Linux Network Device Driver

Linux Networking Primer

By

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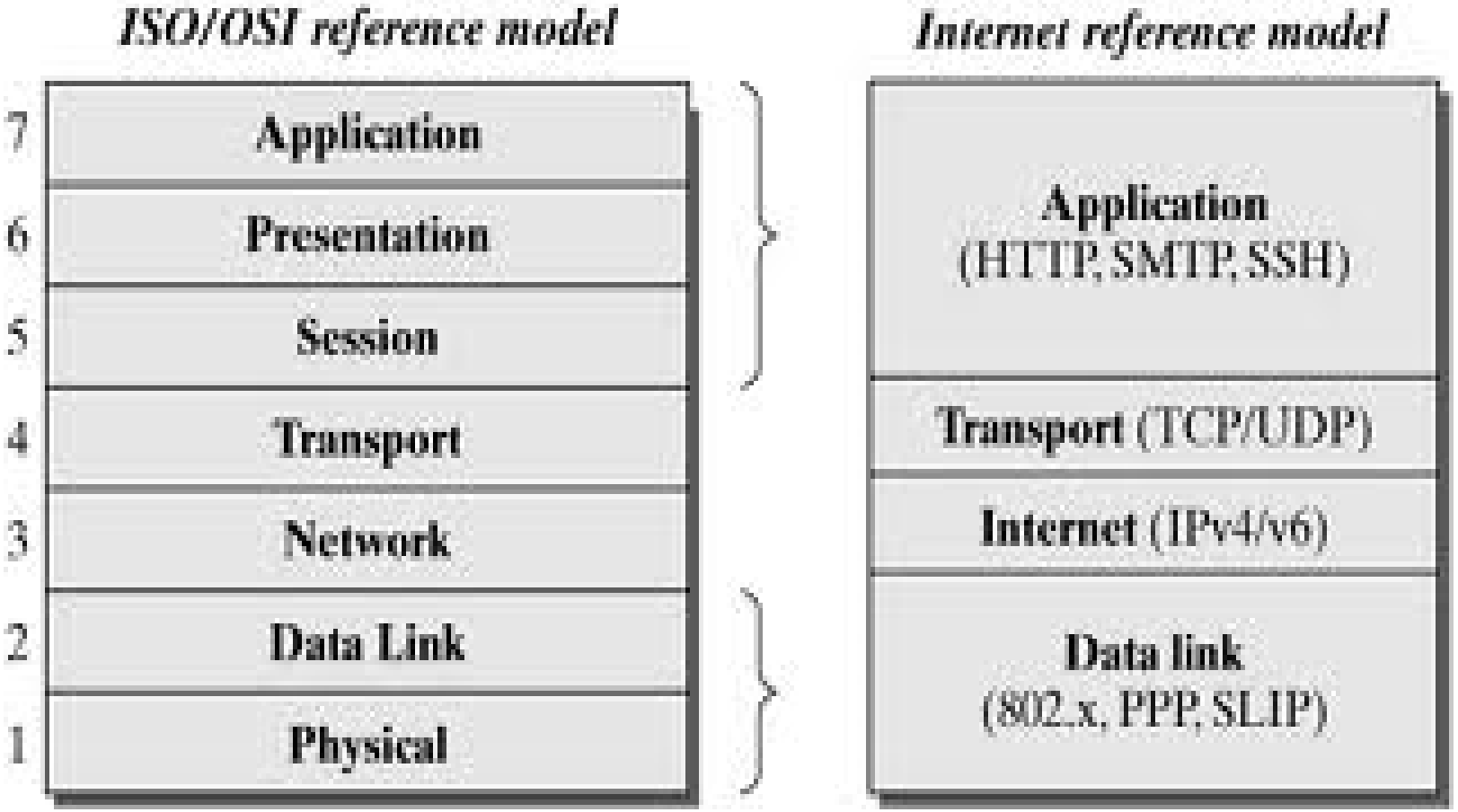
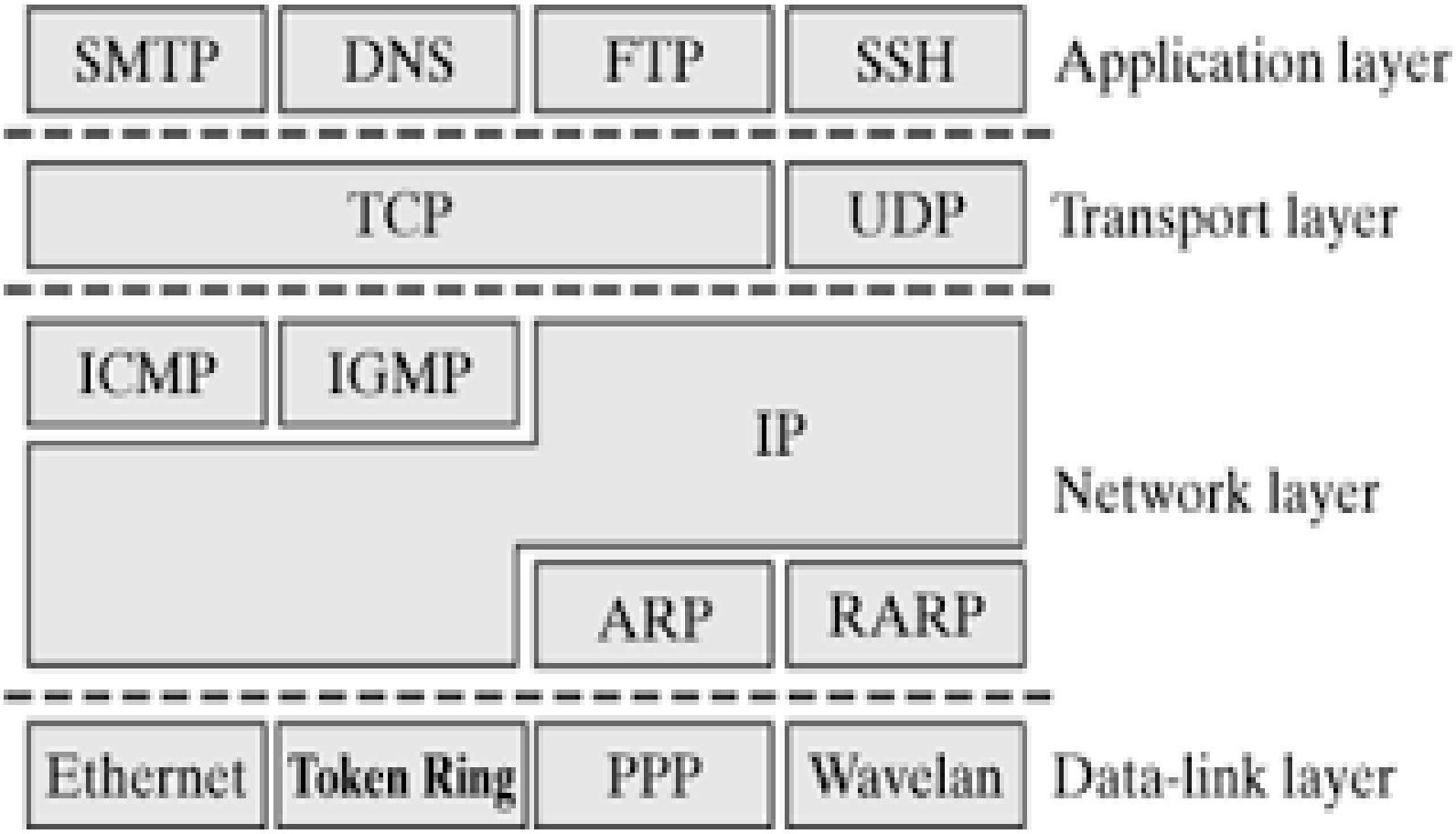
OSI-to-Internet-Protocol Layer Mapping



