Minggu 2
Physical Layer

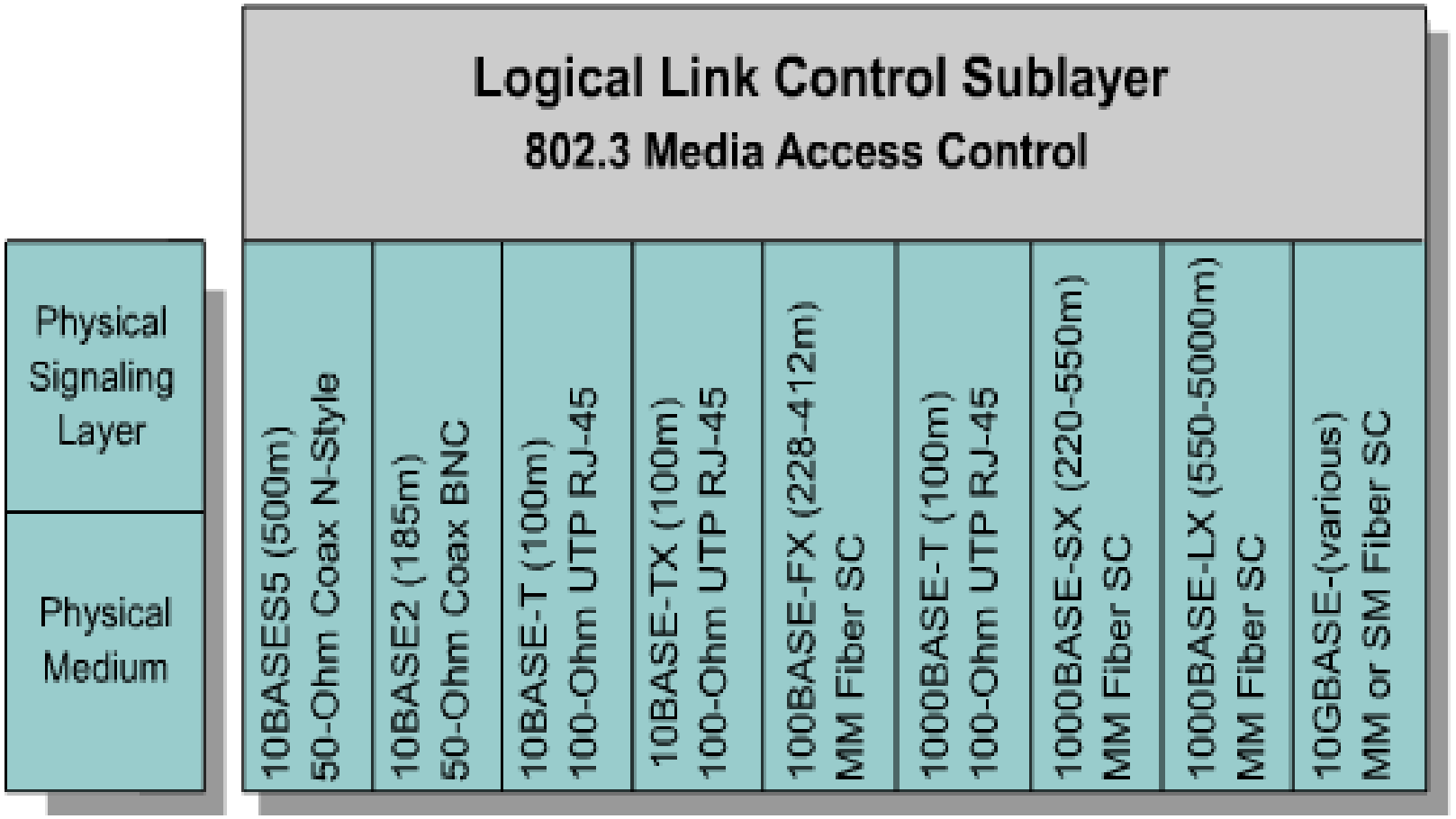
Physical Layer

- Merupakan lapisan terbawah dari OSI. Lapisan ini bertanggung jawab terhadap masalah pemindahan data dari hardware satu ke hardware lain.
- Lapisan ini mendefinisikan tentang media penghantar, jenis konektor, serta aturan pensinyalan
- Beberapa Media yang dipakai di jaringan :
  - Tembaga
    - Coaxial
    - Twisted Pair
  - Fiber Optik
  - Wireless

Media Berdasarkan Kecepatan

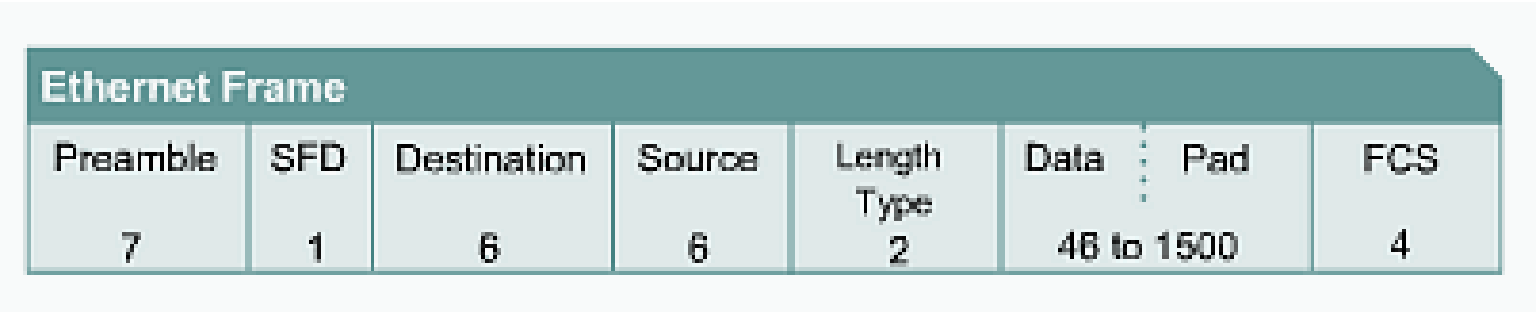
- 10 Mbps (10 Megabit per detik)
  - Coaxial
    - 10Base2
    - 10Base5
  - Twsited Pair
    - 10BaseT
- 100 Mbps
    - 100BaseTX
    - 100BaseFX
- 1000 Mbps
    - 1000BaseCX
    - 1000BaseSX
    - 1000BaseLX
    - 1000BaseT

