



DECSAI

Departamento de Ciencias de la Computación e I.A.

Universidad de Granada



Redes de área local

Transmisión de datos y redes de ordenadores

Redes de área local



Topologías

Estándares IEEE 802

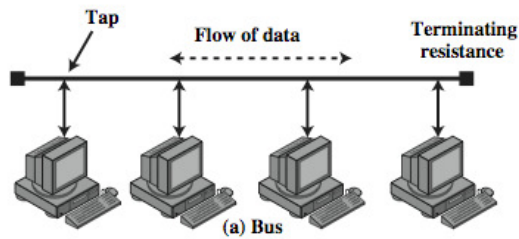
- IEEE 802.3 Ethernet
- IEEE 802.5 Token Ring
- IEEE 802.11 Wi-Fi
- IEEE 802.16 WiMAX

Interconexión de redes

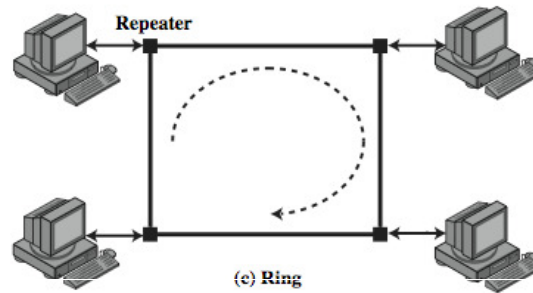
Apéndice: IEEE 802.2 LLC



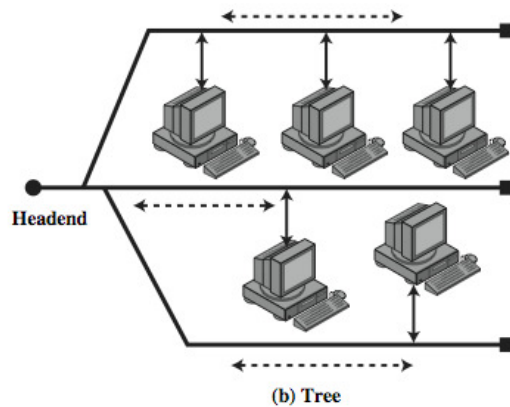
Topologías de red



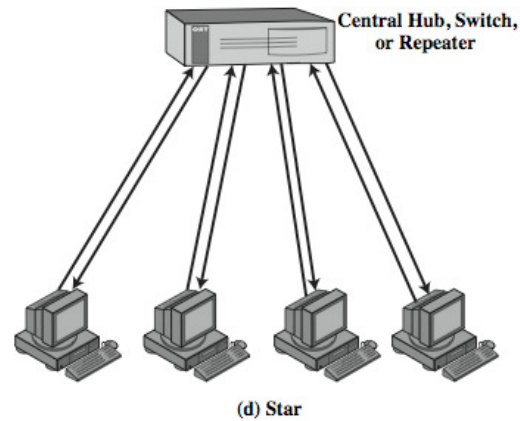
(a) Bus



(c) Ring



(b) Tree



(d) Star



Topologías de red



Bus y árbol

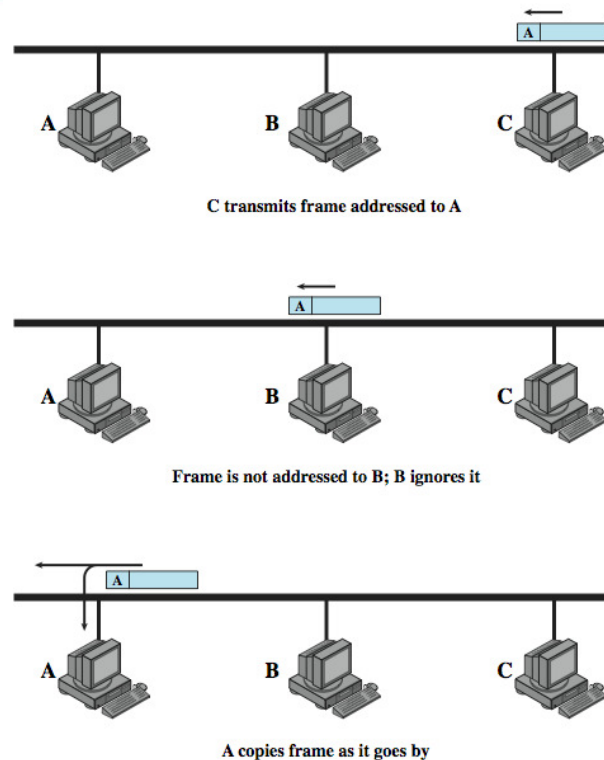
Ethernet (IEEE 802.3), Token Bus (IEEE 802.4), DQDB (IEEE 802.6)...

- Conexiones multipunto.
- Se necesita regular la transmisión (colisiones).
- Los terminadores absorben las tramas al final del medio.

NOTA: El bus es un caso especial de árbol.



Topologías de red



Topologías de red



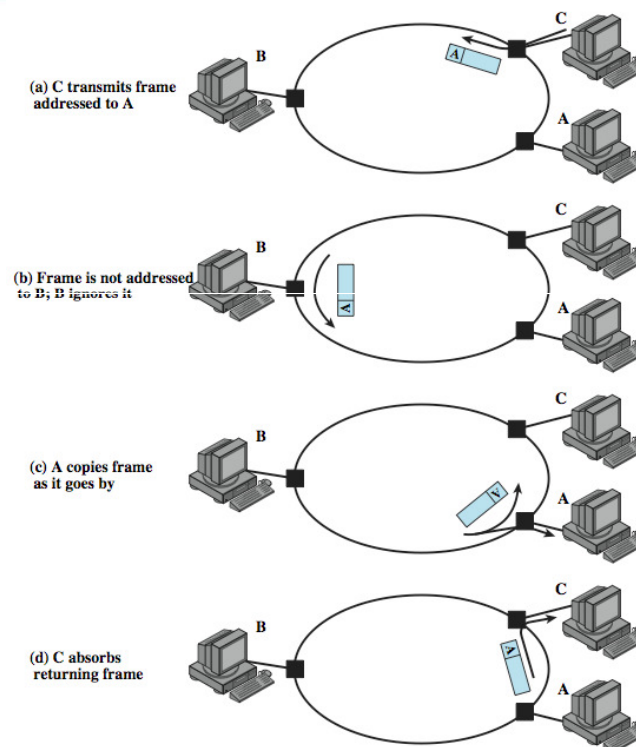
Anillo

IBM Token Ring, FDDI [Fiber Distributed Data Interconnect]...

- Conexiones punto a punto con repetidores.
- Hosts conectados a los repetidores.
- Enlaces unidireccionales.
- Las tramas van pasando por todos los hosts.
- El destinatario reconoce su dirección y copia la trama.
- La trama circula hasta llegar al emisor, que la retira de la red.