Internet-Protocol Suite



Network Applications & Protocols

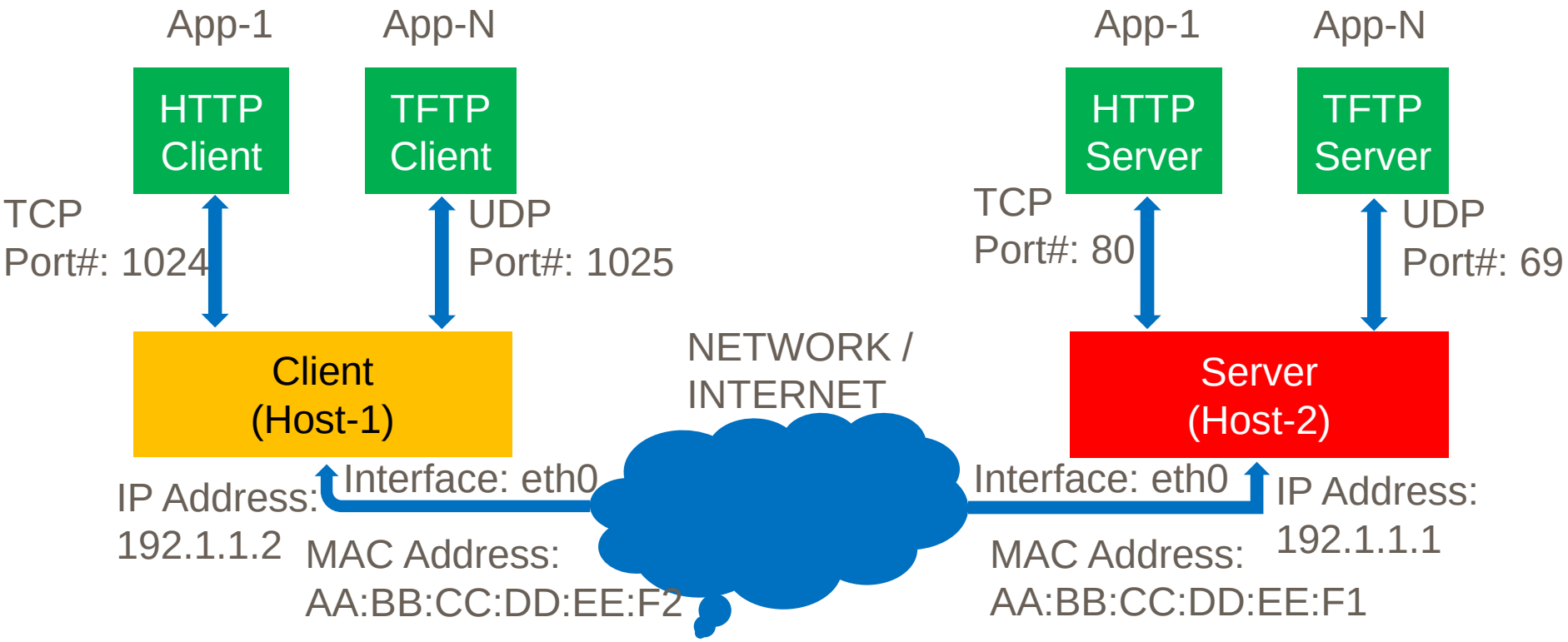
Application	Protocol	Layer
File Transfer	File Transfer Protocol (FTP)	L5-L7
Simple File Transfer	Trivial File Transfer Protocol (TFTP)	L5-L7
E-Mail	Simple Mail Transfer Protocol (SMTP)	L5-L7
Remote Login	Telnet	L5-L7
Remote Login (Secure Shell)	Secure Shell (SSH)	L5-L7
Network Management	Simple Network Management Protocol (SNMP)	L5-L7
Web Application	Hyper-Text Transfer Protocol (HTTP)	L5-L7
Host Configuration (IP Addr Mgt)	Dynamic Host Configuration Protocol (DHCP)	L5-L7
Interior Gateway Routing	Open Shortest Path First (OSPF)	L3
Interior Gateway Routing	Routing Information Protocol (RIP)	L3
Exterior Gateway Routing	Border Gateway Protocol (BGP)	L3
Bridging / Switching	Spanning Tree Protocols (STP, RSTP, MSTP)	L2
Network Tunneling	Layer 2 Tunneling Protocol (L2TP)	L2
Virtual Private Network	VPN, IPSec, SSL	L3

Network Communication Modes

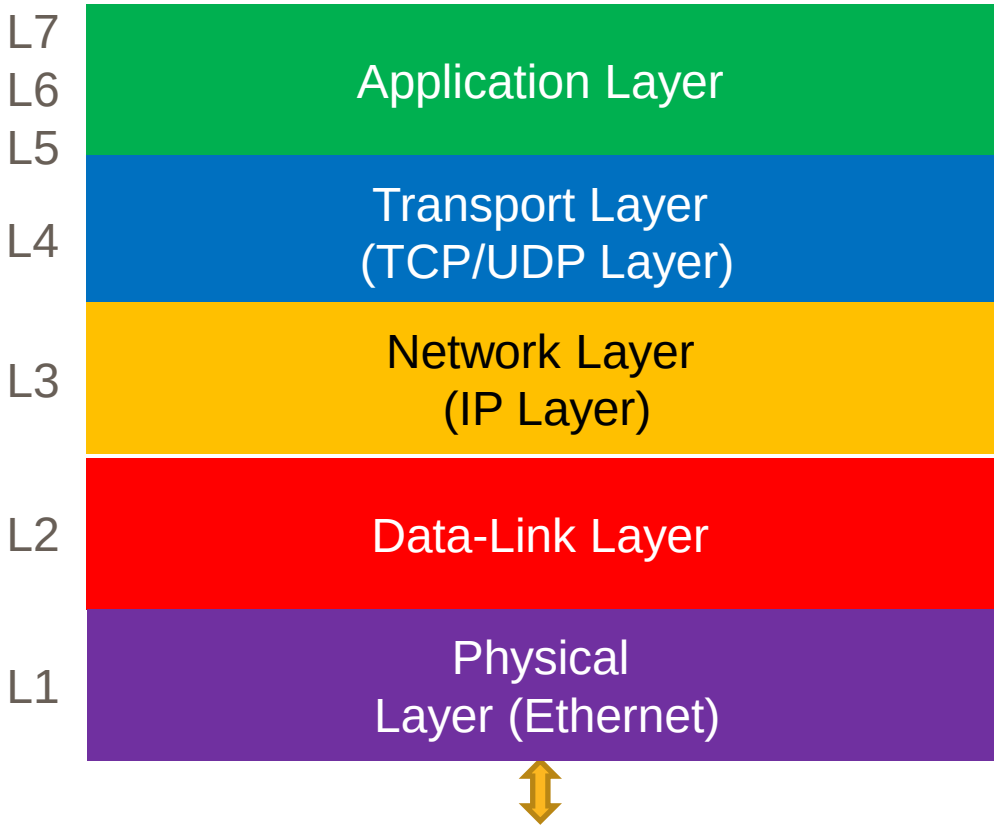
Client-Server Communication (Application Layer Protocols)

Peer-to-Peer Communication (L2-L3 / Switching-Routing Protocols)

