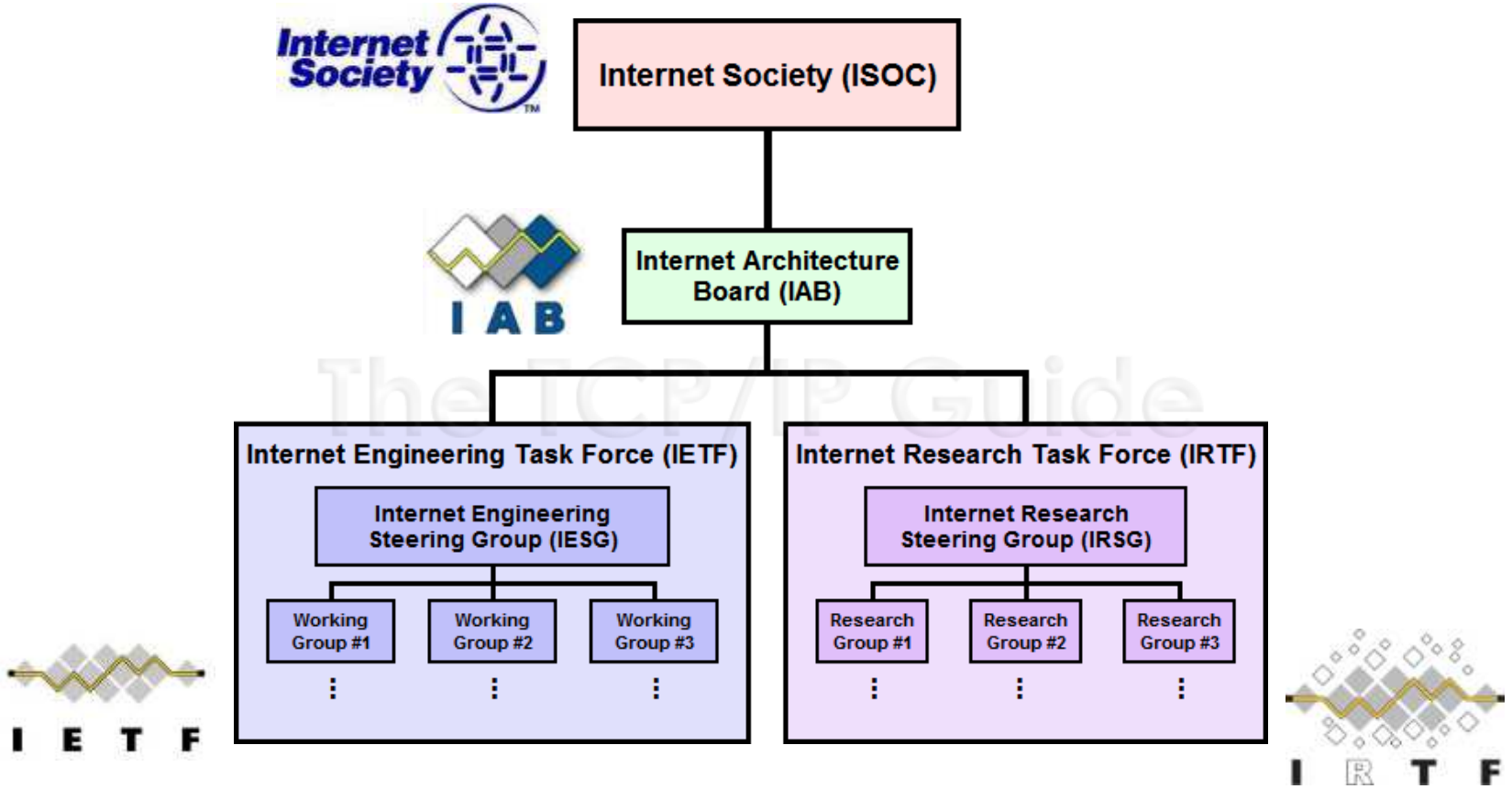
LAN: Этернэт

Лекц №14

АГУУЛГА

- Стандарт
- Этернэт технологийн хөгжлийн явц
- Этернэт технологийн ангилал
- Этернэт технологийн фреймийн бүтэц
- Этернэт технологийн хаяг
- Анхны этернэт технологи /Legacy Ethernet technology/
- Одоогийн этернэт технологи /Fast Ethernet technology/
- Өндөр хурдны этернэт технологи /Giga Ethernet technology/

ISOC, IAB, and IETF



IEEE

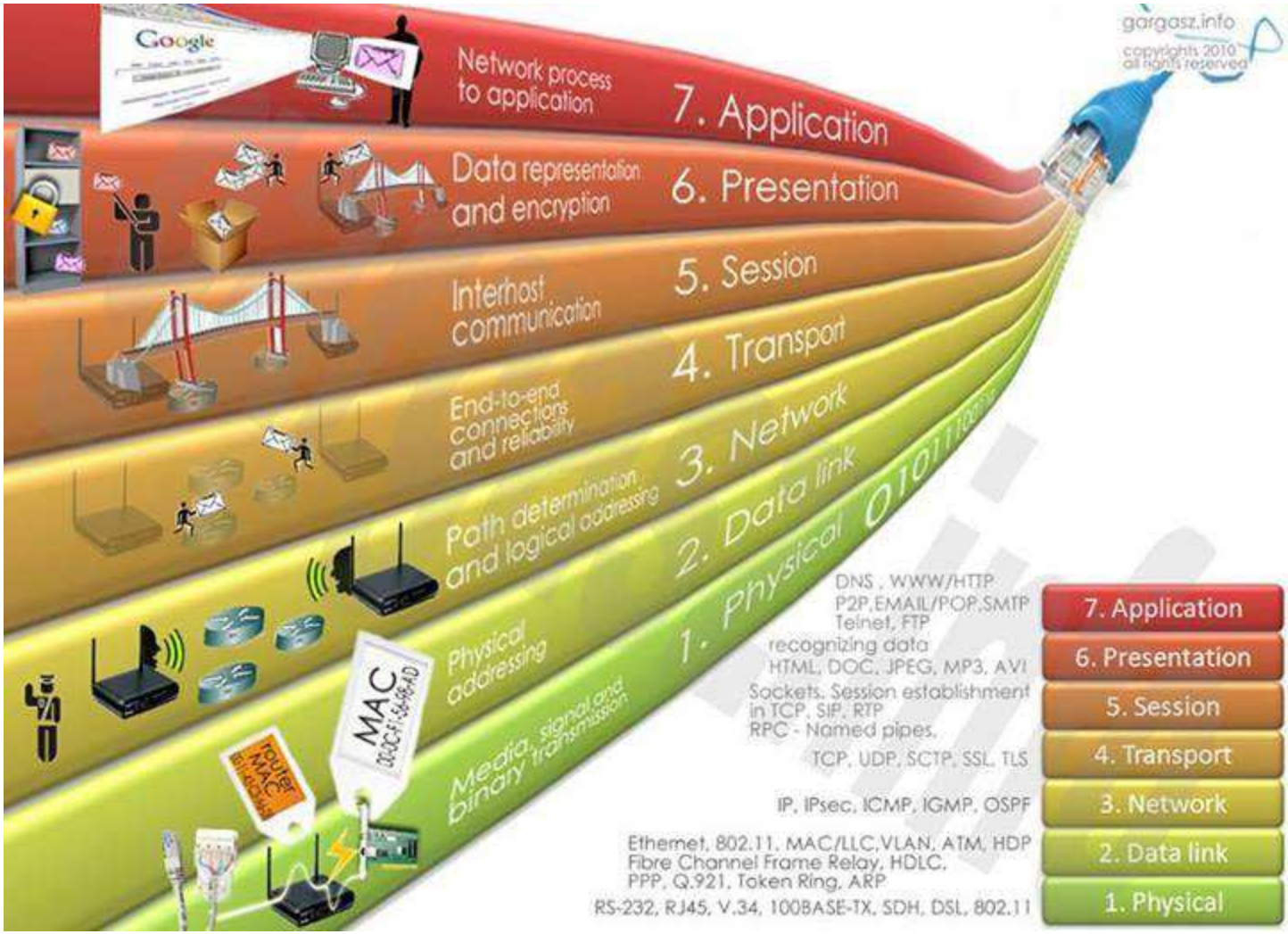
- 38 societies
- 130 journals
- 1,300 conferences each year
- 1,300 standards and projects
- 400,000 members
- 160 countries

IEEE 802 Working Groups and Study Groups

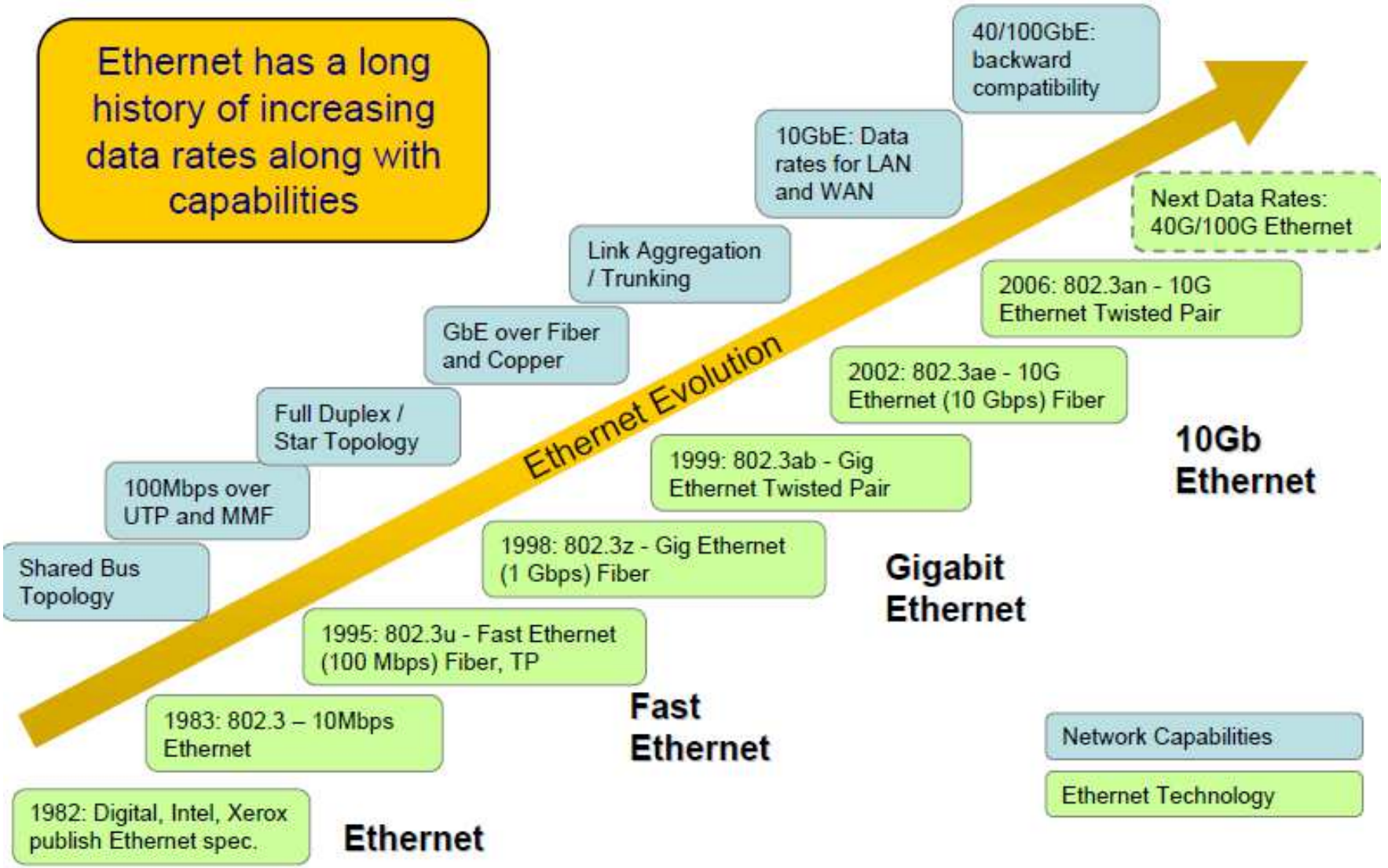
- 802.1 Higher Layer LAN Protocols Working Group
- 802.3 Ethernet Working Group
- 802.11 Wireless LAN Working Group
- 802.15 Wireless Personal Area Network (WPAN) Working Group
- 802.16 Broadband Wireless Access Working Group
- 802.18 Radio Regulatory TAG
- 802.19 Wireless Coexistence Working Group
- 802.21 Media Independent Handover Services Working Group
- 802.22 Wireless Regional Area Networks
- 802.24 Smart Grid TAG

