SMU Course #: EETS 7315

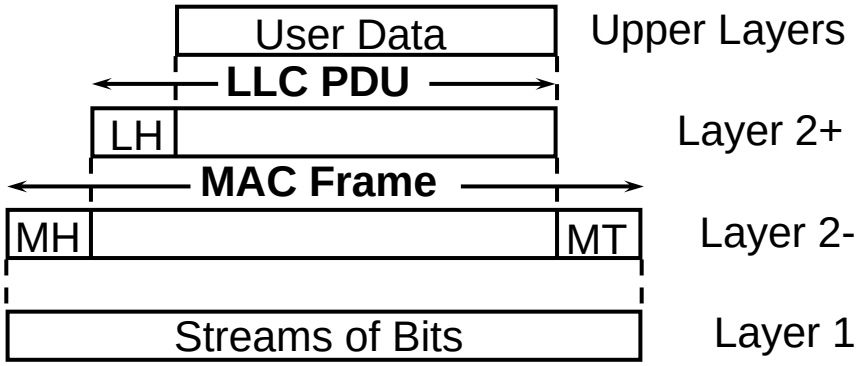
DATA COMMUNICATIONS

Week #10 -- Dr. Baker

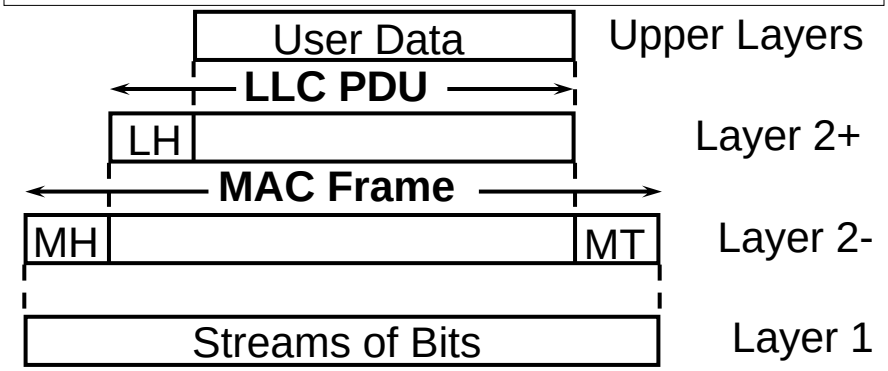
LAN/MAN Sublayers

- The LLC Sublayer is common to all IEEE 802 topologies; that is, 802.3, .4, .5, .6, .9, .11 & .12
- The LLC Sublayer is also used by ANSI's FDDI
- The MAC Sublayer is specific to each topology
- Layer 1 is specific to each topology

The IEEE 802 Frame



The IEEE 802 Frame

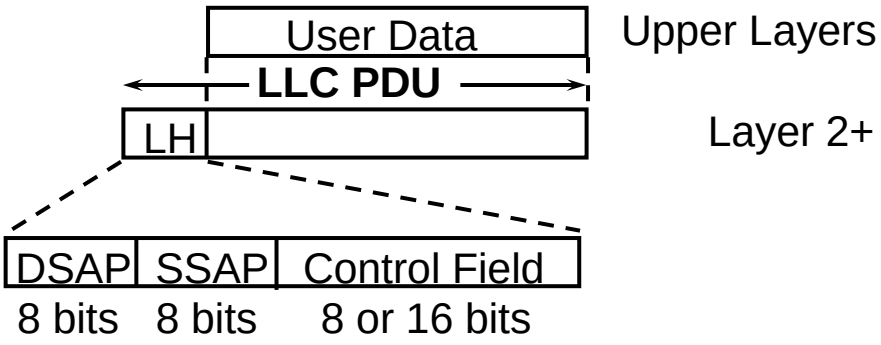


MAC = Medium Access Control
LLC = Logical Link Control
PDU = Protocol Data Unit
MH = MAC Header MT = MAC Tailer

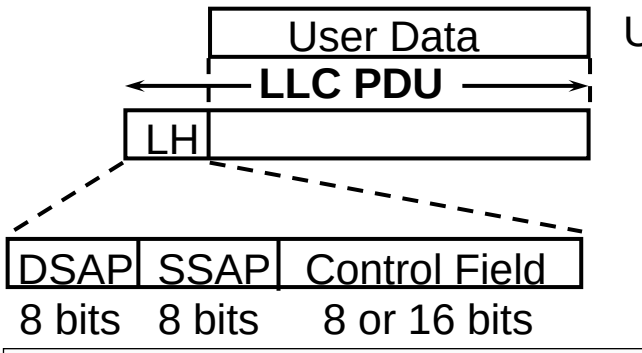
Bus Switching

- All LANs/MANs we are considering in this course use bus switching, a.k.a. broadcast networking.
- It follows, therefore, that these LAN protocols cannot reach above Layer 2.