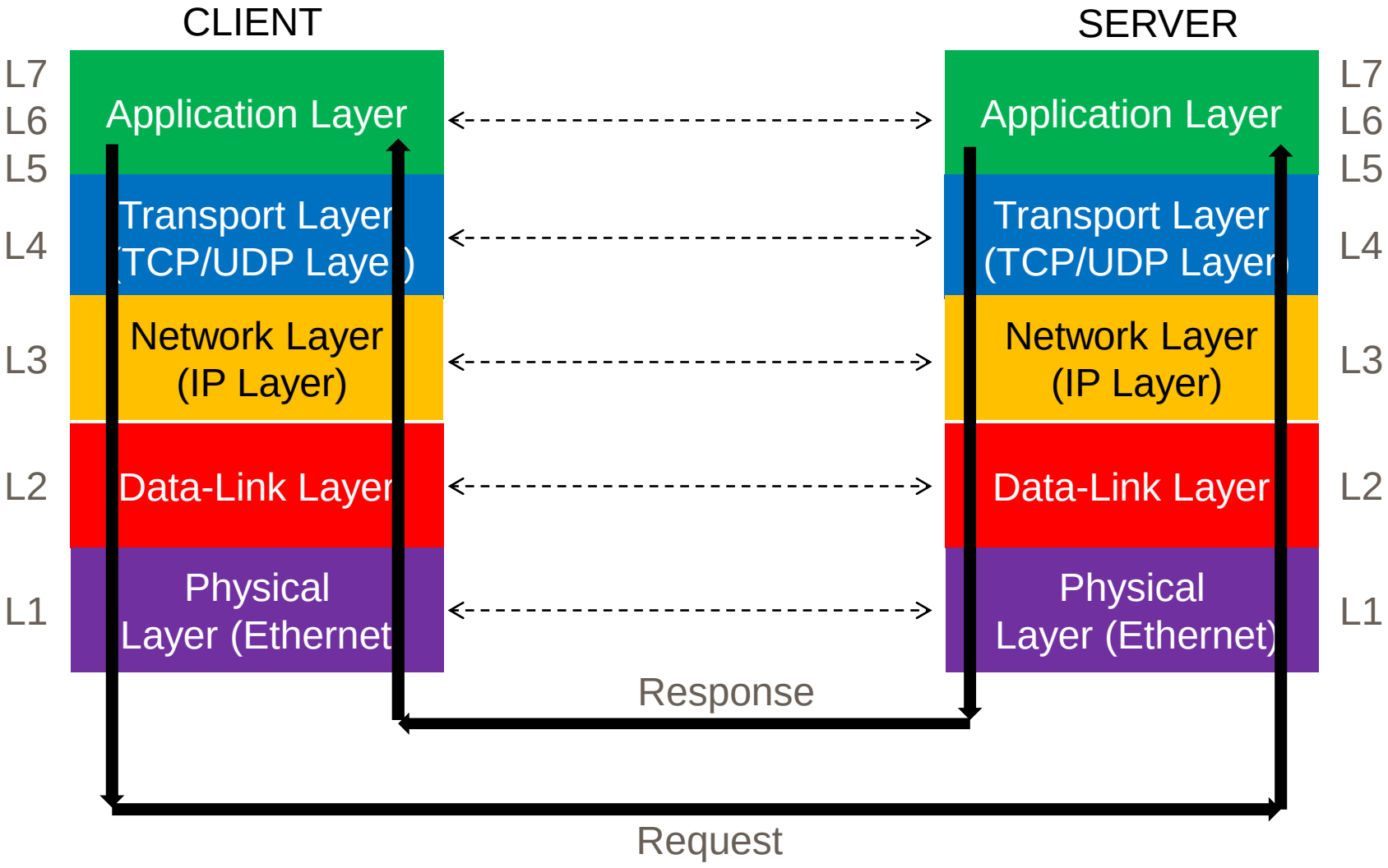
IP Addresses & Port Numbers



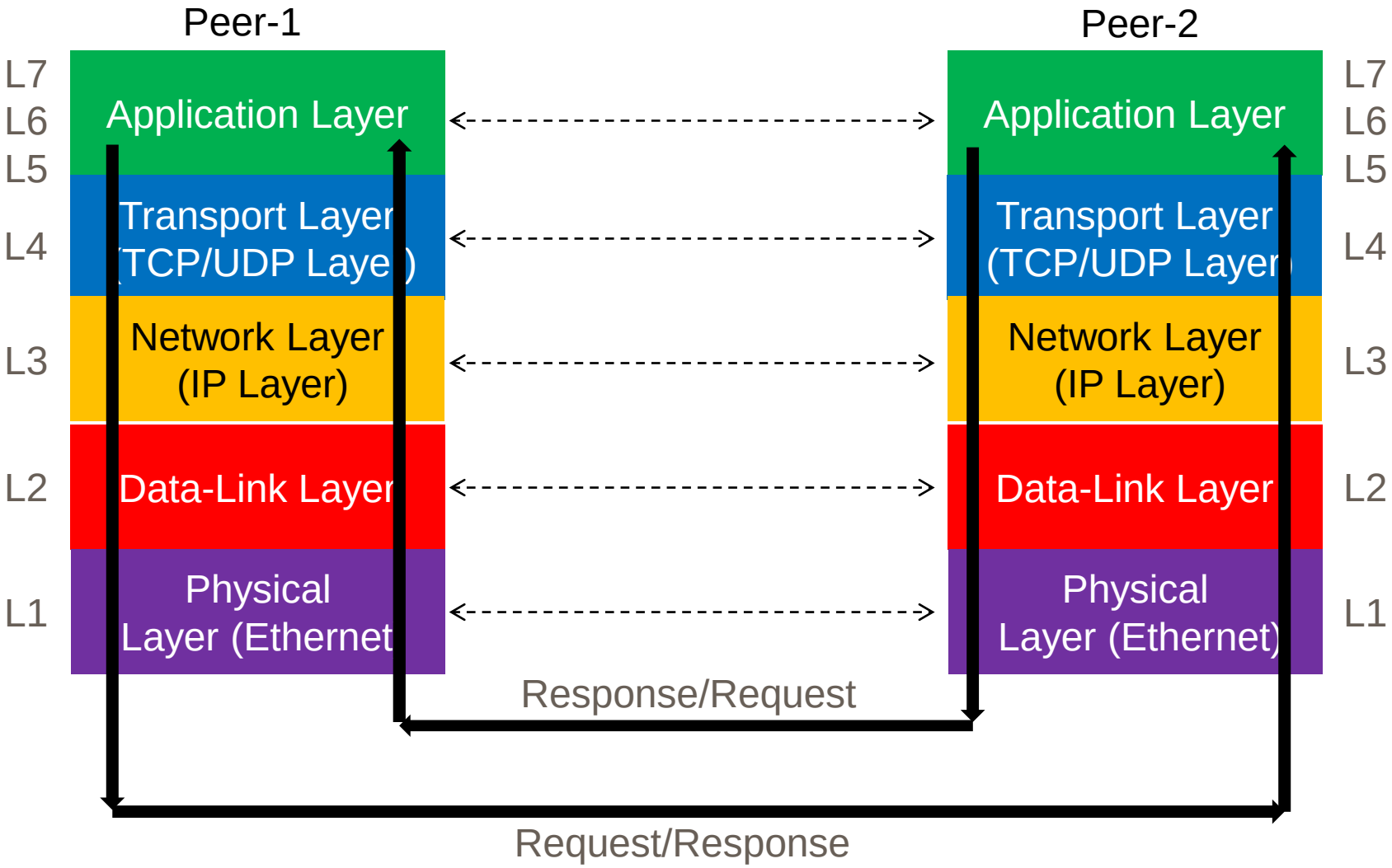
TCP/IP Network Stack–Layered Architecture