Media Berdasarkan Kecepatan



Media Berdasarkan Kecepatan

- Semua kecepatan sama dalam frame yang digunakan



- Beda kecepatan mempunyai karakteristik yang berbeda dalam pewaktuan dan beberapa parameter

Protocol Structure - Ethernet: IEEE 802.3 Local Area Network protocolsThe basic IEEE 802.3 Ethernet MAC Data Frame for 10/100Mbps Ethernet:

7	1	6	6	2	46-1500bytes	4
Pre	SFD	DA	SA	Length Type	Data unit + pad	FCS

- **Preamble (PRE)**- 7 bytes. The PRE is an alternating pattern of ones and zeros that tells receiving stations that a frame is coming, and that provides a means to synchronize the frame-reception portions of receiving physical layers with the incoming bit stream.
- **Start-of-frame delimiter (SFD)**- 1 byte. The SOF is an alternating pattern of ones and zeros, ending with two consecutive 1-bits indicating that the next bit is the left-most bit in the left-most byte of the destination address.
- **Destination address (DA)**- 6 bytes. The DA field identifies which station(s) should receive the frame..
- **Source addresses (SA)**- 6 bytes. The SA field identifies the sending station.
- **Length/Type**- 2 bytes. This field indicates either the number of MAC-client data bytes that are contained in the data field of the frame, or the frame type ID if the frame is assembled using an optional format.
- **Data**- Is a sequence of n bytes (46=< n =<1500) of any value. (The total frame minimum is 64bytes.)
- **Frame check sequence (FCS)**- 4 bytes. This sequence contains a 32-bit cyclic redundancy check (CRC) value, which is created by the sending MAC and is recalculated by the receiving MAC to check for damaged frames.

Istilah Yang Digunakan

- ***Time Slot*** : Berulangnya interval waktu yang dibutuhkan 2 device berkomunikasi
- ***Bit Time*** : lamanya untuk mentransmisikan 1 bit
- ***Bit Rate*** : kecepatan transmisi data
- ***Propagation Delay*** : waktu yang dipakai untuk mentransmisikan signal dari 1 tempat ke tempat lain. Tergantung mutu media
- ***Interframe Spacing*** : Minimum jarak 2 frame tidak bertabrakan. Diukur dari bit terakhir field FCS
  Setelah bit ditransmisikan semua station butuh waktu tunggu minimum untuk mentransfer frame berikutnya. Untuk 10Mbps 9,6 mikrosecond.
- ***Spacing Gap*** : disebut juga Interframe Spacing
- ***Latency*** : waktu antara inisial request s/d actual data ditransmisikan

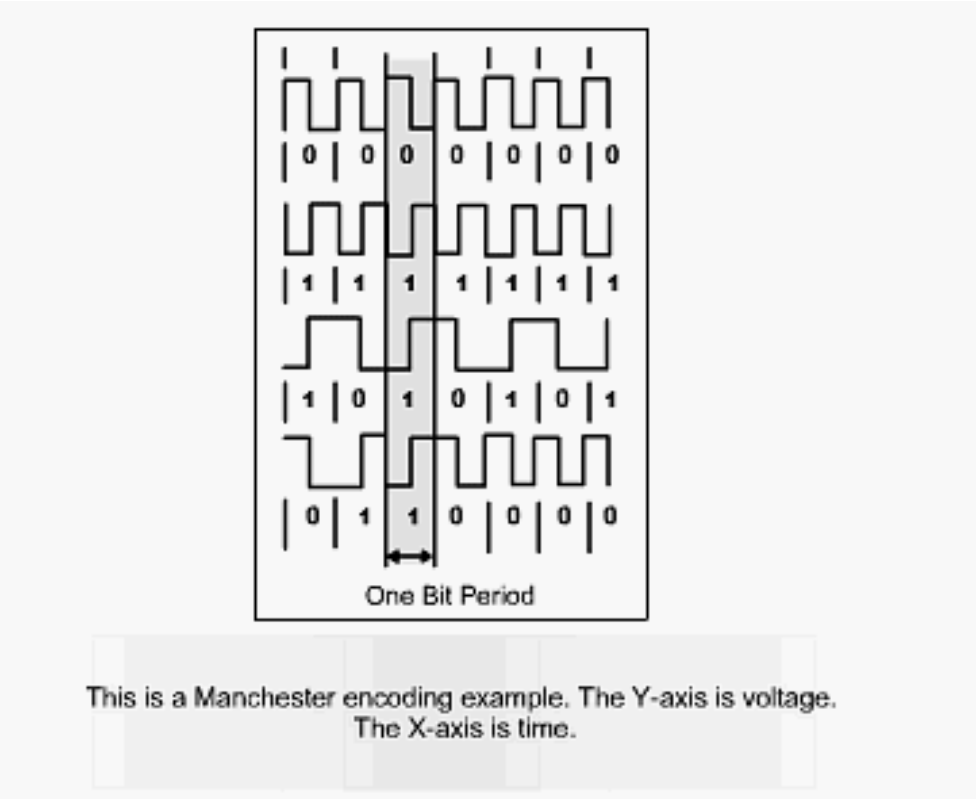
10 Mbps

Parameter	Value
Bit Time	100 nsec
Slot Time	512 bit times
Interframe Spacing	96 bits *
Collision Attempt Limit	16
Collision Backoff Limit	10
Collision Jam Size	32 bits
Maximum Untagged Frame Size	1518 octets
Minimum Frame Size	512 bits (64 octets)

* The value listed is the official interframe spacing.

