LLC-802.2 Based Congestion Management

Presentation for IEEE Congestion Management Study Group

May 2004

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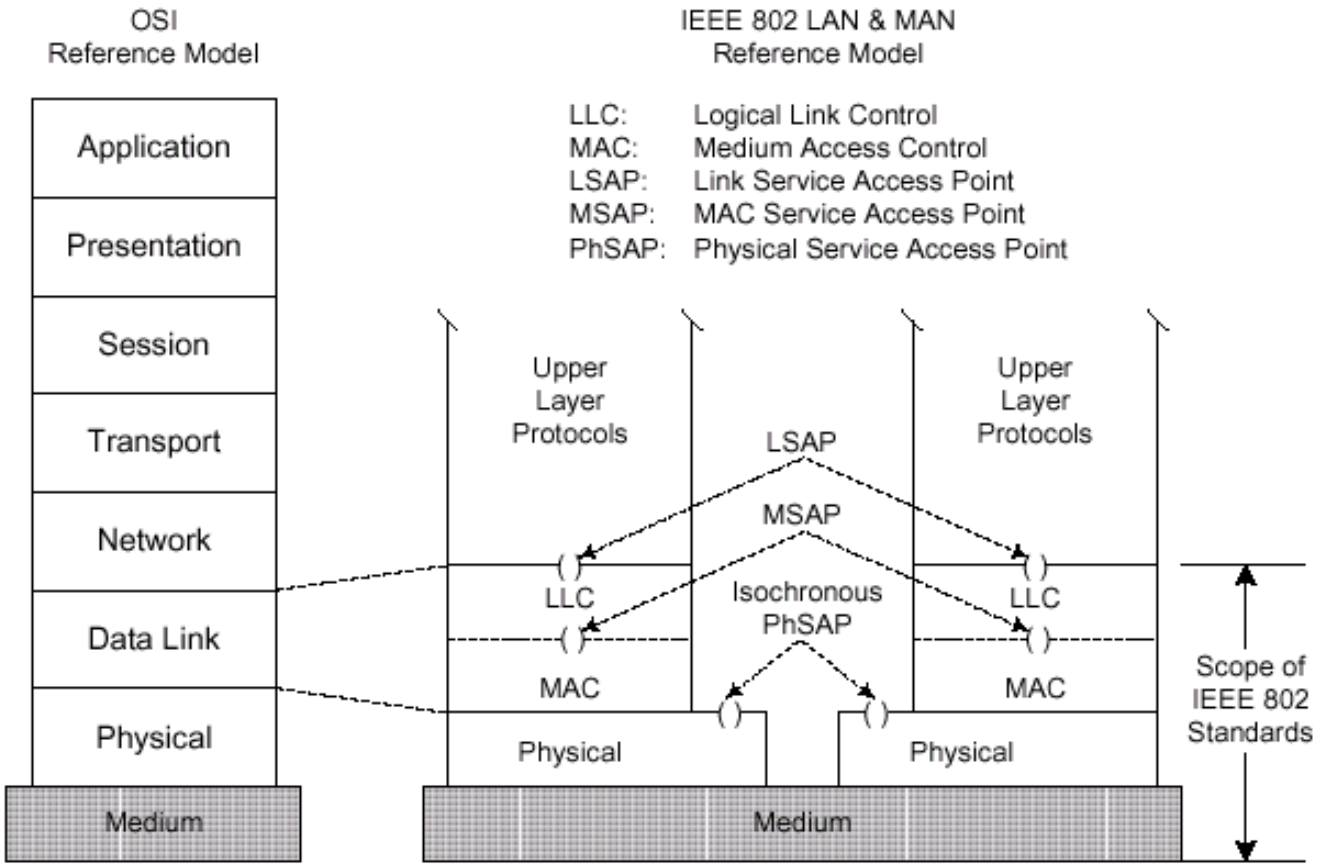
IEEE 802 ® RM for end stations (LAN&MAN/RM)

FROM IEEE Std 802-2001 ®



IEEE 802 ® RM for end stations (LAN&MAN/RM)

FROM IEEE Std 802-2001 ®

- **Multiple-link service access points (LSAPs) provide interface ports to support multiple higher layer users above the LLC sublayer.**