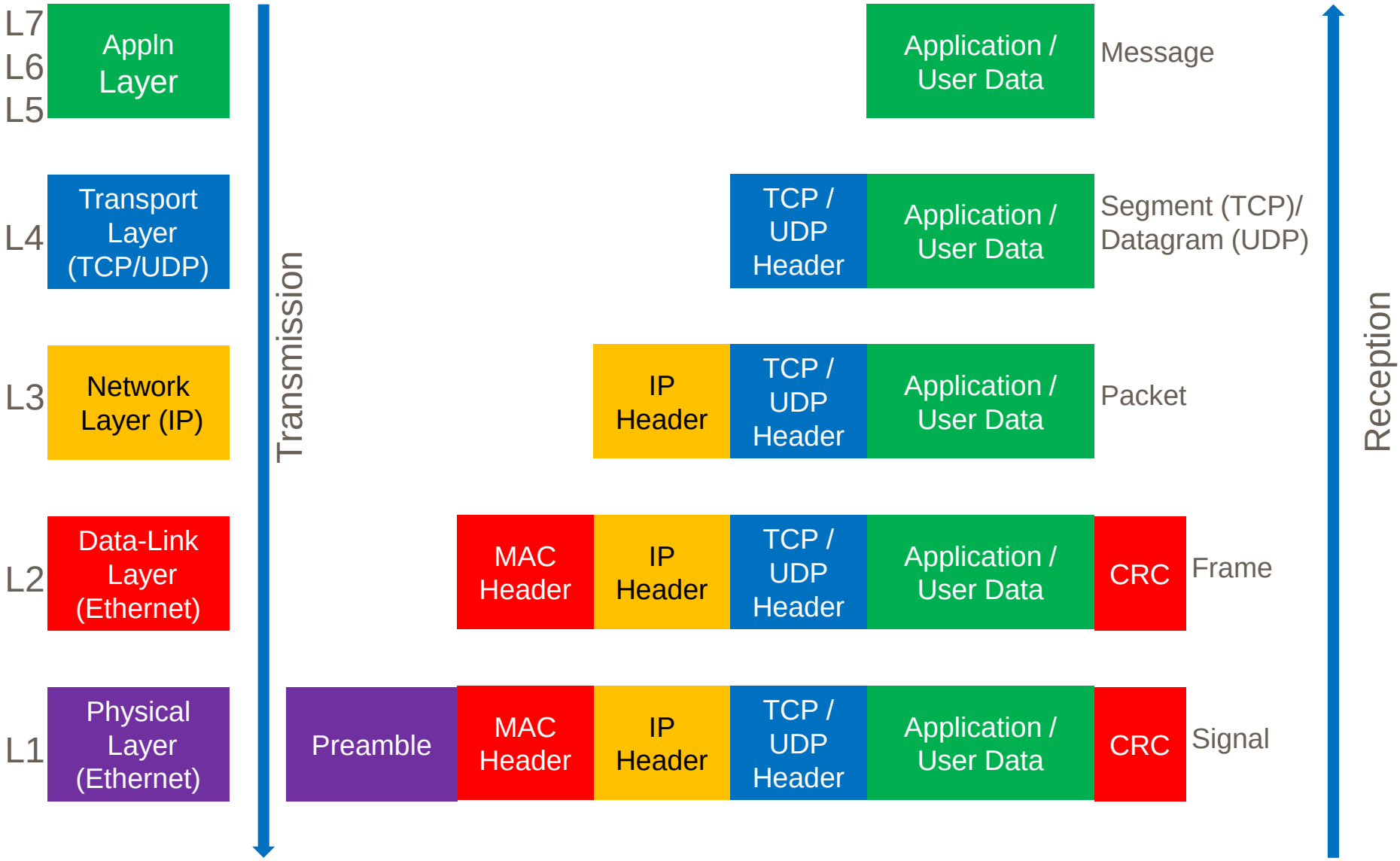
Client - Server Communication



Peer-to-Peer Communication

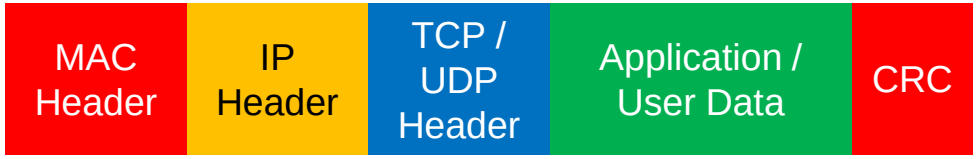


TX/RX Processing: Adding/Removing Headers



Layer-specific Packets

Application Packet
(Normal Packet)

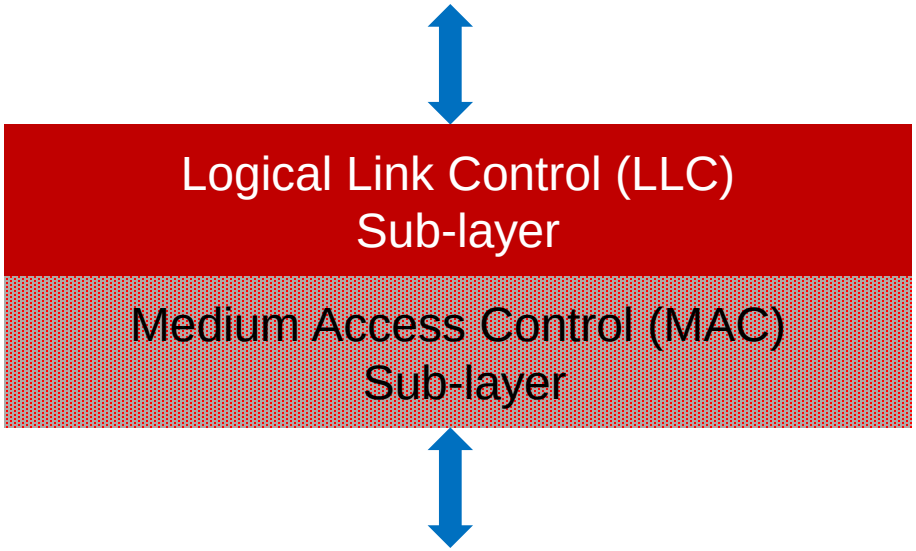


Layer-4 Packet
(e.g. TCP Ack Packet)

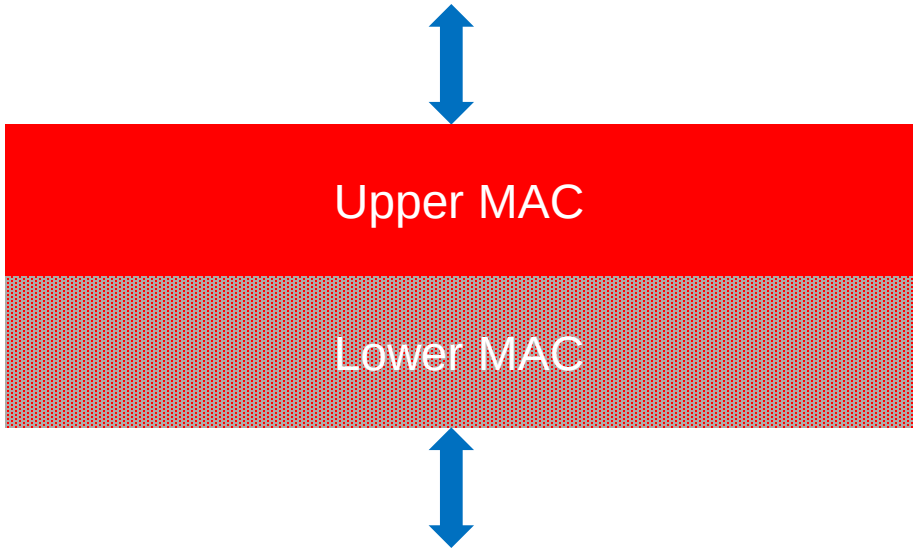
Layer-3 Packet
(e.g. ICMP/ARP Packet

Layer-2 Packet
(e.g. BPDU Packet)