10 Mbps

- Dalam sinyaling menggunakan pengkodean mancester encoding

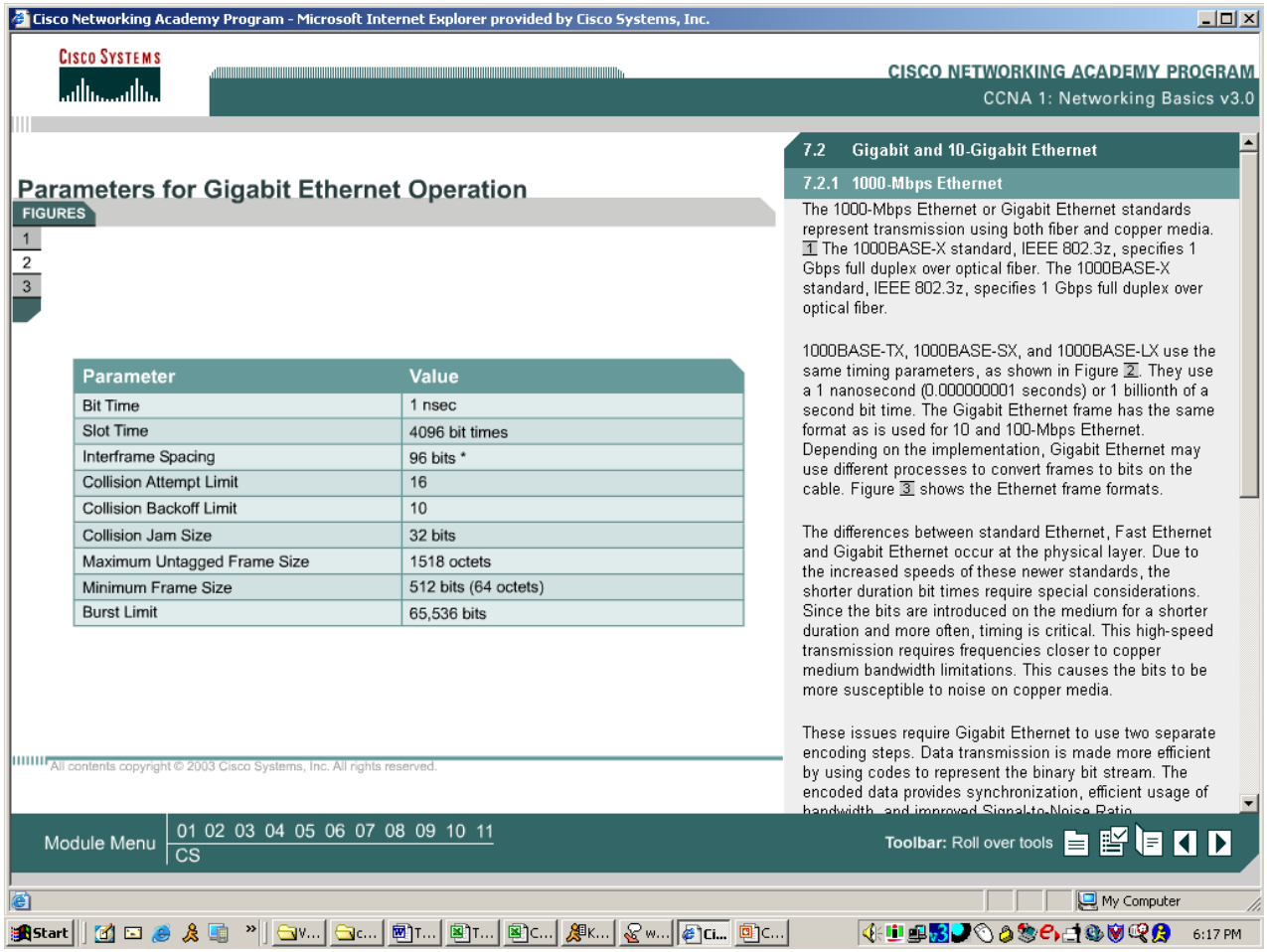


This is a Manchester encoding example. The Y-axis is voltage.
The X-axis is time.

100 Mbps

Parameter	Value
Bit Time	10 nsec
Slot Time	512 bit times
Interframe Spacing	96 bits
Collision Attempt Limit	16
Collision Backoff Limit	10
Collision Jam Size	32 bits
Maximum Untagged Frame Size	1518 octets
Minimum Frame Size	512 bits (64 octets)

1000 Mbps


Cisco Networking Academy Program - Microsoft Internet Explorer provided by Cisco Systems, Inc.
CISCO SYSTEMS
CISCO NETWORKING ACADEMY PROGRAM
CCNA 1: Networking Basics v3.0
Parameters for Gigabit Ethernet Operation
FIGURES
1
2
3
Parameter | Value
Bit Time | 1 nsec
Slot Time | 4096 bit times
Interframe Spacing | 96 bits *
Collision Attempt Limit | 16
Collision Backoff Limit | 10
Collision Jam Size | 32 bits
Maximum Untagged Frame Size | 1518 octets
Minimum Frame Size | 512 bits (64 octets)
Burst Limit | 65,536 bits
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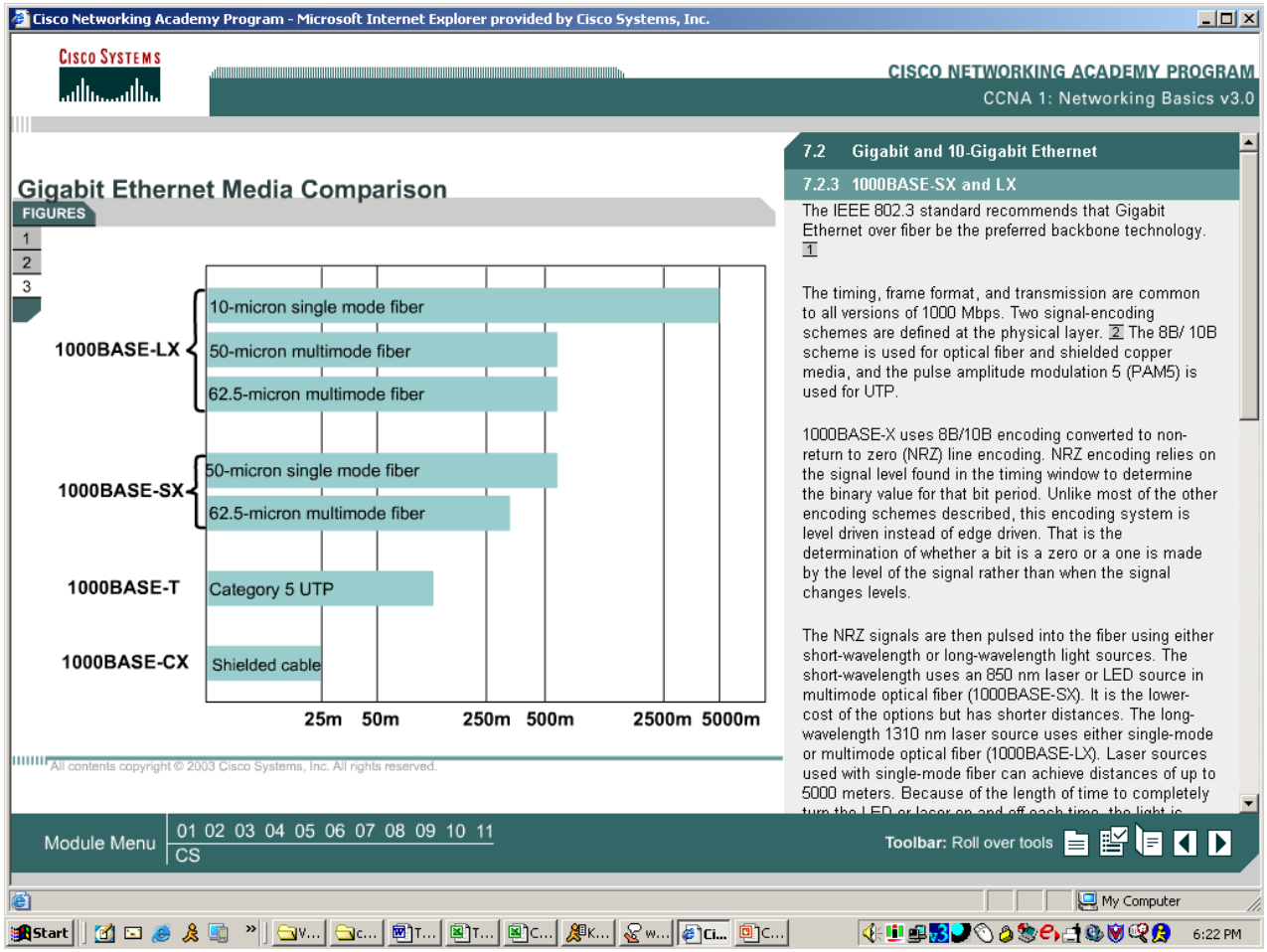
7.2 Gigabit and 10-Gigabit Ethernet
7.2.1 1000-Mbps Ethernet
The 1000-Mbps Ethernet or Gigabit Ethernet standards represent transmission using both fiber and copper media. 1 The 1000BASE-X standard, IEEE 802.3z, specifies 1 Gbps full duplex over optical fiber. The 1000BASE-X standard, IEEE 802.3z, specifies 1 Gbps full duplex over optical fiber.
1000BASE-TX, 1000BASE-SX, and 1000BASE-LX use the same timing parameters, as shown in Figure 2. They use a 1 nanosecond (0.000000001 seconds) or 1 billionth of a second bit time. The Gigabit Ethernet frame has the same format as is used for 10 and 100-Mbps Ethernet. Depending on the implementation, Gigabit Ethernet may use different processes to convert frames to bits on the cable. Figure 3 shows the Ethernet frame formats.
The differences between standard Ethernet, Fast Ethernet and Gigabit Ethernet occur at the physical layer. Due to the increased speeds of these newer standards, the shorter duration bit times require special considerations. Since the bits are introduced on the medium for a shorter duration and more often, timing is critical. This high-speed transmission requires frequencies closer to copper medium bandwidth limitations. This causes the bits to be more susceptible to noise on copper media.
These issues require Gigabit Ethernet to use two separate encoding steps. Data transmission is made more efficient by using codes to represent the binary bit stream. The encoded data provides synchronization, efficient usage of
Module Menu
01 02 03 04 05 06 07 08 09 10 11
CS
Toolbar: Roll over tools
My Computer
Start
6:17 PM

