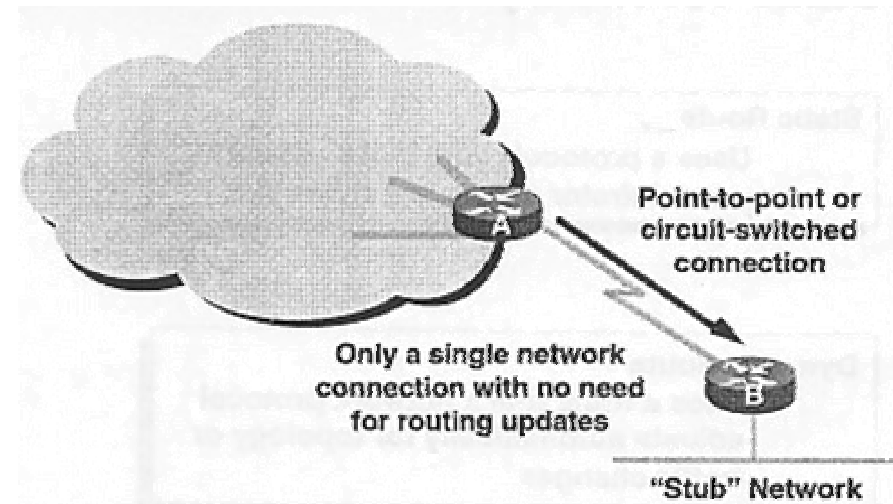
□ Jenis-jenis routing dilihat dari cara update tabel routingnya

■ Routing Static

- Dengan memasukkan tabel routing secara manual
- Di jaringan yang stabil (1 jaringan down ->seluruh jaringan yang melewati jaringan tersebut down)
- Di jaringan kecil (2 , 3 jaringan)

■ Routing dinamic

- Dengan menggunakan routing protocol tabel routing otomatis terbentuk dan *terupdate* otomatis
- Digunakan pada jaringan besar
- Dapat digunakan pada jaringan yang tidak stabil



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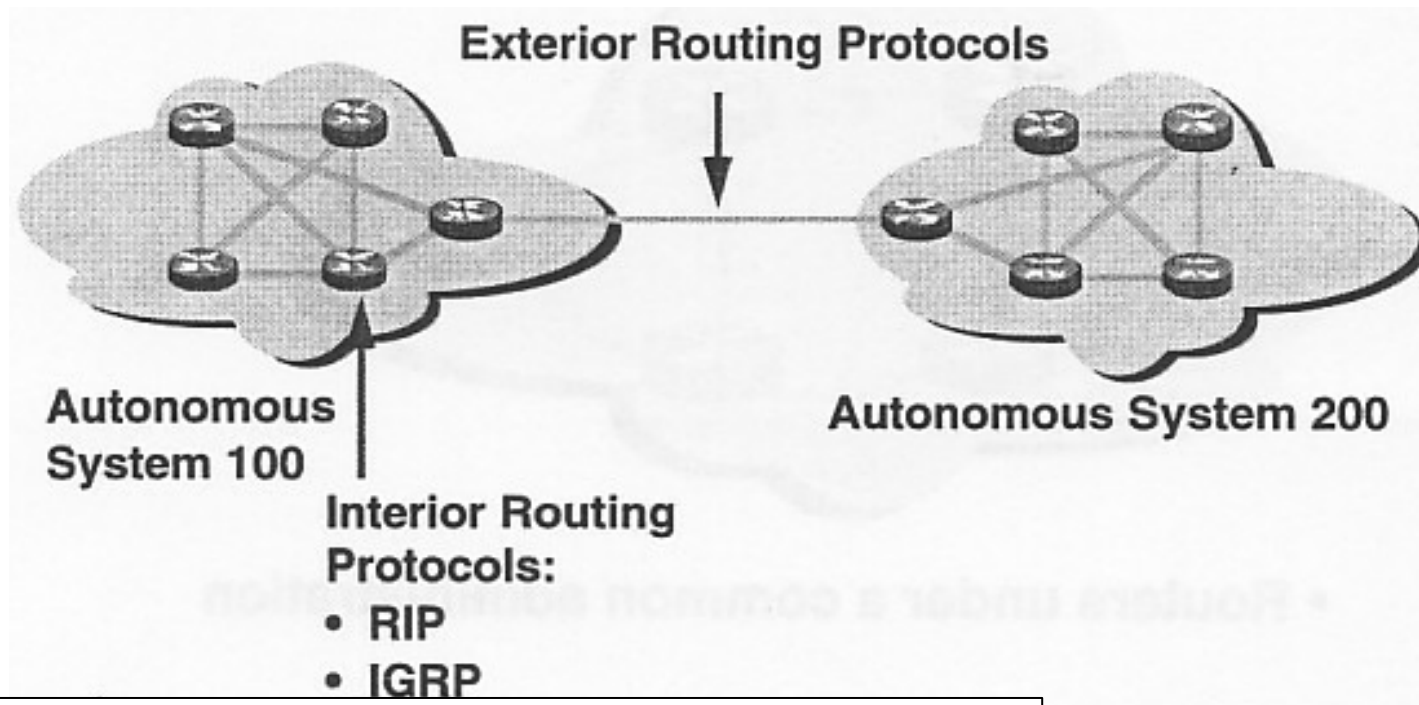
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Routing (4)

□ Routing Protocol

- Bertujuan mencari rute tersingkat
- Terbagi menjadi 2:
 - Interior Routing Protocol (Seperti RIP dan OSPF)
 - Exterior Routing Protocol (seperti EGP dan BGP)