Standards Organizations ISO-OSI тайлбар загвар

- Олон улсын стандарчлалын байгууллагаас санаачилсан
- De-Jure буюу албаёсных
- Open System Interconnection
- Олон үйлдвэрлэгчийн програм ба техник хангамжийн бүтээгдэхүүнүүдийг хооронд нь зохицуулах
- 7 түвшинтэй



ЭТЕРНЭТ ТЕХНОЛОГИЙН ХӨГЖЛИЙН ЯВЦ

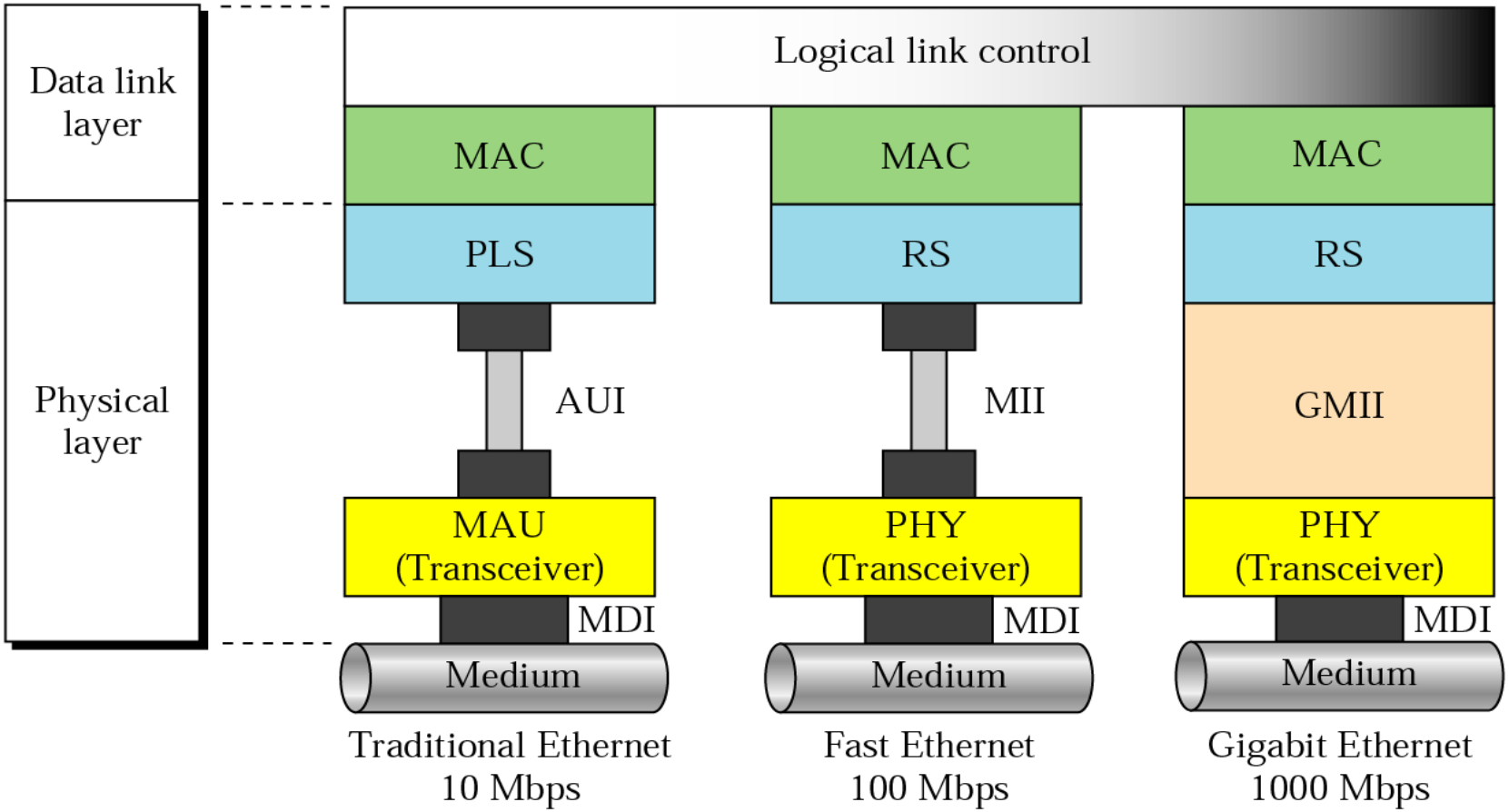


Этернэт технологийн ангилал

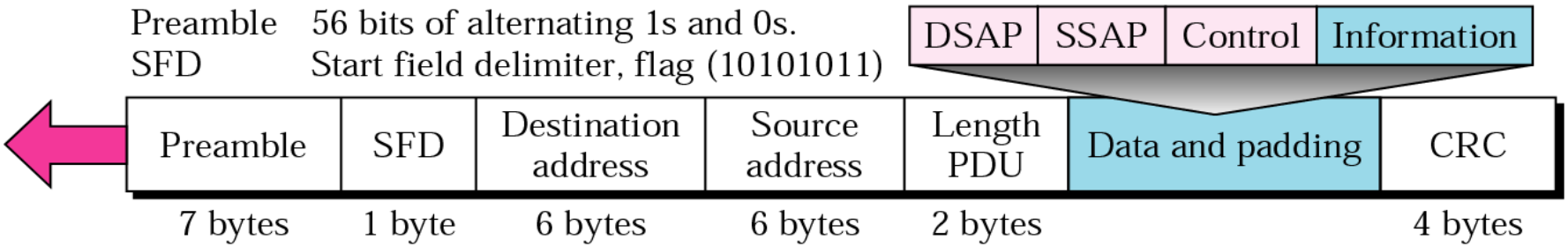
AUI: Attachment Unit Interface
MAC: Media Access Control
MAU: Medium Attachment Unit

MDI: Medium-Dependent Interface
MII: Medium-Independent Interface
GMII: Gigabit Medium-Independent Interface

PHY: Physical Layer Entity
PLS: Physical Layer Signaling
RS: Reconciliation Signaling



Этернэт Frame



Preamble энэ нь хүлээн авагчид фрейм ирж буйг мэдэгдэнэ. 7 byte(56bits), 1 ба 0-ийн үелэл. Физик түвшинд нэмэгддэг ба фреймийн хэсэгт тооцогдохгүй

Start Frame Delimiter (SFD) Хоёр дахь фреймийн эхлэлийг тодорхойлох 1 byte: 10101011 мэдээлэл байна. SFD нь төхөөрөмжид сүүлийн синхрончлол хийх боломж олгодог. Сүүлийн хоёр бит нь 11 байх бөгөөд энэ нь хүлээн авагчид дараагийн талбар хүлээн авагчийн хаяг гэдгийг хэлнэ.

Destination Address (DA) 6 byte Физик хаяг

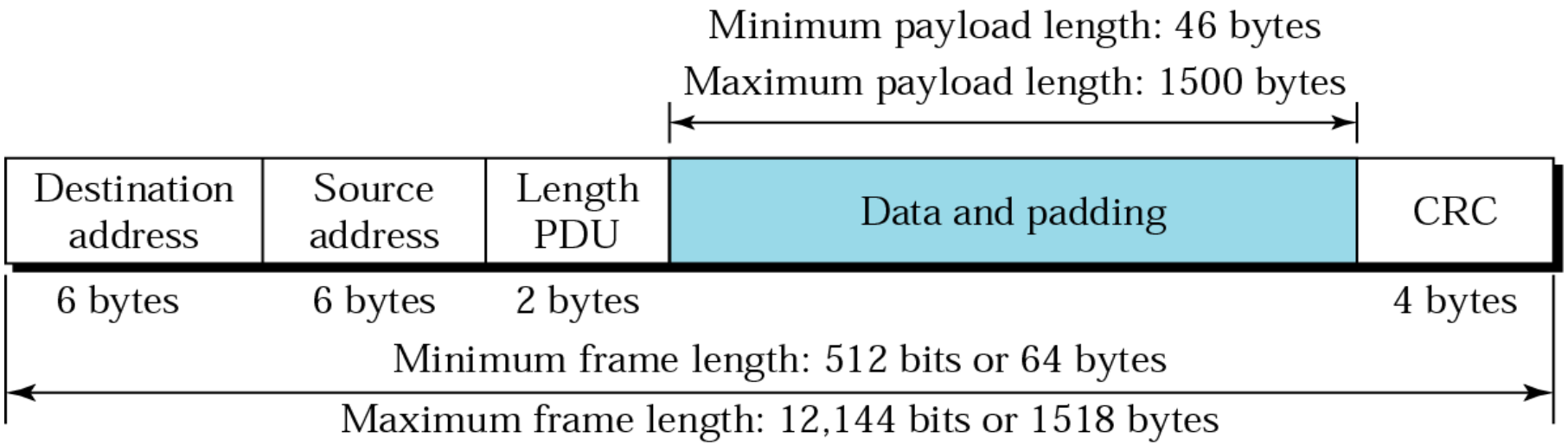
Source Address (SA) 6 byte Физик хаяг

Length/Type Фреймийн хэмжээ/Encapsulated Protocol Type

Data Network Layer PDU

CRC/FCS CRC-32

Minimum and Maximum Length



Этернэт технологийн хаяг

06-01-02-01-2C-4B

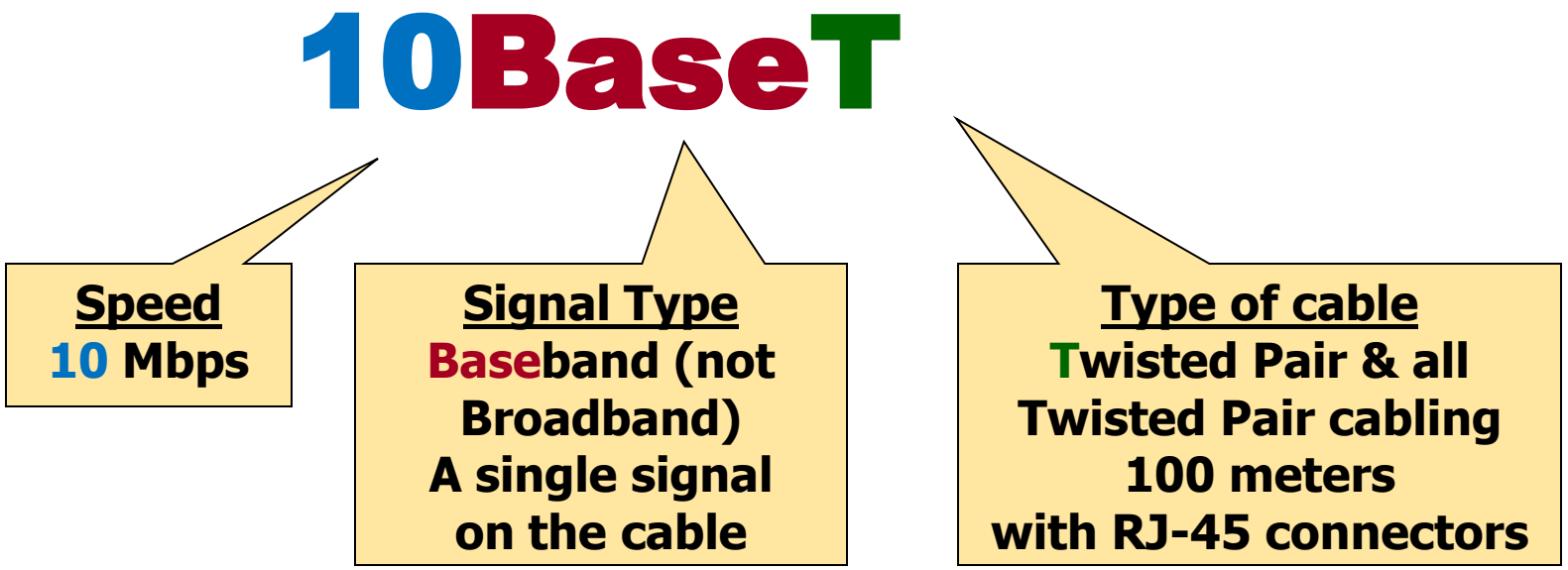
Дамжууллын төрөл

Unicast - Unicast Destination

Multicast - One-to-Many

Broadcast - One-to-All /FF-FF-FF-FF-FF-FF/

Legacy Ethernet



Ethernet: 'Legacy Ethernet'

