

Ethernet a 10Mbps y Hubs

Area de Ingeniería Telemática
<http://www.tlm.unavarra.es>

Grado en Ingeniería en Tecnologías de
Telecomunicación, 3º

Temario

1. Introducción
2. **Tecnologías LAN**
 - **Tecnologías Ethernet**
 - Conmutación Ethernet
 - VLANs
 - Spanning Tree Protocol
 - Otros mecanismos en LANs Ethernet
 - WiFi
 - Diseño de redes campus
3. Tecnologías WAN
4. Redes de acceso

Objetivos

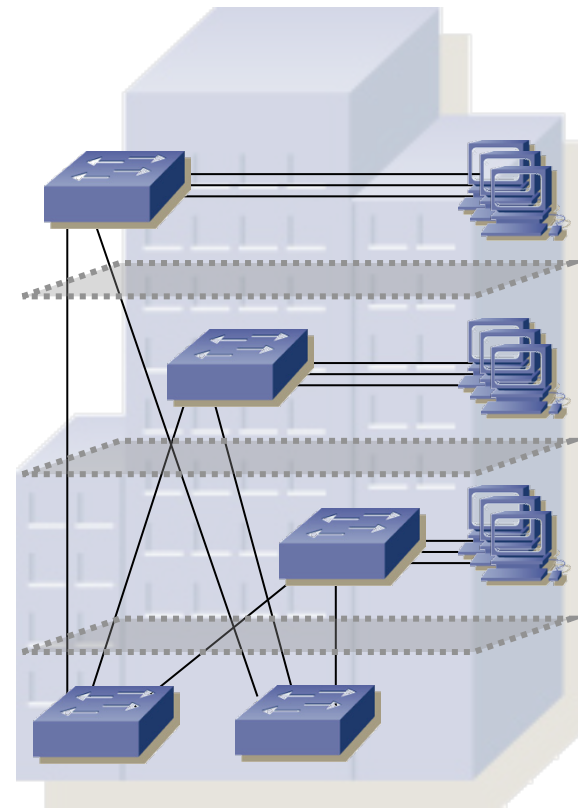
- Recordar el funcionamiento de la Ethernet original
- Recordar los formatos de tramas
- Entender el funcionamiento de un hub
- Comprender los límites de la Ethernet a 10 Mbps

Contenido

- Ethernet 10Mbps
- Formatos de trama
- Evolución del medio físico
- Equipos activos: hubs

Local Area Networks (LANs)

- Son redes privadas
 - Principalmente para **datos**
 - **Voz usa otra red en paralelo** (hasta llegar VoIP)
 - “*Conmutación de paquetes*”
 - Se limitan a un edificio o una zona local (1 ó 2Km)
 - Velocidades 10 - 1000Mbps
 - Conectan workstations, periféricos, terminales, etc
 - Muchos usuarios
 - Se producen pocos errores
 - Suelen ser tecnologías basadas en medios de *broadcast*
- Tecnologías: Ethernet, WiFi, Token Ring, Token Bus, etc



Ethernet

- Tecnología de LAN ampliamente extendida
- Simple de instalar
- Barata
- Múltiples medios físicos (coaxial, par trenzado, fibra)
- Ha ido aumentando su velocidad (10Mbps-100Gbps)
- Se ha extendido fuera de la LAN



Ethernet “original”

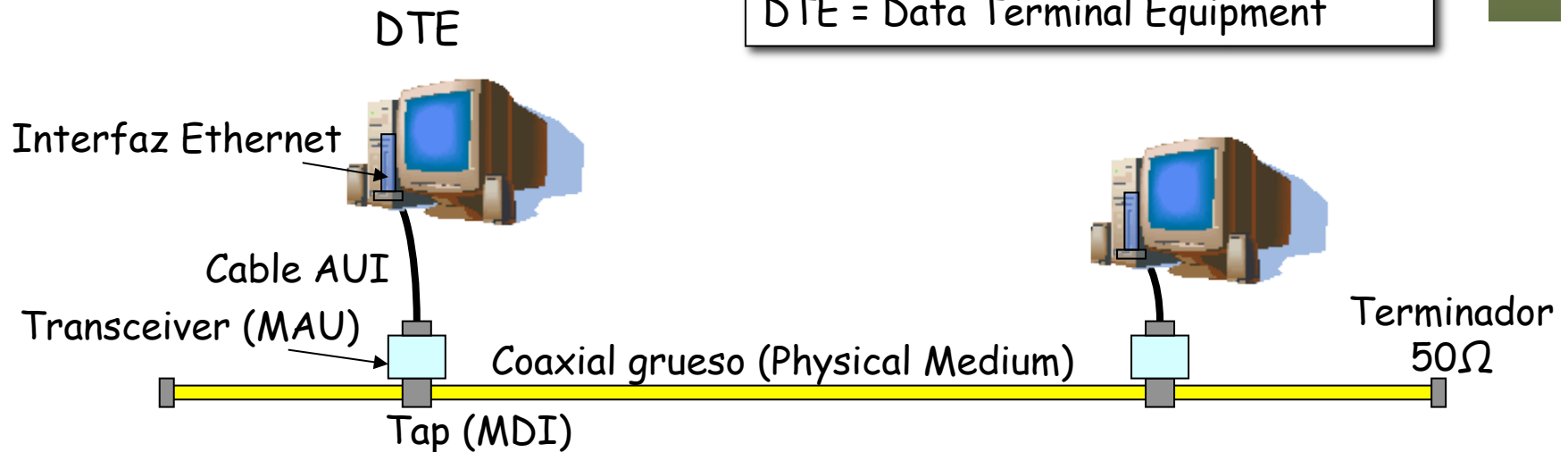
10Base5

- “Thick Ethernet”
- Coaxial grueso (amarillo)
- 5 → 500m (entre repetidores)