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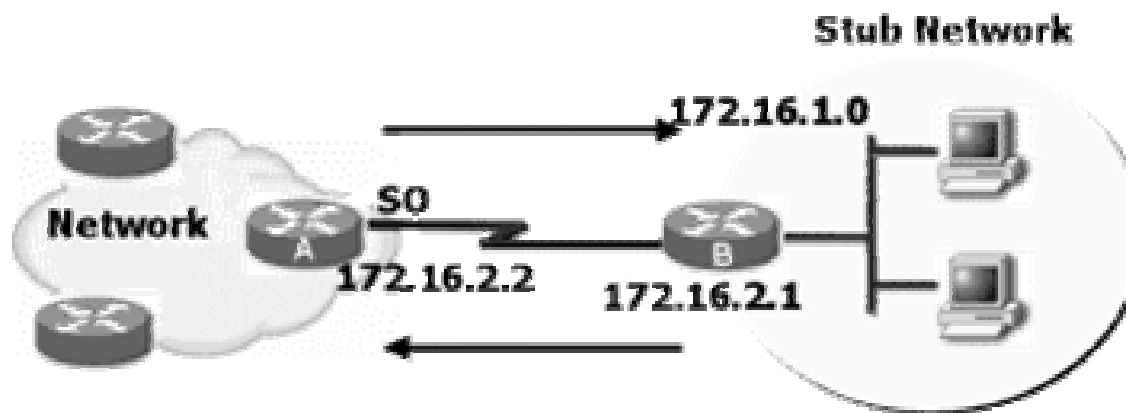
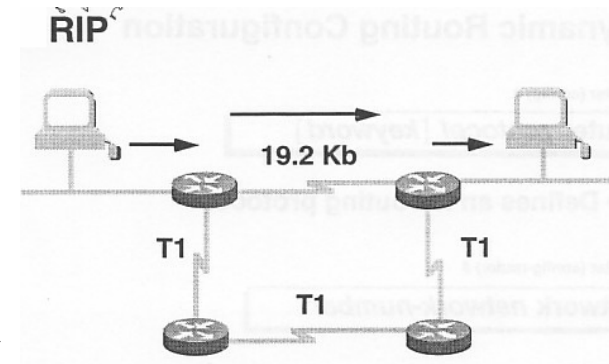
Routing (5)

□ Algoritma routing protocol

- *Distance vector*, contoh RIP
- *Linkstate*, contoh OSPF

□ Variabel-variabel penting dalam routing

- Network ID jaringan yang dituju
- Subnetmask jaringan yang dituju
- Gateway yang akan digunakan untuk mencapainya



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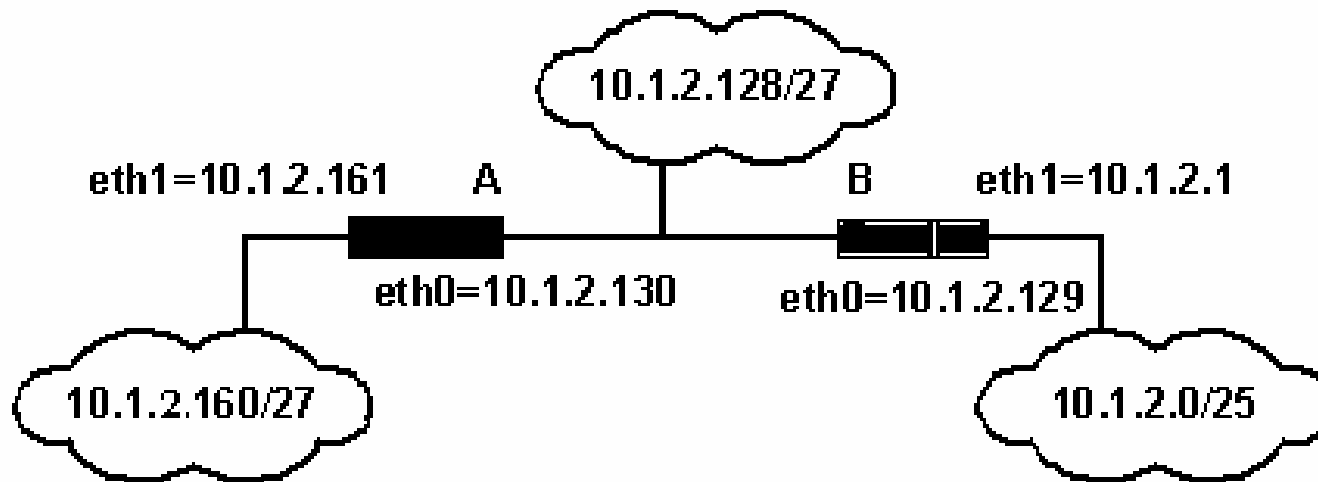
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Routing (6)

□ Contoh Routing Static

Terdapat 3 jaringan A,B,C:

- A = 10.1.2.0 - 10.1.2.127 (SM=255.255.255.128)
- B = 10.1.2.128 - 10.1.2.159 (SM =255.255.255.224)
- C = 10.1.2.160 - 10.1.2.191 (SM=255.255.255.224)



Konfigurasi agar semua jaringan dapat saling berkomunikasi!

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Routing (7)

- **Konfigurasi client di tiap jaringan**

- 10.1.2.0/25 = Default gateway diarahkan ke 10.1.2.1

```
# route add -net default gw 10.1.2.1
```

- 10.1.2.160/27 = Default gateway diarahkan ke 10.1.2.161

```
# route add -net default gw 10.1.2.161
```

- 10.1.2.128/27 = Gateway ke 10.1.2.0/25 melalui 10.1.2.129 dan gateway ke 10.1.160/27 melalui 10.1.2.130

```
# route add -net 10.1.2.0/25 gw 10.1.2.129
```

```
# route add -net 10.1.2.160/25 gw 10.1.2.130
```

- **Konfigurasi Router A**

```
# route add -net 10.1.2.0/25 gw 10.1.2.129
```

- **Konfigurasi Router B**

```
#route add -net 10.1.2.160/27 gw 10.1.2.130
```

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Routing (8)

□ Contoh sintaks manajemen tabel routing

- Menambahkan tabel routing default gateway
`# route add -net default gw 10.10.1.1`
- Menambahkan tabel routing tujuan dengan gateway tertentu.
Contoh tujuan 167.205.207.160/28 melalui gateway=10.10.1.1
`# route add -net 167.205.207.160/28 gw 10.10.1.1`
- Menghapus tabel routing tujuan dengan gateway tertentu.
Contoh tujuan 167.205.207.160/28 melalui gateway=10.10.1.1
`# route del -net 167.205.207.160/28 gw 10.10.1.1`