Topologías de red



Topologías de red



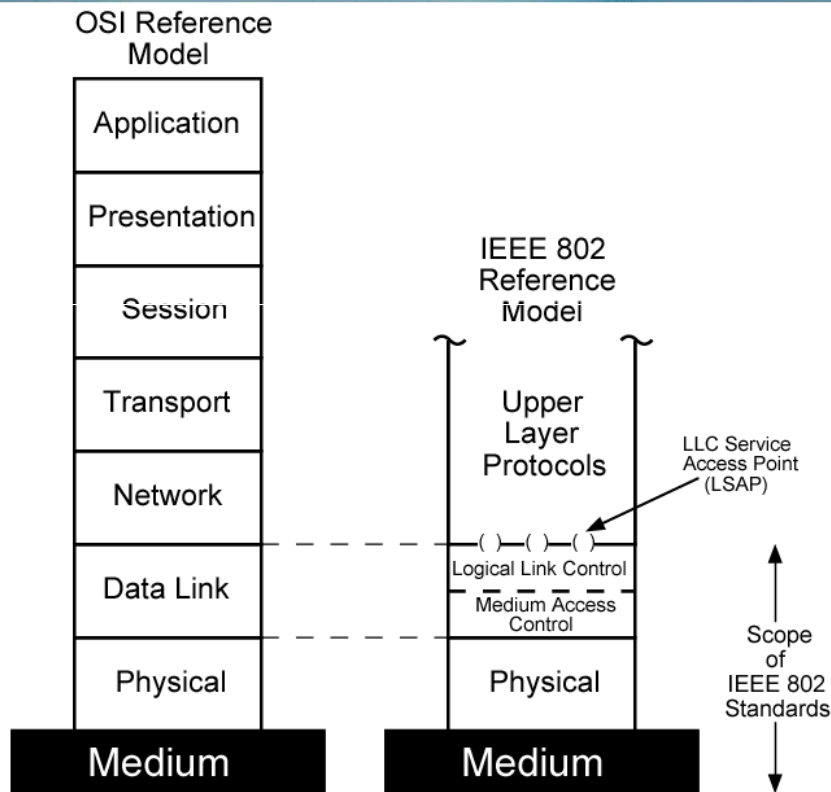
Estrella

vg: ATM

- Cada host tiene una conexión punto a punto con el nodo central.
- El nodo central retransmite las tramas a todos los hosts, formando un bus desde el punto de vista lógico.



IEEE 802



IEEE 802



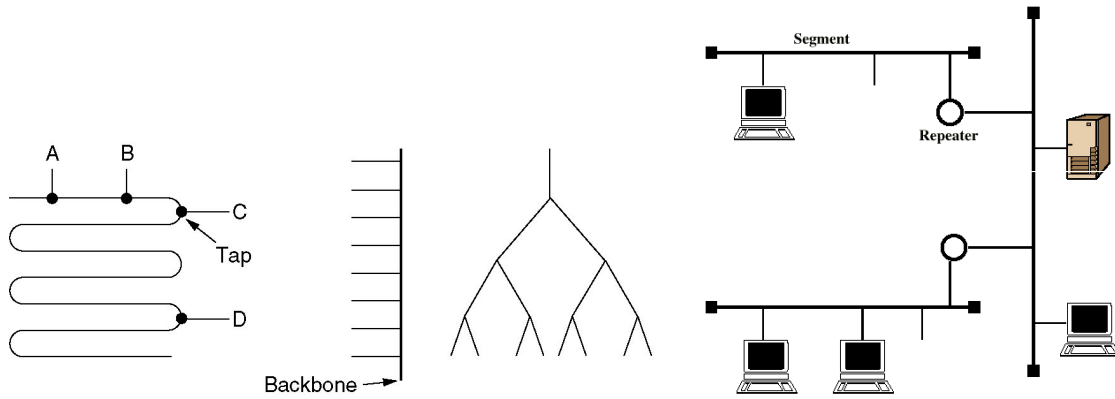
Number	Topic
802.1	Overview and architecture of LANs
802.2 ↓	Logical link control
802.3 *	Ethernet
802.4 ↓	Token bus (was briefly used in manufacturing plants)
802.5	Token ring (IBM's entry into the LAN world)
802.6 ↓	Dual queue dual bus (early metropolitan area network)
802.7 ↓	Technical advisory group on broadband technologies
802.8 †	Technical advisory group on fiber optic technologies
802.9 ↓	Isochronous LANs (for real-time applications)
802.10 ↓	Virtual LANs and security
802.11 *	Wireless LANs
802.12 ↓	Demand priority (Hewlett-Packard's AnyLAN)
802.13	Unlucky number. Nobody wanted it
802.14 ↓	Cable modems (defunct: an industry consortium got there first)
802.15 *	Personal area networks (Bluetooth)
802.16 *	Broadband wireless
802.17	Resilient packet ring



IEEE 802.3 Ethernet



Topología



Lineal

Dorsal

Árbol

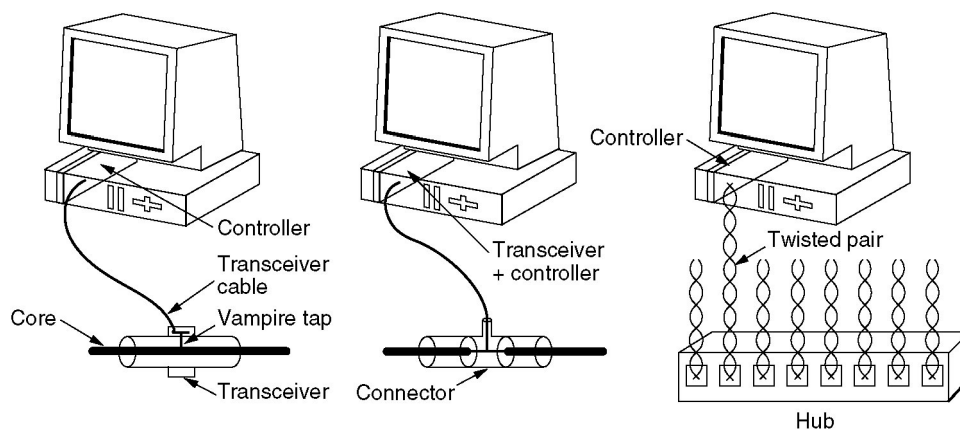
Segmentos



IEEE 802.3 Ethernet



Cableado



10-Base-5

10-Base-2
"Cheapernet"