Bob Metcalfe

MAU = Medium Attachment Unit
MDI = Medium Dependent Interface
AUI = Attachment Unit Interface
DTE = Data Terminal Equipment



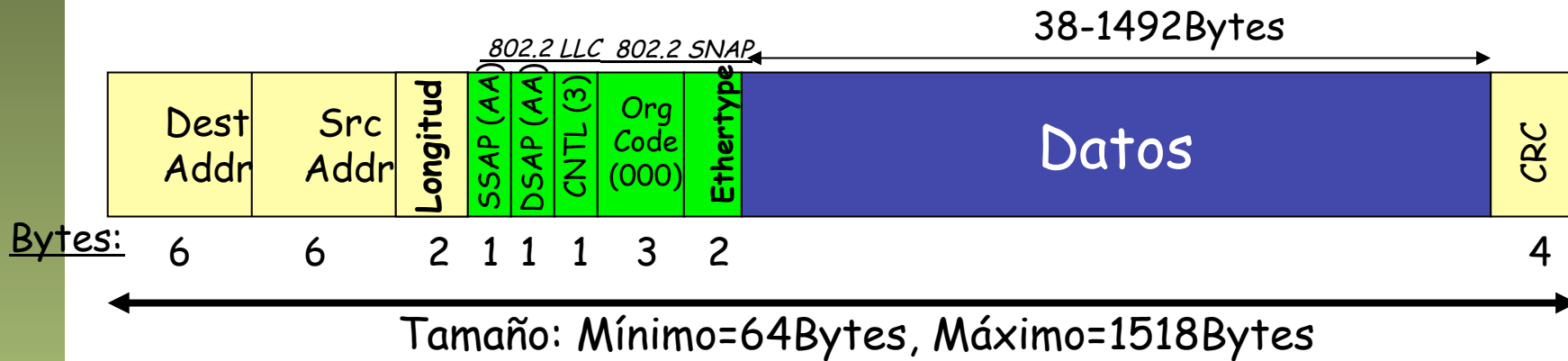
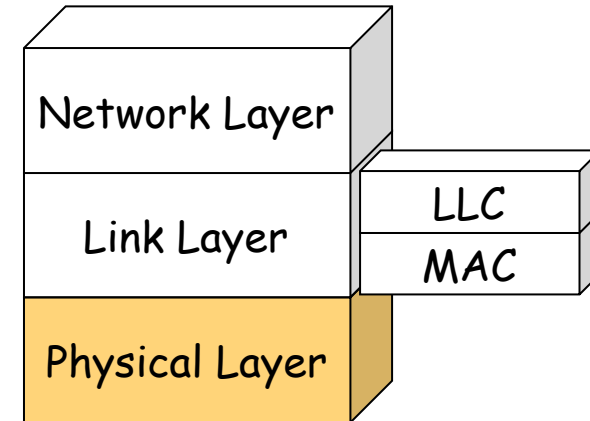
Nivel MAC

- PDU del nivel de enlace = Trama (*Frame*)
- Formato de la trama (estándar DIX)
 - Direcciones MAC
 - *Ethertype*
 - Datos
 - CRC
- Hoy en día recogido también en el IEEE 802.3



Trama IEEE

- IEEE 802.3 + 802.2 (LLC/SNAP)
- Campo de **Longitud** (hace referencia a todo lo que le sigue, sin contar el CRC)
- Los *Ethertype* son > 1500 por lo que ambos formatos son compatibles
- IP sobre 802 en RFC 1042



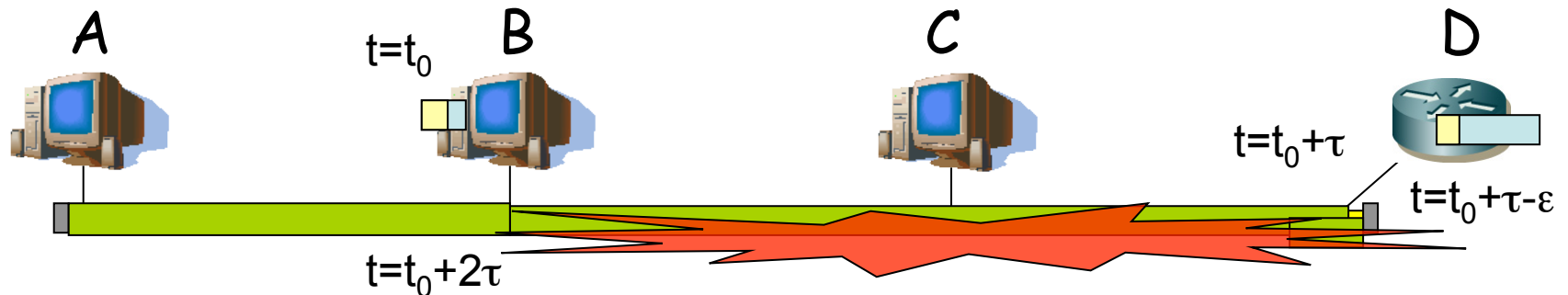
DIX (Ethernet II)