Routing (9)

☐ Melihat tabel routing yang sudah masuk

```
[root@rooting root]# netstat -nr
```

```
Kernel IP routing table
```

Destination	Gateway	Genmask	Flags	MSS	window	irrt	Iface
167.205.207.160	0.0.0.0	255.255.255.240	U	0	0	0	eth0
10.10.1.0	0.0.0.0	255.255.255.0	U	0	0	0	eth1
169.254.0.0	0.0.0.0	255.255.0.0	U	0	0	0	eth1
127.0.0.0	0.0.0.0	255.0.0.0	U	0	0	0	lo
0.0.0.0	167.205.207.161	0.0.0.0	UG	0	0	0	eth0

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Routing (10)

□ Melihat route menuju host tujuan

```
c:\>tracert 10.1.2.162
```

```
Tracing route to komp [10.1.2.162]  
over a maximum of 30 hops:
```

```
  1    <10 ms    <10 ms    <10 ms    komp [10.1.2.1]  
  2    <10 ms    <10 ms    <10 ms    komp [10.1.2.130]  
  3    <10 ms    <10 ms    <10 ms    komp [10.1.2.162]
```

```
Trace complete.
```

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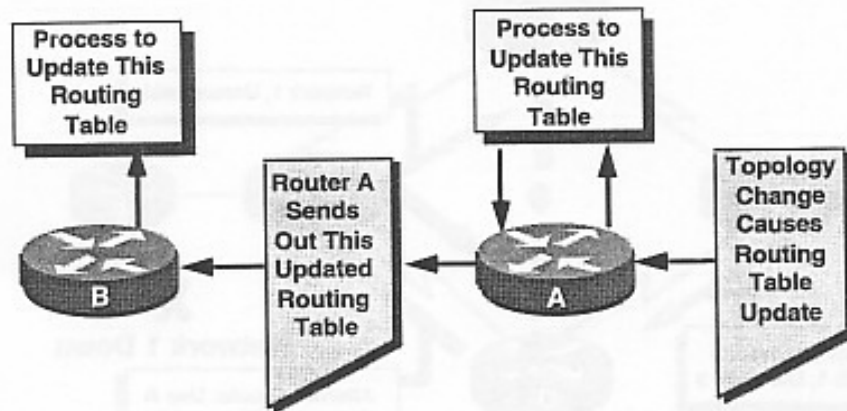
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Routing (11)

□ Routing dinamik dengan RIP

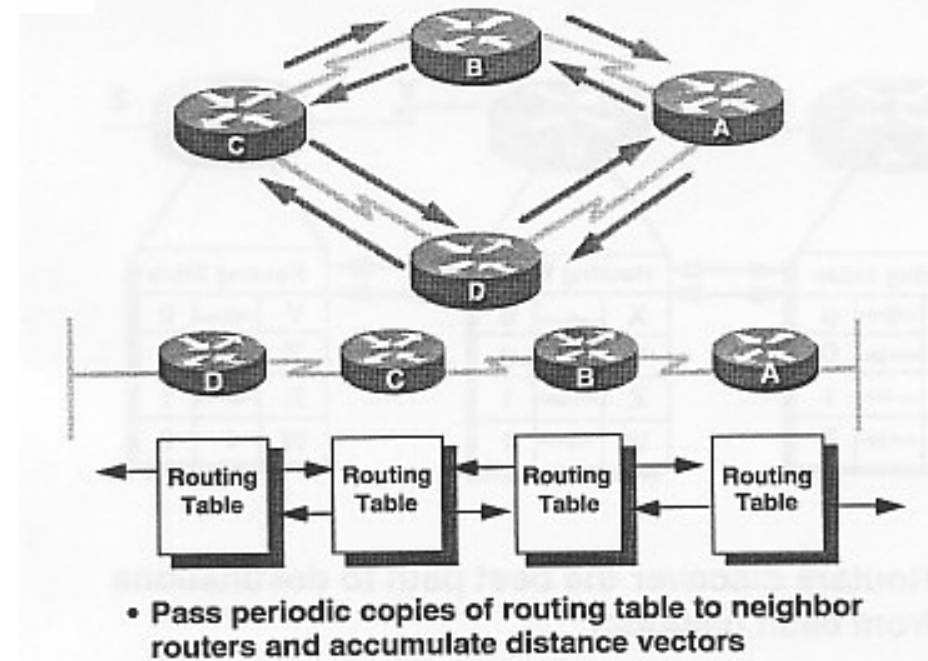
- Konsep RIP

Distance Vector Topology Changes



- Updates proceed step by step from router to router

Distance Vector Concept



- Pass periodic copies of routing table to neighbor routers and accumulate distance vectors

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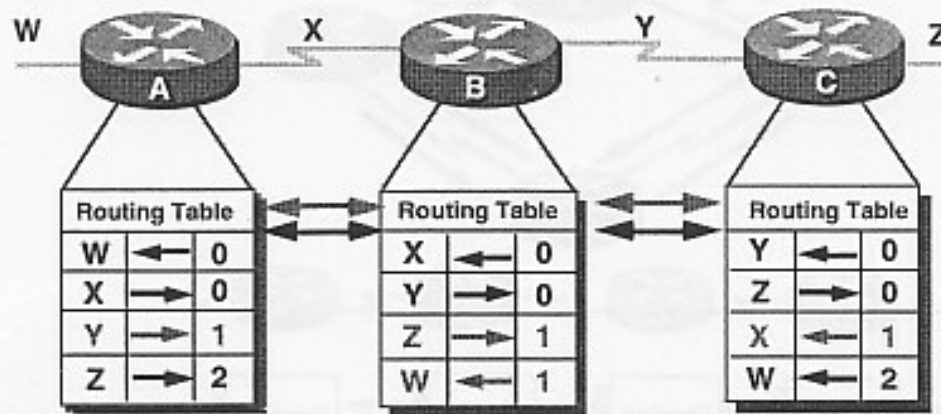
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Routing (12)