10-Base-T

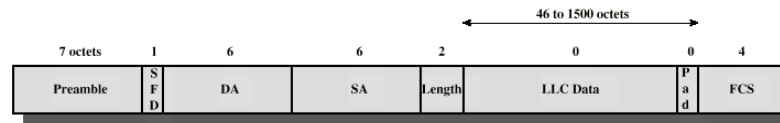


IEEE 802.3 Ethernet



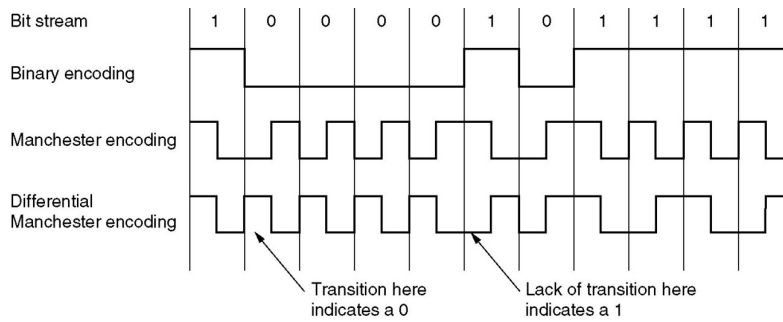
Transmisión de datos

Trama



SFD = Start of frame delimiter
 DA = Destination address
 SA = Source address
 FCS = Frame check sequence

Codificación Manchester (10Mbps) vs. 4B/5B u 8B6T (100Mbps)



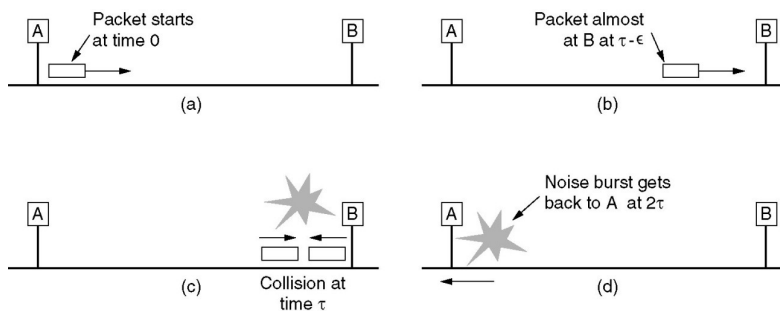
IEEE 802.3 Ethernet



Transmisión de datos

Detección de colisiones

CSMA/CD [Carrier Sense Multiple Access with Collision Detection]



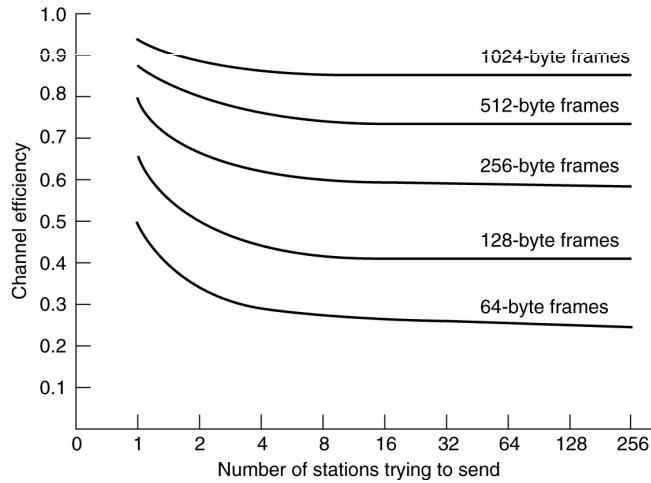
IEEE 802.3 Ethernet



Transmisión de datos

Detección de colisiones

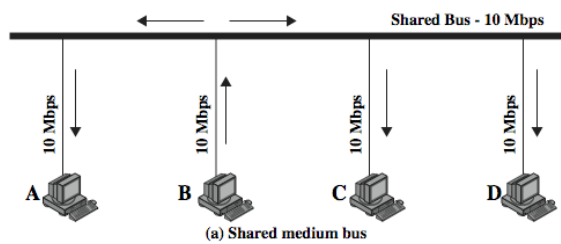
CSMA/CD [Carrier Sense Multiple Access with Collision Detection]



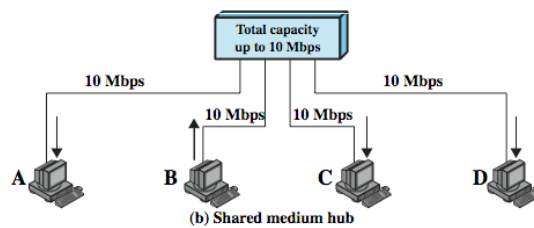
Ethernet 10Mbps



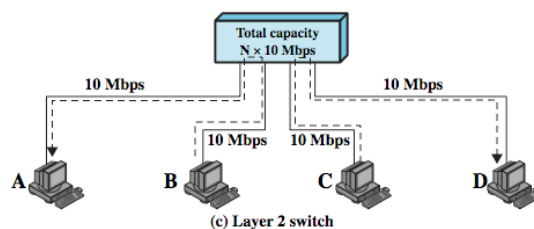
IEEE 802.3 Ethernet



Bus



Hub



Switch



IEEE 802.3 Ethernet



10 Mbps Ethernet

	10BASE5	10BASE2	10BASE-T	10BASE-FP
Transmission medium	Coaxial cable (50 ohm)	Coaxial cable (50 ohm)	Unshielded twisted pair	850-nm optical fiber pair
Signaling technique	Baseband (Manchester)	Baseband (Manchester)	Baseband (Manchester)	Manchester /on-off
Topology	Bus	Bus	Star	Star
Maximum segment length	500 m	185 m	100 m	500 m
Nodes per segment	100	30	—	33
Cable diameter	10 mm	5 mm	0.4 to 0.6 mm	62.5/125 μ m



IEEE 802.3 Ethernet



100 Mbps "Fast Ethernet"

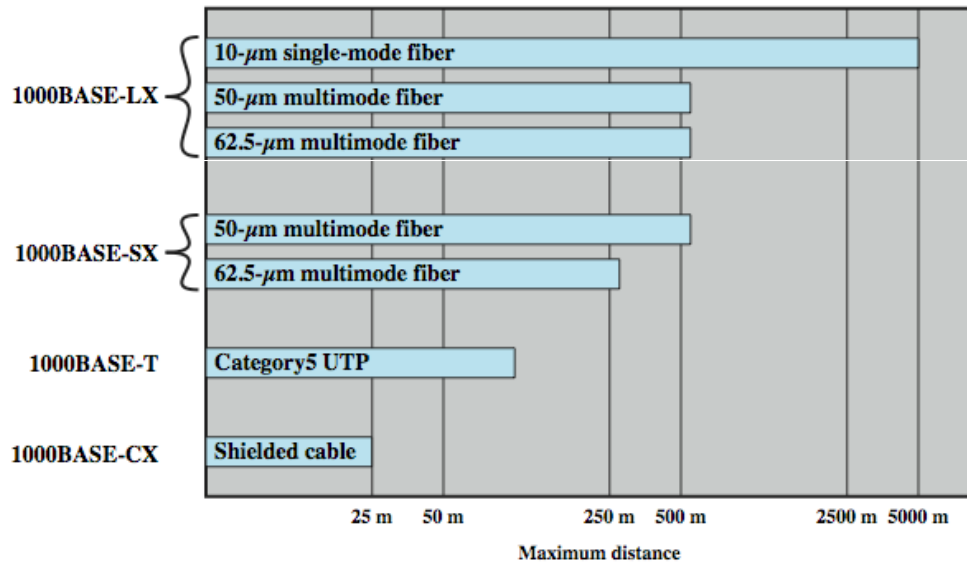
	100BASE-TX		100BASE-FX	100BASE-T4
Transmission medium	2 pair, STP	2 pair, Category 5 UTP	2 optical fibers	4 pair, Category 3, 4, or 5 UTP
Signaling technique	MLT-3	MLT-3	4B5B, NRZI	8B6T, NRZ
Data rate	100 Mbps	100 Mbps	100 Mbps	100 Mbps
Maximum segment length	100 m	100 m	100 m	100 m
Network span	200 m	200 m	400 m	200 m