Subnivel MAC

Tamaño mínimo de trama

- Emisor hace CD solo mientras transmite
- ¿Hacer CD hasta que el primer bit llegue a la estación más lejana y ya se haya producido colisión o no vaya a haber ya? (...)
- $diámetro_máximo = \tau \cdot veloc_propag$
- Peor caso: trama mínima y colisión a la máxima distancia
- Colisión además debe llegar hasta el emisor (... ..)
- *Collision window (slot time)*
- $2\tau = trama_mínima / velocidad_tx = trama_mínima / 10Mbps$



Subnivel MAC

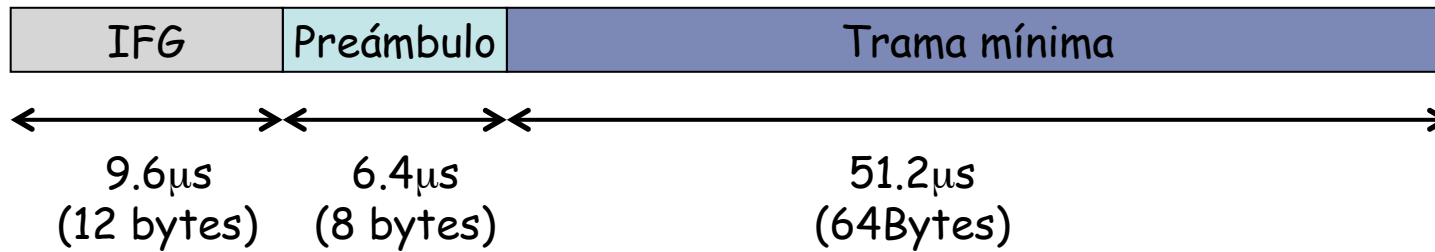
- Máximo 2500 m
- Mínimo 64 Bytes de trama
- Dominio de Colisión: una red CSMA/CD en la cual habrá una colisión si dos máquinas conectadas al sistema transmiten “al mismo tiempo”
- Con alta carga se disparan las colisiones

Tamaño de trama (bytes)	Tiempo de Tx (μseg)
64	51.2
512	409.6
1000	800
1518	1214.4



Frame rate

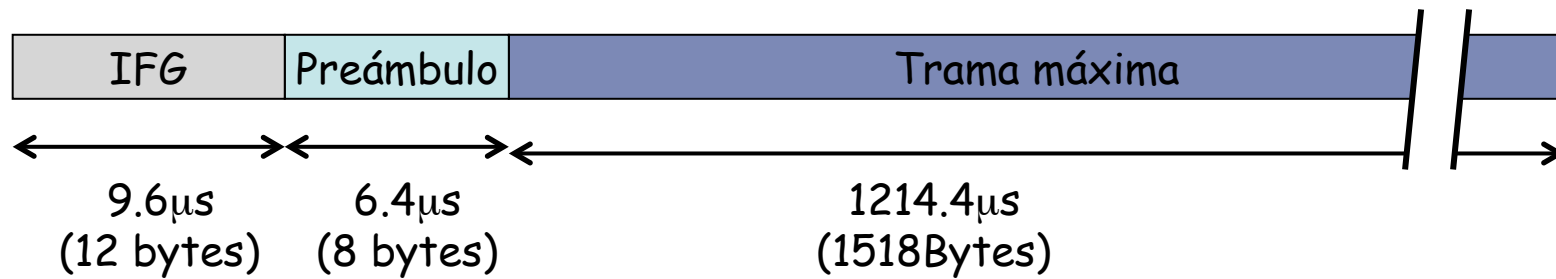
- ¿Máximo número de tramas por segundo?
(. . .)



IFG = Inter Frame Gap

Frame rate

- ¿Mínimo número de tramas por segundo ocupando toda la capacidad? (. . .)

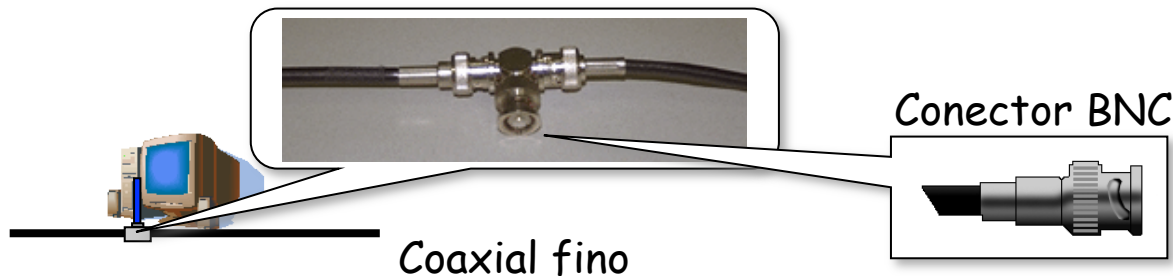
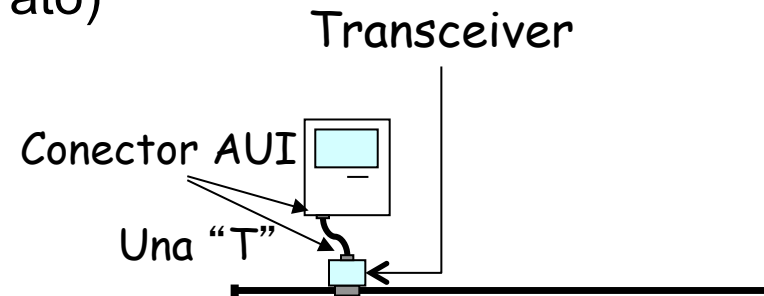