- Routing dinamik dengan RIP, setiap 30 detik antar router tetangga saling memberikan informasi tabel routing

Distance Vector Network Discovery



- Routers discover the best path to destinations from each neighbor

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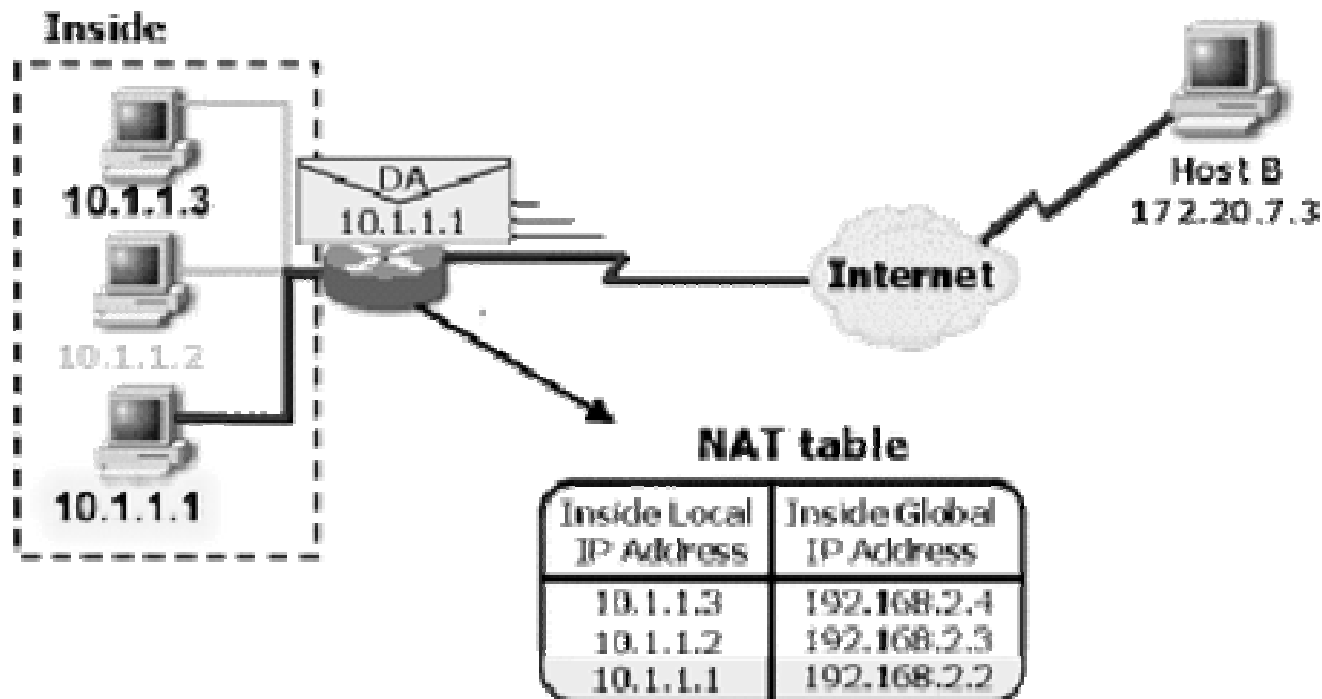
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Routing (13)

□ NAT (Network Address Translation)

- Mekanisma pemetaan IP dalam sebuah jaringan menjadi IP tertentu
- Banyak digunakan untuk mengatasi terbatasnya jumlah IPV4 yaitu dengan memetakan IP private menjadi IP public



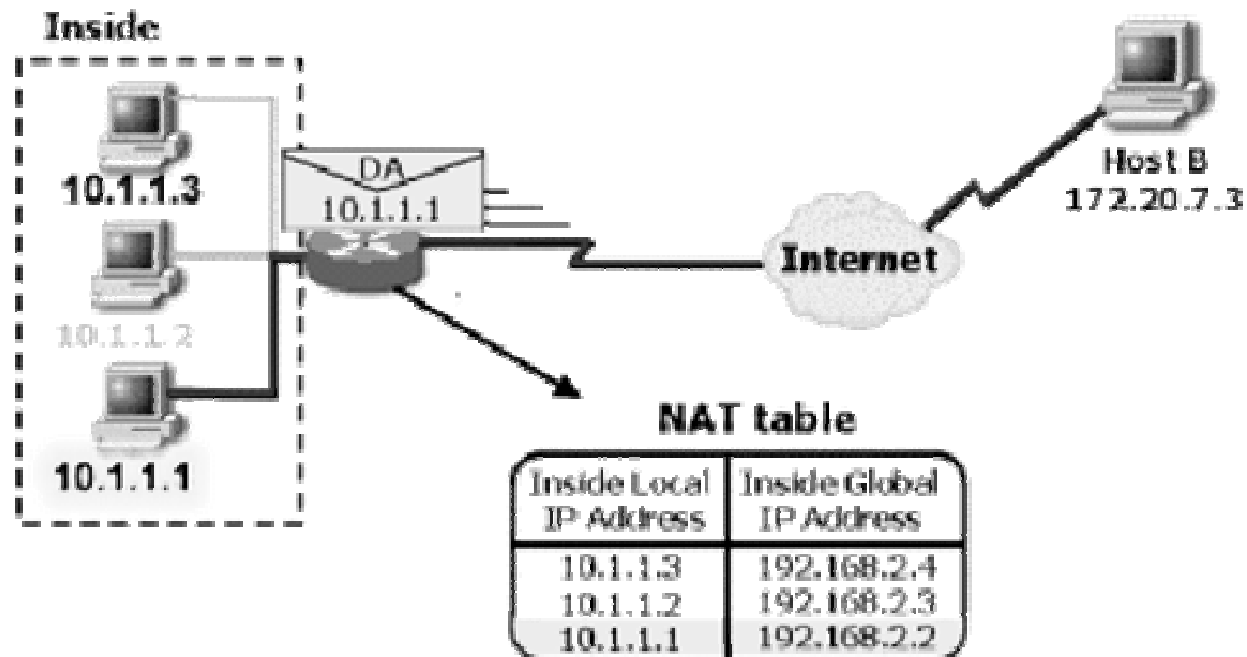
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NAT (Network Address Translation) (14)