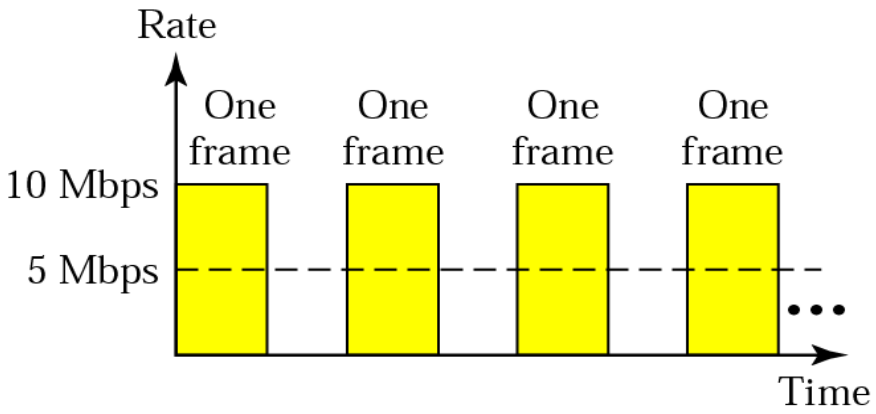
Speeds: 10-Mbps, Category-3,4,5 UTP Cable, RJ-45

Legacy Ethernet

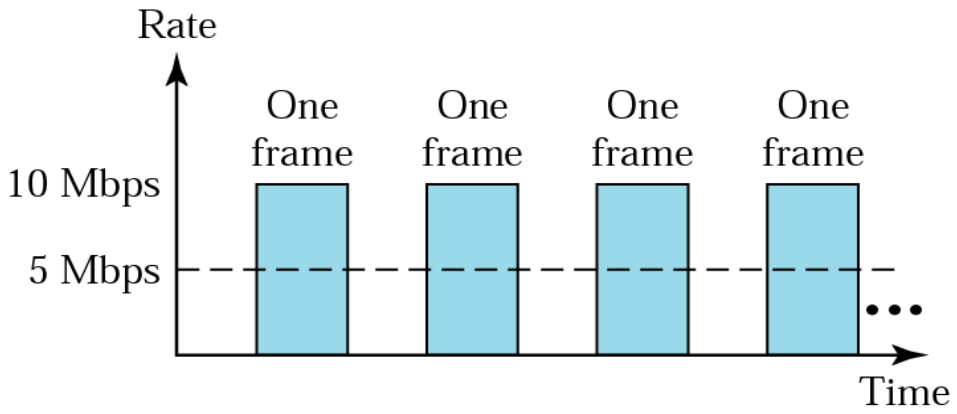
Ethernet

- Ethernet Networks, 10 Mbps;
- IEEE дэмжих төрөл: 10Base5, 10Base2, 10BaseT, 10BaseFL
  - 10 Mbps хурдтай
  - Half-duplex
  - CSMA/CD
  - Bus topology
  - Hub-based
- 10Base5: First Ethernet, Thick coaxial, bus
- 10Base2: Second Ethernet, Thin coaxial, bus
- 10BaseT: Third Ethernet, star
- 10BaseFL: Star topology, хос шилэн кабель

Sharing Bandwidth

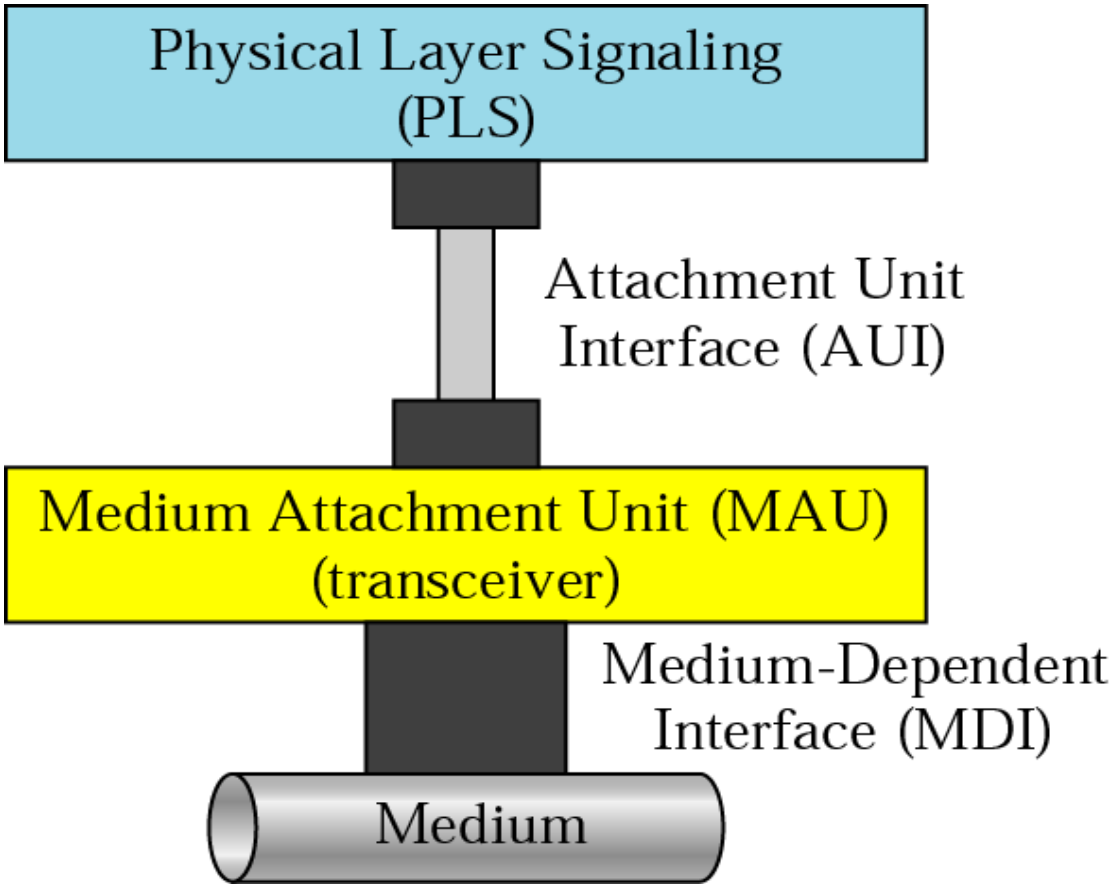


a. First station

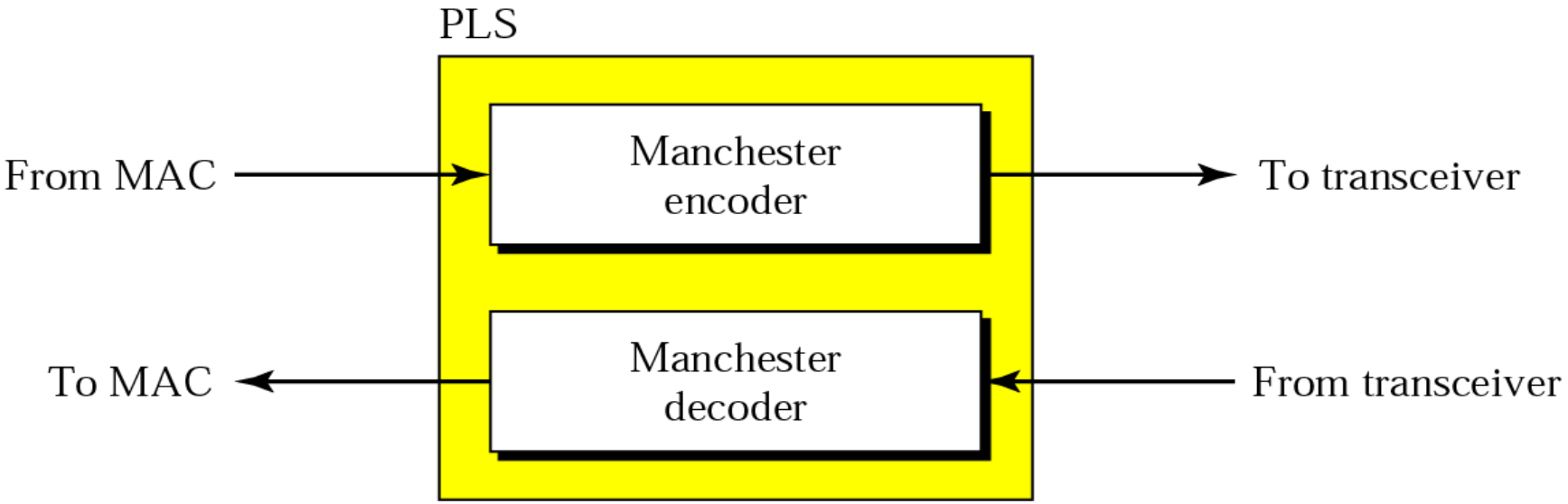


b. Second station

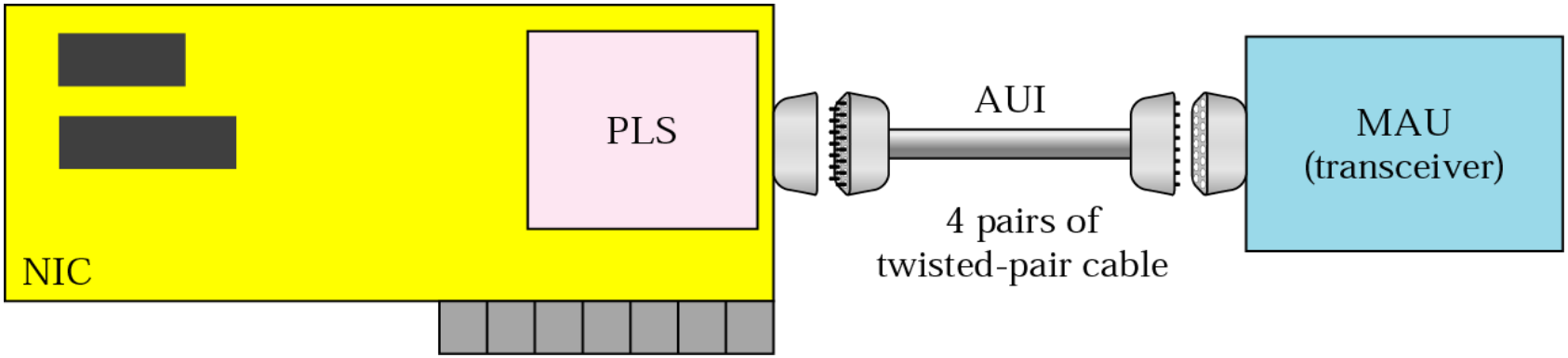
Physical Layer



Physical Layer Signaling (PLS)