IFG = Inter Frame Gap

Tecnologías Ethernet

10Base2

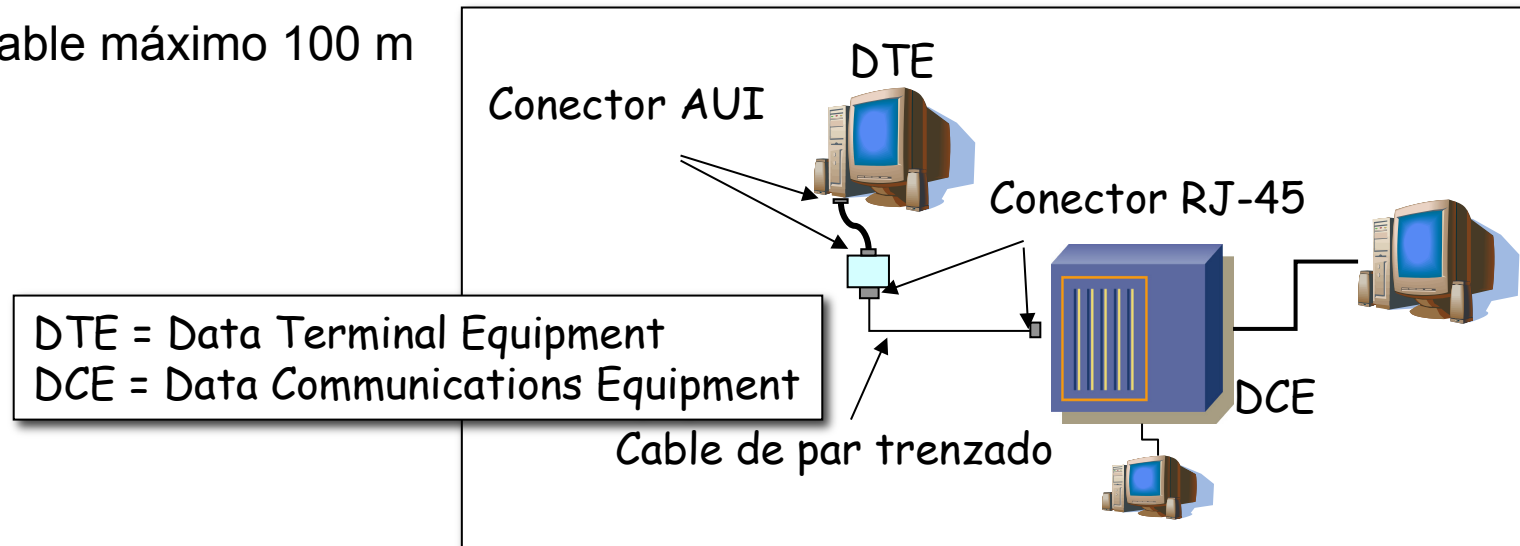
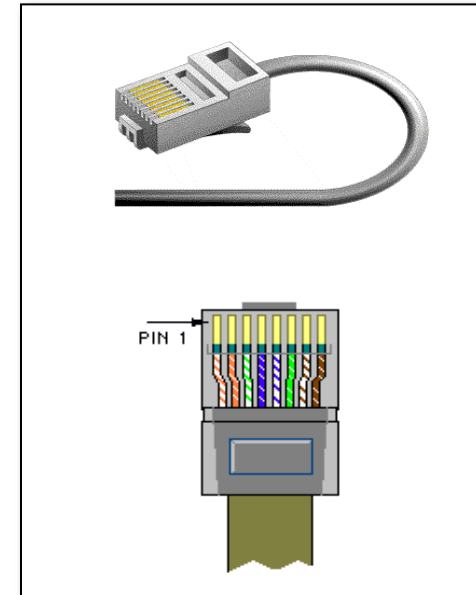
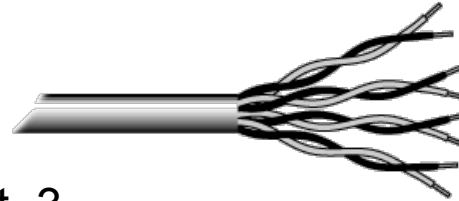
- “Thinnet” o “Cheapernet”
- IEEE 802.3a
- Coaxial fino y flexible (negro)
- 2 → 185m (entre repetidores)
- Transceiver opcional (más barato)



Tecnologías Ethernet

10Base-T

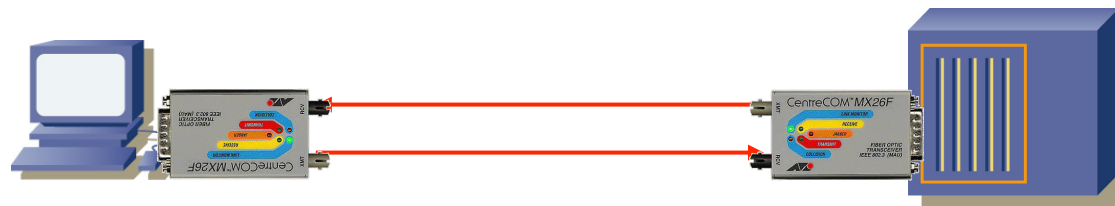
- IEEE 802.3i
- Cables de par trenzado cat. 3
- Topología física en estrella
 - Elemento central = “Hub”
- Topología lógica en bus
- Transceiver opcional
- Conector RJ-45
- Cable máximo 100 m