■ Implementasi NAT pada Linux



Contoh untuk memetakan IP lokal 10.1.1.0/24

```
# iptables -t nat -A POSTROUTING -s 10.1.1.0/24 -d 0.0.0.0/0  
-j MASQUERADE
```

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DNS (1)

- DNS
- Struktur domain
- Contoh cara kerja DNS
- Jenis-jenis DNS Server
- Dimana mendaftarkan domain?
- Mengecek registrasi domain

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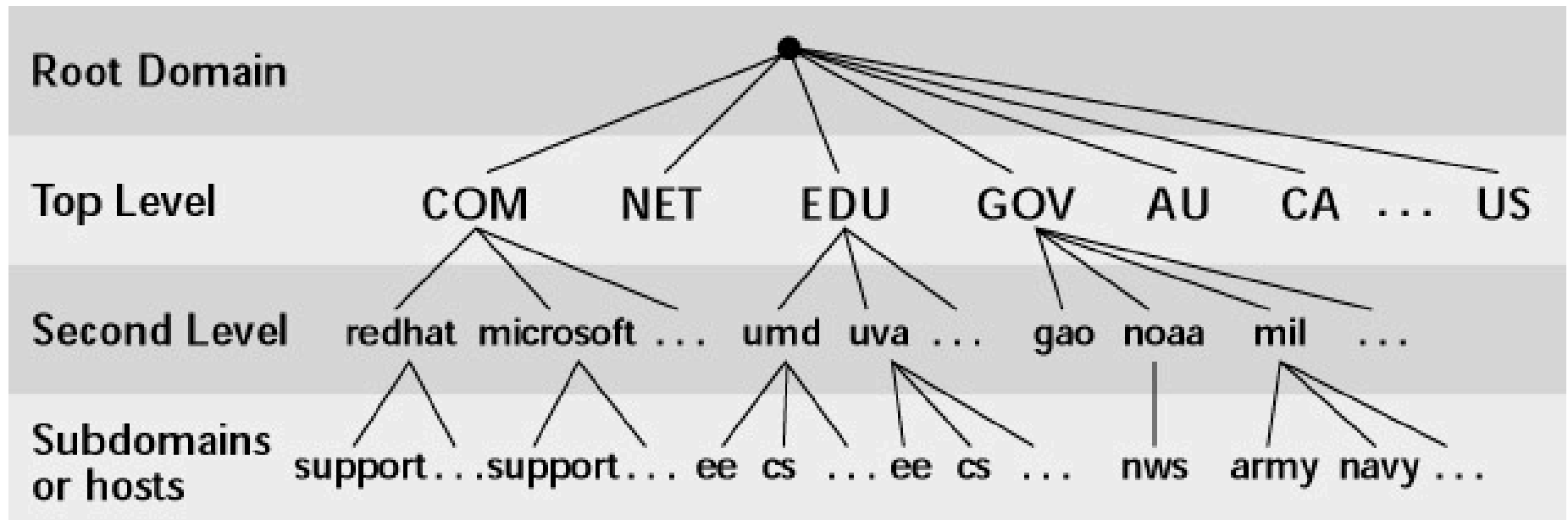
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DNS (2)

❑ Domain Name System

Memetakan nama domain menjadi IP address. Contoh (www.detik.com dengan IP 202.158.66.28)

❑ Struktur domain



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DNS (3)

□ Contoh Cara kerja DNS

1. Host melakukan query domain ke DNS lokal (misal fedora.redhat.com)
2. DNS lokal mengecek *cache*, jika ada maka diberikan, jika tidak akan menanyakan ke root domain
3. DNS lokal tanya ke root DNS
4. Root DNS mereferensi DNS .com
5. DNS lokal tanya ke DNS .com
6. DNS .com mereferensi DNS Redhat.com
7. DNS lokal tanya ke DNS Redhat.com
8. DNS Redhat.com menjawab bahwa fedora.redhat.com ber IP 209.132.177.50
9. DNS lokal memberikan jawaban ke host yang meminta

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DNS (4)

□ Jenis-jenis DNS server

■ RESOLVER

komputer hanya membangkitkan query informasi domain name kepada sebuah DNS server dan tidak menjalankan fungsi DNS server

■ CACHE ONLY

Mempelajari jawaban-jawaban query yang diberikan oleh remote DNS server dan menyimpannya dalam memory

■ PRIMARY

Menjalankan fungsi name server berdasarkan database yang dimilikinya , Server ini menjadi authoritative Source bagi domain tertentu.

■ SECONDARY

Mengambil dari primary Server ini menjadi authoritative Source bagi domain

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DNS (5)

□ Dimana mendaftarkan domain?

- TLD (Top Level Domain) seperti .com, .org, .net di:
 - Network Solutions Inc. (<http://www.nsi.com/>)
 - GKG Inc. (<http://www.gkg.net/>)
 - Register Inc. (<http://www.register.com/>)
 - Dll

- Domain berakhiran .id
di <http://www.depkominfo.go.id>

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DNS (6)

☐ Mengecek registrasi domain

```
[root@linux root]# whois kompas.com
[Querying whois.internic.net]
[Redirected to whois.opensrs.net]
[Querying whois.opensrs.net]
[whois.opensrs.net]
```

Registrant:

```
PT Kompas Media Nusantara
Jalan Palmerah Selatan 26-28
Jakarta, Jakarta 10270
ID
```

Domain name: KOMPAS.COM

Administrative Contact:

```
Division, Internet admin@vic.com
Jalan Palmerah Selatan 26-28
Jakarta, Jakarta 10270
ID
```

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DNS (7)

Technical Contact:

Administration, VIC DNS hostmaster@vic.com
P.O. Box 31571
Knoxville, TN 37930
US
865 470 7851 Fax: 865 470 7369

Registration Service Provider:

Virtual Interactive Center, admin@vic.com
865 524 8888
865 524 0740 (fax)

Please contact us for domain login/passwords, DNS/Nameserver changes,
and general domain support questions.