1000 Mbps


Cisco Networking Academy Program - Microsoft Internet Explorer provided by Cisco Systems, Inc.
Cisco Systems
CISCO NETWORKING ACADEMY PROGRAM
CCNA 1: Networking Basics v3.0
Gigabit Ethernet Media Comparison
FIGURES
1
2
3
1000BASE-LX
10-micron single mode fiber
50-micron multimode fiber
62.5-micron multimode fiber
1000BASE-SX
50-micron single mode fiber
62.5-micron multimode fiber
1000BASE-T
Category 5 UTP
1000BASE-CX
Shielded cable
25m 50m 250m 500m 2500m 5000m
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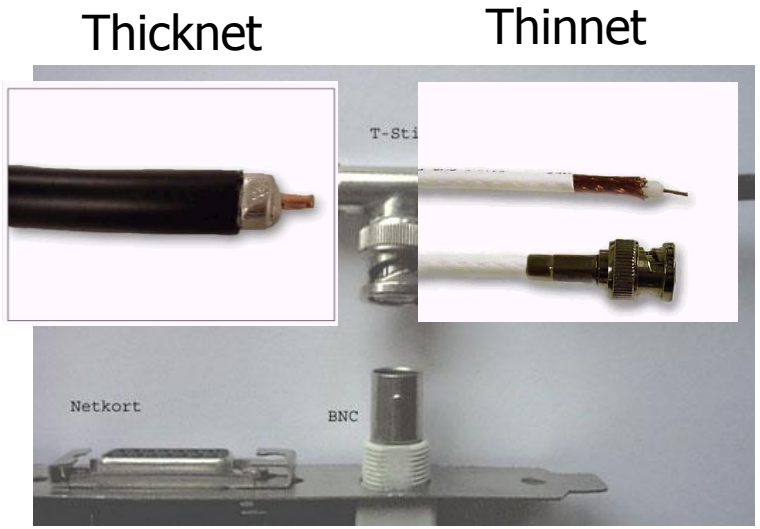
7.2 Gigabit and 10-Gigabit Ethernet
7.2.3 1000BASE-SX and LX
The IEEE 802.3 standard recommends that Gigabit Ethernet over fiber be the preferred backbone technology. 1
The timing, frame format, and transmission are common to all versions of 1000 Mbps. Two signal-encoding schemes are defined at the physical layer. 2 The 8B/ 10B scheme is used for optical fiber and shielded copper media, and the pulse amplitude modulation 5 (PAM5) is used for UTP.
1000BASE-X uses 8B/10B encoding converted to non-return to zero (NRZ) line encoding. NRZ encoding relies on the signal level found in the timing window to determine the binary value for that bit period. Unlike most of the other encoding schemes described, this encoding system is level driven instead of edge driven. That is the determination of whether a bit is a zero or a one is made by the level of the signal rather than when the signal changes levels.
The NRZ signals are then pulsed into the fiber using either short-wavelength or long-wavelength light sources. The short-wavelength uses an 850 nm laser or LED source in multimode optical fiber (1000BASE-SX). It is the lower-cost of the options but has shorter distances. The long-wavelength 1310 nm laser source uses either single-mode or multimode optical fiber (1000BASE-LX). Laser sources used with single-mode fiber can achieve distances of up to 5000 meters. Because of the length of time to completely
Module Menu
01 02 03 04 05 06 07 08 09 10 11
CS
Toolbar: Roll over tools
My Computer
Start
6:22 PM