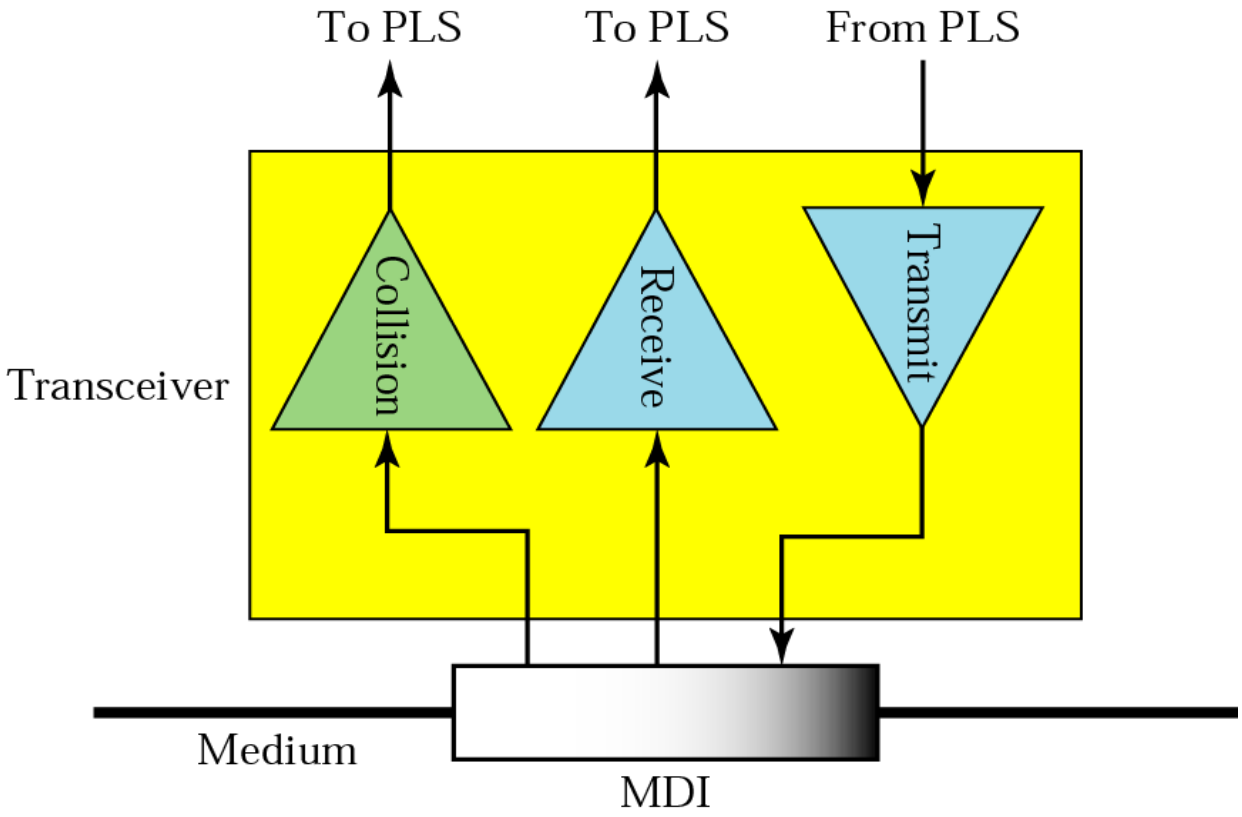


Attachment Unit Interface (AUI)



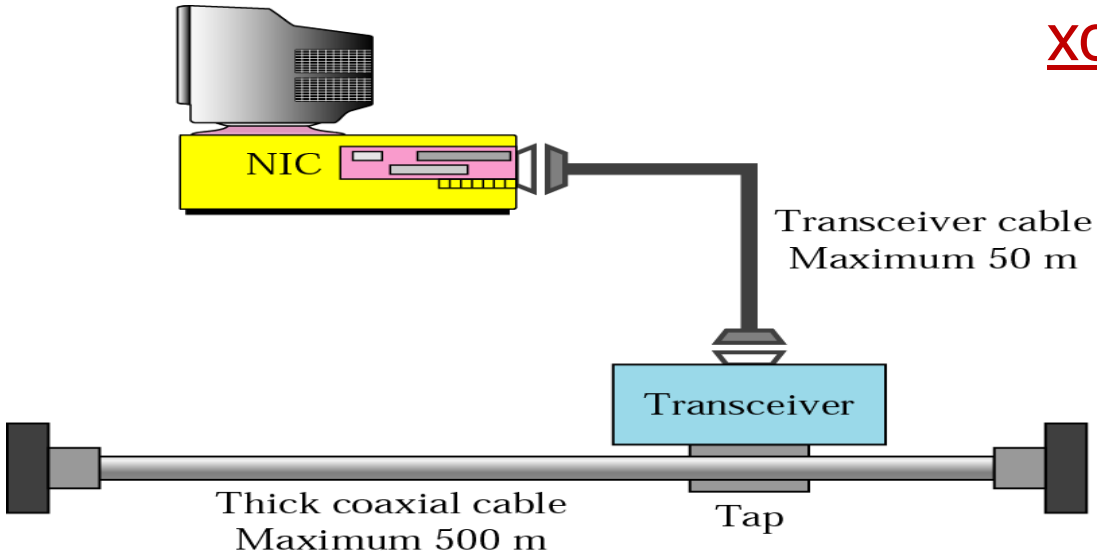
- PLS, MAU холбох интерфейс, 15 pin
- Орчноос хамаарахгүй
- 10Base5 (thicknet) – богино кабель
- 10Base2 (thinnet) – NIC дотор

Medium Attachment Unit (MAU) (transceiver)