IEEE 802.3 Ethernet



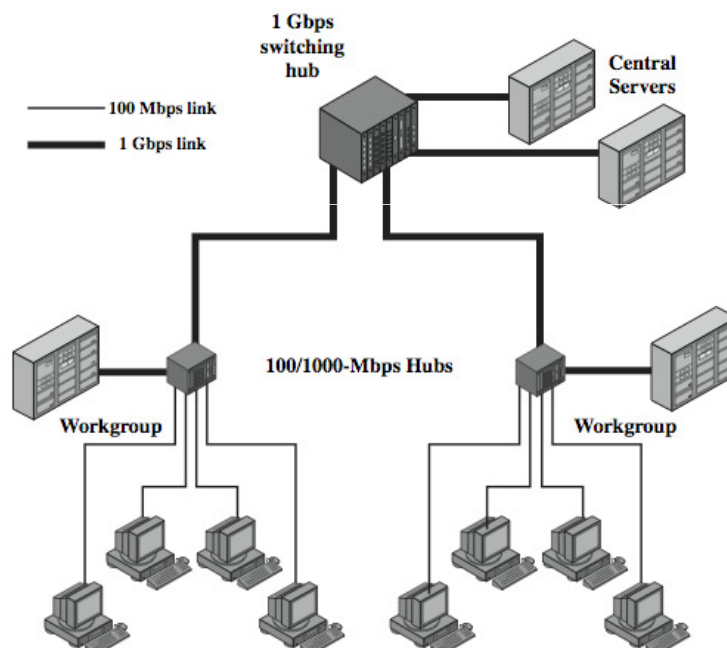
1Gbps Ethernet



IEEE 802.3 Ethernet



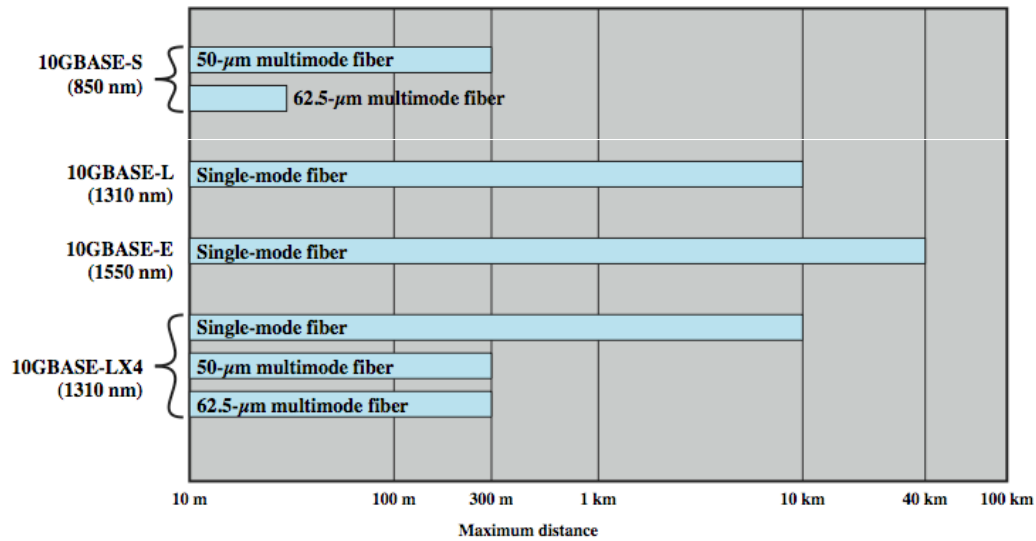
1Gbps Ethernet



IEEE 802.3 Ethernet



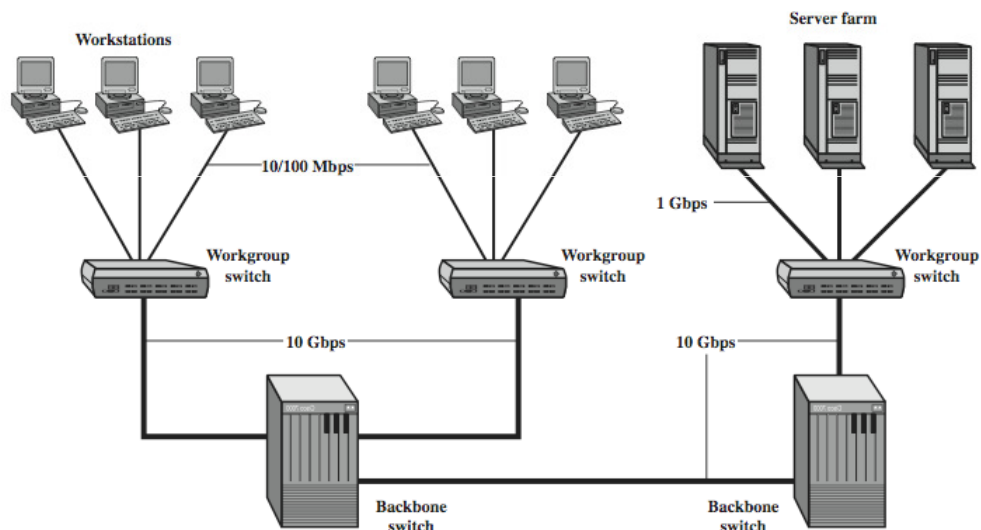
10Gbps Ethernet



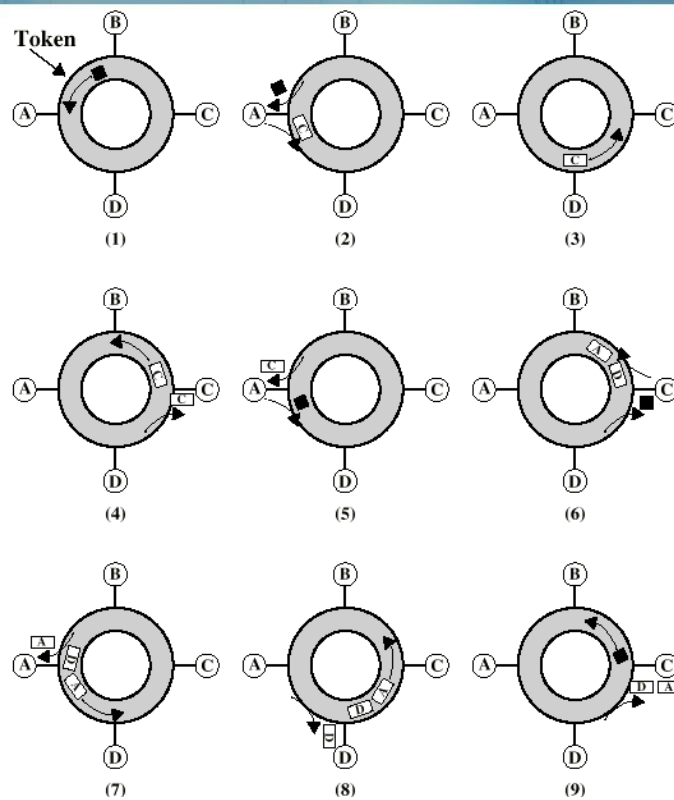