- **The MAC sublayer provides a single MAC service access point (MSAP) as an interface port to the LLCsublayer in an end station. In general, the MSAP is identified (for transmission and reception) by a single individual MAC address and (for reception) by the LAN-wide broadcast MAC address; it can also be identified (for reception) by one or more group MAC addresses. Clause 9 provides details of how these MAC addresses are constructed and used; see also ISO/IEC 15802-1.**

- **A user of LLC is identified by, at a minimum, the logical concatenation of the MAC address field and the LLC address field in a frame. See ISO/IEC 8802-2 and ISO/IEC TR 11802-1 for a description of LLC addresses.**

IEEE 802 ® RM for end stations (LAN&MAN/RM)
FROM IEEE Std 802-2001 ®

- The LLC sublayer standard, ISO/IEC 8802-2, describes three types of operation for data communication between service access points: unacknowledged connectionless-mode (type 1), connection-mode (type 2), and acknowledged connectionless-mode (type 3).

- With type 1 operation, information frames are exchanged between LLC entities without the need for the prior establishment of a logical link between peers. The LLC sublayer does not provide any acknowledgments for these LLC frames, nor does it provide any flow control or error recovery procedures.
  - LLC type 1 also provides a TEST function and an Exchange Identification (XID) function. The capability to act as responder for each of these functions is mandatory: This allows a station that chooses to support initiation of these functions to check the functioning of the communication path between itself and any other station, to discover the existence of other stations, and to find out the LLC capabilities of other stations.

- With type 2 operation, a logical link is established between pairs of LLC entities prior to any exchange of information frames. In the data transfer phase of operation, information frames are transmitted and delivered in sequence. Error recovery and flow control are provided, within the LLC sublayer.

- With type 3 operation, information frames are exchanged between LLC entities without the need for the prior establishment of a logical link between peers. However, the frames are acknowledged to allow error recovery and proper ordering. Further, type 3 operation allows one station to poll another for data.