Tecnologías Ethernet

10BaseFL

- Fibra óptica multimodo (50 o 62.5 μm)
- IEEE 802.3j
- Inmune a interferencias electromagnéticas
- Hasta 2 Km
- Usado en:
 - El *backbone* de una LAN
 - Cableado vertical
 - Larga distancia a un host



AUI to 10BASE-FL transceiver y Media converter

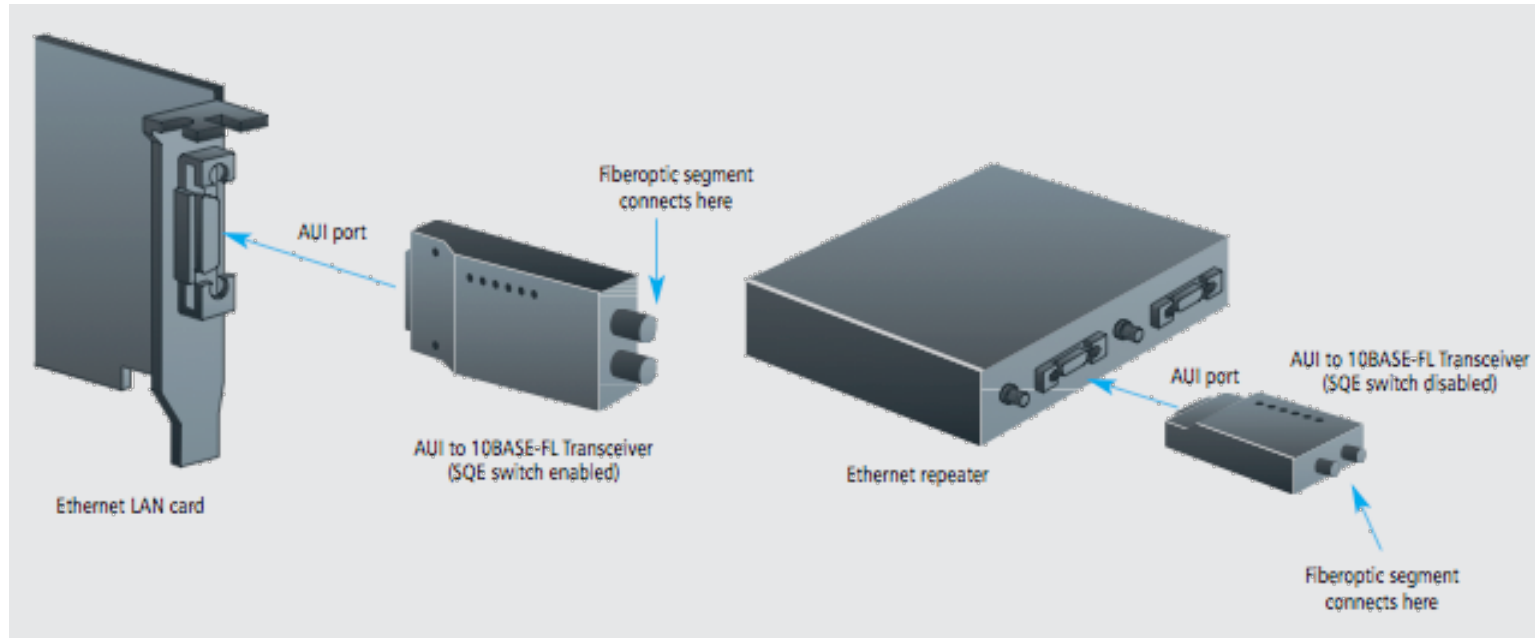


LE1603A



LMC001A-R5

AUI to 10BASE-FL transceiver



OVERVIEW

AUI Transceivers provide a way to connect legacy Ethernet devices to ThinNet (10BASE2) or 10BASE-FL cabling.

The AUI to BNC Transceiver (LE1601A) enables you to connect a legacy Ethernet device with an AUI connector to Thin Ethernet coaxial cable. It extends coaxial cable segments up to 606.8 feet (185 m) without a repeater. This transceiver complies with the 10BASE2 specification for Thin Ethernet networks.

Or connect your legacy Ethernet device to a multimode 10BASE-FL fiberoptic network or device using the AUI to 10BASE-FL Transceiver (LE1603A). The 10BASE-FL segments can be up to 1.2 miles (1.9 km) long. The LE1603A fits the requirements of the 10BASE-FL Ethernet standard.

On the AUI side of the transceivers, you can use a standard AUI cable (50 feet [15.2 m] long) to connect to the Ethernet device, or you can directly mount the transceiver to the DTE.

Both models feature an SQE (Signal Quality Error) switch that enables or disables Signal Quality Error (heartbeat). SQE must be enabled when connecting the transceiver to a LAN card, bridge, or router. This test must be disabled when connecting to a hub or repeater. The BNC model has a 2-position slide switch that sets SQE. On the fiber model, SQE is set via a 4-position DIP switch.

LEDs tell you network status at a glance. The AUI to 10BASE-FL Transceiver also features a link integrity test that automatically checks fiberoptic cables.