Coaxial

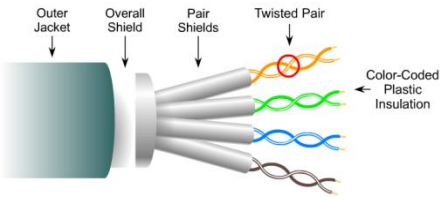
- Dipakai pada teknologi Bus
- Sudah tidak dipakai lagi
- Ada dua tipe coaxial :
  - Thinnet → Max 185 M
    - 10Base2
  - Thicknet → Max 500 M
    - 10Base5
- Perlu repeater untuk jarak melebihi batas max kabel



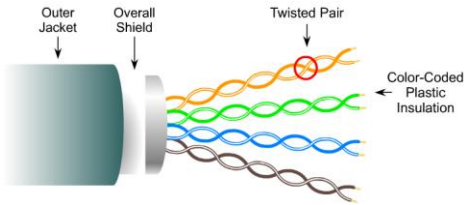
Twisted Pair

- Dipakai untuk teknologi Star
- Paling umum dipakai
- Type Twisted Pair
  - Shielded Twisted Pair (STP)
  - Screen Twisted Pair(ScTP
  - Unshield Twisted Pair(UTP)

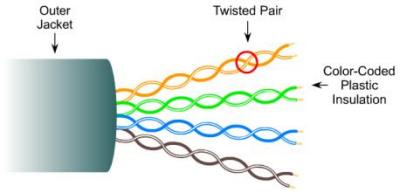
STP



ScTP



UTP



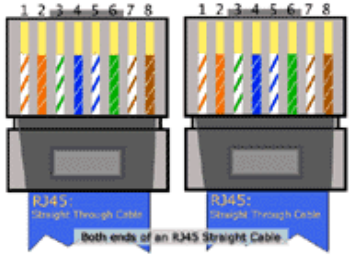
Kabel UTP

- 10 Mbps (10 Megabit per detik)
    - 10BaseT
- 100 Mbps
    - 100BaseTX
- 1000 Mbps
    - 1000BaseT

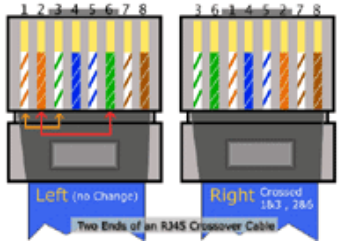
Type Kabel UTP

- Straight Trough,untuk koneksi :
  - Hub/Switch to PC/Router
- Cross Over, Untuk koneksi :
  - Router to Router, PC to PC, Hub/Switch to Hub/Switch
- Roll Over, Untuk koneksi :
  - PC to Router/Switch →console, manajemen switch/router

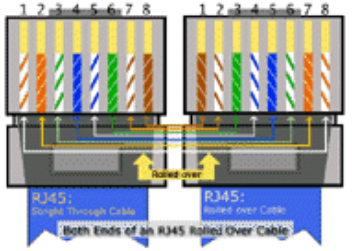
Straight-through



Cross-over

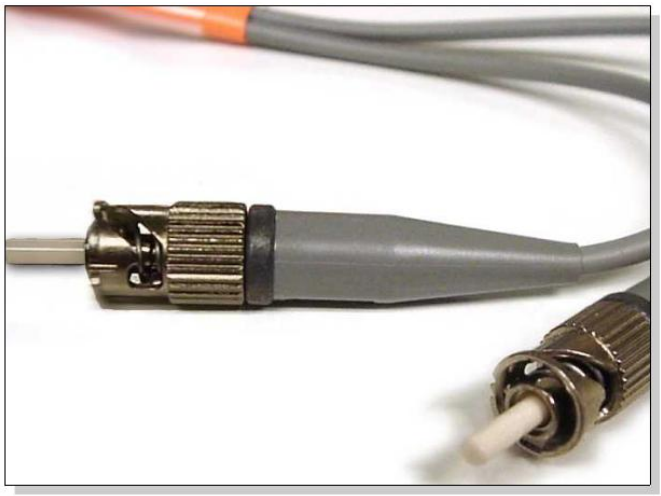


Rollover



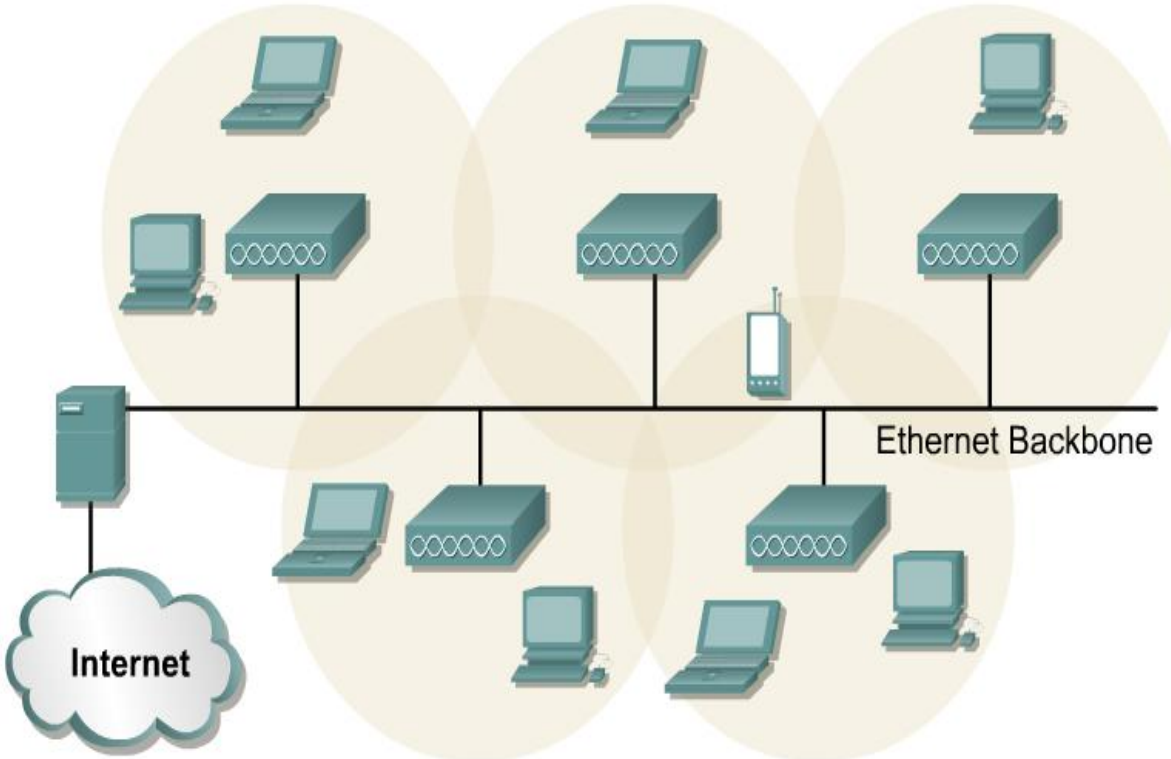
Fiber Optic

- Menggunakan infra merah atau laser untuk mengirimkan data
- Terdiri dari dua kabel :
  - Transmit Data
  - Receive Data
- Menyediakan komunikasi full duplex