ETHERNET - IEEE 802.3

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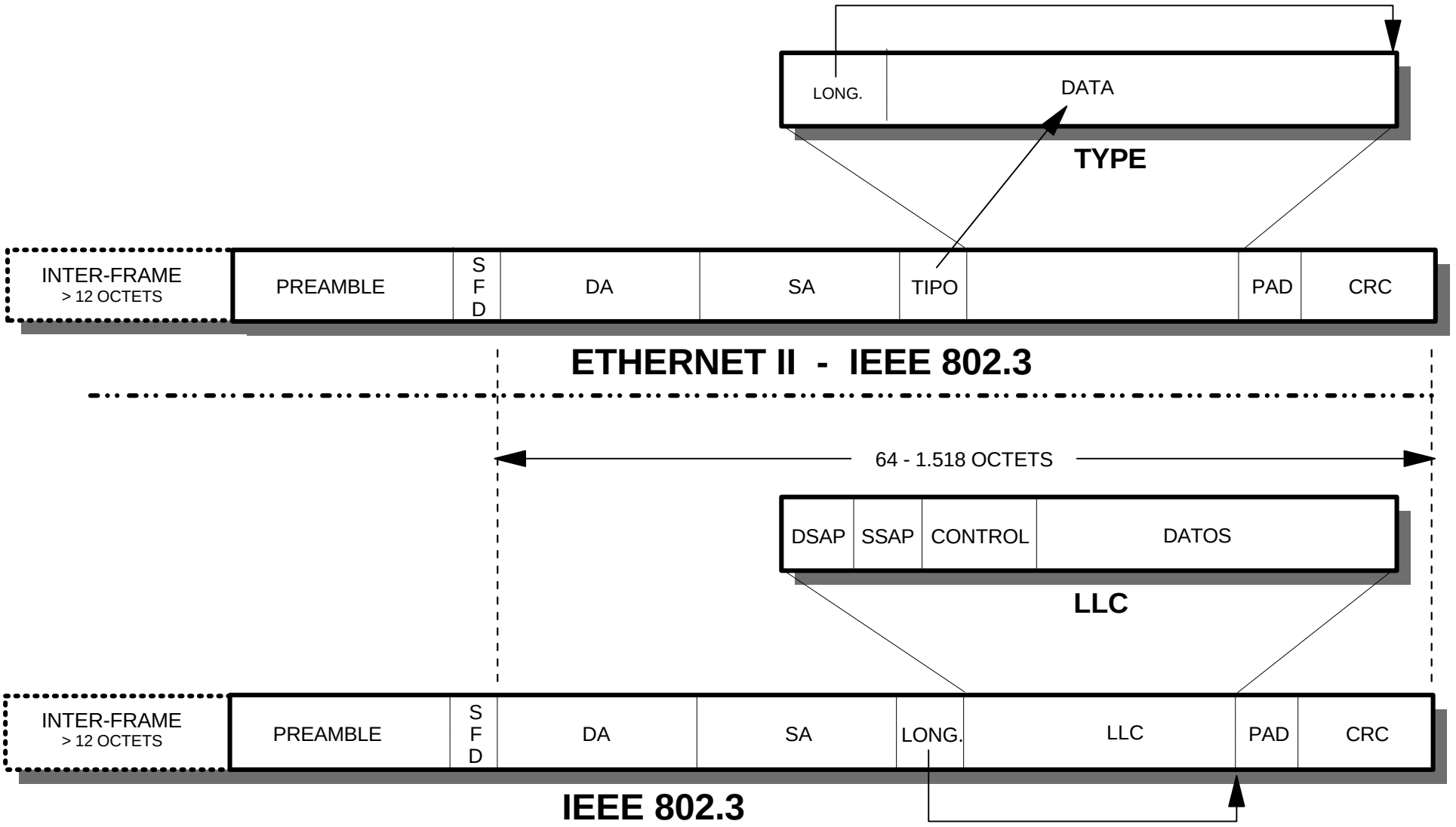
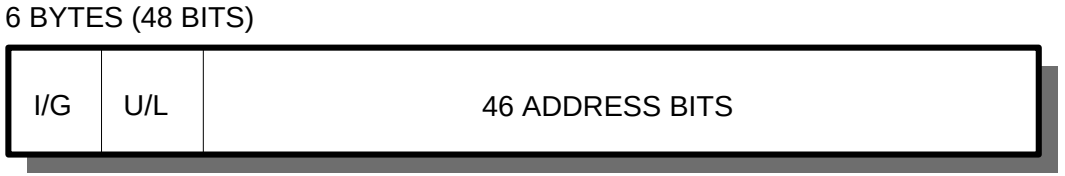
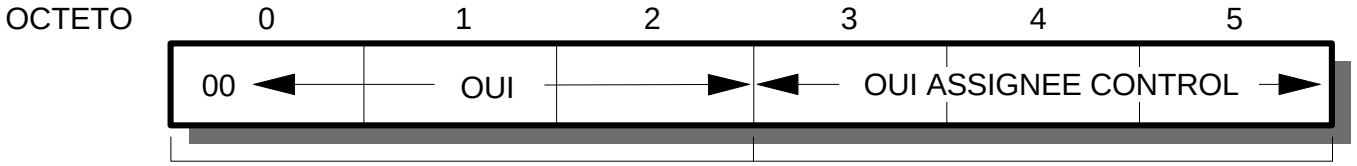


MAC IEEE 802
ADDRESS ADMINISTRATION

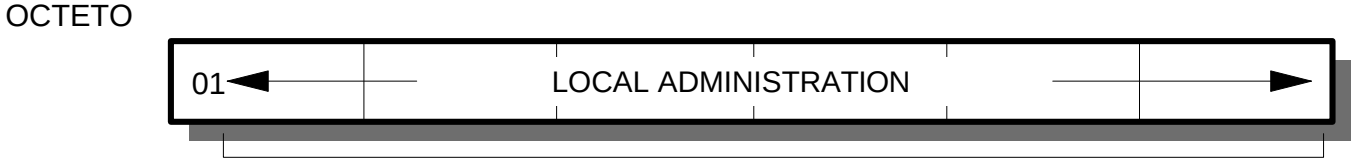


I/G = INDIVIDUAL (O) OR GROUP (1) ADDRESS
U/L = GLOBAL (O) OR LOCAL (1) ADMINISTERED ADDRESS

UNIVERSAL ADMINISTRATION



LOCAL ADMINISTRATION



LLC-802.3 Based Congestion Management
MAC ADDRESSES

- **FOR THE PURPOSES OF CONGESTION MANAGEMENT IN BACKPLANE ETHERNET IT MIGHT BE A GOOD IDEA TO USE TWO MAC ADDRESSES REGISTERS IN EACH STATION CONNECTED TO THE BACPLANE:**