Registrar of Record: TUCOWS, INC.

Record last updated on 06-Nov-2002.

Record expires on 17-Dec-2003.

Record Created on 18-Dec-1995.

Domain servers in listed order:

NS.VIC.COM 64.203.64.10
NS2.VIC.COM 64.203.64.11

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whois.html

Proxy Server (1)

- Apa itu proxy server?
- Parent dan sibling pada proxy
- Jenis-jenis konfigurasi parent sibling pada proxy
- Konfigurasi proxy client

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Proxy Server (2)

□ Proxy Server

- Web cache → akses lebih cepat
- Filtering di level aplikasi

□ Konsep parent-sibling, proxy server disusun bertingkat seperti DNS

- Parent akan langsung mengambil ke website yang diminta apapun kondisinya
- Sibling digunakan untuk proxy “cadangan”

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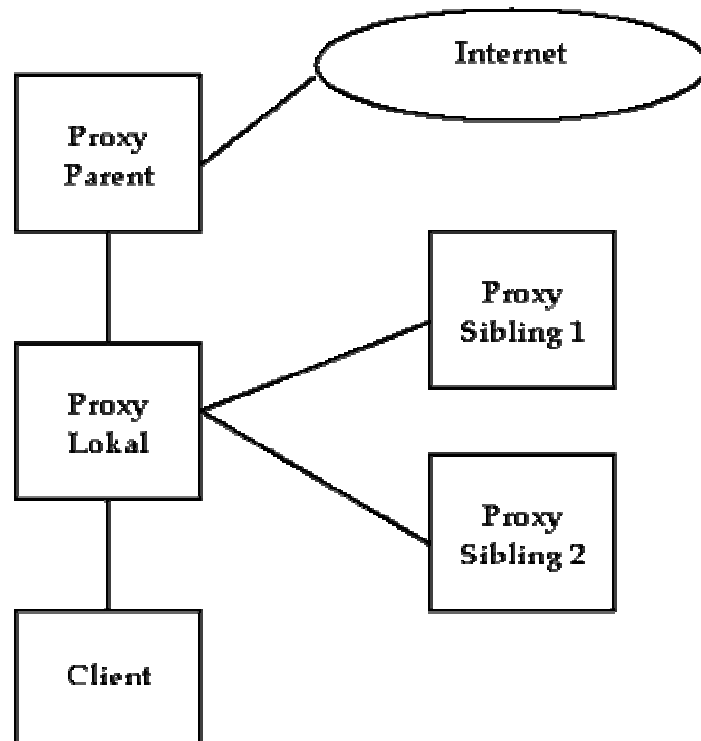
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Proxy Server (3)

□ Proxy dengan Parent & dengan Sibling

- Untuk jaringan besar
- Kerja Parent sangat berat



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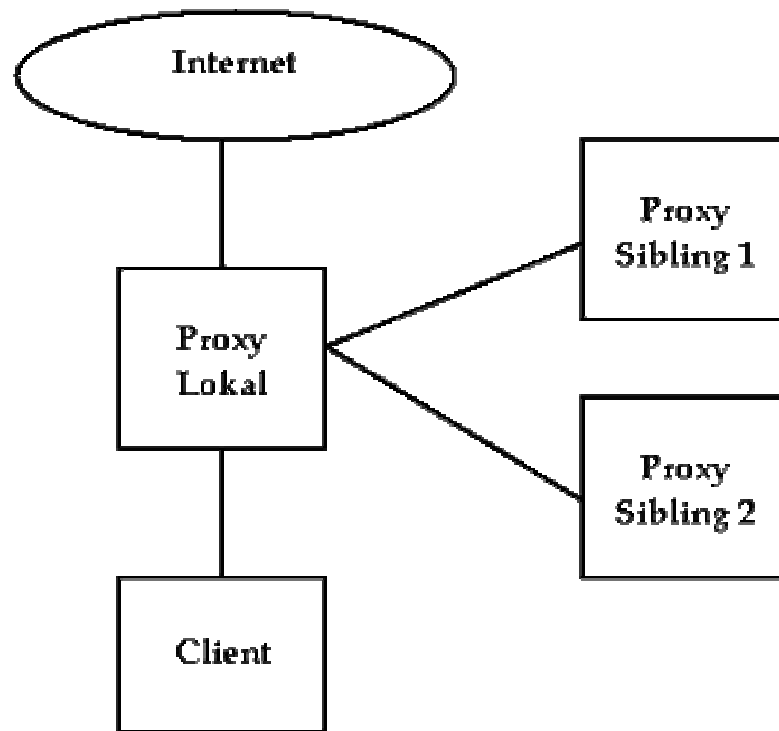
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Proxy Server (4)

□ Proxy tanpa Parent & dengan Sibling

- Jaringan tidak besar
- Bandwidth ke sibling harus besar



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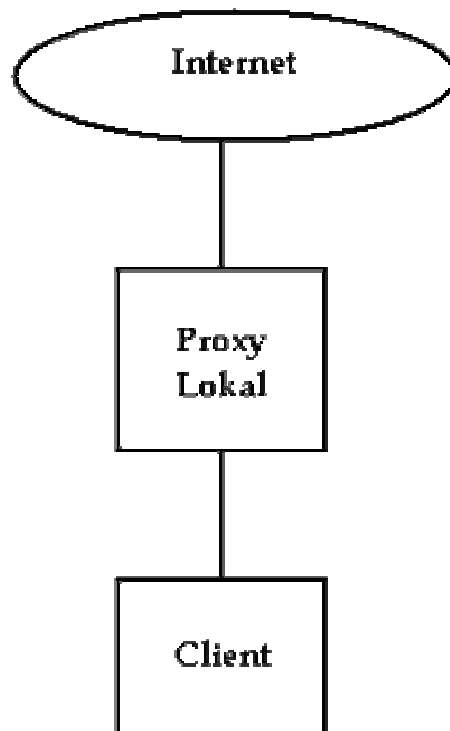
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Proxy Server (5)