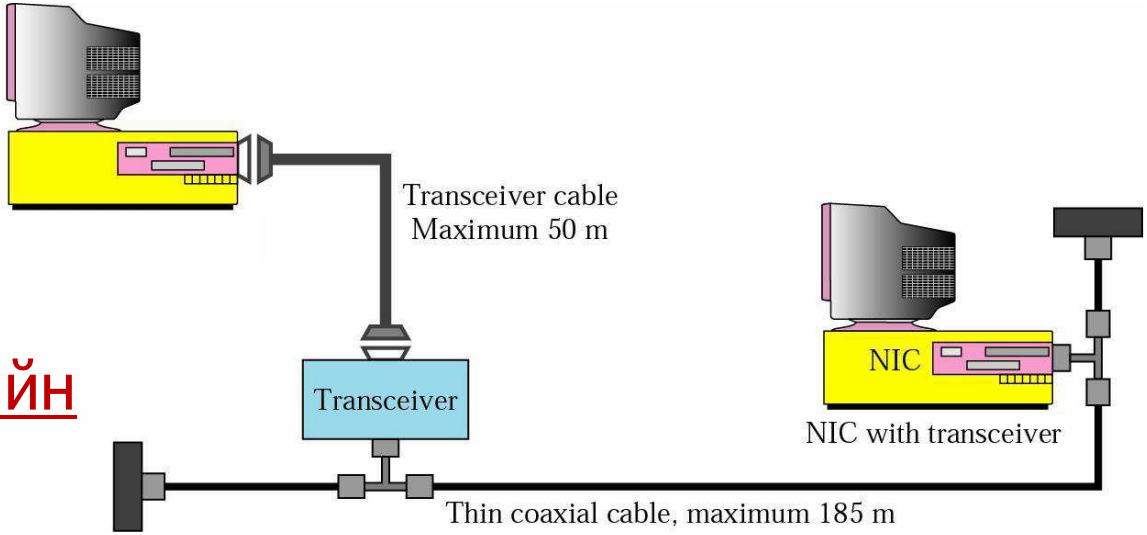


- Орчноос хамааралтай
- Дохиог орчинд гаргана

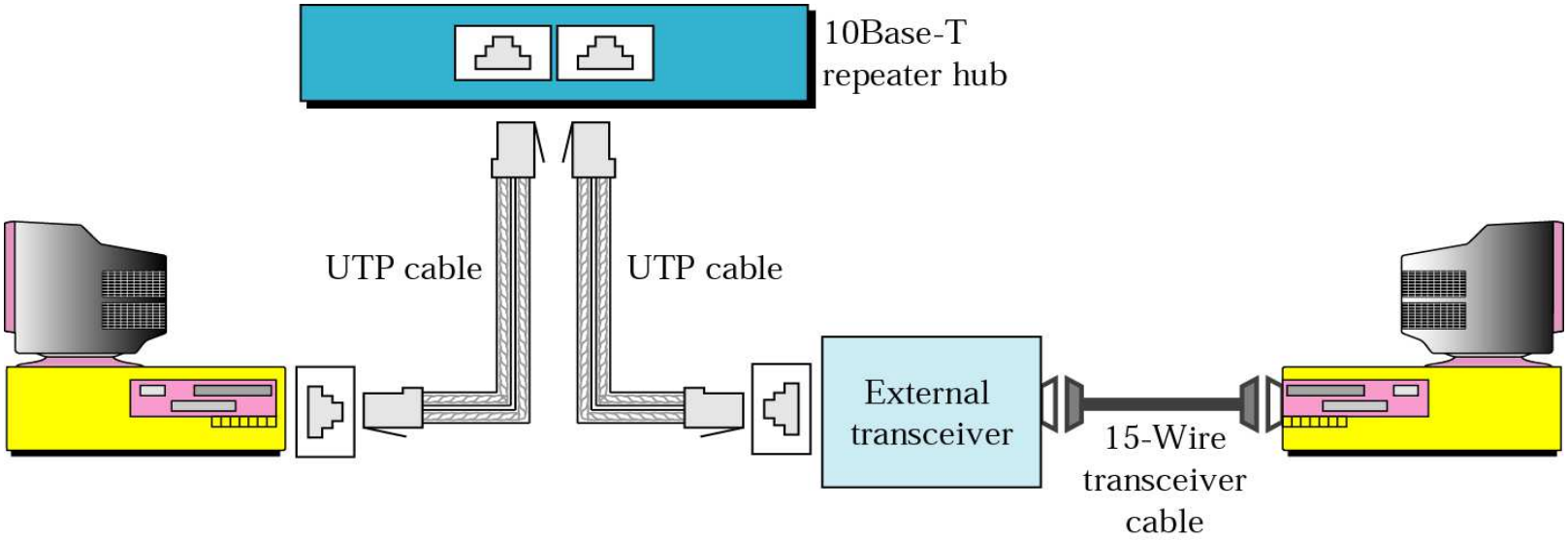
10Base5 төхөөрөмжийн холболт



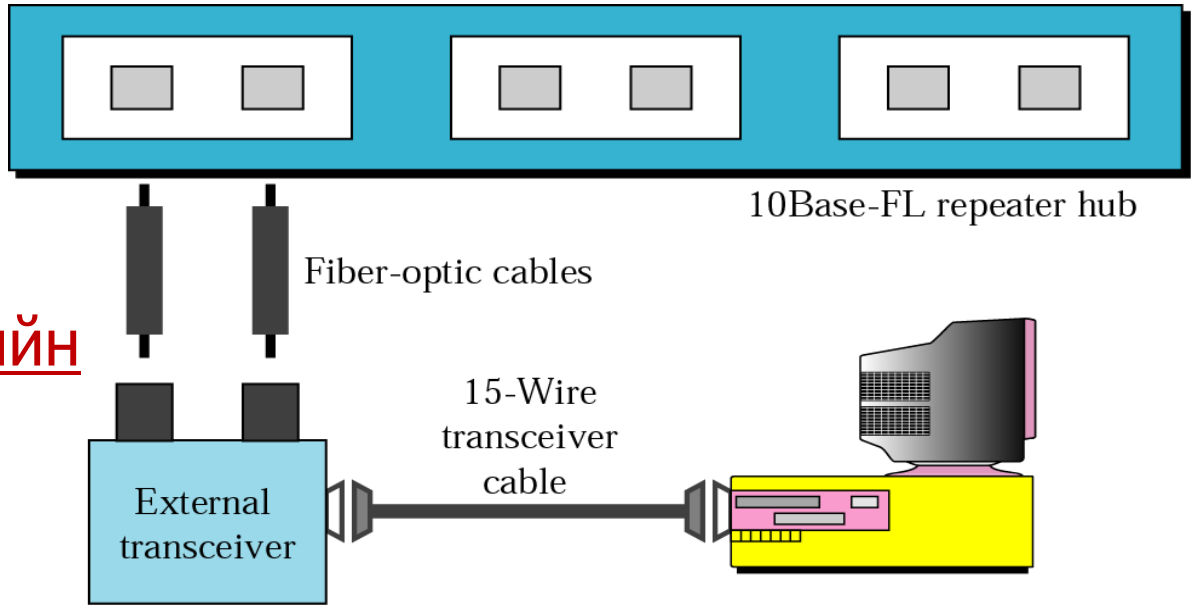
10Base2 төхөөрөмжийн холболт



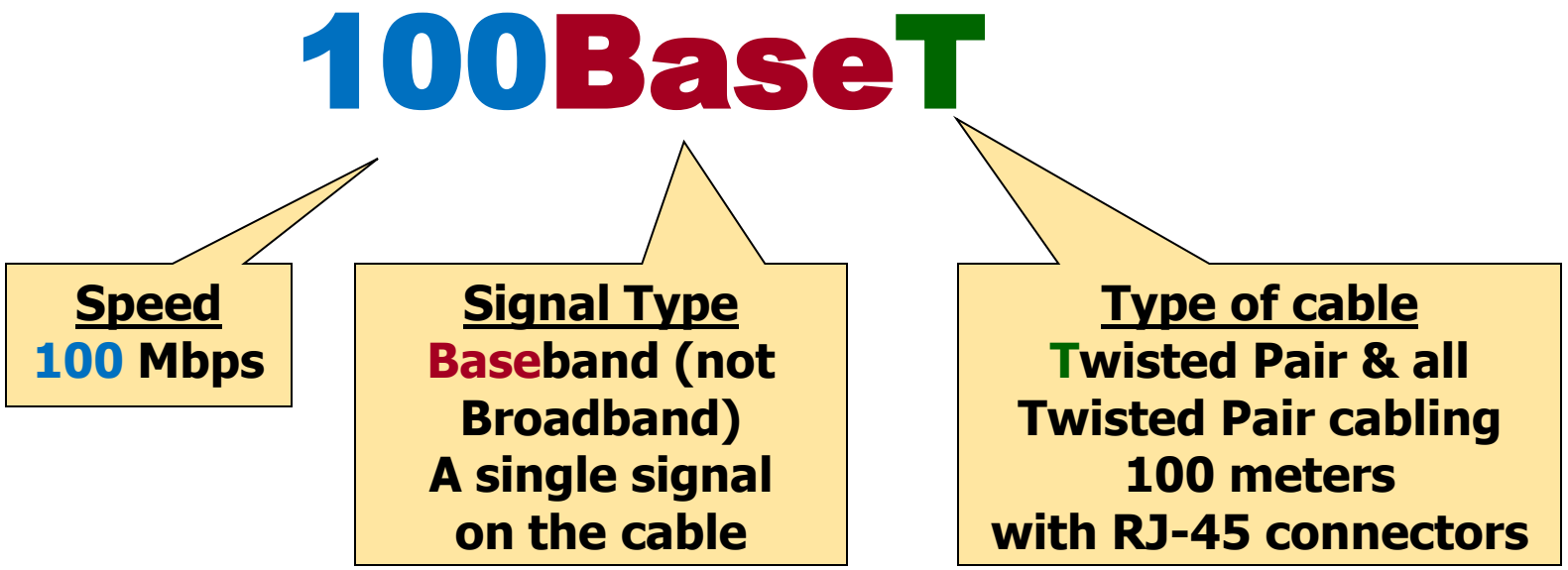
10BaseT төхөөрөмжийн холболт



10BaseFL төхөөрөмжийн холболт



Мушгиа хос Ethernet



Ethernet: 'Fast Ethernet'

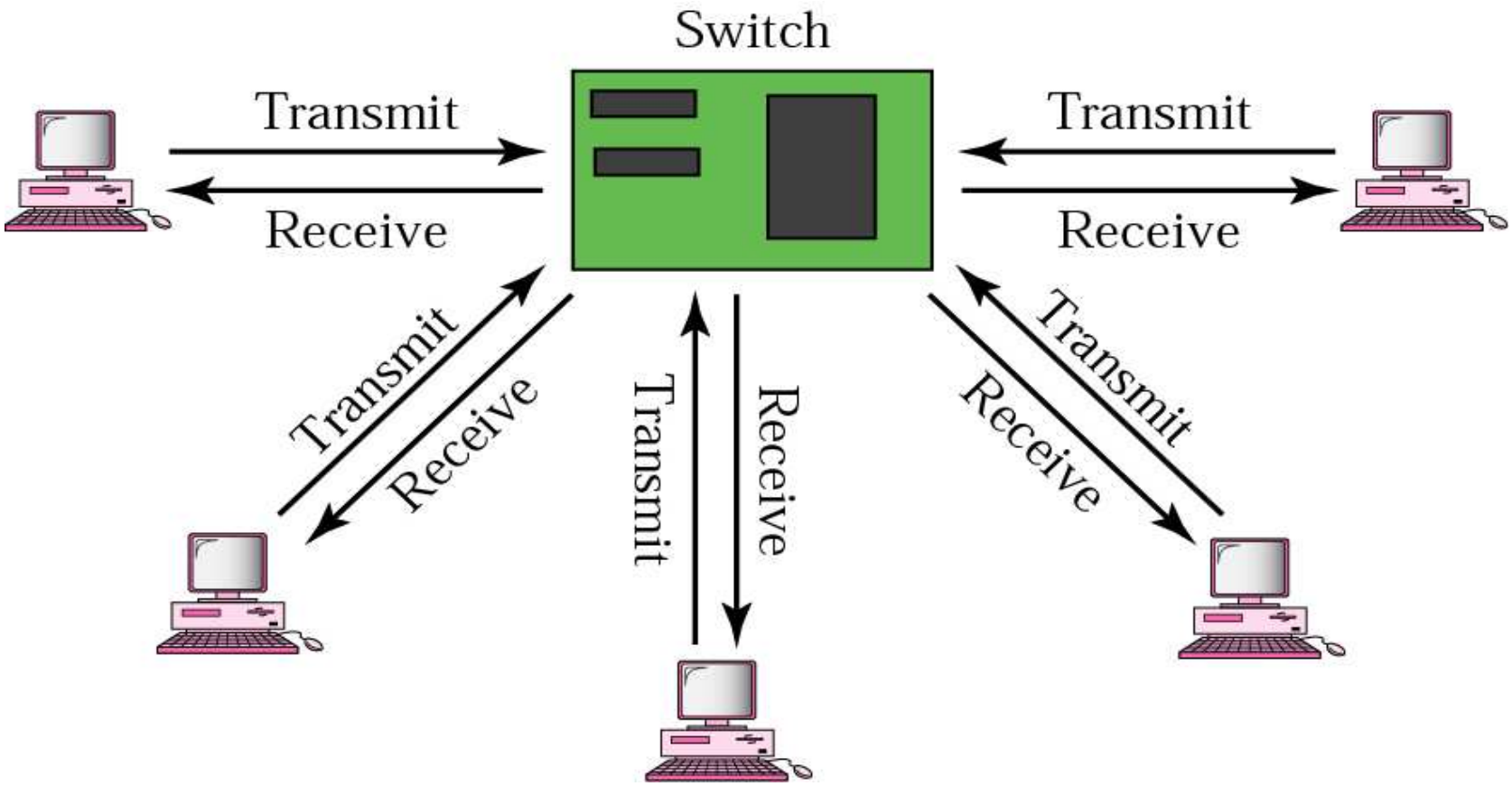
Speeds: 100-Mbps, Category-5,5e UTP Cable, RJ-45

Мушгиа хос Ethernet

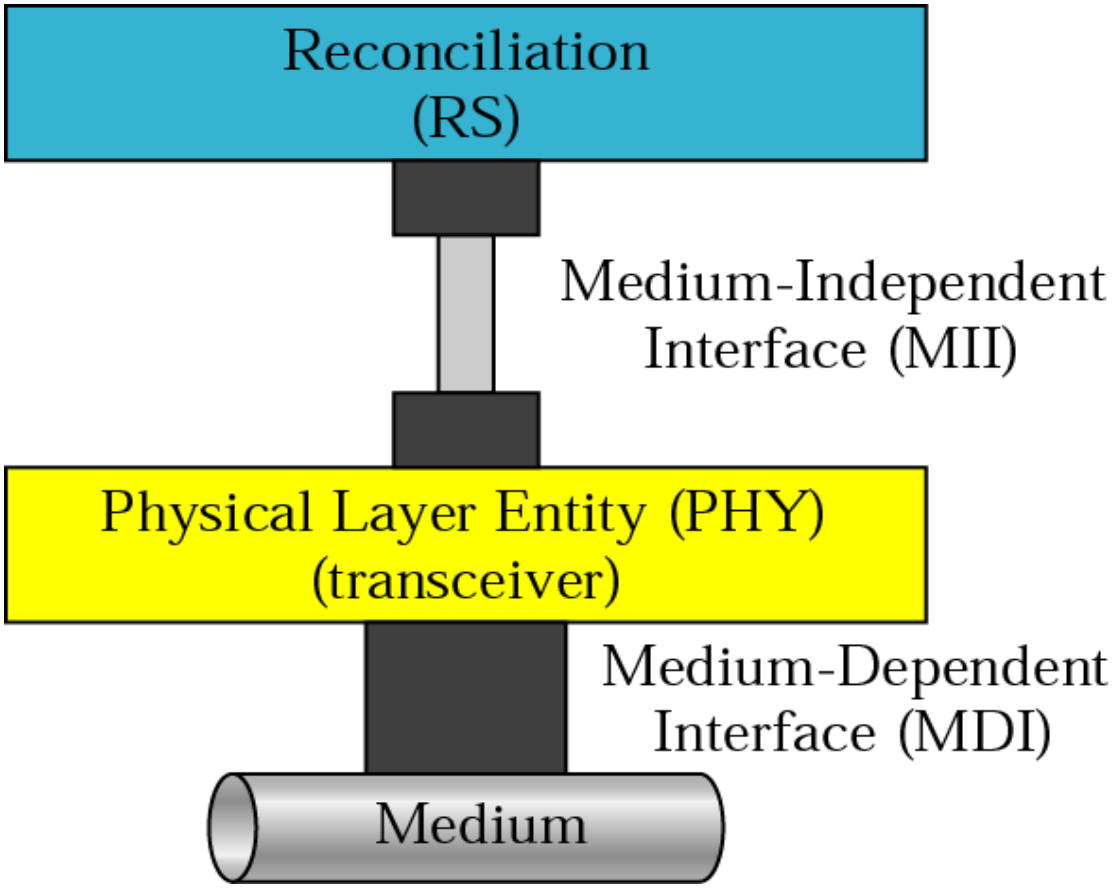
Fast Ethernet – First Modern Ethernet Network

- Fast Ethernet: Ethernet Networks, 100 Mbps;
- IEEE дэмжих төрөл: 100BaseTX, 100BaseFX, 100BaseT4
  - 100 Mbps хурдтай
  - 100 метр хуваалттай Twisted-pair cable
  - Full-duplex
  - Collision free /not use CSMA/CD/
  - Switch-based
  - Star topology, Cat-5 or 5e UTP cabling
  - RJ-45 коннектор
- 100BaseTX: CAT 5e, Хос утаст кабел: нэг нь илгээнэ, нөгөө нь хүлээн авна *(100BaseT гэж нэрлэнэ)*
- 100BaseFX: 1300nm гэрлийн долгион дамжуулах хос оптик кабель: RX, TX
- 100BaseT4: CAT 3, дөрвөн утаст кабел: 4 хосоор илгээнэ, хүлээн авна