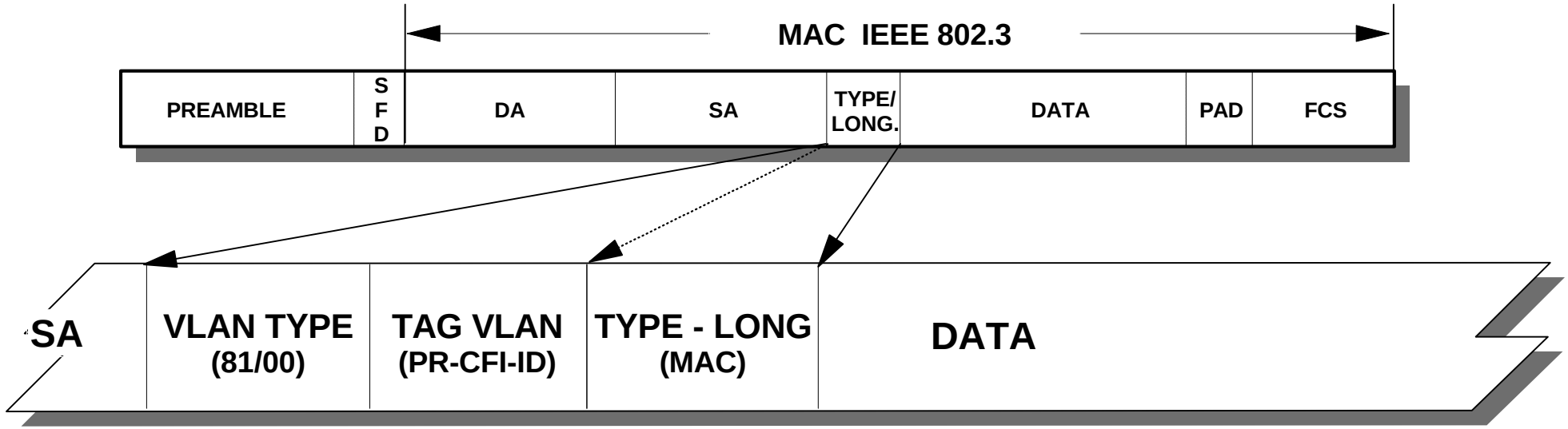
  - ONE MAC LOCALLY ADMINISTERED ADDRESS IDENTIFICATION IN THE BACKPLANE

  - ONE MAC UNIVERSAL ADDRESS IDENTIFICATION IN THE 802.3 LAN (OUTSIDE OF THE BACKPLANE)