AUI to 10BASE-FL transceiver

TECH SPECS

Maximum Cable Segment Distance —

Both models: AUI port: Up to 50 ft. (15.2 m);

LE1601A: Coaxial: Up to 606.8 ft. (185 m);

LE1603A: Fiber: Up to 1.2 mi. (1.9 km)

Speed — 10 Mbps

Standards —

LE1601A: IEEE 802.3 10BASE2;

LE1603A: IEEE 802.3 10BASE-FL

User Controls — LE1601A: (1) SQE slide switch;

LE1603A: (1) 4-position DIP switch (SQE, Link Alert, Link, and Full Duplex)

Connectors — LE1601A: (1) DB15 AUI M, (1) BNC F;

LE1603A: (1) DB15 AUI M, (2) ST*

Indicators — LE1601A: (2) LEDs: (1) Power, (1) SQE;

LE1603A: (6) LEDs: (1) Power, (1) Link, (1) Transmit, (1) Receive,

(1) Collision, (1) Full Duplex

Temperature Tolerance —

Operating: 32 to 122°F (0 to 50°C);

Storage: -40 to +212°F (-40 to +100°C)

Relative Humidity — Operating: 8 to 80%, noncondensing;

Storage: 5 to 98%, noncondensing

Power — From the AUI interface

Size — LE1601A: 0.8"H x 1.6"W x 3.8"D (2 x 4.1 x 9.7 cm);

LE1603A: 0.8"H x 1.6"W x 3.4"D (2 x 4.1 x 8.6 cm)

Weight — 0.2 lb. (<0.1 kg)

WHAT'S INCLUDED

- ◆ (1) AUI to BNC or 10BASE-FL Transceiver
- ◆ (1) BNC "T" connector (included with LE1601A only)
- ◆ (1) Users' manual

Item	Code
AUI to BNC Transceiver	LE1601A
AUI to 10BASE-FL Transceiver	LE1603A
You might also need...	
Ethernet Transceiver Cable (Office Environment)	
Stranded Copper Connectors, Double Shielded	LCN215
ThinNet Cable (NEC® CL2 & CL2P), PVC	LCN300
Ceramic Terminated Multimode Fiber Optic Cable, ST-SC, Duplex, Riser	EFN4010

Media converter



LMC001A-R5

OVERVIEW

Compact Media Converters are low cost, fixed configuration media converters. Converters with 10-Mbps modules provide a single conversion between 10BASE-T and either 10BASE2 (ThinNet) or multimode or single-mode fiber. Converters with 100-Mbps modules provide conversion between 100BASE-TX and either 100BASE-SX multimode fiber or 100BASE-FX multimode or single-mode fiber.

At only 1U high, these units are extremely compact. All selectable features are externally accessible, and each port includes diagnostic LEDs. Twisted-pair ports feature a straight-through/crossover switch. BNC ports feature a termination switch.

An autosensing power supply is built into each converter, so there's no need to buy any additional equipment.

To assist you in pinpointing link faults between media-conversion products, the media converters feature LinkLoss™ and FiberAlert™.

When the fiber segment has a link fault, LinkLoss passes the fault to the twisted-pair segment and drops the twisted-pair link LED.

When a fiber optic receive fault is detected, FiberAlert makes the link LED for the opposite end of the fiber conversion pulse, indicating that there's a problem and eliminating "silent failures."

You can enable or disable LinkLoss/FiberAlert via a DIP switch located on the bottom of any converter unit.

The LMC009A-R4 includes two external switches, one that selects termination on the BNC port and one that selects crossover for the UTP port. The other converters include an external MDI-X switch for selecting crossover or passthrough twisted-pair connections on the UTP port.

Media converter

TECH SPECS

Approvals — UL®, cUL, CE, RoHS

Full-Duplex Distance (maximum) —

LMC001A-R5–LMC004A-R5, LMC007A-R5–LMC008A-R5, LMC009A-R4:
 10BASE-T link: 100 m (328 ft.);
 LMC001A-R5–LMC002A-R5, LHC001A-R4–LHC002A-R4, LHC009A-R3:
 Fiber link: 2 km (1.2 mi.);
 LMC003A-R5–LMC004A-R5: Fiber link: 10 km (6.2 mi.);
 LMC007A-R5–LMC008A-R5: Fiber link: 40 km (24.9 mi.);
 LMC010A–LMC011A: Fiber link: 80 km (49.7 mi.);
 LMC012A: Fiber link: 100 km (62.1 mi.);
 LMC009A-R4: 10BASE2 link: 185 m (607 ft.);
 LHC008A-R3–LHC009A-R3: Fiber link: 300 m (984.3 ft.);
 LHC001A-R4–LHC002A-R4, LHC005A-R4–LHC006A-R4,
 LHC008A-R3–LHC009A-R3: 100BASE-TX link: 100 m (328 ft.);
 LHC005A-R4–LHC006A-R4: Fiber link: 40 km (24.9 mi.);
 LHC037A–LHC039A: Fiber link: 80 km (49.7 mi.)