IEEE 802.3 Ethernet



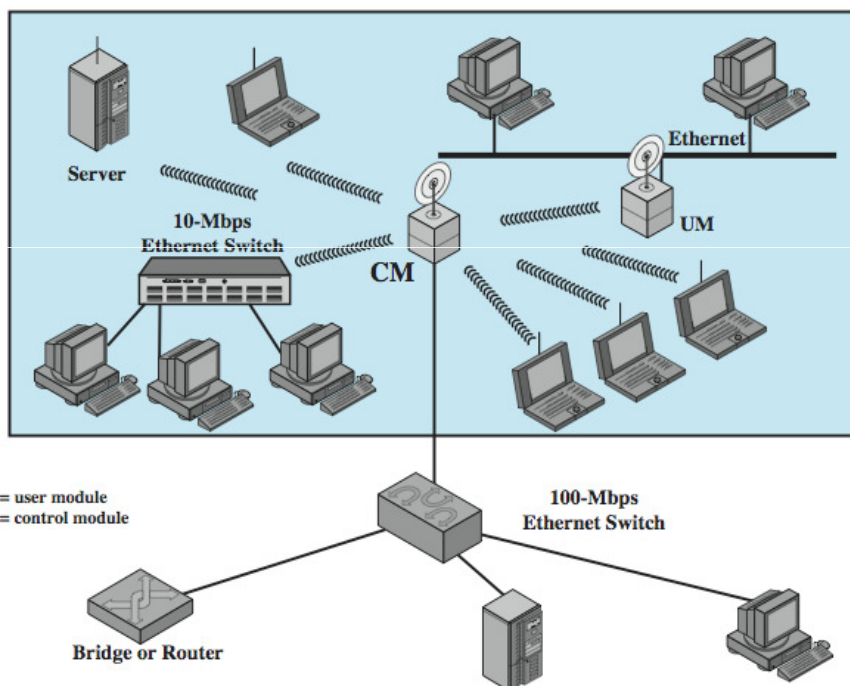
10Gbps Ethernet



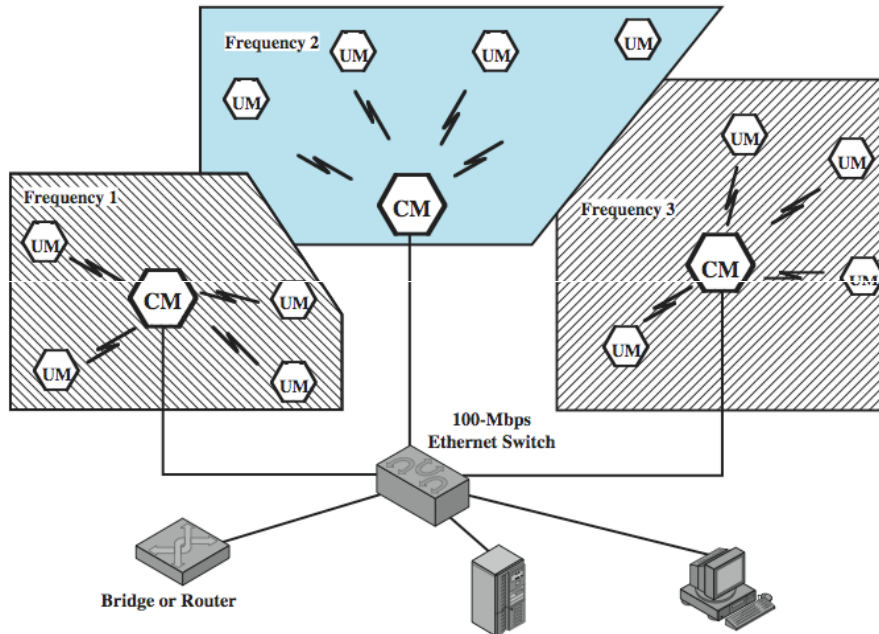
IEEE 802.5 Token Ring



IEEE 802.11 Wi-Fi



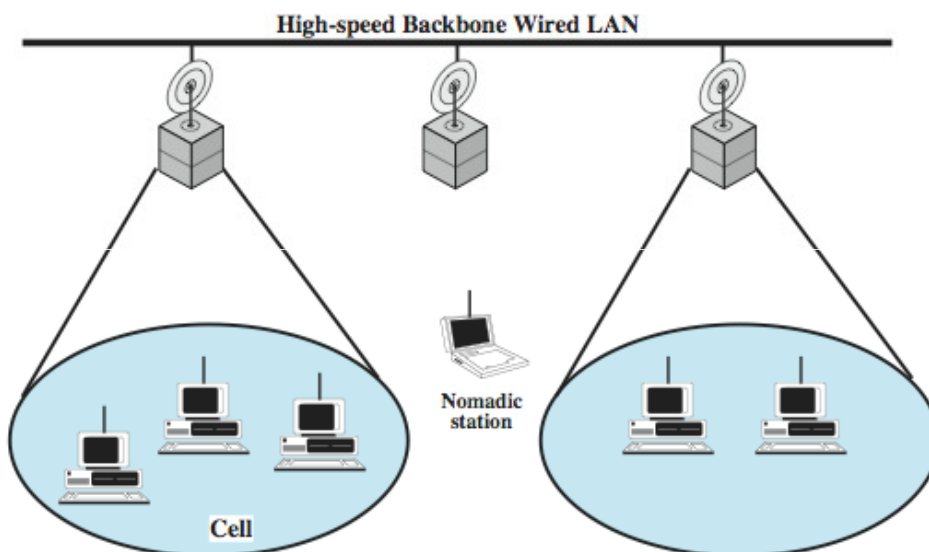
IEEE 802.11 Wi-Fi



- CM: Módulo de control (estación base).
- UM: Módulo de usuario.