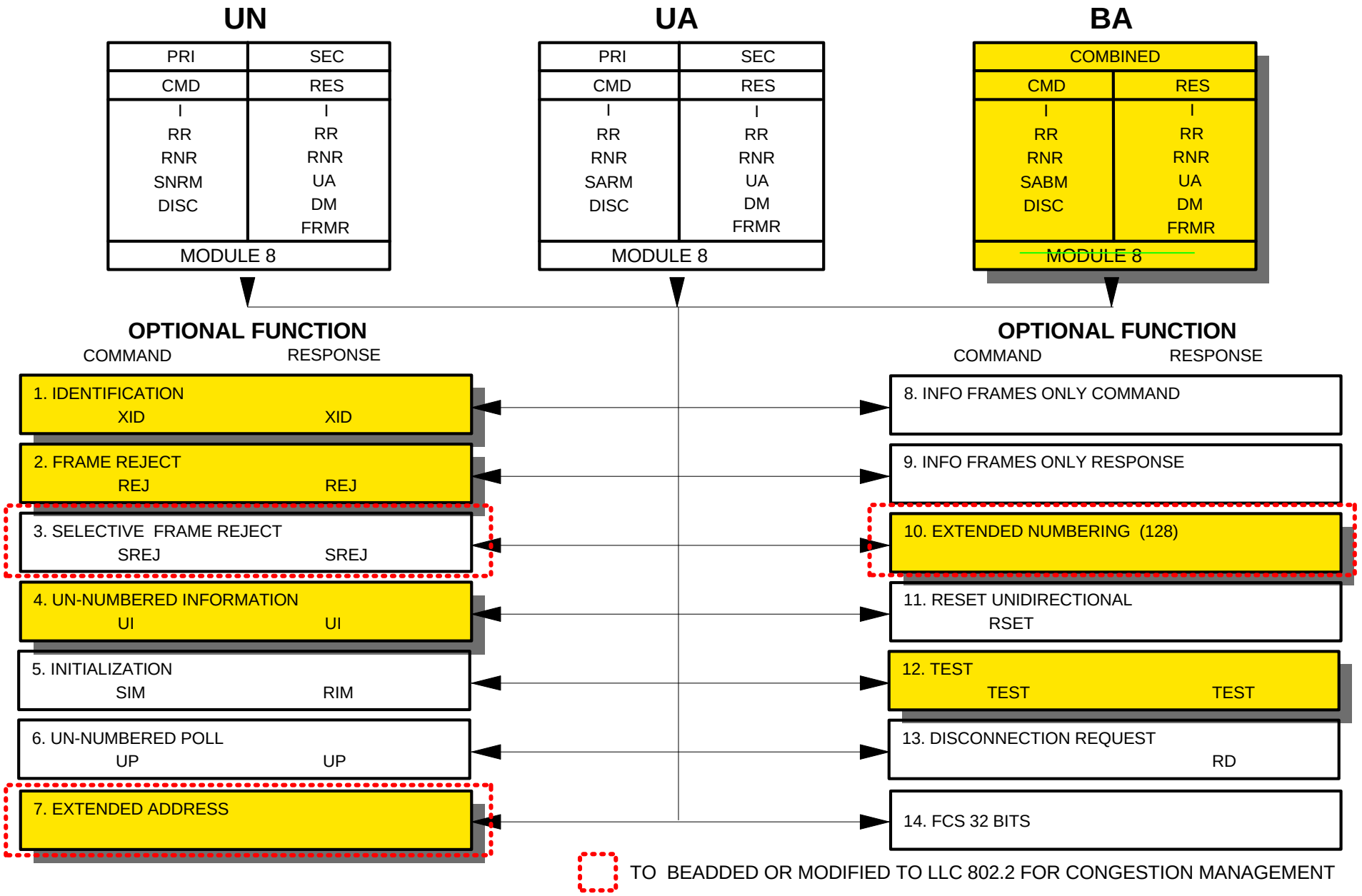
- **THIS WAY, IT IS POSSIBLE TO DIFFERENTIATE THE INNER TRAFFIC OF THE BACKPLANE (LOCAL ADDRESS) AND OUTER TRAFFIC (UNIVERSAL ADDRESS)**