□ Proxy tanpa Parent & tanpa Sibling

- Banyak digunakan di ISP, warnet
- Konfigurasi paling sederhana



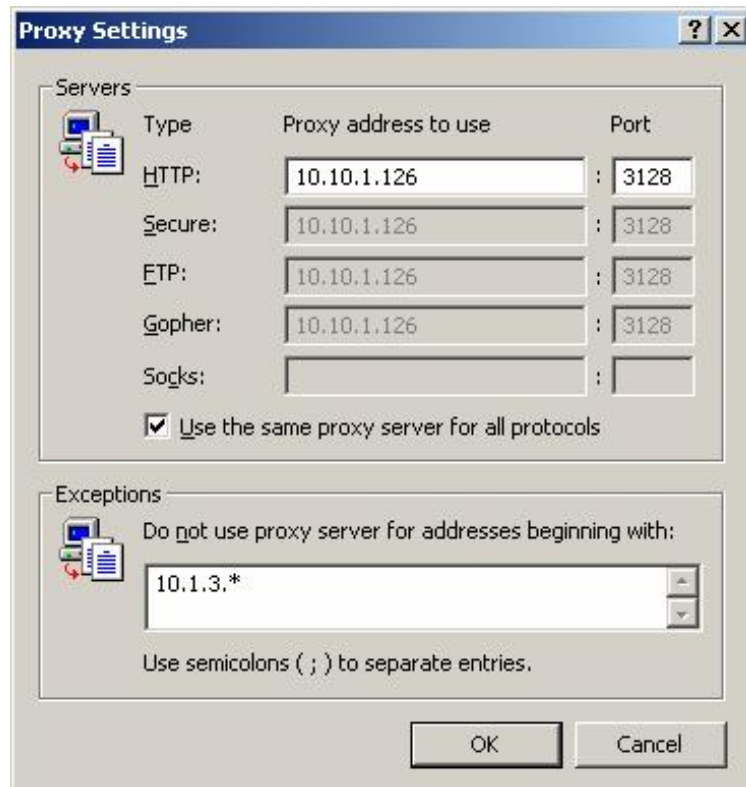
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Proxy Server (6)

□ Konfigurasi proxy client, contoh pada IE



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Desain Jaringan (1)

□ Desain Jaringan

- Skema logic jaringan
- Alokasi IP
- Skema fisik jaringan
- Implementasi desain yang telah dibuat dari konfigurasi IP Address, konfigurasi client, router sampai dengan pengkabelan

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Desain Jaringan (2)

□ Contoh kasus

Sebuah perusahaan ingin membangun jaringan intranet dan internet di lingkungan kerjanya. Anda diberi IP address 200.1.1.10 sebagai IP gateway ke ISP-nya, dan gateway di ISPnya adalah 200.1.1.9. Alokasi IP perusahaan Anda yang diberikan oleh ISP adalah 200.1.1.32/29 .

Kebutuhan perusahaan tersebut:

- Web dan Database server 2 buah (perusahaan.co.id dan layanan.perusahaan.co.id)
- FTP server 1 buah (ftp.perusahaan.co.id)
- DNS server 2 buah (ns1.perusahaan.co.id dan ns2.perusahaan.co.id)
- Proxy server 1 buah (proxy.perusahaan.co.id)
- Mail server 1 buah (mail.perusahaan.co.id)
- Router secukupnya

Komputer karyawan sebanyak n komputer (berada dalam 1 jaringan) dapat terkoneksi ke internet untuk keperluan browsing dll.

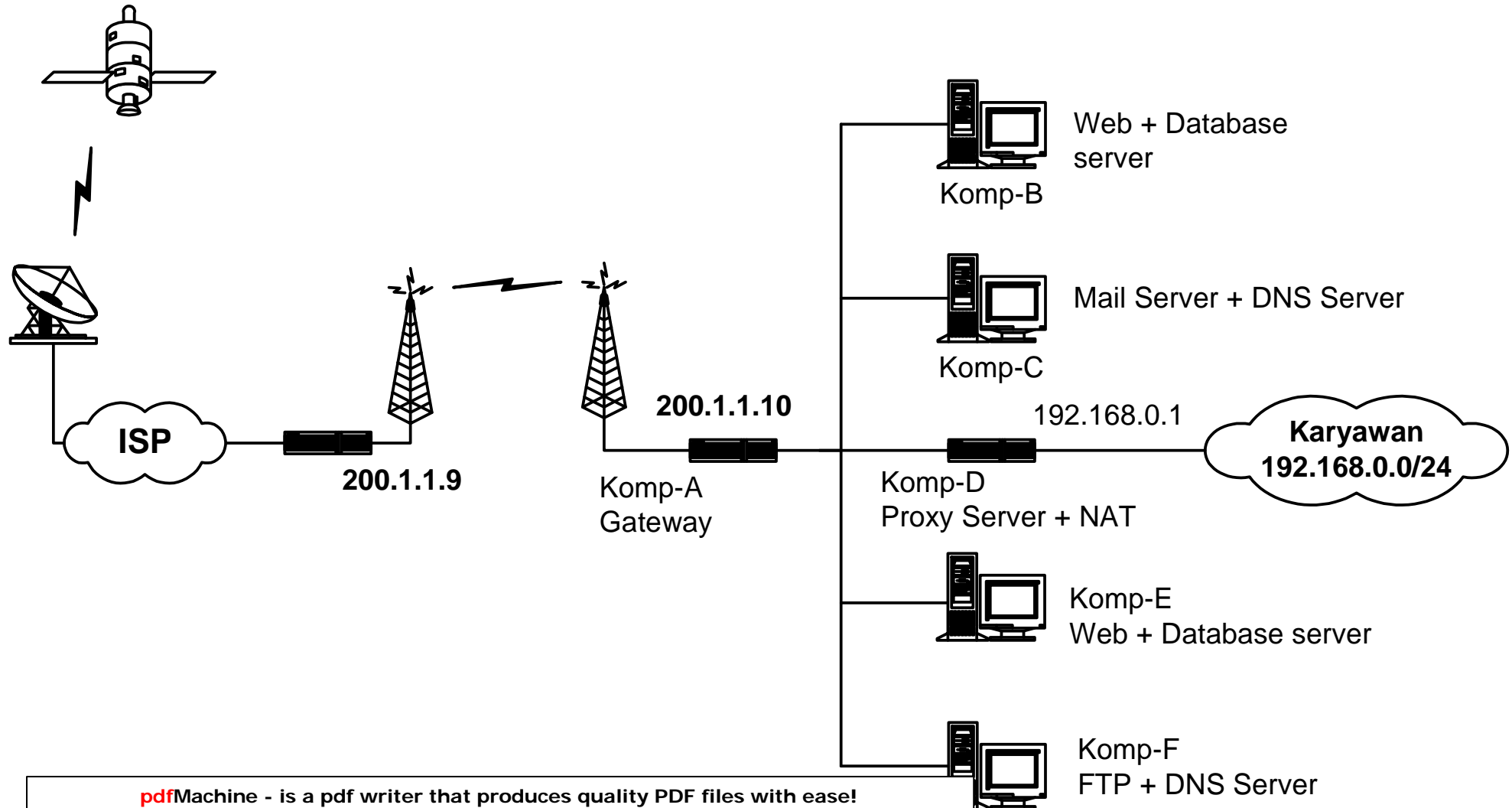
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Desain Jaringan (3)