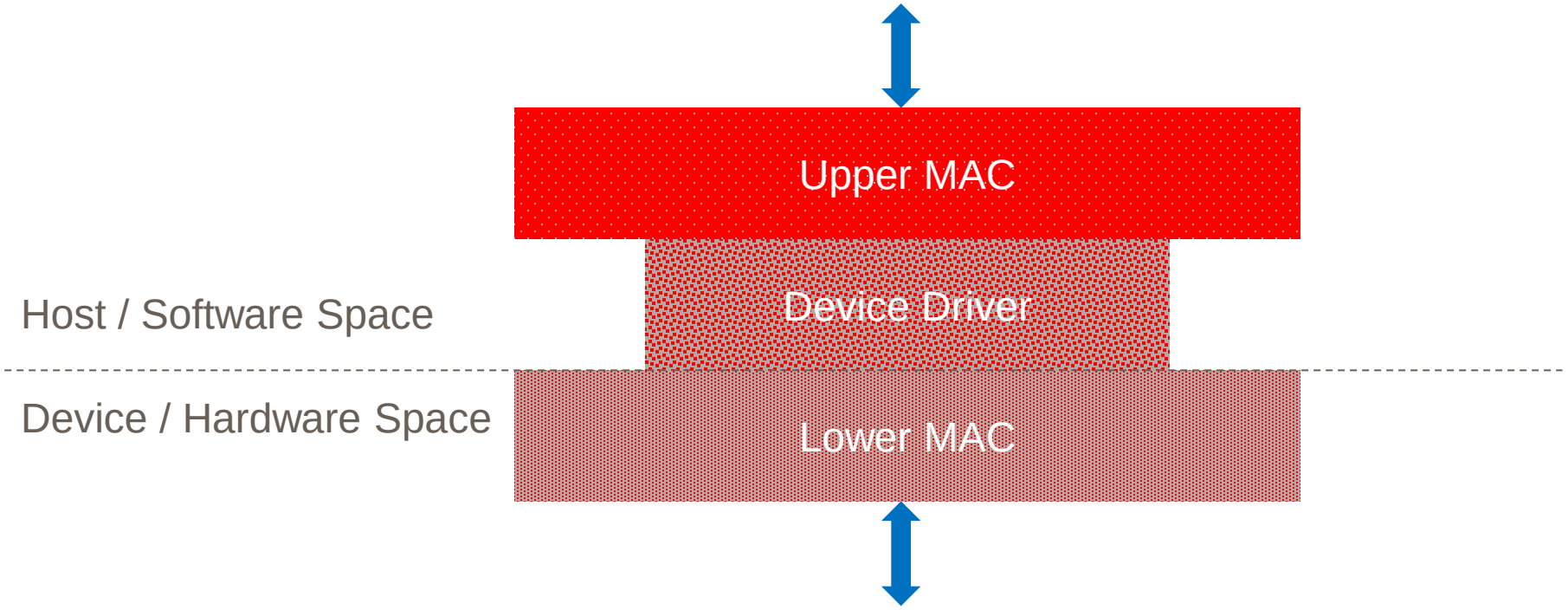
DataLink Layer – Functional Architecture



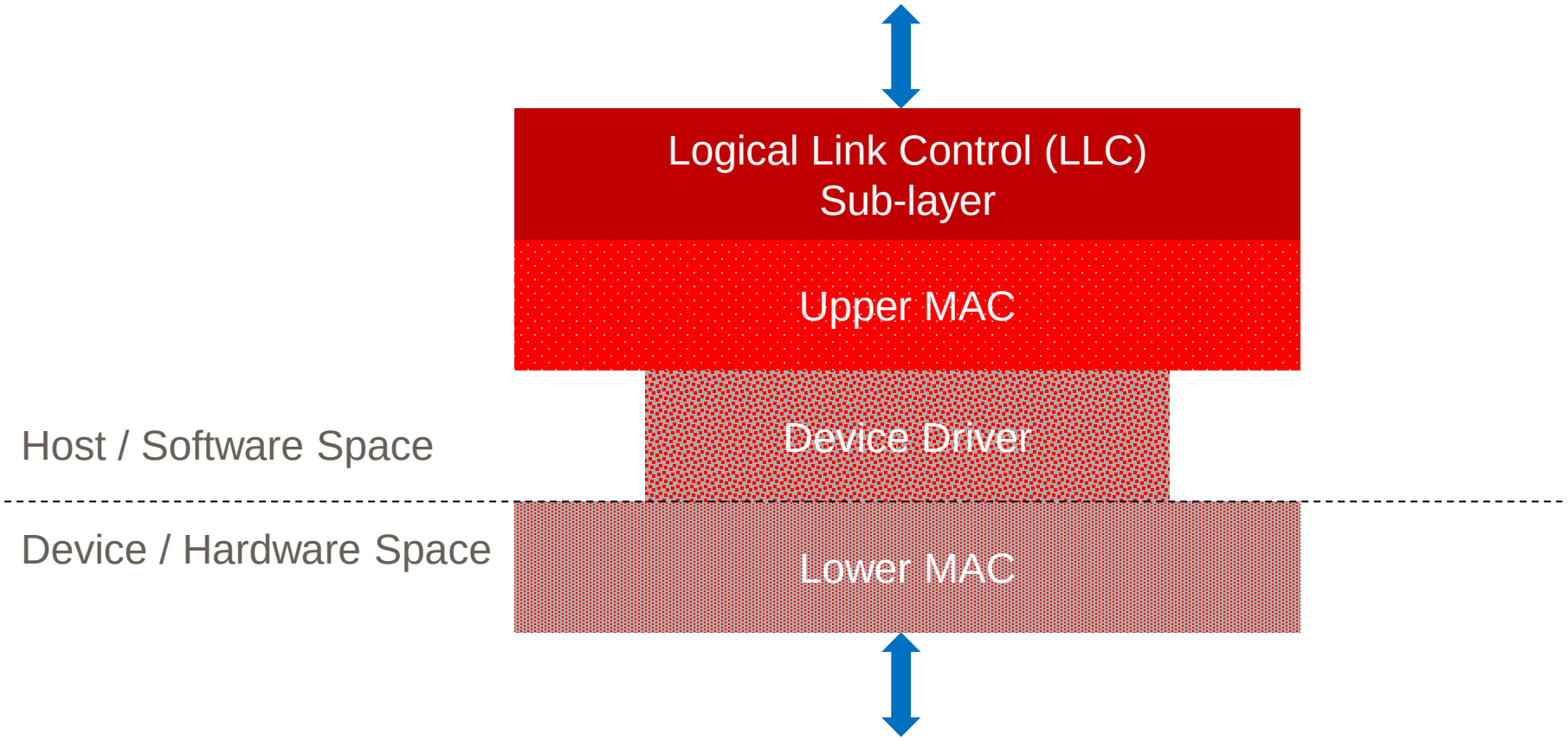
MAC Sub-layer – Functional Architecture



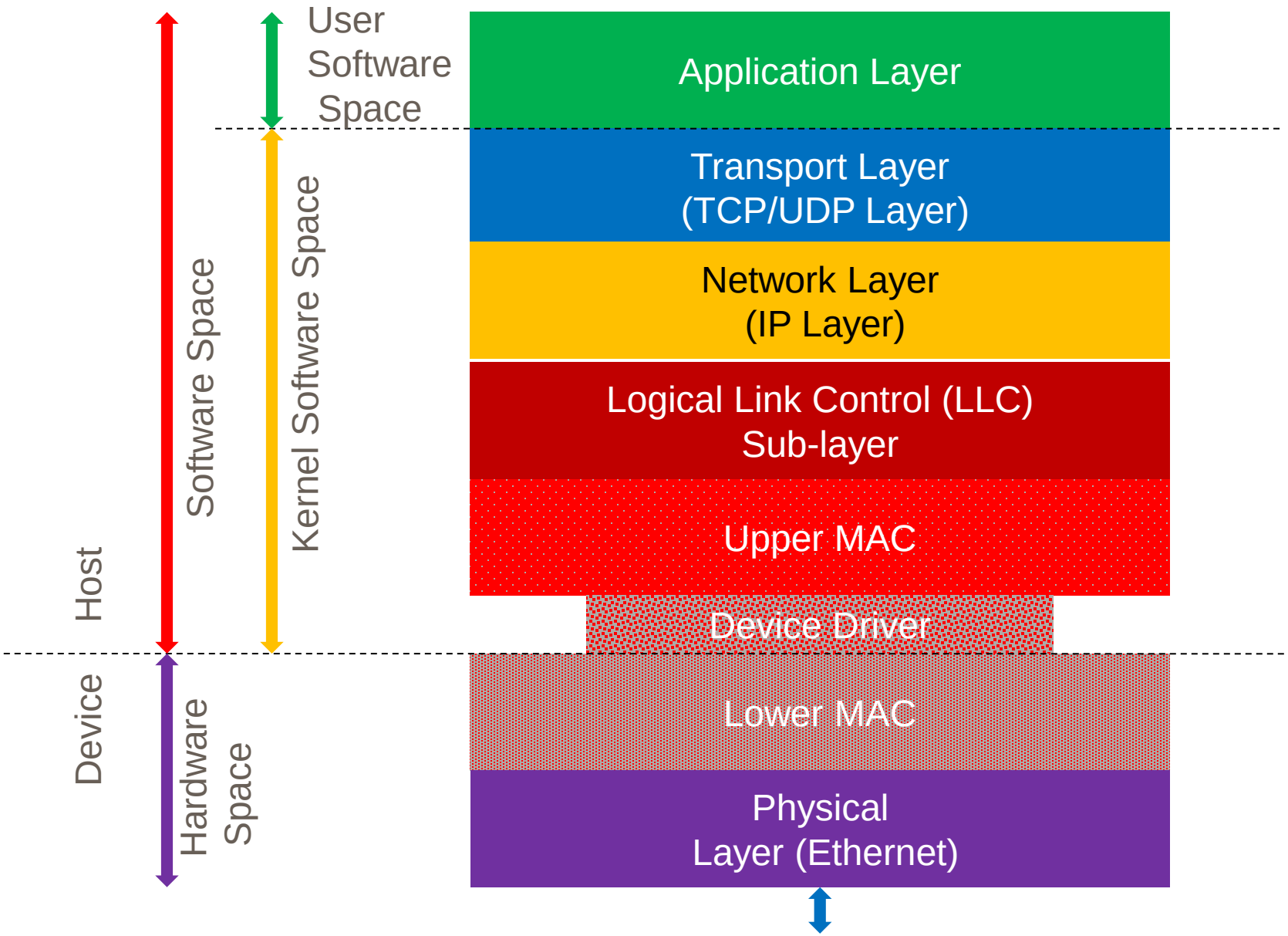
MAC Sub-layer – Implementation Architecture