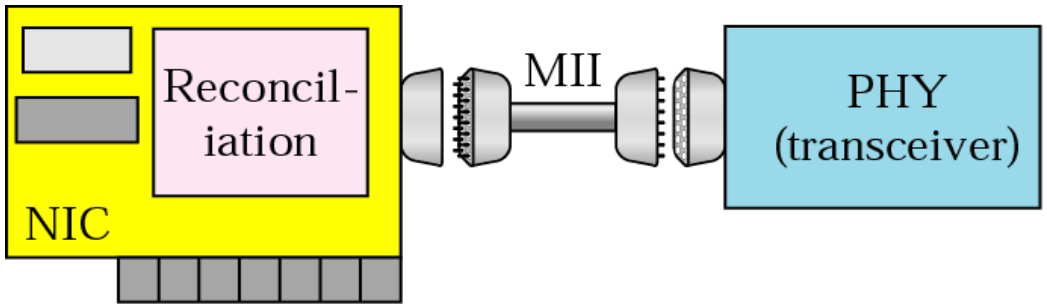
Full-Duplex Switched Ethernet



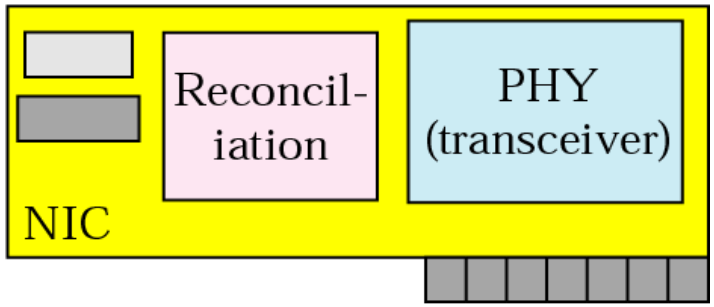
Fast Ethernet Physical Layer



Medium Independent Interface (MII)



a. MII is needed for external transceiver



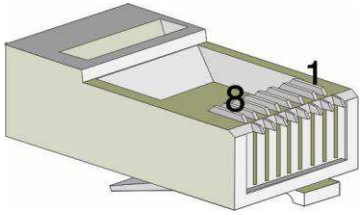
b. MII is not needed for internal transceiver

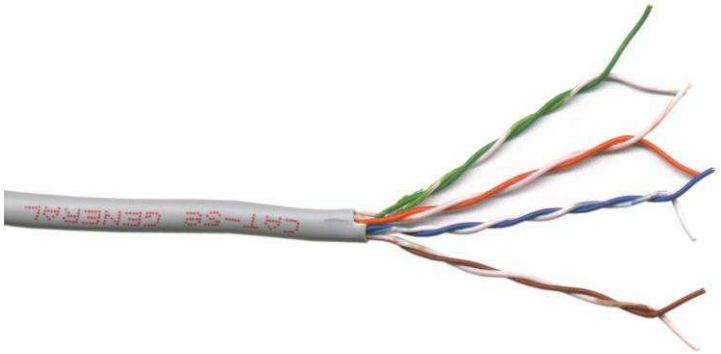
- 10Mbps, 100Mbps хоёуланг нь дэмжих интерфейс
- Parallel 4 bit time
- Удирдлагын функцүүд нэмэгдсэн

Medium Dependent Interface (MDI)

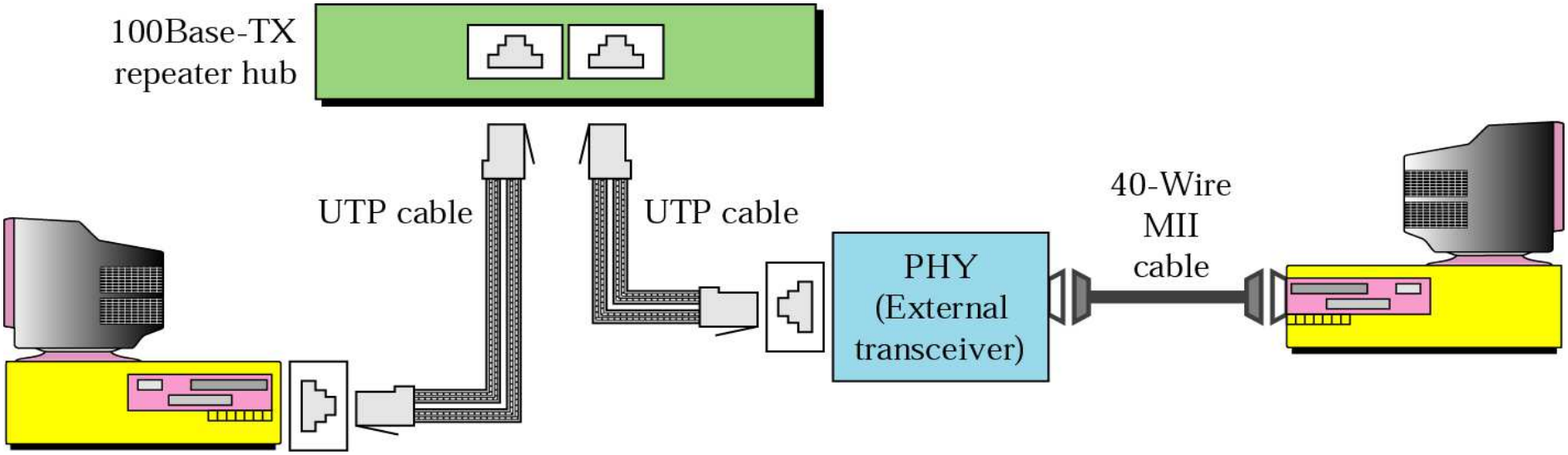
100BaseT: Fast Ethernet

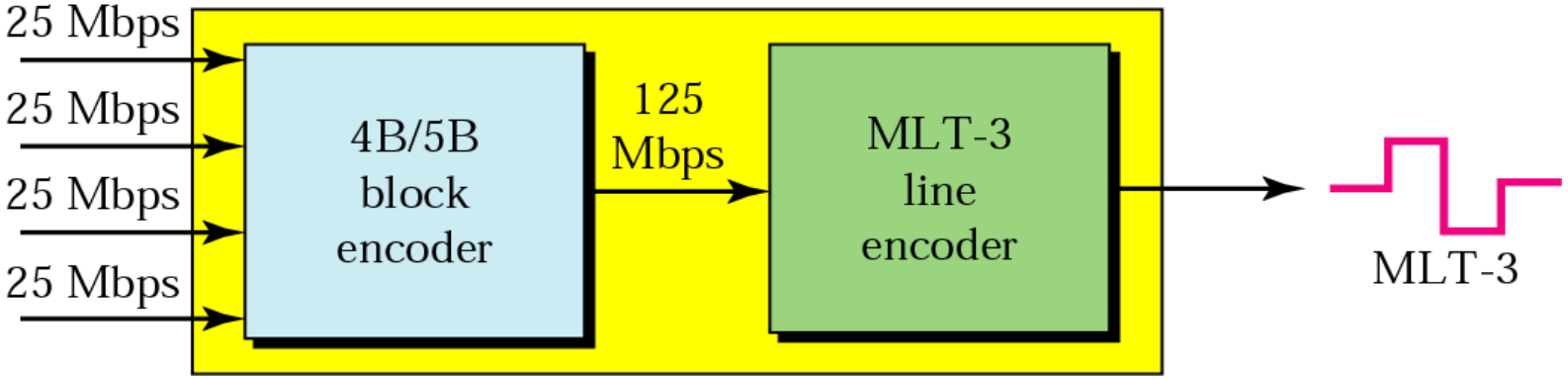
- 100BaseT CAT-5 ашиглана.
- CAT-5 UTP cable нь дөрвөн хос утас: нэг хосоор өгөгдөл илгээнэ, өөр нэг хосоор хүлээн авна. *(Pins 1 & 2 өгөгдөл илгээнэ, Pins 3 & 6 өгөгдөл хүлээн авна)*
- CAT-5 UTP RJ-45 connector ашиглана.
- CAT-5 UTP 100метрийн хязгаартай
- 100BaseT сүлжээний төхөөрөмж (Hubs, Switch)-тэй Star топологиор холбогдоно.





100BaseTX, Encoding/Decoding





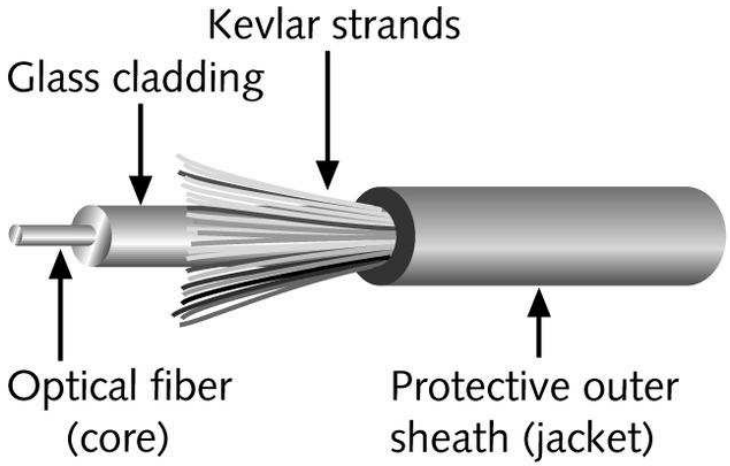
100BaseFX (Fiber-Optic)

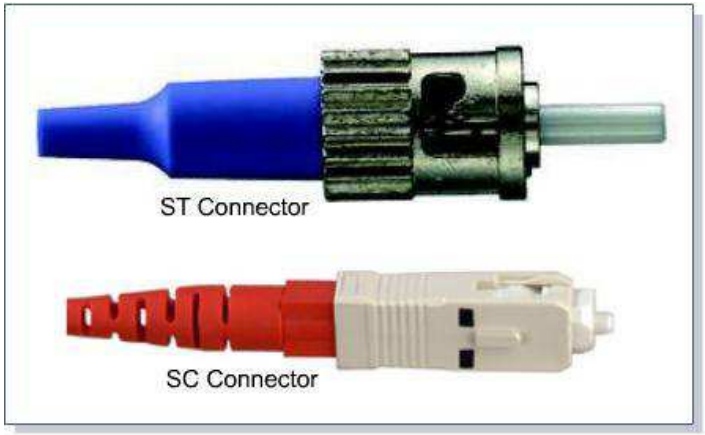
100BaseFX

- 10BaseFL-тэй ижил боловч 100Mbps хурдыг дэмжинэ.
- Multimode (LEDs),

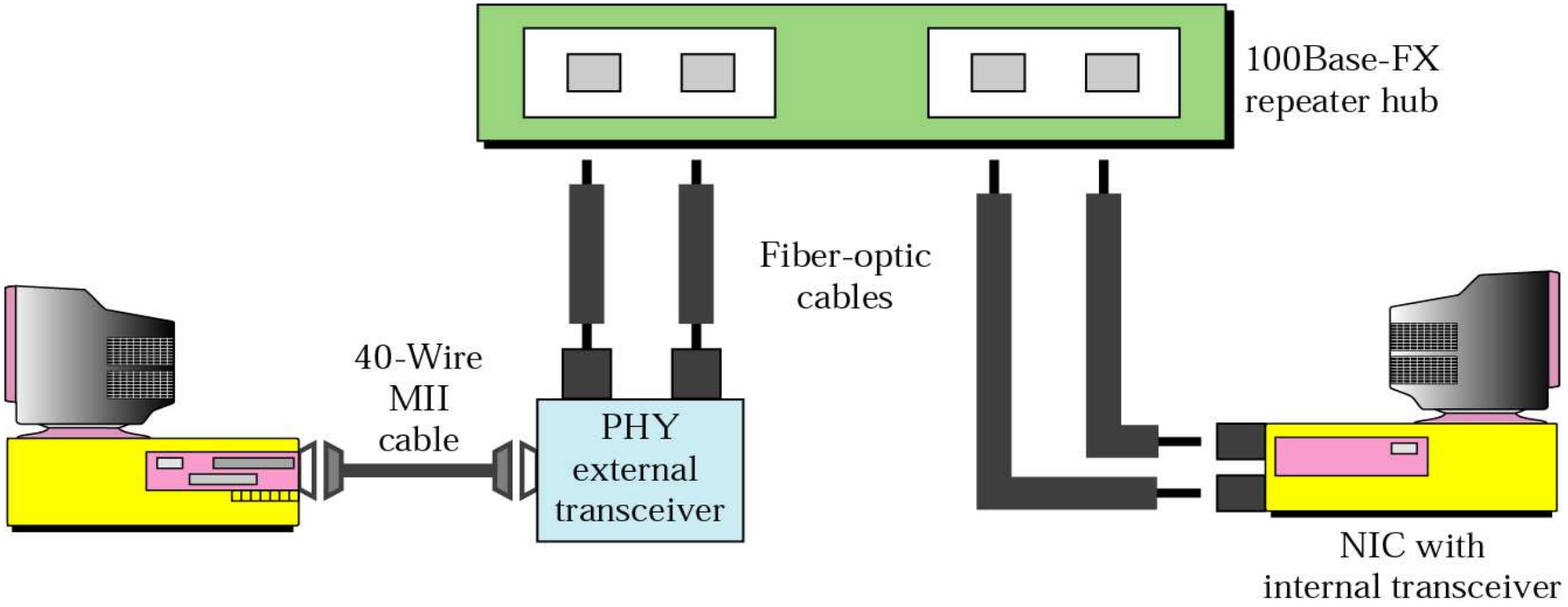
  ST (Straight-Tip)