The LLC PDU



The LLC PDU



DSAP = Destination Service Access Point
SSAP = Source Service Access Point
Control Field = Connection/Connectionless
(depends on Type #)

Control Field Types

Type	Commands	Responses
1	UI	--
	XID	XID
	TEST	TEST
2	I	I
	RR	RR
	RNR	RNR
	REJ	REJ
	SABME	UA
	DISC	DM
		FRMR

Type 1 is almost universal; Type 2 is becoming very rare.

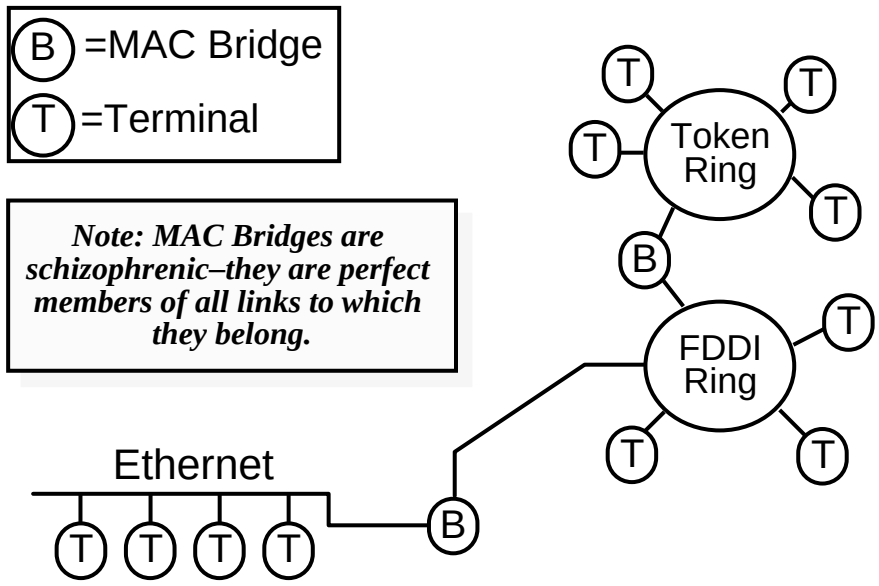
Service Access Points

- A Service Access Point is a pointer that selects software or hardware.
- In the context of the LLC sublayer, the SAP selects software and/or hardware at the geographical point at which control is passed between Layers 2 and 3; i.e., at the ends of the catalink.

Catalinks

Definition: A concatenation of data links that allows data to travel from link to link in such a way that it does not go above Layer 2 is called a Catalink.

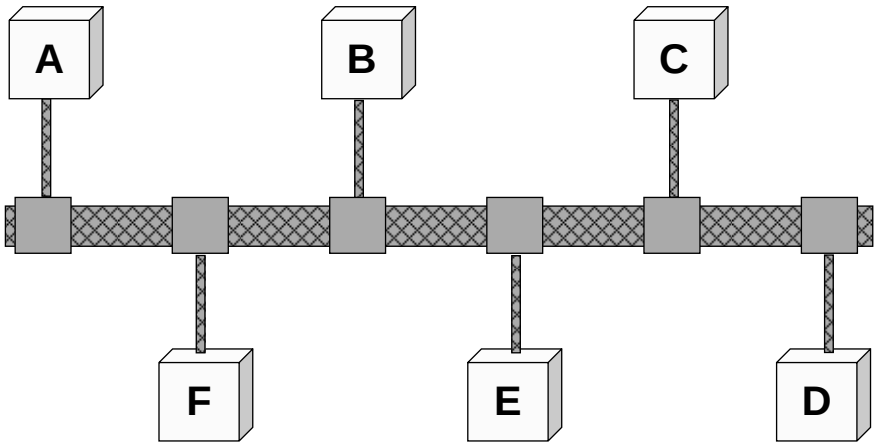
Example of a Catalink



Enterprise Data Networks Today

- Except for specific legacy situations and specific industries, the enterprise network today is constructed using various IEEE 802.3, 802.11, and various types of internets
- Bluetooth subsystems (IEEE 802.15) do not have high enough bit rate for compatibility with these systems and will be considered beyond the scope of this data communications course
- Unless there are class questions, 802.4, 802.5, and 802.6 will be skipped. Slides are included for those who have interest.