MAC FRAME: VLANs 802.3

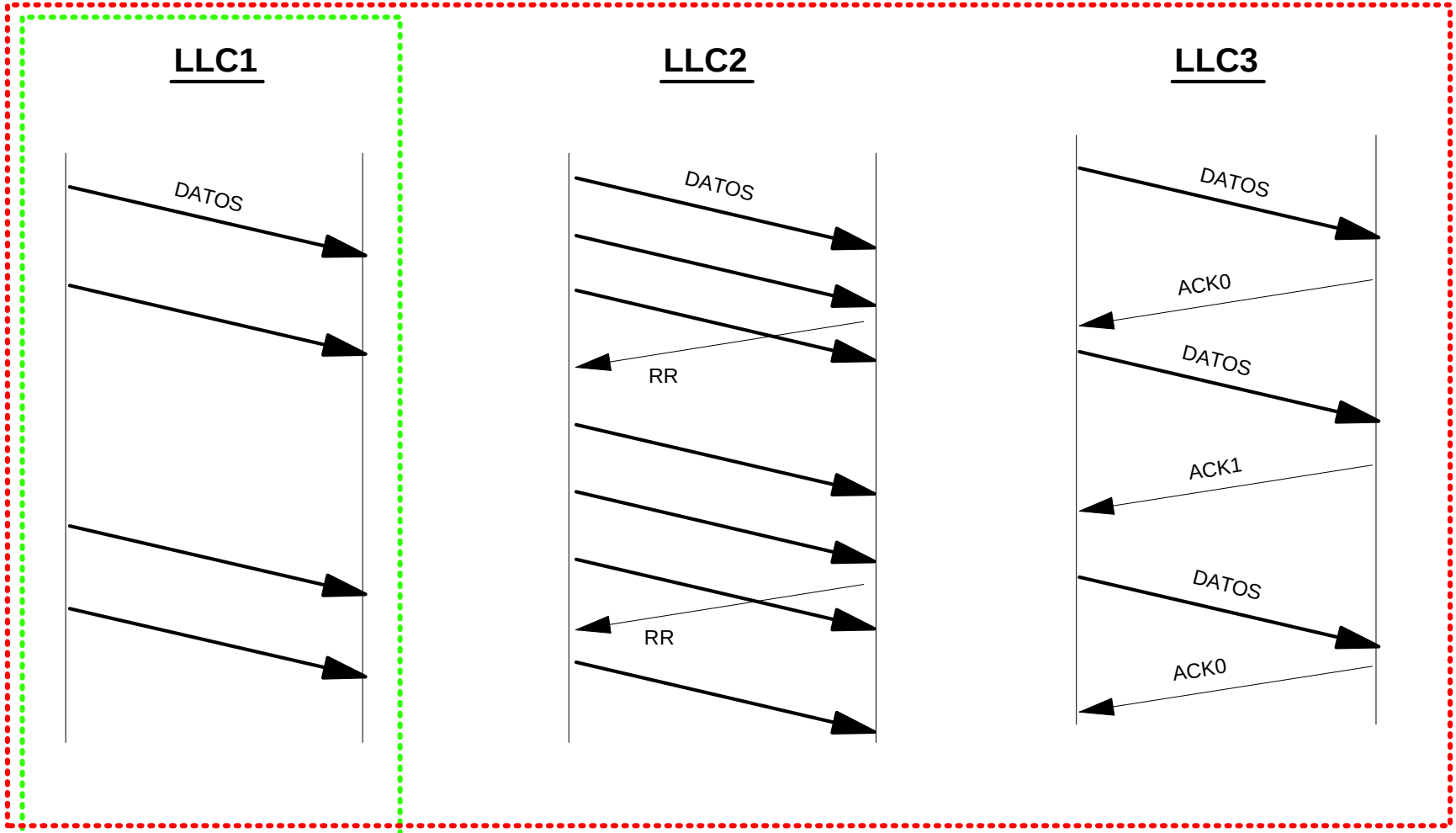
- **ALSO, WILL BE USED VLAN TCI (Tag Control Information)**
  - User Priority: 3 bits
  - CFI (Canonical Format Indicator): 1 bit
  - VLAN IDENTIFIER: 12 bits