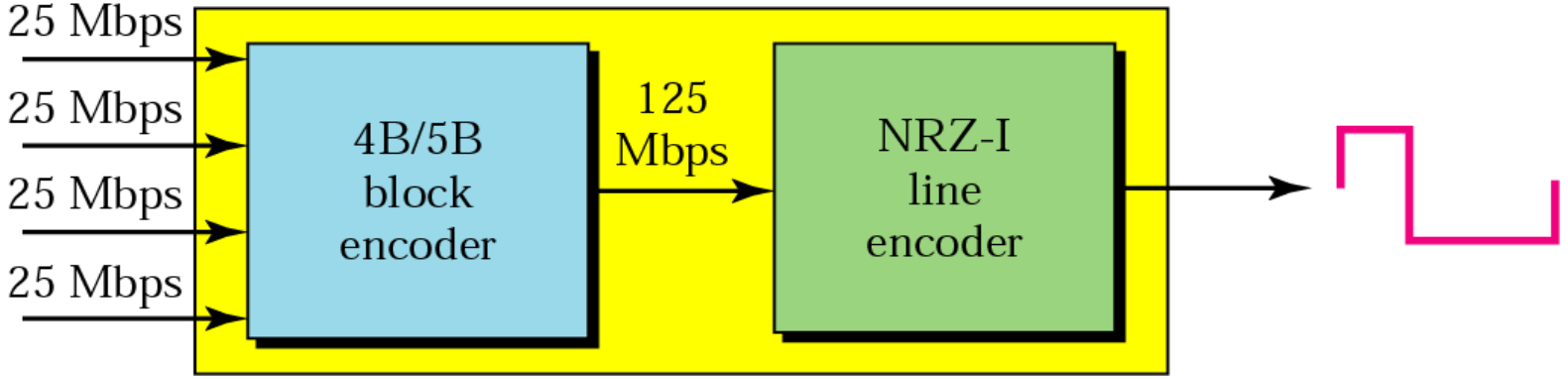
  SC (Square Connector) коннектор бүхий шилэн кабель хэрэглэнэ.
- Half-Duplex 400 м,
  Full-Duplex 2000 м



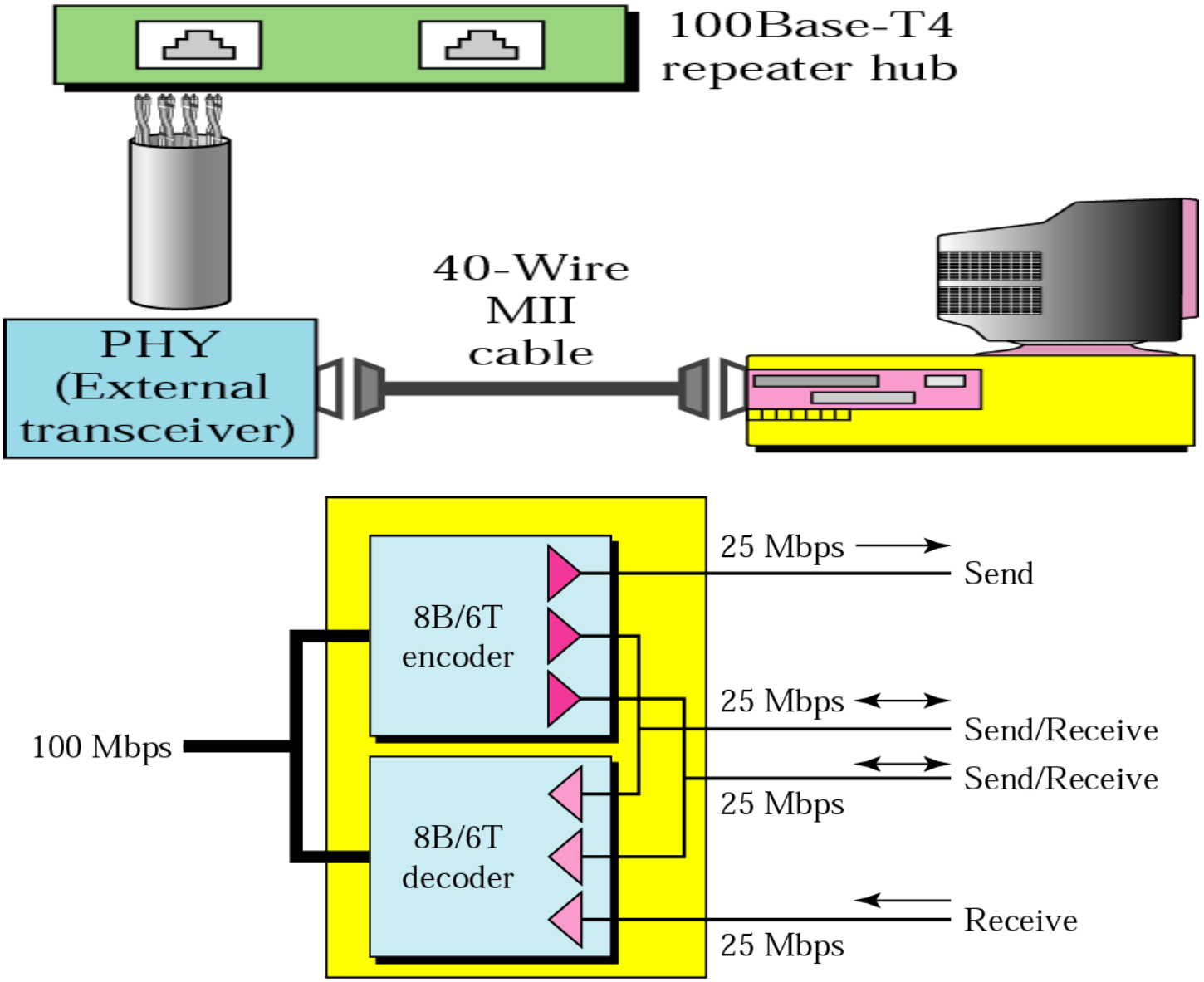


100BaseFX, Encoding/Decoding





100BaseT4, Encoding/Decoding



Gigabit Ethernet

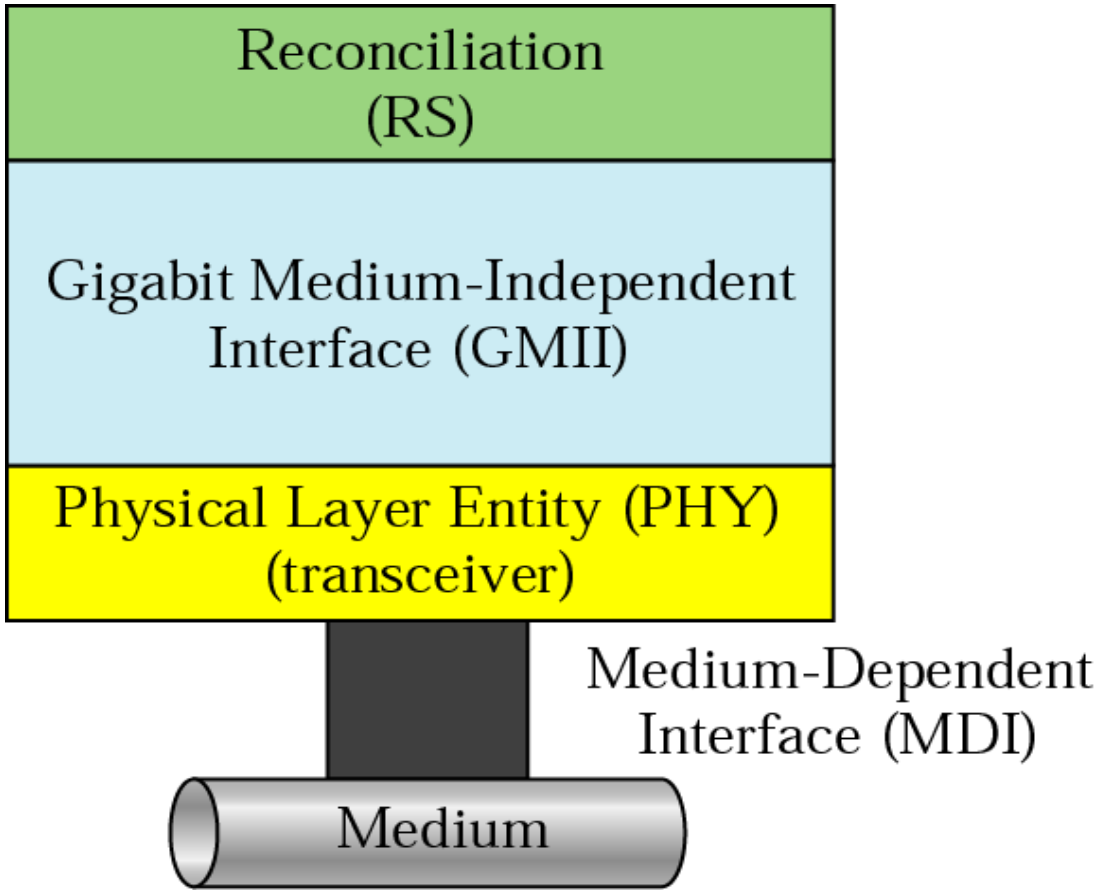
Gigabit Ethernet: 802.3ab, 802.3z)

- Gigabit Ethernet: Ethernet Networks, 1000Mbps
- Gigabit Ethernet-ийн төрлүүд:
  - 1000BaseSX, 1000BaseLX, 1000BaseT, 1000BaseCX
- 1000BaseT, зонхилох стандарт
  - CAT 5e or CAT 6, дөрвөн-хос утаст кабель, хурдыг ихэсгэсэн T стандарт (100 м, RJ-45 коннектор)