Heat Generated (Maximum) — 30 BTU/hour

Wavelength —

LMC001A-R5–LMC002A-R5: 850 nm multimode;
 LMC003A-R5–LMC004A-R5, LHC001A-R4–LHC002A-R4,
 LHC008A-R3–LHC009A-R3: 1300 nm multimode;
 LMC007A-R5–LMC008A-R5, LHC005A-R4–LHC006A-R4,
 LHC037A–LHC038A: 1300 nm single-mode;
 LHC039A: 1550 nm single-mode

Connectors — LMC009A-R4: (1) RJ-45 (shielded), (1) BNC F;
 All others: (1) RJ-45 (shielded), (1) ST® or SC

Indicators —

LMC001A-R5–LMC004A-R5, LMC007A-R5–LMC008A-R5,
 LHC008A-R3–LHC009A-R3, LHC001A-R4–LHC002A-R4,
 LHC005A-R4–LHC006A-R4, LHC037A–LHC039A: Fiber Receive,
 Twisted-Pair Link, Fiber Alert, Fiber Link;
 LMC009A-R4: Twisted-Pair Receive, Twisted-Pair Link, BNC Collision,
 BNC Receive

Temperature —

Operating: 32 to 104°F (0 to 40°C);
 Storage: 22 to 160°F (-5 to +71°C)

Humidity Tolerance — 5 to 95%, noncondensing

Power —

LMC001A-R5–LMC004A-R5, LMC007A-R5–LMC008A-R5, LMC009A-R4,
 LHC008A-R3–LHC009A-R3, LHC037A–LHC039A: 110–240 VAC,
 50–60 Hz, internal, autosensing;
 LHC001A-R4–LHC002A-R4, LHC005A-R4–LHC006A-R4:
 95–240 VAC, 50–60 Hz, 0.1/0.5 A, internal, autosensing

Size — 1.5"H x 4.7"W x 4.4"D (3.8 x 11.9 x 11.2 cm)

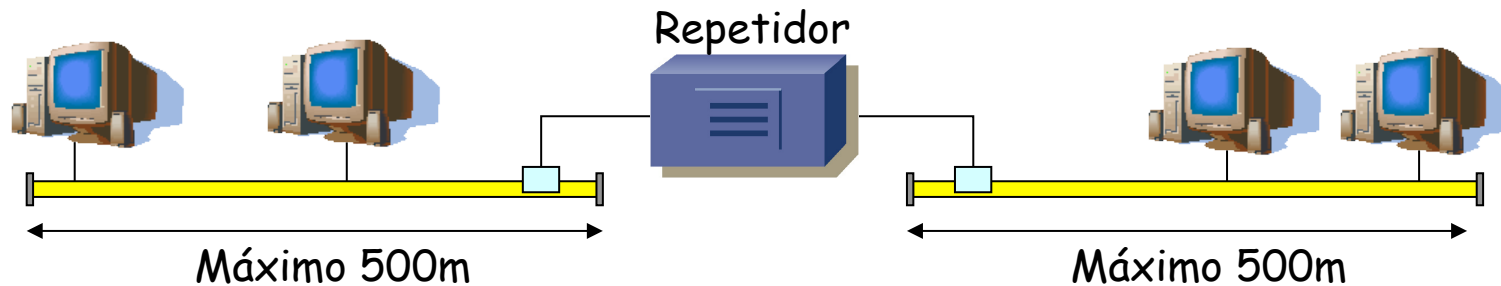
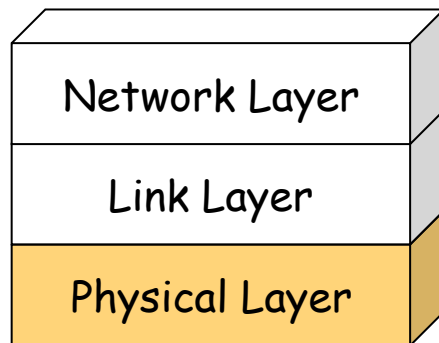
Weight — 2 lb. (0.9 kg)



LMC001A-R5

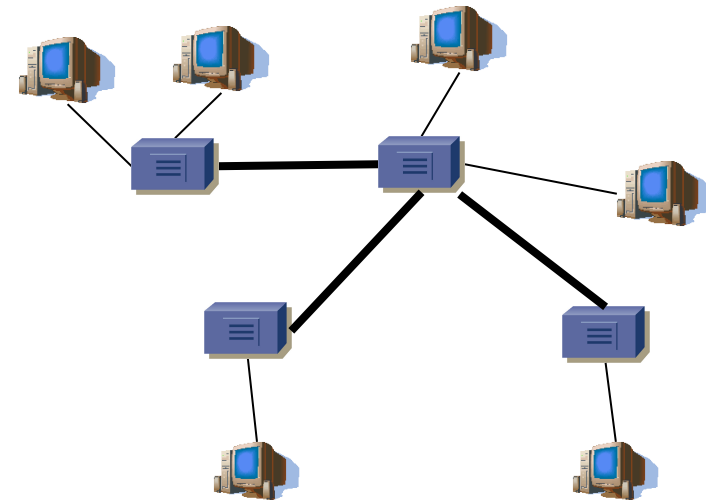
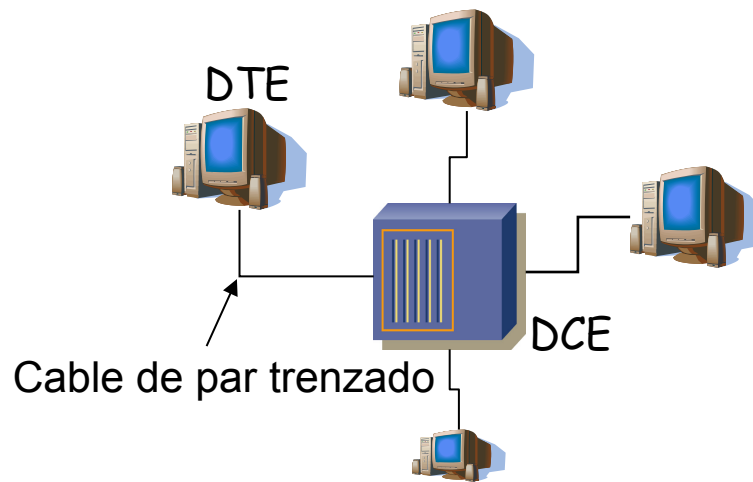
Repetidores