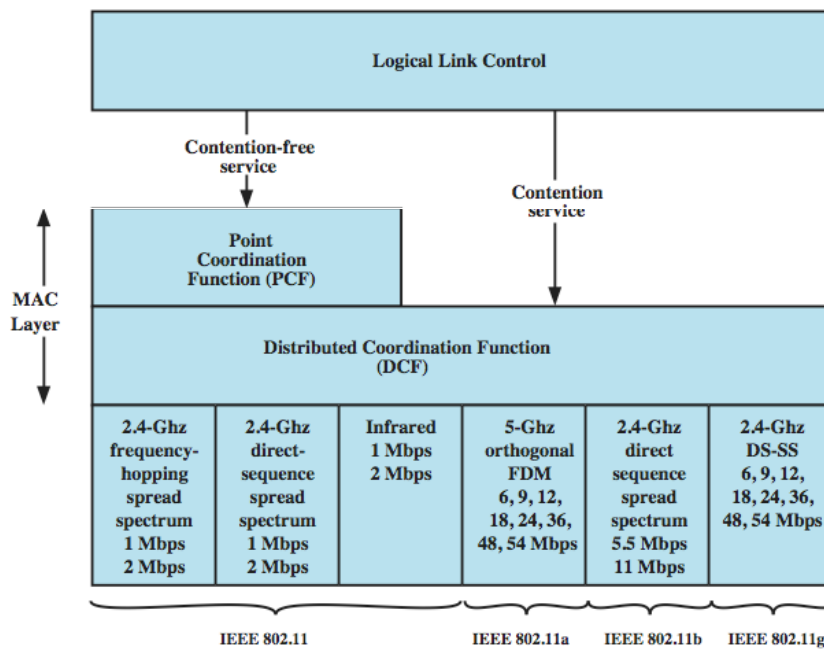
IEEE 802.11 Wi-Fi



IEEE 802.11 Wi-Fi



Wi-Fi ("Wireless Fidelity")



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IEEE 802.11 Wi-Fi



- FHSS Frequency Hopping Spread Spectrum
- DSSS Direct Sequence Spread Spectrum
- OFDM Orthogonal Frequency Division Multiplexing
- HR-DSSS High Rate DSSS

Acceso al medio

DFWMAC [Distributed Foundation Wireless MAC]

PCF (función de coordinación puntual)

- Servicio sin competición (la estación base decide quién transmite).

DCF (función de coordinación distribuida)

- Servicio con competición (CSMA/CD).

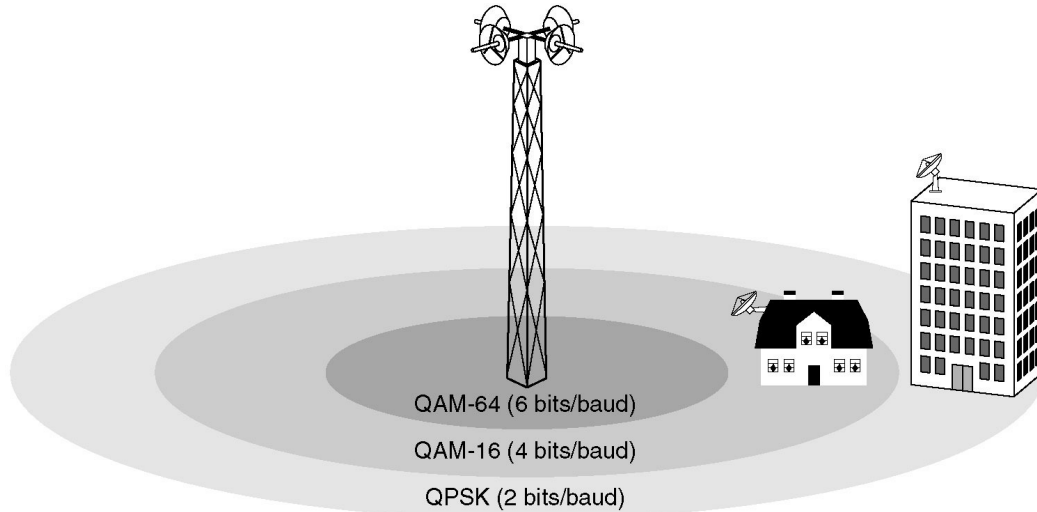


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IEEE 802.16 WiMAX



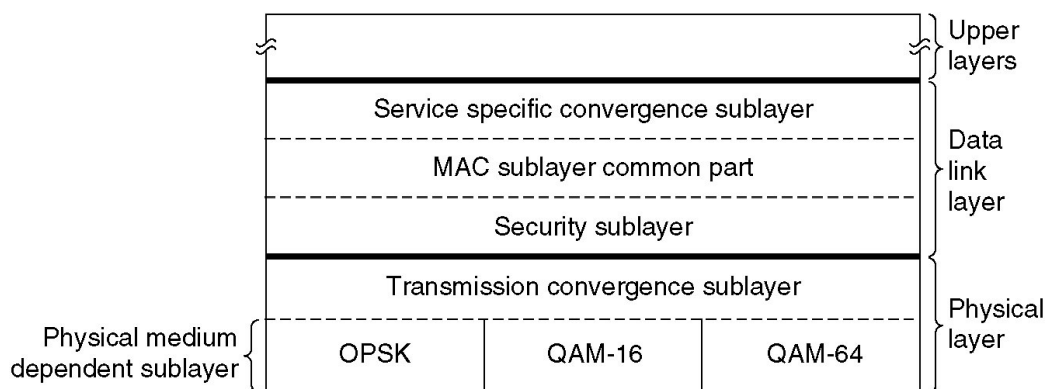
WiMAX (Worldwide Interoperability for Microwave Access)



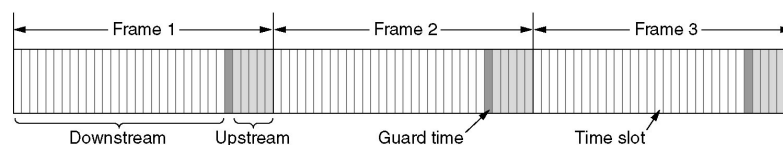
IEEE 802.16 WiMAX



WiMAX (Worldwide Interoperability for Microwave Access)