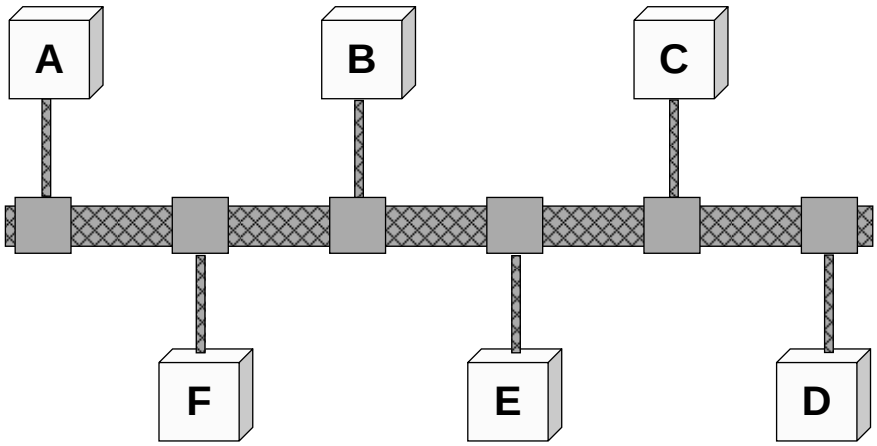
Ethernet I (a.k.a. CSMA/CD) uses a Logical Bus – can be a Physical Bus or Star



How CSMA/CD Works

1. A terminal wishing to transmit must first listen and wait for an idle medium.
2. A transmitting terminal continues to listen while transmitting.
3. If other pulses are heard while transmitting, the terminal goes into collision recovery.
4. Recovery: Any terminal having been a party to a collision waits a random amount of time before returning to 1.

Ethernet & CSMA/CD use a Logical Bus – can be a Physical Bus or Star



CSMA/CD Back-off Algorithm*

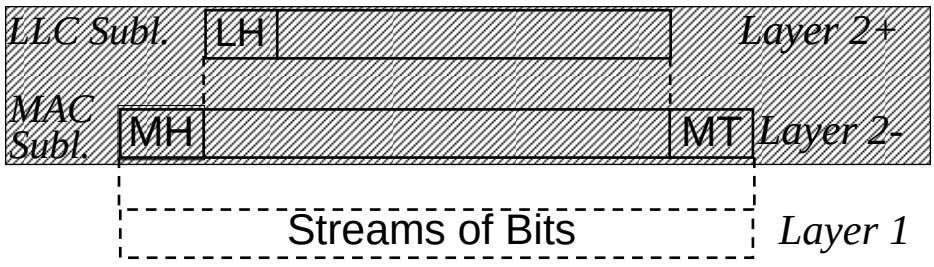
- After two consecutive collisions, the random number is multiplied by by 2^n, where n= number of collisions, up to n=10.
- After n=16, the terminal stops trying and returns an error code

* a.k.a. Binary Exponential Back-off

CSMA/CD Concerns

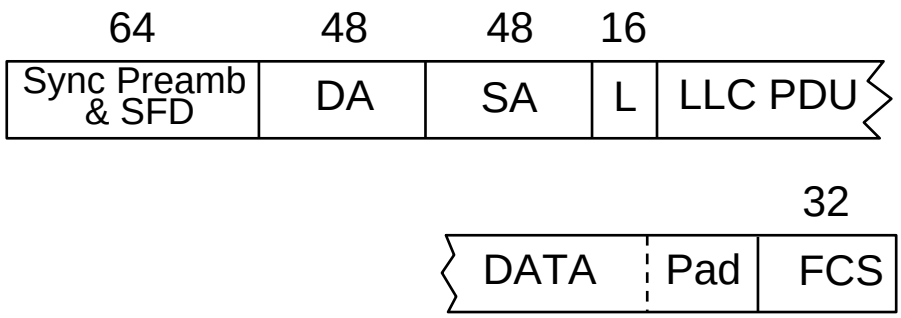
- The system is non-deterministic.
- The system is subject to collapse.
- The system is biased toward long messages.
- The frame length must exceed a certain minimum depending on cable length in order to avoid undetected collisions.