- Skema Logic Jaringan yang TELAH Anda buat sebagai berikut



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Desain Jaringan (4)

- **Konfigurasi server**

Berikan konfigurasi NIC tiap komputer server dengan mengisi tabel berikut

Parameter	Komp-A	Komp-B	Komp-C	Komp-D	Komp-E	Komp-F
IP Address						
Net ID						
Sub Mask						
Broadcast						
Gateway						

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Desain Jaringan (5)

■ Konfigurasi Komputer karyawan

- Berapa jumlah komputer karyawan maksimal yang bisa terkoneksi ke internet jika karyawan berada dalam jaringan 192.168.0.0/24?
- Konfigurasi Network Interface Card komputer karyawan

IP Address	x.x.x.x sd y.y.y.y
Subnet Mask	
Network ID	
Broadcast ID	
Gateway	

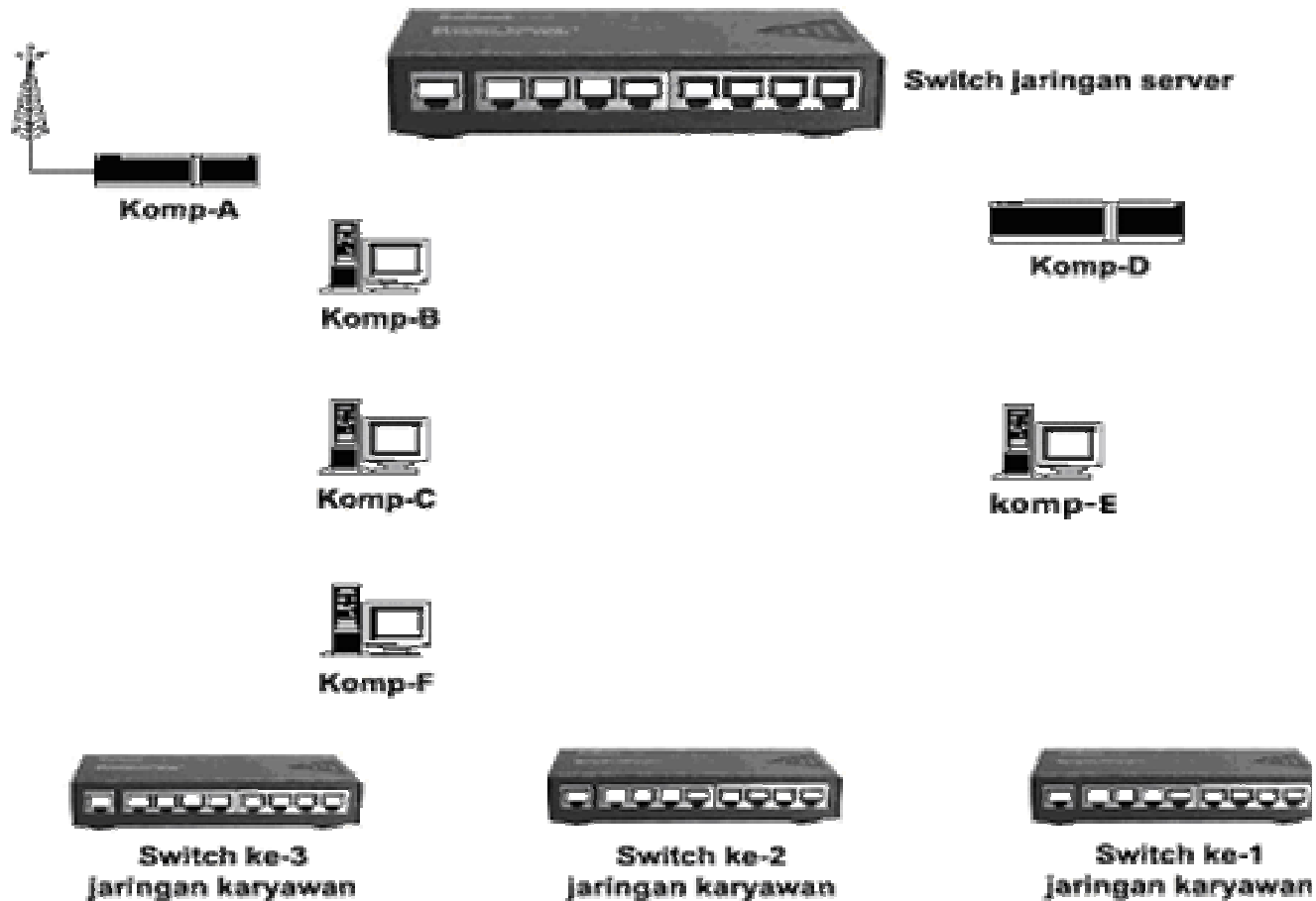
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Desain Jaringan (6)

- Skema fisik jaringan
- Buat pengkabelan jaringannya



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