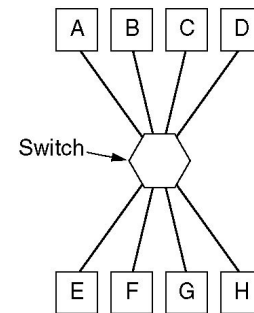
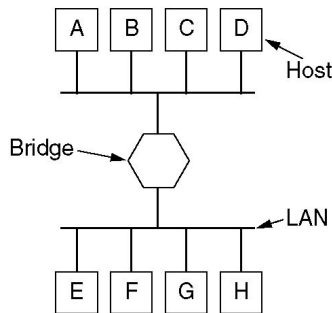
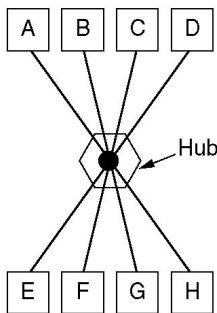
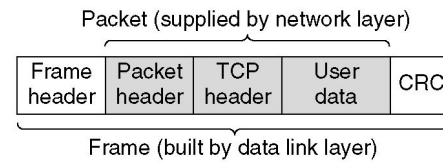
TDM



Interconexión de redes



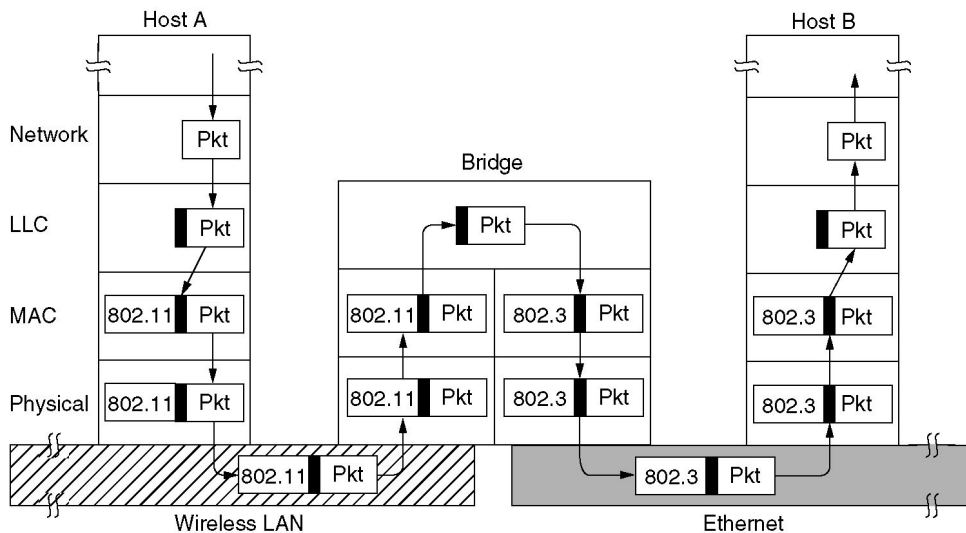
Application layer	Application gateway
Transport layer	Transport gateway
Network layer	Router
Data link layer	Bridge, switch
Physical layer	Repeater, hub



Interconexión de redes



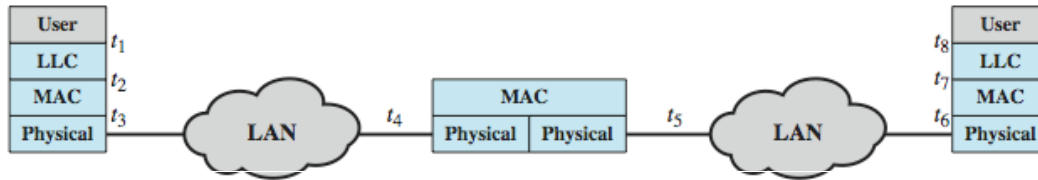
Puentes



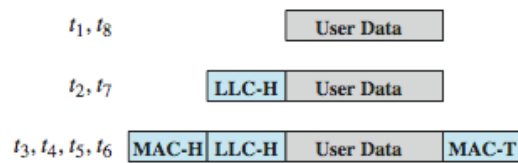
Interconexión de redes



Conexión de dos redes de área local



(a) Architecture



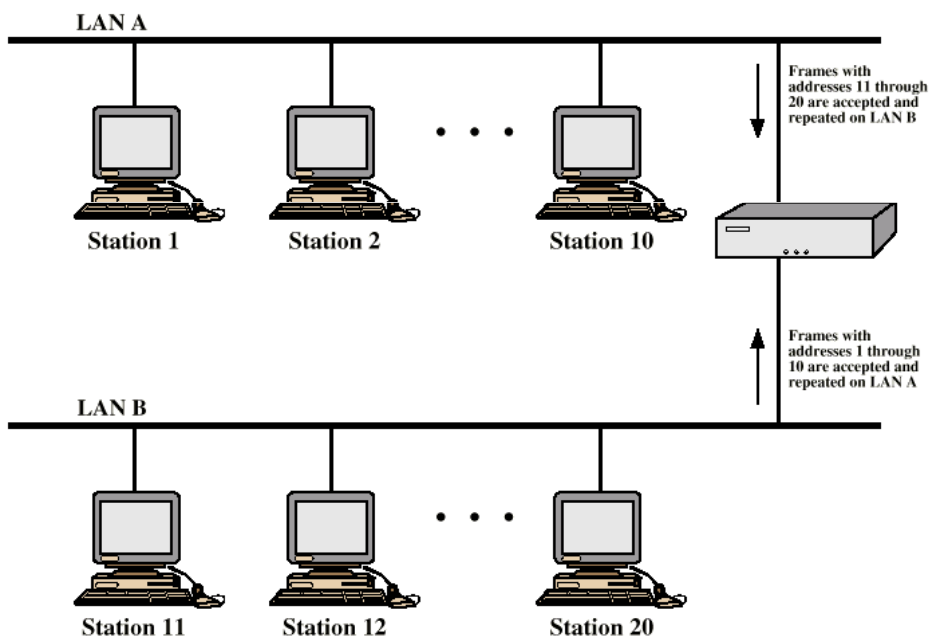
(b) Operation



Interconexión de redes



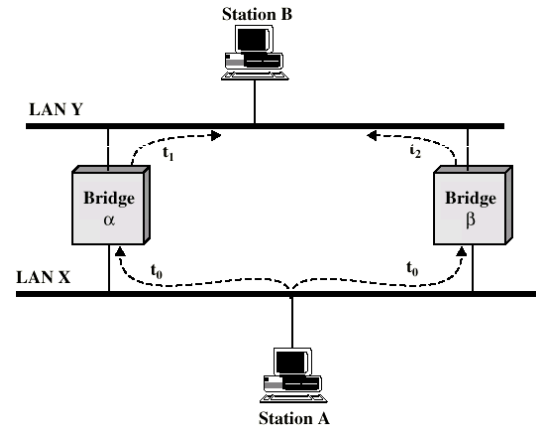
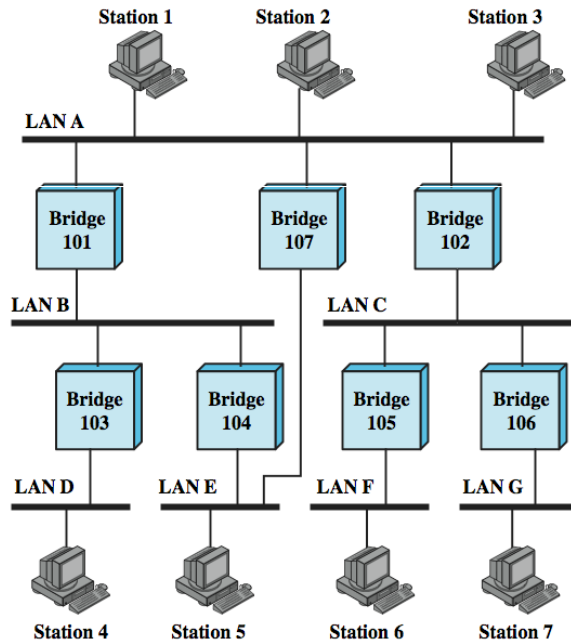
Conexión de dos redes de área local