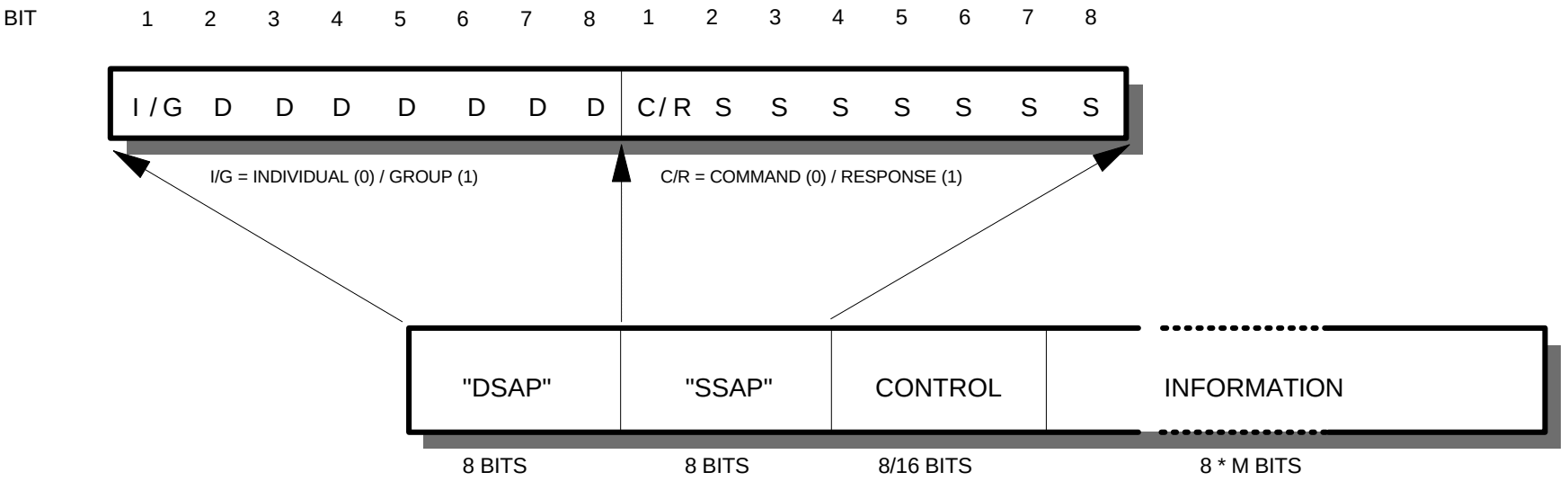
LLC PROCEDURES



LLC TYPES


LLC1
LLC2
LLC3
DATOS
DATOS
RR
DATOS
ACK0
DATOS
ACK1
RR
DATOS
ACK0
MOST COMMON WITH IP
TO BE USED IN CONGESTION MANAGEMENT

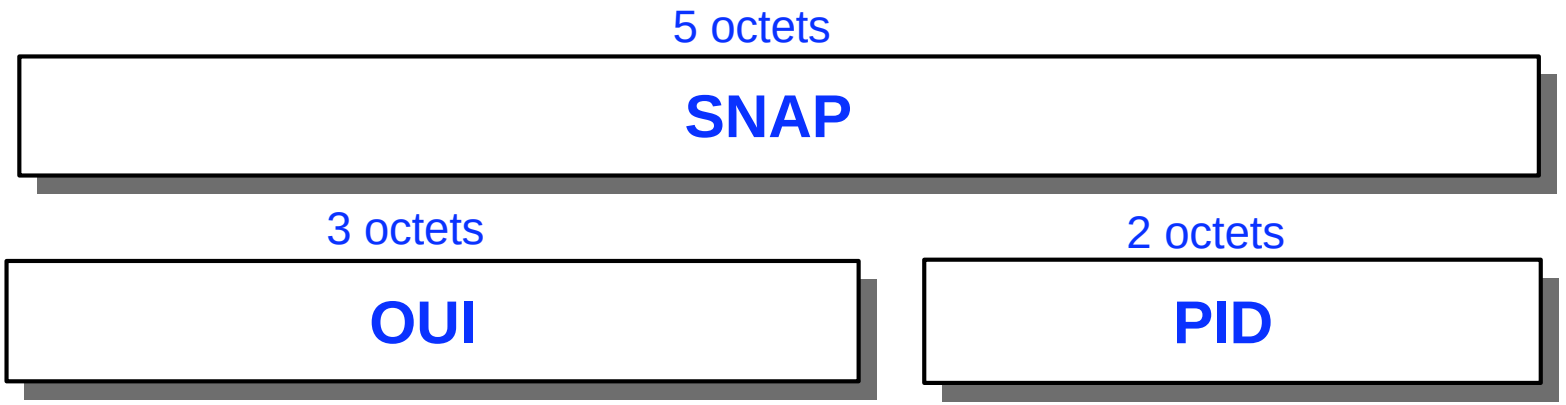
LLC: DSAP/SSAP



LSAPs (Link Service Access Points)

SAP	PROTOCOL	ORGANIZATION	UTILIZATION
00 -	NULO	IEEE	Non-Connected service, XID y TEST
02 -	LLC	IEEE	Management
03 -	LLC	IEEE	Management
04 -	SNA	IBM	Path Control SNA - INDIVIDUAL
05 -	SNA	IBM	Path Control SNA - GROUP
06 -	**IP**	**DoD**	**Identifier IP Protocol**
08 -	SNA	IBM	IBM 3270 Workstation Program - INDIVIDUAL
0C -	SNA	IBM	IBM 3270 Workstation Program - GROUP
0E -	IEC 955	IEEE	PROWAY Network Mgmt & Initialization
10 -	IPX	Novell	
18 -		Texas Instruments	
20 -	CLNP	ISO	
34 -	CLNP	ISO	
42 -	BPDU	IEEE	Bridge Spanning Tree Protocol
4E -	EIA RS-511	IEEE	Manufacturing Message Service
7E -	ISO 8208	IEEE	X.25 SOBRE LLC 802.2 TIPO 2
80 -	XNS	Xerox	Xerox Network Services
86		Nestar	
8E -	IEC955	IEEE	PROWAY Active Station List Maintenance
98 -		IETF	ARPANET Address Resolution Protocol (ARP)
AA -	**SNAP**	**DoD**	**SubNetwork Access Protocol**
BC -	VIP	Banyan	Vines
E0 -	IPX	Novell	Network Layer Routing
EC -	CLNP	ISO	
F0 -	NetBIOS	IBM	
F4 -	LNM	IBM	Lan Network Manager - INDIVIDUAL
F5 -	LNM	IBM	Lan Network Manager - GROUP
F8 -	RPL	IBM	Remote Program Load - INDIVIDUAL
FA -		Ungermann-Bass	
FC -	RPL	IBM	Remote Program Load - GROUP
FE -	NL	ISO	"NLP" (Network Layer Protocol)
FF -	LLC	IEEE	Global LSAP (BROADCAST)