Wireless

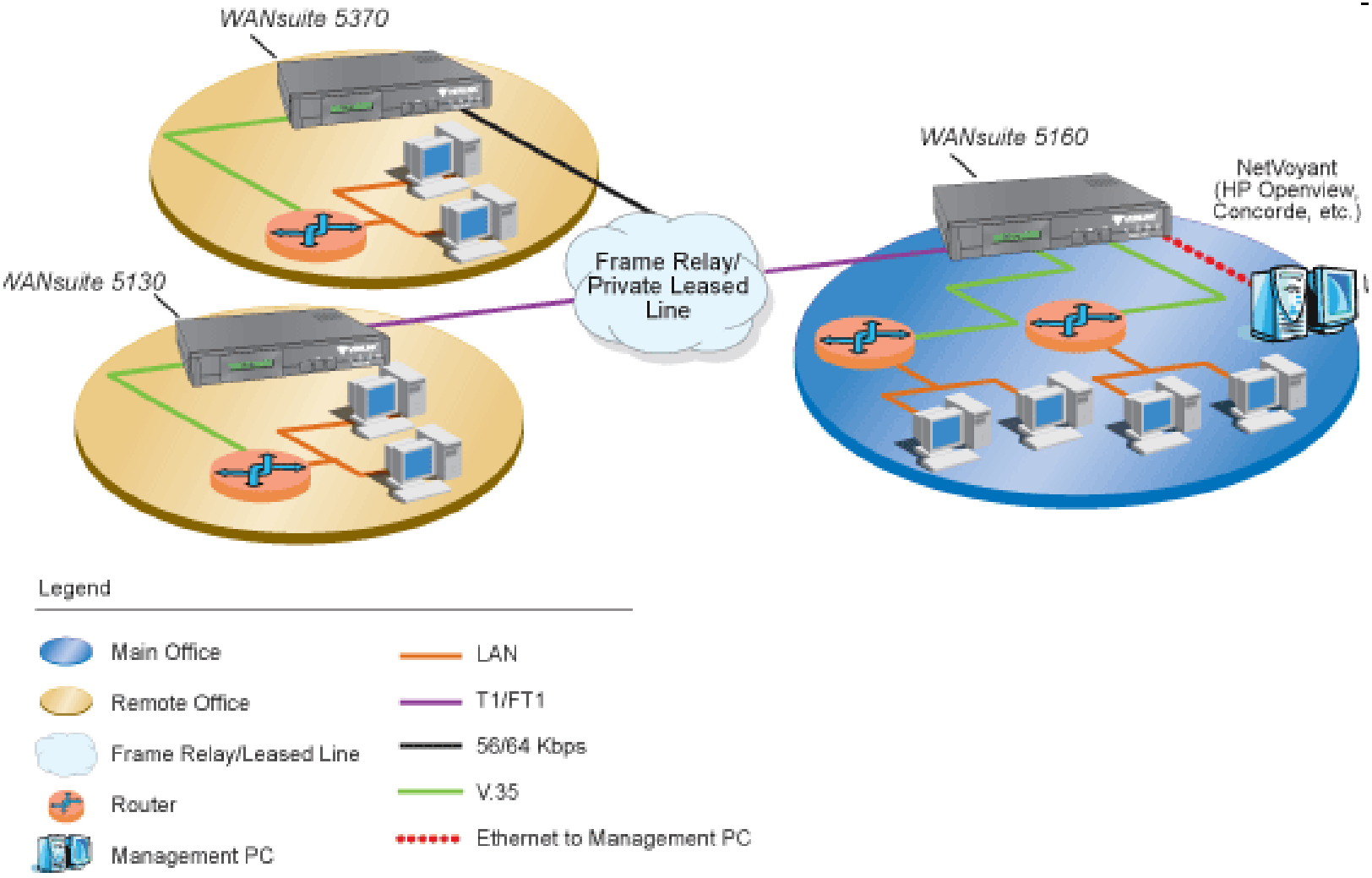


Koneksi WAN

- WAN membutuhkan koneksi khusus untuk hubungan antar area yang berjauhan
- Biasa menggunakan koneksi serial untuk menghubungkan area yang berjauhan
- Pada Cisco router, dikenal dua tipe koneksi serial :
  - 60-pin connector.
  - ‘smart serial’ connector yang lebih kecil