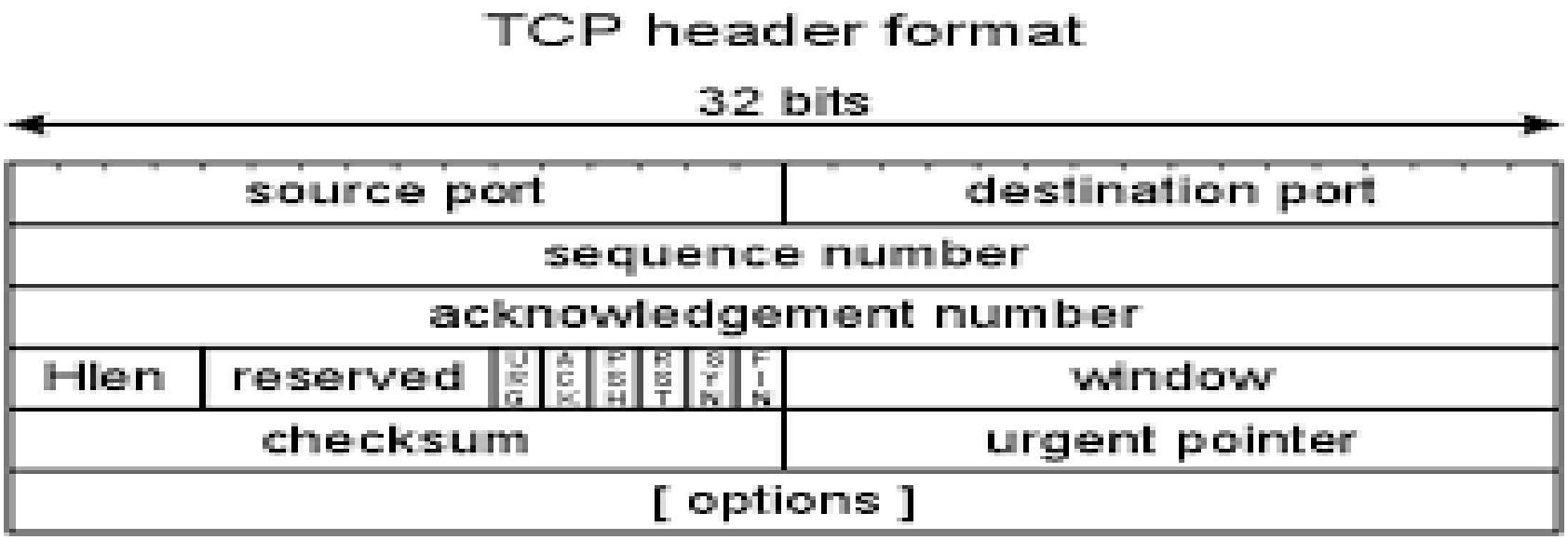
Data-Link Layer – Implementation Architecture



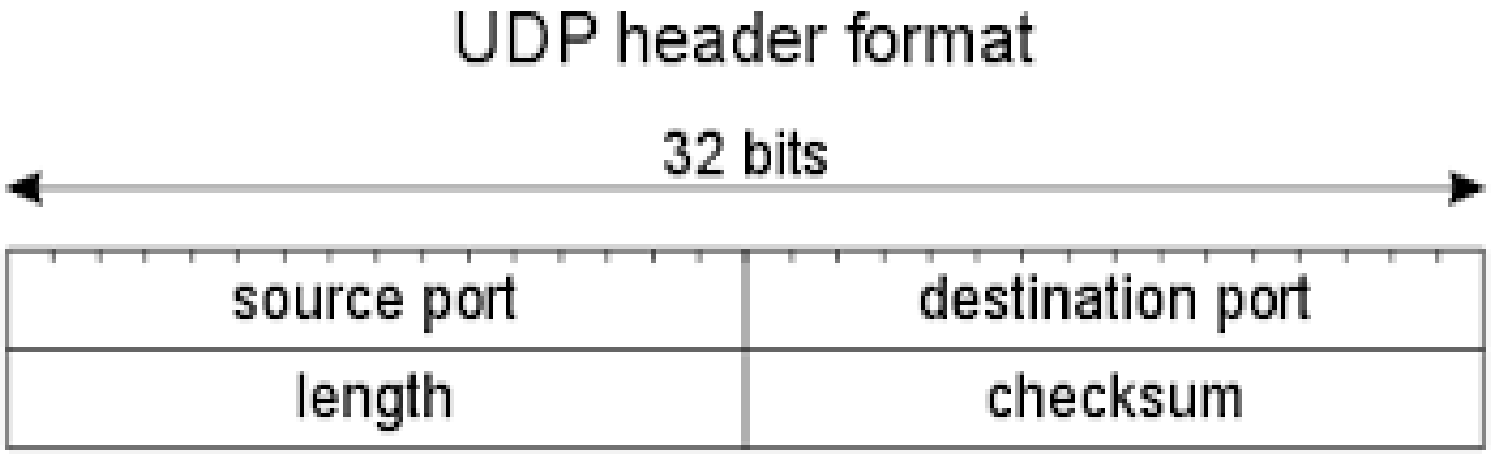
Network Stack – Implementation Architecture