SNAP (SubNetwork Access Protocol)



OUI (IEEE Organizationally Unique Identifier)

LANs 802: 0/0 8/0 C/2 (IEEE 802)

0/0 0/0 0/0 (EtherType)

PID (Protocol IDentifier)

IN BOTH CASES

IP: 0/8 0/0

ARP: 0/8 0/6

RARP: 8/0 3/5

PROTOCOL	SNAP
802.3	0/0 8/0 C/2 - 0/0 0/1
802.4	0/0 8/0 C/2 - 0/0 0/2
802.5	0/0 8/0 C/2 - 0/0 0/3
FDDI	0/0 8/0 C/2 - 0/0 0/4
802.6	0/0 8/0 C/2 - 0/0 0/5
802.9	0/0 8/0 C/2 - 0/0 0/6
IP	0/0 8/0 C/2 - 0/8 0/0

802.3 + 802.2
LOGICAL ARCHITECTURE

- **LAYERS**
  - LOGICAL LINK CONTROL (LLC): IEEE 802.2
  - MEDIUM ACCESS CONTROL (MAC): IEEE 802.3 - ETHERNET
  - PHYSICAL: BACKPLANE ETHERNET

- **SERVICES**
  - MULTIPLE "LSAP" PROVIDES MULTIPLE I/F PORTS
  - ONLY ONE PORT IN LLC-MAC AND MAC-PHYSICAL INTERFACES

- **SERVICE CONNECTION ID**
  - MAC AND LLC LOGICAL CONCATENATION

802.3 Based Congestion Management
LLC - IEEE 802.2

- **IEEE 802.2 STANDARD, SPECIFIED IN 802.3 FOR SUBLAYER 2**
  - OFFERS A DATAGRAM SERVICE WITH LLC TYPE 1
  - PERMITS TO ESTABLISH CONNECTIONS IN LAYER 2 WITH LLC TYPE 2
  - IN SOME APPLICATIONS WILL BE ALSO USEFUL LLC TYPE 3

- **BROAD PRACTICAL EXPERIENCE**
  - LLC TYPE 2 WIDELY USED IN IBM/SNA AND OTHER ENVIRONMENTS

- **HARDWARE ORIENTED: DOES NOT INTRODUCES LATENCY**
  - WILL OPERATE AT 10 Gbps AND MORE (LIKE ROUTERS WITH PoS/PPP)

- **VERY EFFICIENT, BECAUSE IT IS A HDLC PROTOCOL**
  - VERY LOW OVERHEAD

802.3 Based Congestion Management
LLC - IEEE 802.2

- **EXTENDED ADDRESS (DSAP/SSAP)**
  - COULD CONSIDER TO INCREASE THE SIZE OF ADDRESS FIELD (DSAP/SSAP)
  - TO IDENTIFY NOT ONLY SERVICES, BUT CONNECTIONS
  - IN CASE: MODIFY OPTION 7

- **SNAP**
  - WITH OUI = 0/0 0/0 0/0 PERMITS USE OF EtherTypes IN PID

- **LINK LEVEL GUARANTEED DELIVERY, ERROR FREE**
  - MUST ADD OPTION 3 (SELECTIVE FRAME REJECT)

- **LINK LEVEL FLOW CONTROL, CURRENT WINDOW MODULE 128**
  - 127 frames x 1500 octets = 190500 octets without acknowledge: WITH 10 Gbps ONLY 15 km
  - GOOD FOR THE BACKPLANE, BUT NOT FOR REMOTE CONNECTIONS
  - MUST INCREASE THE SIZE OF N(S) AND N(R) TO 3 OCTETS
  - THEREFORE: MODIFY OPTION 10