- “Repetidor”
- “Hub”
- “Hub repetidor”
- “Concentrador”
- “Concentrador de cableado”
- Nivel 1 OSI (nivel físico)
- Regeneración de la señal eléctrica
- No tienen direcciones MAC
- No modifican las tramas
- En desuso, difíciles de encontrar
- Su función la hacen switches
- Ofrecían medio compartido interesante para captura de tráfico



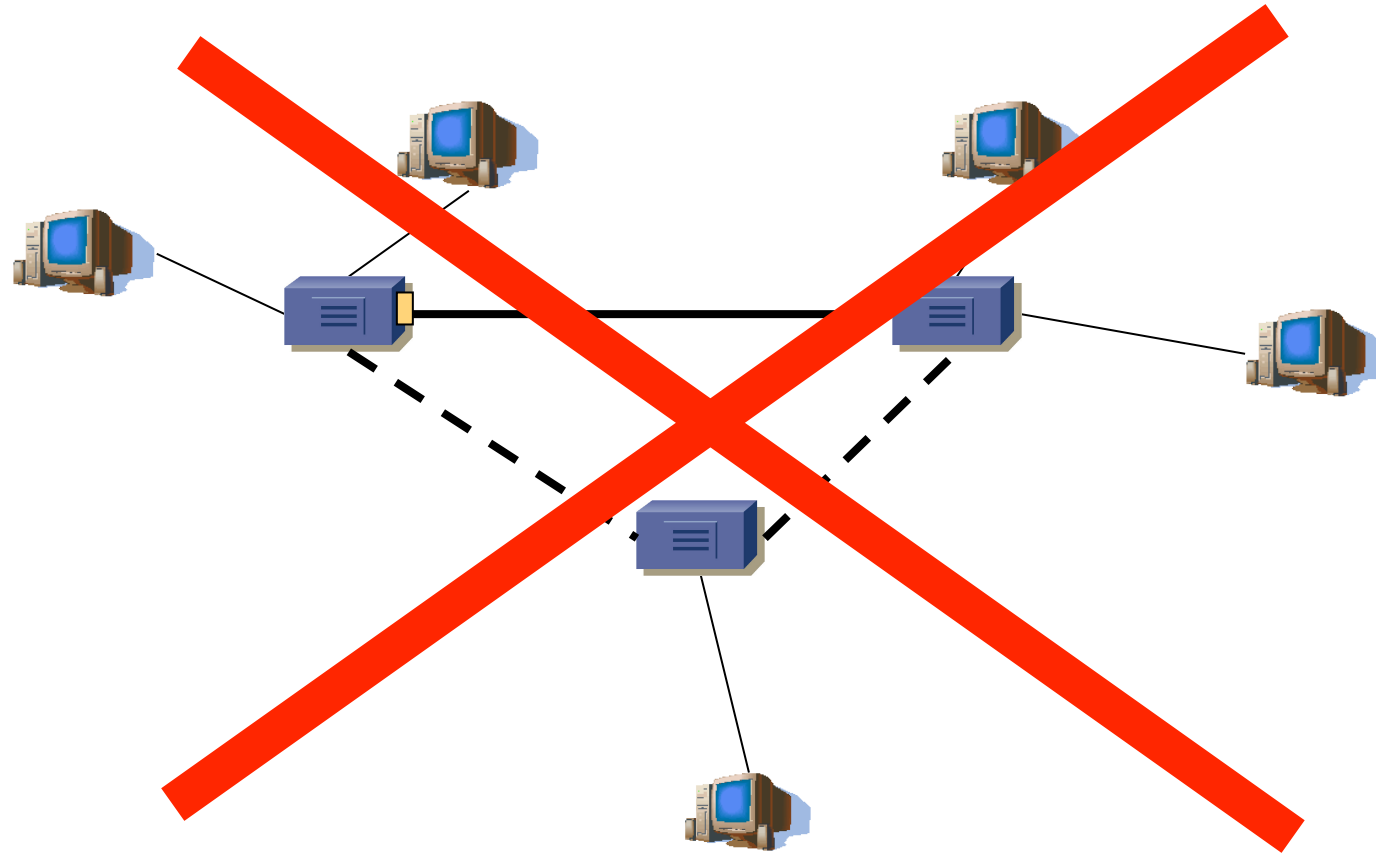
Hubs y 10Base-T

- Topología física en estrella
- Topología lógica en bus
- Topología física estrella extendida
- Límite en el número de ellos en el camino (aproximadamente 5)



Conexión de Hubs

- Nunca nunca nunca... forme un bucle



Resumen

- Formato de trama DIX
- Formato de trama IEEE con 802.2
- Máximo 14.880 pps
- 10Mbps sobre coaxial grueso y fino, par trenzado y fibra óptica
- Topología física en bus o en estrella
- Topología lógica en bus
- Limitada en host, distancia y número de repetidores