TCP Header



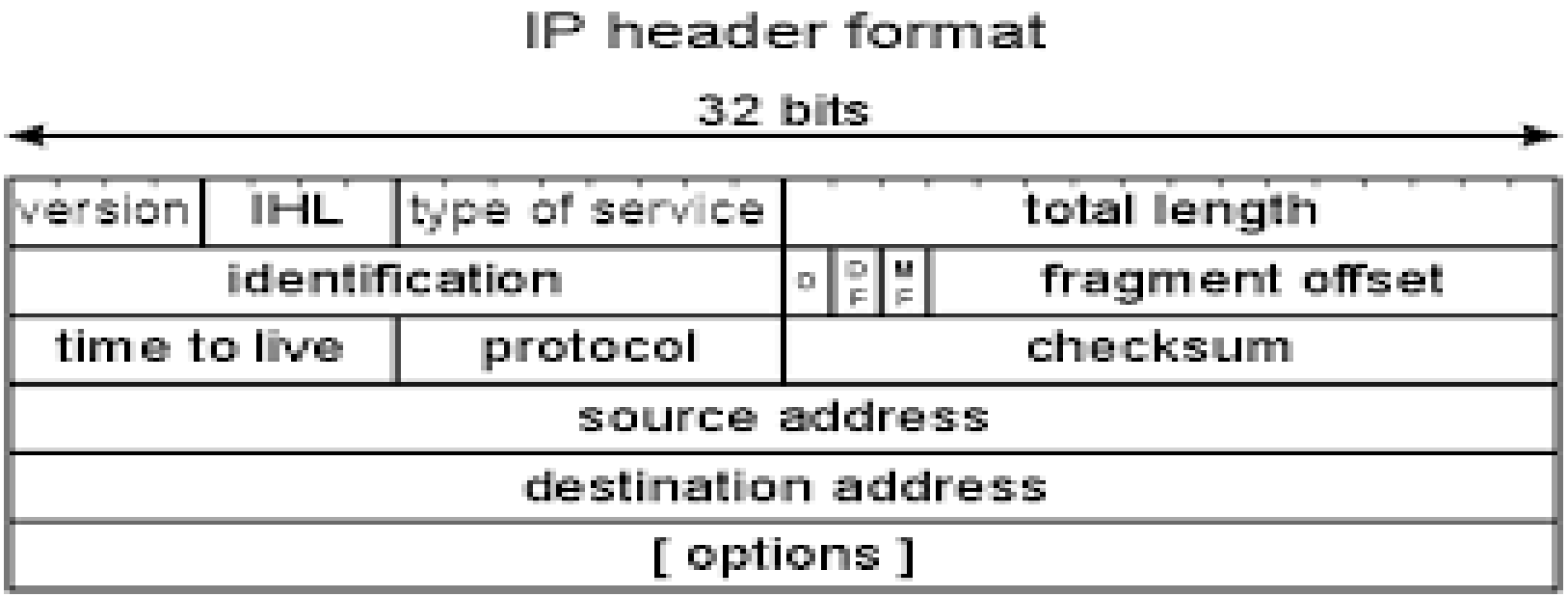
UDP Header



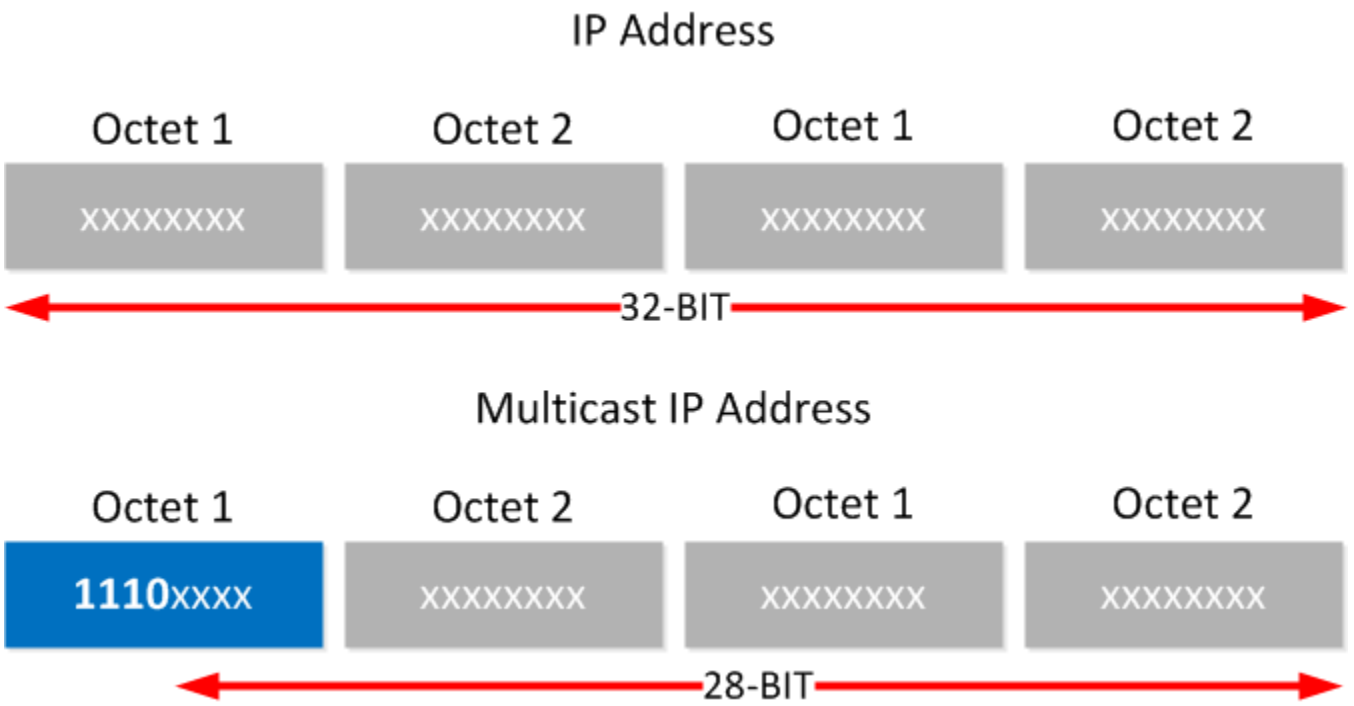
Network Protocols & Port Numbers

Application	Protocol	Port Type	Port #
File Transfer	FTP	TCP	20, 21
Remote Login (Secure Shell)	SSH	TCP	22
Remote Login	Telnet	TCP	23
E-Mail	SMTP	TCP	25
Web Application	HTTP	TCP	80
Exterior Gateway Routing	BGP	TCP	179
Host Configuration (IP Addr Mgmt)	DHCP	UDP	67,68
Simple File Transfer	TFTP	UDP	69
Network Management	SNMP	UDP	161
Interior Gateway Routing	RIP	UDP	520

IP Header



IP Addresses

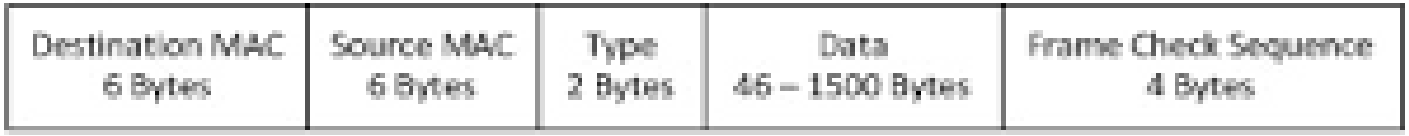


IP Addresses (Contd.)