LAN/WAN/LAN Layer 2 Sublayers



LLC = Logical Link Control
MAC = Medium Access Control
LH = LLC Header
MH = MAC Header

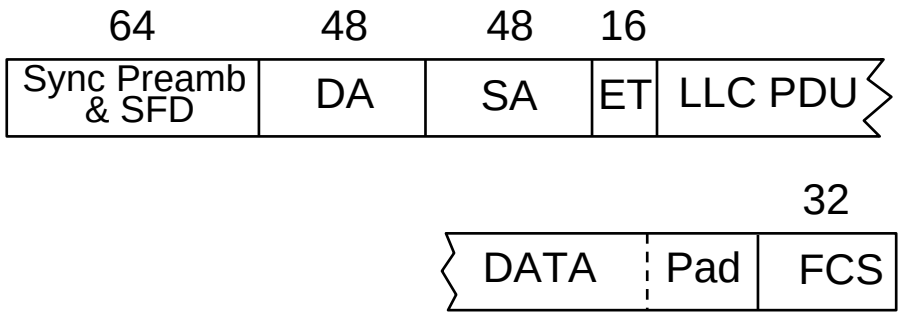
The 802.3 MAC Header & Tailer



L_{max} = 1500, incl. Pad

Questions:
How is transparency accomplished here?
What problem does the "Pad" solve?

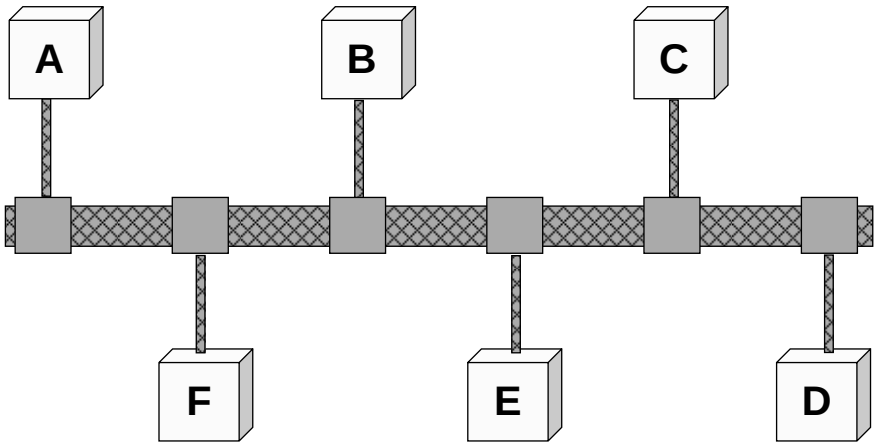
The Ethernet II (a.k.a.DIX) Header & Tailer



ET = “Ethertype”

Any “L” greater than 1500 is assumed to be ET (DIX) rather than L.

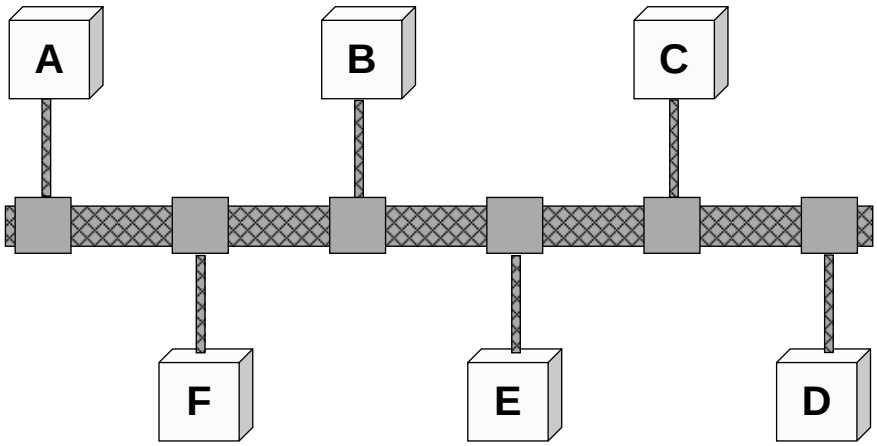
Token Bus uses a Logical Bus – normally also a Physical Bus



How Token Bus Works

1. The "token," (a special code) can be passed in any set order.
2. A Station receiving the token may transmit to other stations until its timer expires
or until it finishes transmitting.
3. A station wishing to drop out of the cycle issues a "Set Successor" command.
4. A station wanting into the cycle waits for a "Solicit Successor" command.

Token Bus uses a Logical Bus – normally also a Physical Bus



Token Bus Concerns

- In a lightly-loaded system, token passing may waste time and add to overhead.
- Since it is usually broadband, it is more expensive than 802.3 and 802.5
- Programming the algorithm is much more complex than for the other types of LANs.