Koneksi WAN Beberapa Area



Physical Layer WAN

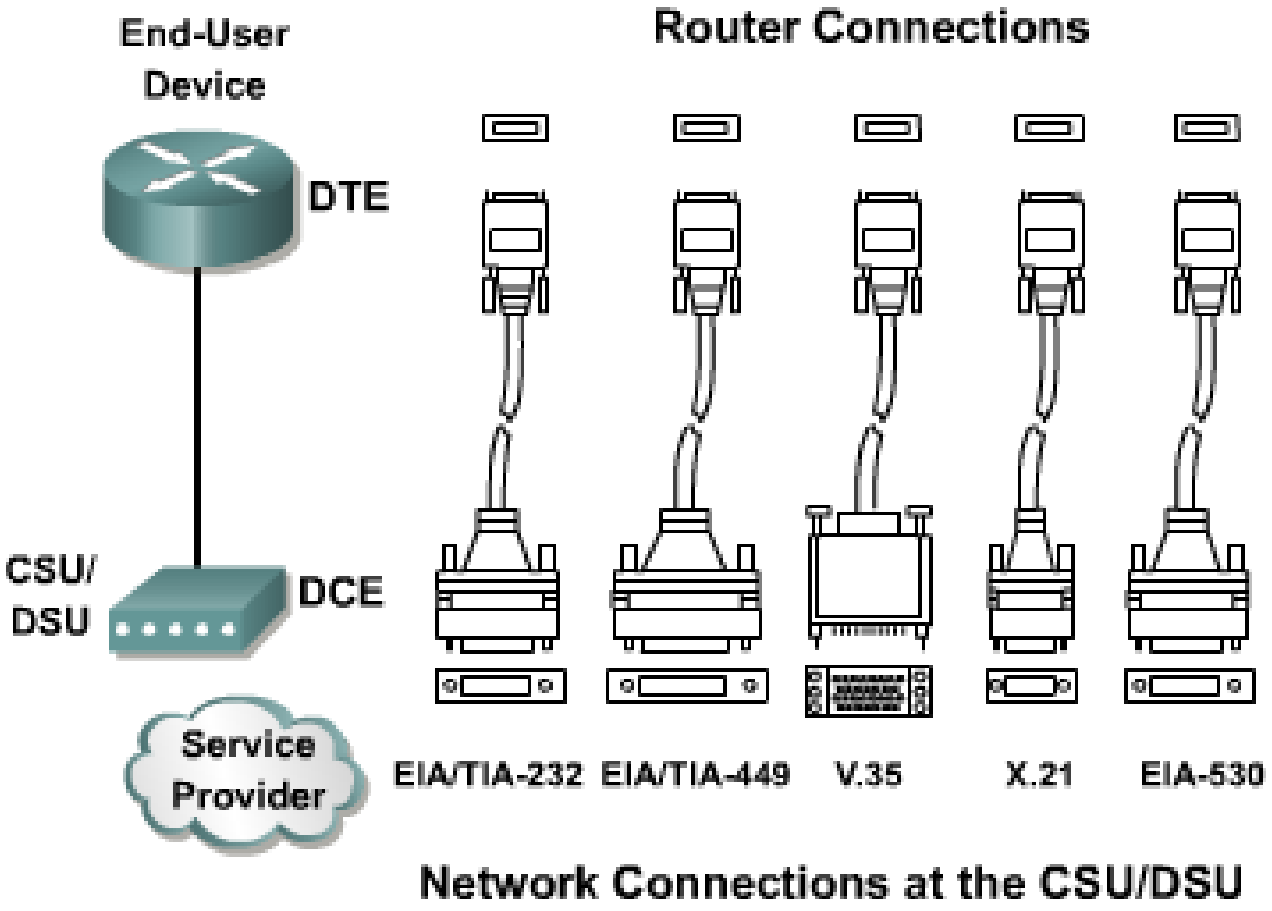
Cisco HDLC / PPP / Frame Relay	ISDN BRI	DSL Modem	Cable Modem
EIA/TIA-232 EIA/TIA-449 X.21 V.24 V.35 High Speed Serial Interface (HSSI)	RJ-45 Note: ISDN BRI cable pinouts are different than the pinouts for Ethernet	RJ-11 Note: Works over telephone line	F Note: Works over Cable TV line

- Physical Layer implementation vary
- Cable specifications define speed of link

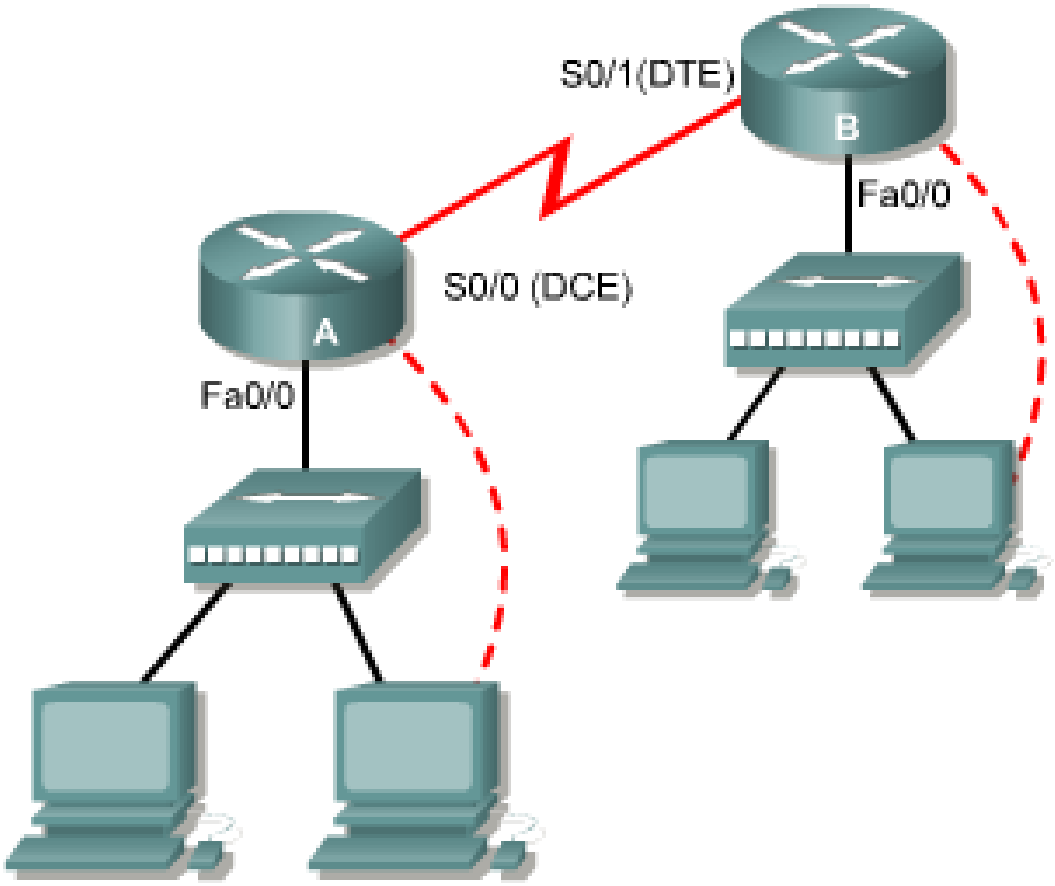
Koneksi Serial dan Kecepatannya

Data (bps)	Distance (Meters) EIA/TIA-232	Distance (Meters) EIA/TIA-449
2400	60	1250
4800	30	625
6900	15	312
19,200	15	156
38,400	15	78
115,200	3.7	—
T1 (1.544 Mbps)	—	15