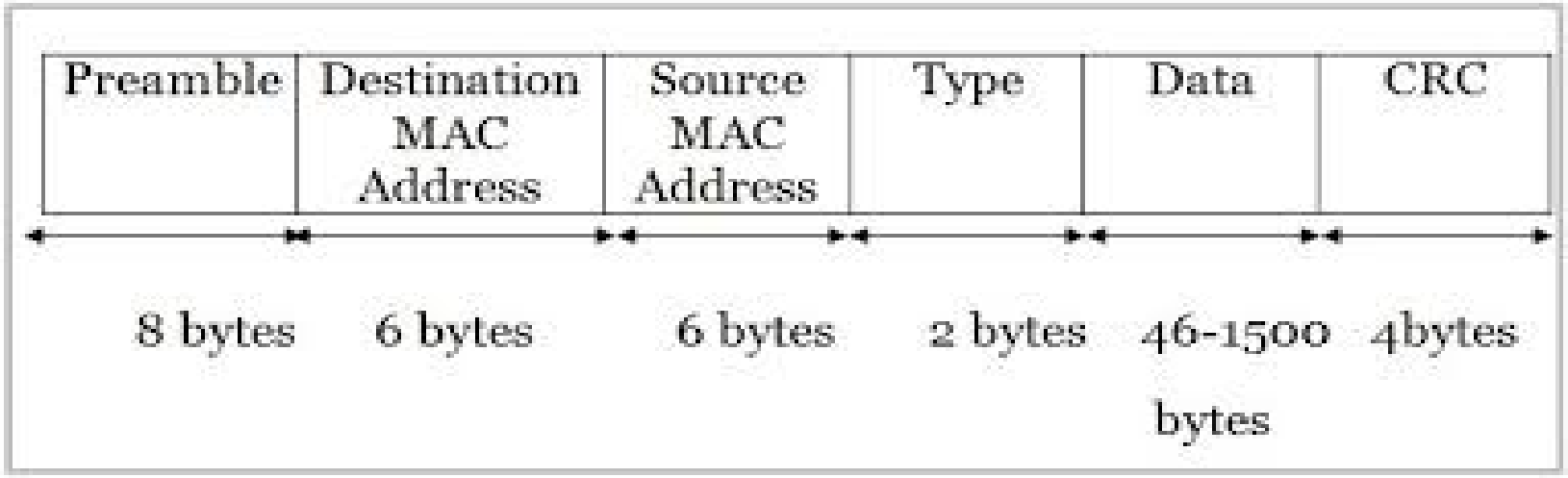
IP Address Length:	4 Bytes
IP Address Format:	ddd.ddd.ddd.ddd
All Broadcast IP Address:	255.255.255.255
Multicast IP Address range:	224.0.0.0 – 239.255.255.255
Class A IP Address range:	ddd.0.0.0 – ddd.255.255.255
Class B IP Address range:	ddd.ddd.0.0 – ddd.ddd.255.255
Class C IP Address range:	ddd.ddd.ddd.0 - ddd.ddd.ddd.255
Class A Broadcast IP Address:	ddd.255.255.255
Class B Broadcast IP Address:	ddd.ddd.255.255
Class C Broadcast IP Address:	ddd.ddd.ddd.255
Class A Network Address:	ddd.0.0.0
Class B Network Address:	ddd.ddd.0.0
Class C Network Address:	ddd.ddd.ddd.0
Unicast IP Addresses:	Remaining IP Addresses
Classless IP address	

MAC (Ethernet) Header

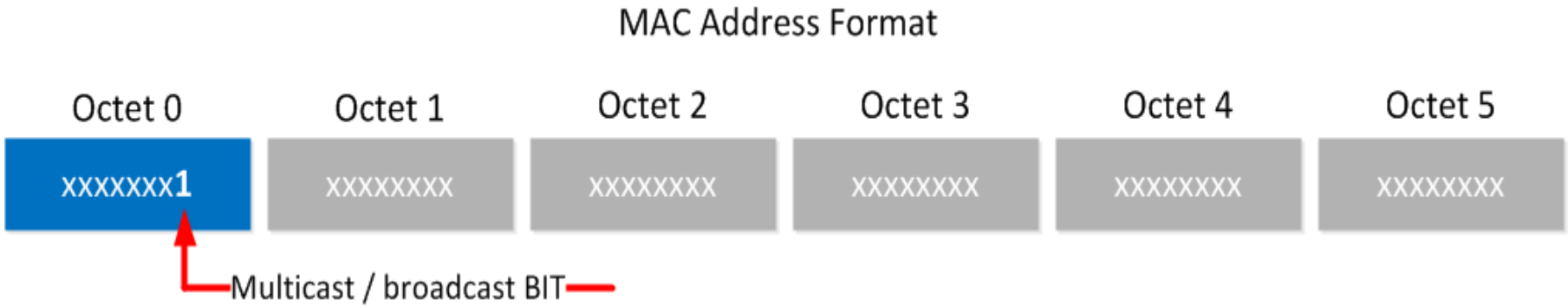
Ethernet II



MAC (Ethernet) Frame Format



MAC Addresses



MAC Address Length:	6 Bytes
MAC Address Format:	XX:XX:XX:XX:XX:XX
Broadcast / Multicast MAC Address:	X1:XX:XX:XX:XX:XX
Multicast MAC Address:	01:00:5E:XX:XX:XX
Broadcast MAC Address:	FF:FF:FF:FF:FF:FF
Unicast MAC Address:	Remaining MAC Addresses

Layer-wise Identifiers

Layer	Identifier	Identifies
MAC sub-layer (L2)	MAC Address	Network Interface
Network (IP) Layer (L3)	IP Address	Host
Transport (TCP/UDP) Layer (L4)	Protocol Number	Transport Protocol (TCP/UDP)
Application Layer (L5-L7)	Port Number	Network Application / Process

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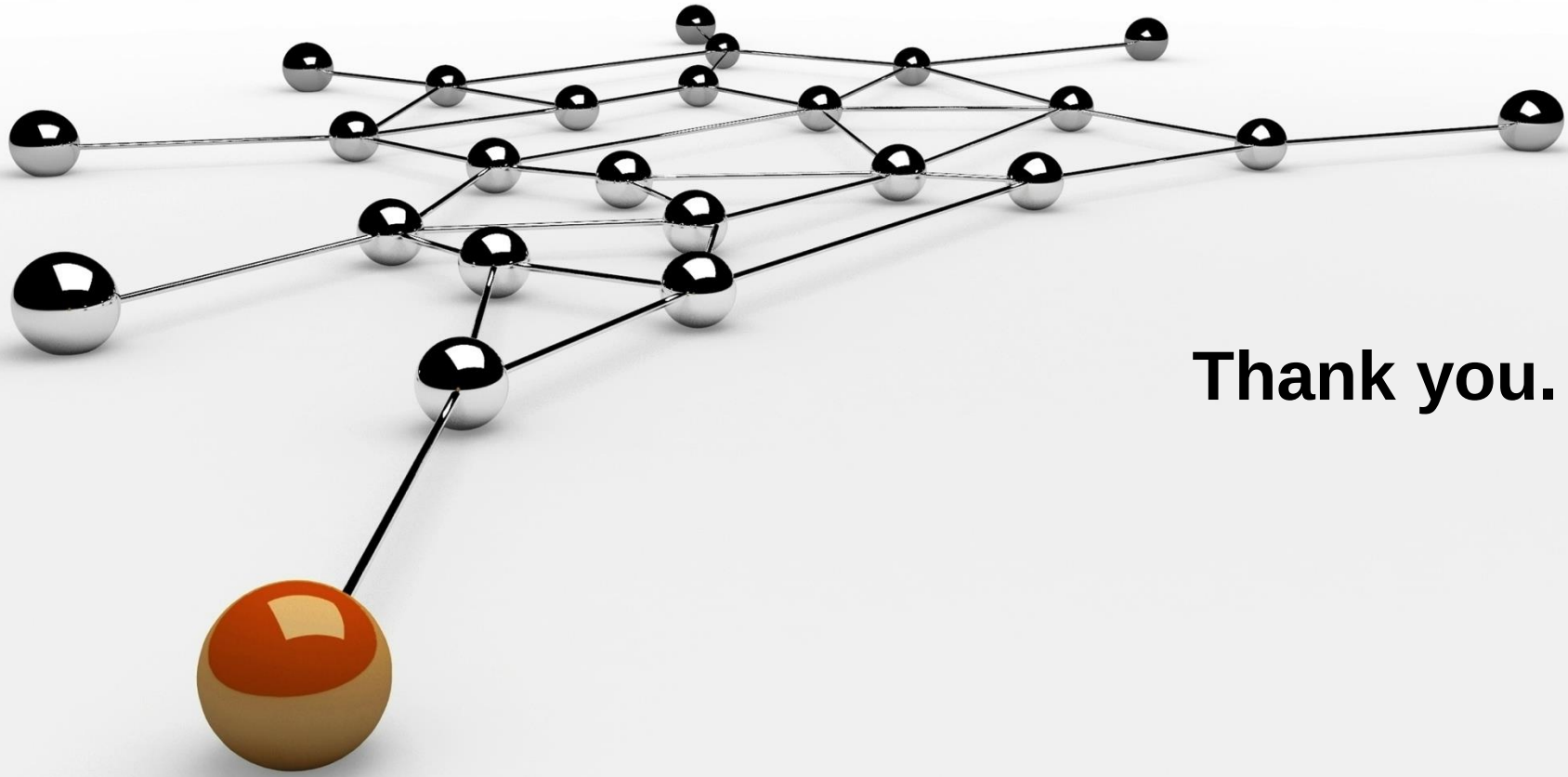

Thank you.