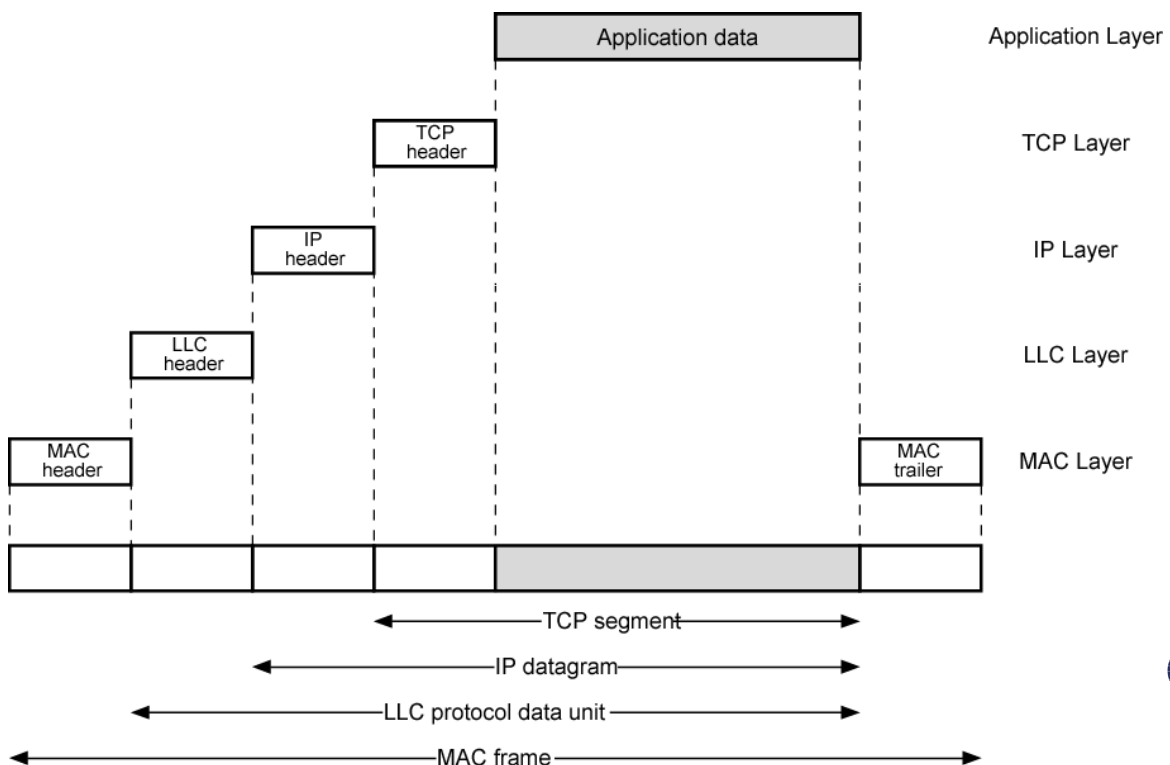
Interconexión de redes



Problemas de interconexión



Apéndice: IEEE 802.2 LLC



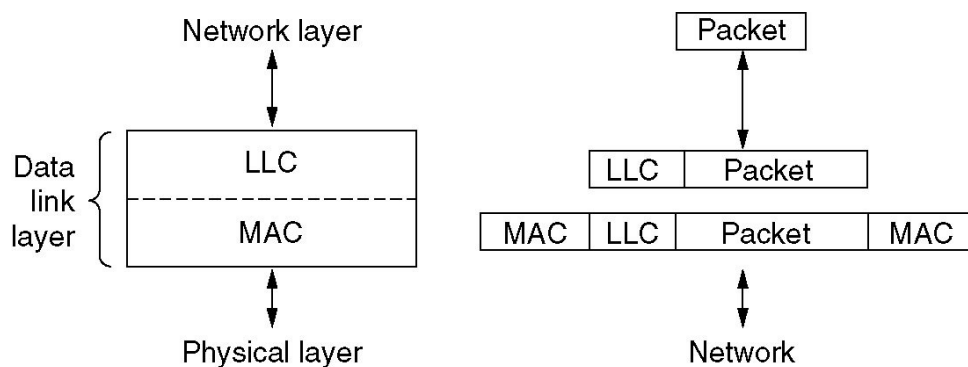
Apéndice: IEEE 802.2 LLC



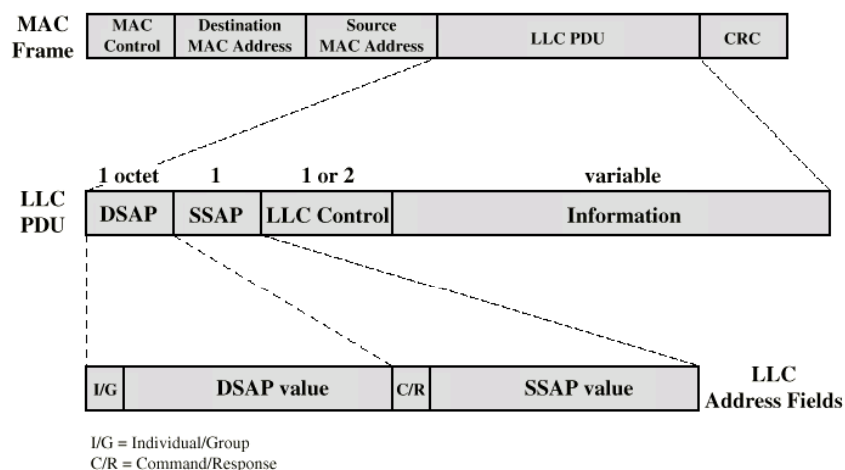
Logical Link Control (LLC)

Funciones:

- Control de flujo y de errores.
- Interfaz estándar para los niveles superiores.



Apéndice: IEEE 802.2 LLC



MAC

Trama con campos de dirección y detección de errores.

LLC

Da soporte a múltiples accesos: SAPs [Service Access Points].
Protocolo basado en HDLC.



Bibliografía



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