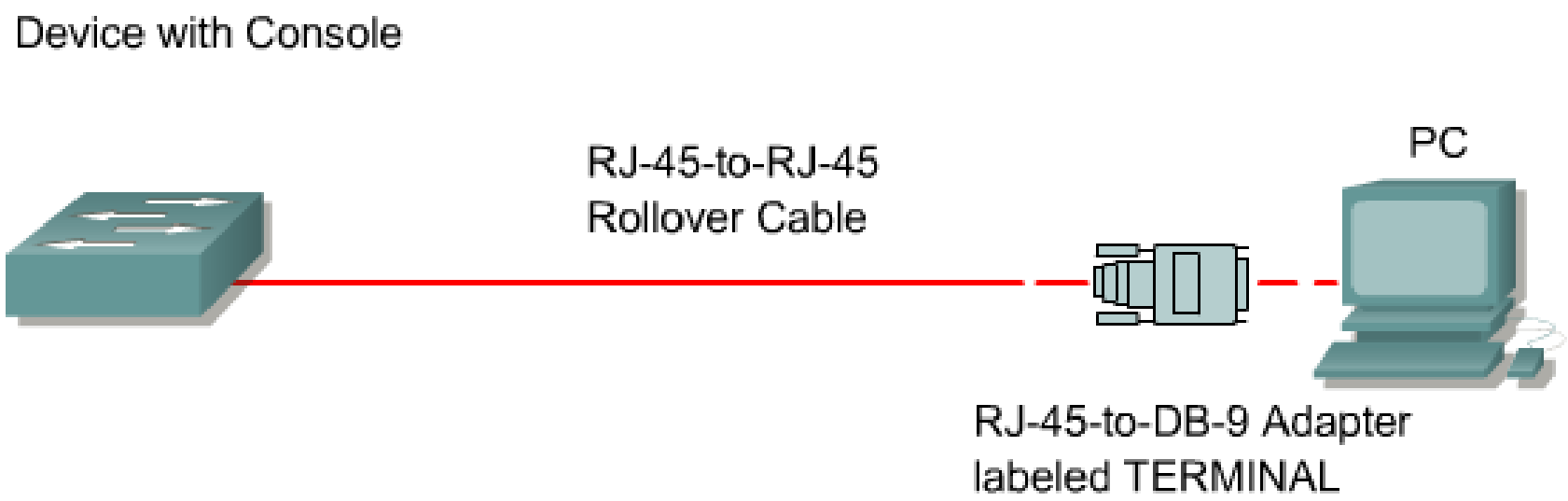
Koneksi Serial WAN



Koneksi WAN Dengan Router



Physical Connection Untuk Konfigurasi Device



Physical Connection Untuk Konfigurasi Device

- Menggunakan tipe kabel roolover

  Pada device jaringan menggunakan port console dan pada komputer menggunakan port COM(1/2), shg Perlu konverter RJ45 to DB9
- Pada komputer Menggunakan COM dengan port settings: 9600 bps, 8 data bits, no parity, 1 stop bit, and no flow control.

  Pada device bisa juga menggunakan port AUX untuk konfigurasi menggunakan modem
- Untuk AUX menggunankan 9600 bps, 8 data bits, no parity, 1 stop bit, and no flow control.

Peralatan Jaringan Layer 1

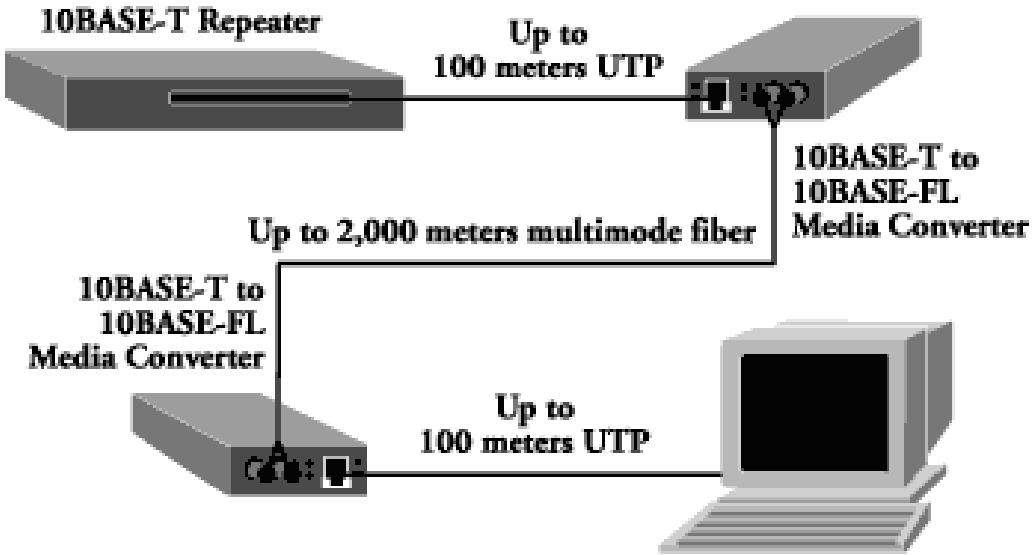
- Repeater
- Hub

Repeaters

Medium	Max Distance
Twisted Pair	100 meters
Coaxial Cable	185/500 meters
Fiber Optic	2+ kilometers

- Sinyal selama travel mempunyai batas max. panjang sesuai media masing-masing sebelum menjadi lemah dan menjadi sampah
- Pelemahan biasa disebut dengan **attenuation**.
- Attenuation bertambah karena:
    - Bertambahnya panjang kabel
    - Bertambahnya node/titik/komputer yang terkoneksi ke jaringan

The Repeater

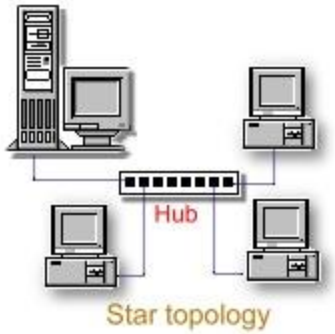


- Repeater berguna untuk menguatkan sinyal selama terjadi pelemahan sinyal

Repeaters Extend Distances

- Dengan menggunakan repeater jarak yang bisa ditempuh sinyal bisa ditambah
- *Contoh:* 10Base-T max. panjang yang diijinkan 100 meters. Satu repeater dapat memperpanjang jarak menjadi dua kali lipat menjadi 200 meters!
- Repeater hanya berfungsi menguatkan sinyal tidak lebih, tidak ada fungsi tambahan yang lebih smart

Hub



- Ketika mulai diperkenalkan teknologi star, dibutuhkan peralatan sebagai concentrator, maka diciptakan hub
- Hub merupakan mulitport repeater.
- Prinsip hub, data yang datang dari satu port akan dikeluarkan ke semua port kecuali port sumber.
- Dianggap sebagai device Layer 1 karena tidak ada fungsi smart yang lain kecuali sebagai concentrator

Pertanyaan :

1. Sebutkan peralatan di layer fisik !
2. Sebutkan struktur dan fungsi dari frame ethernet !
3. Sebutkan jenis-jenis ethernet yang ada di pasaran !
4. Sebutkan fungsi dari hub !
5. Sebutkan jenis-jenis hub yang ada di pasaran !