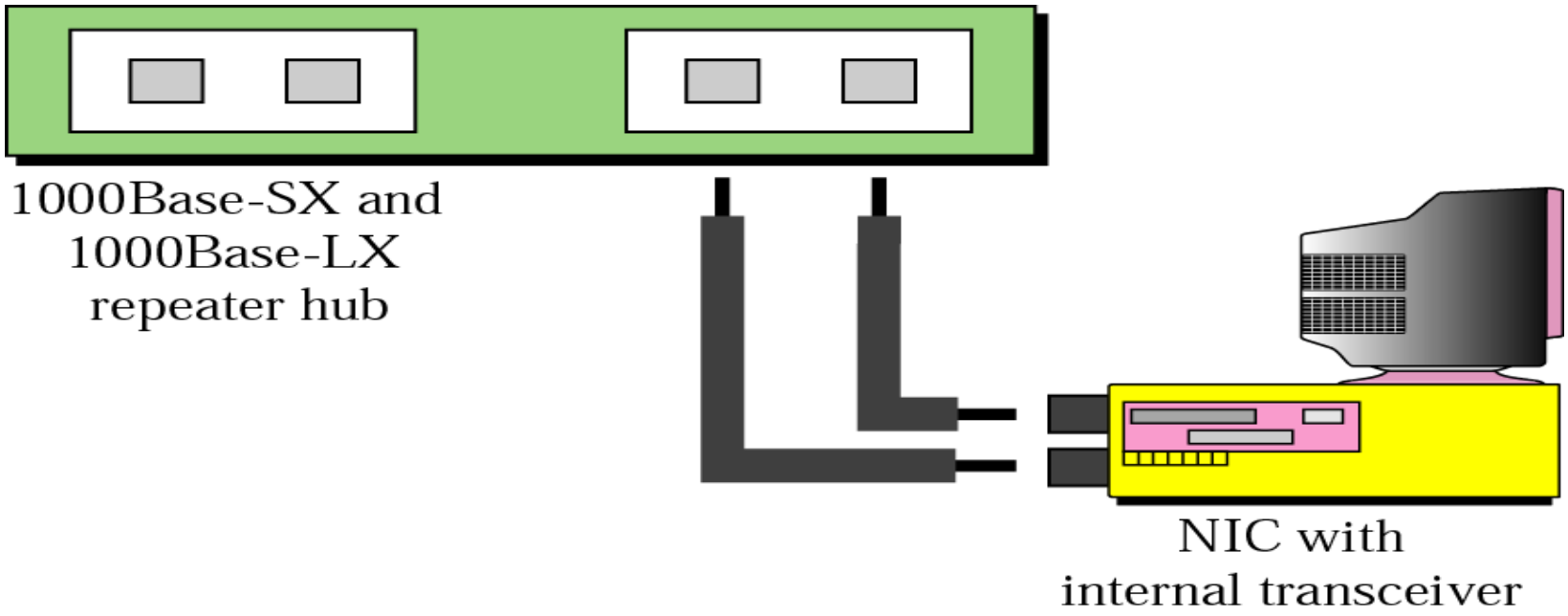
Gigabit and Metro Ethernet

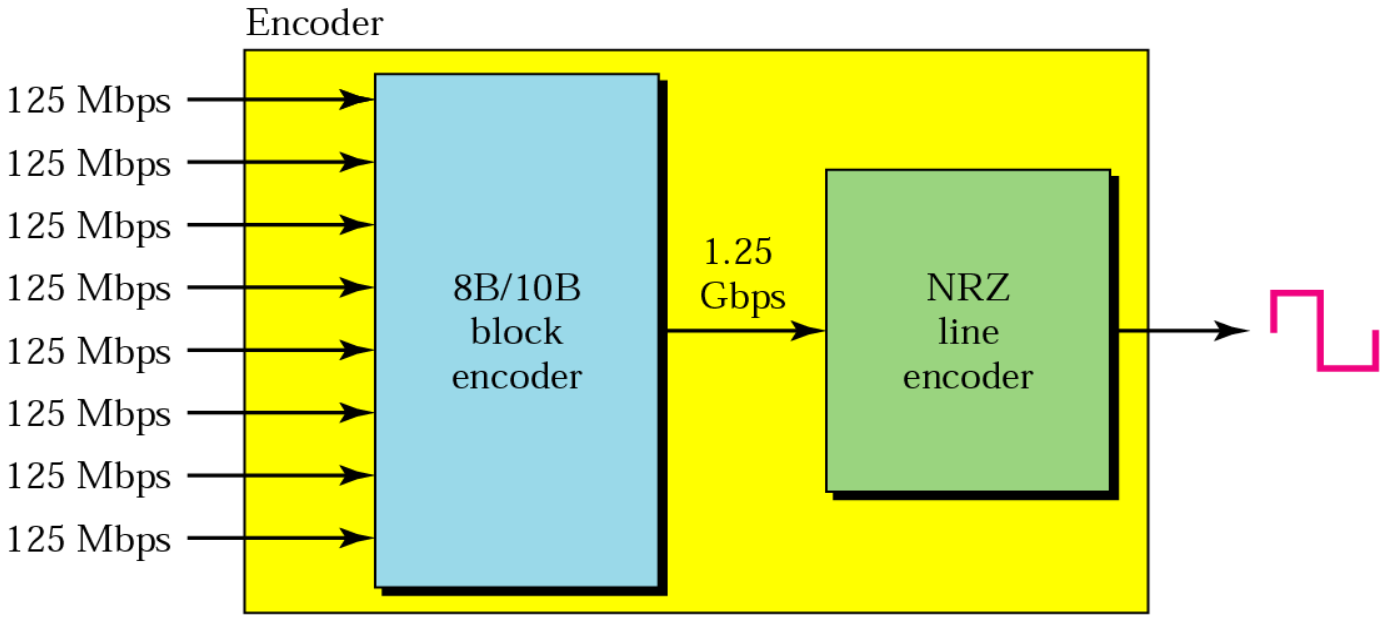
КАБЕЛЬ	**ТАЙЛБАР**
1000BaseCX (1,000Mbps)	**Twin-axial cable** (Copper Based), 25 Meters 9-pin High Speed Serial Data Connector (HSSDC) Note: It could only stretch 25 meters (very, very short)
1000BaseSX (1,000Mbps)	S=Short, Multi-mode, 500/550 meters 850nm LED
1000BaseLX (1,000Mbps)	L=Long, Single-mode, 2000 meters 1300nm Laser
10GBaseSR (10,000Mbps)	S=Short, Multi-mode, 300 meters
10GBaseLR (10,000Mbps)	L=Long, Single-mode, 10 km (1310 nanometer laser)
10GBaseER (10,000Mbps)	E=Extended, Single-mode, 40 Kilometers (1550 nanometer laser)

Physical Layer in Gigabit Ethernet

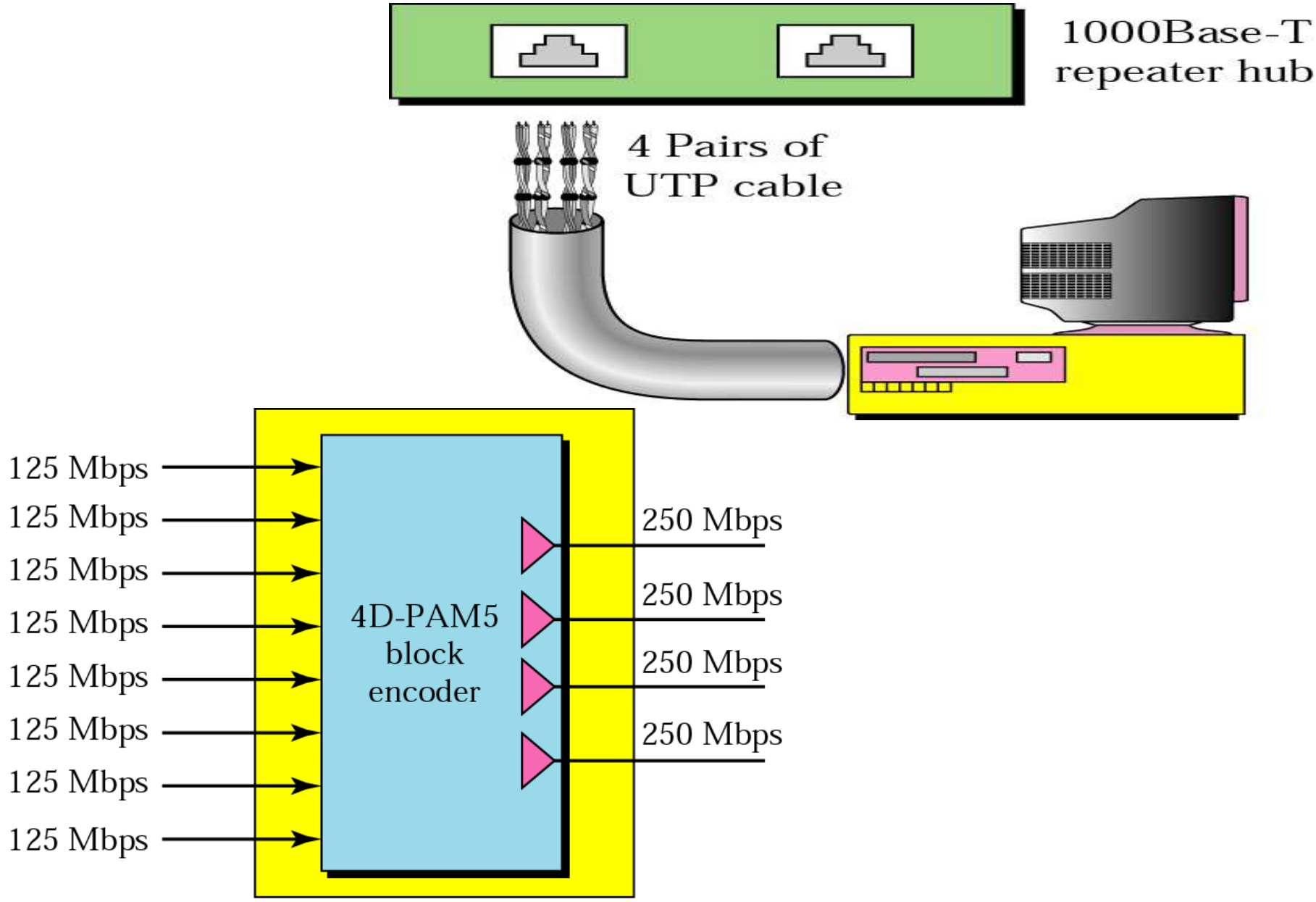


1000BaseSX, 1000BaseLX; Encoding/Decoding





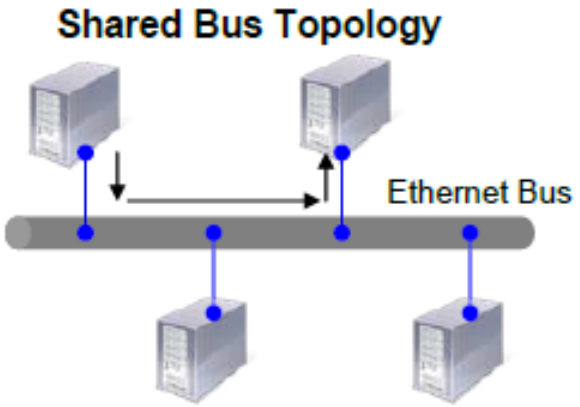
1000BaseT, Encoding/Decoding



Дүгнэлт

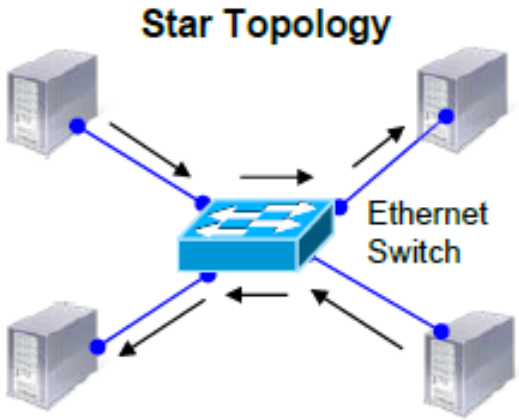
Original Ethernet – Shared Bus Topology

- Single Coaxial bus
- Half duplex operation
- Media contention managed using CSMA/CD protocol
- Low utilization



Today: Star Topology

- Point-to-Point connections
- Full Duplex operation
- No Media contention
- Higher Aggregate bandwidth



Modern implementations of Ethernet are all Switched