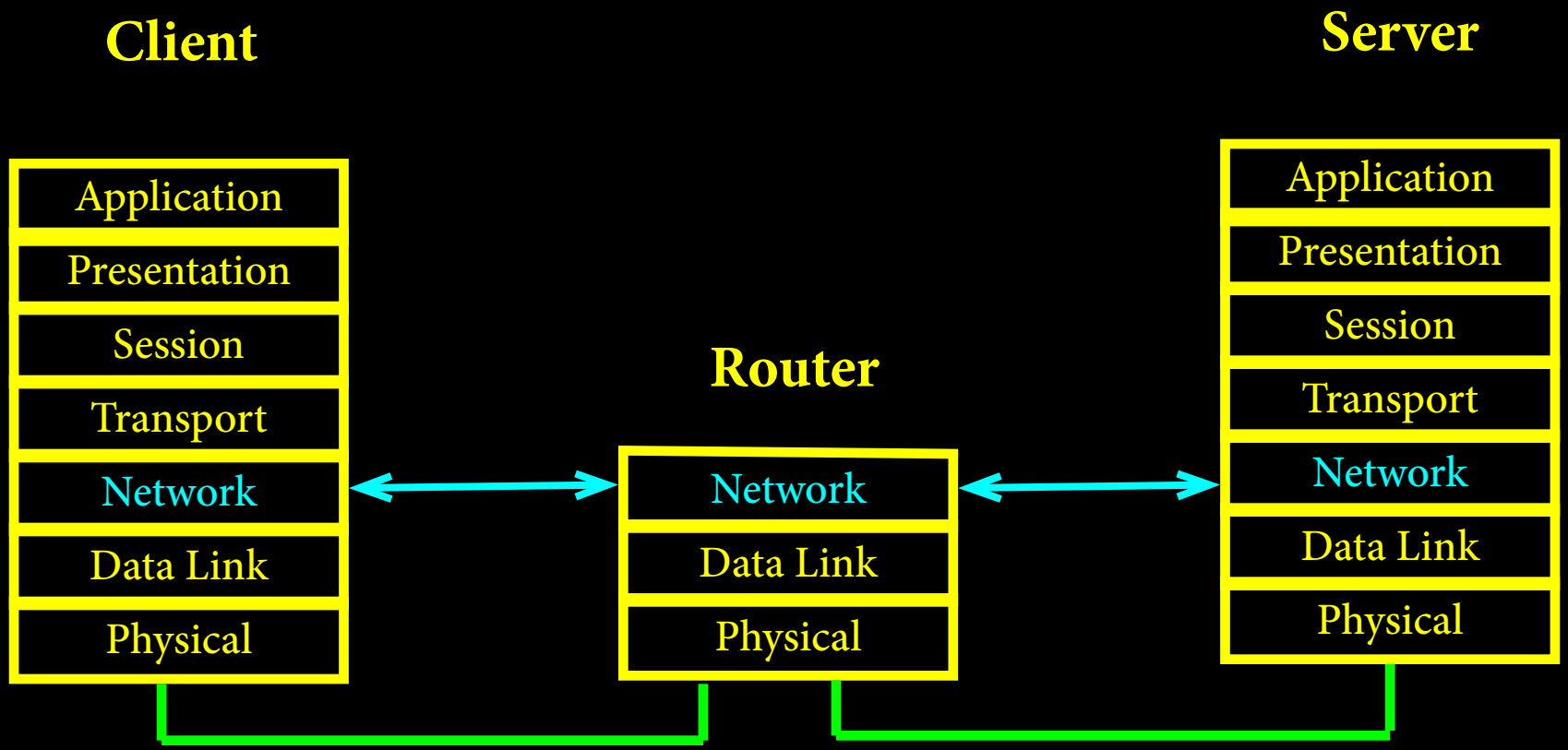
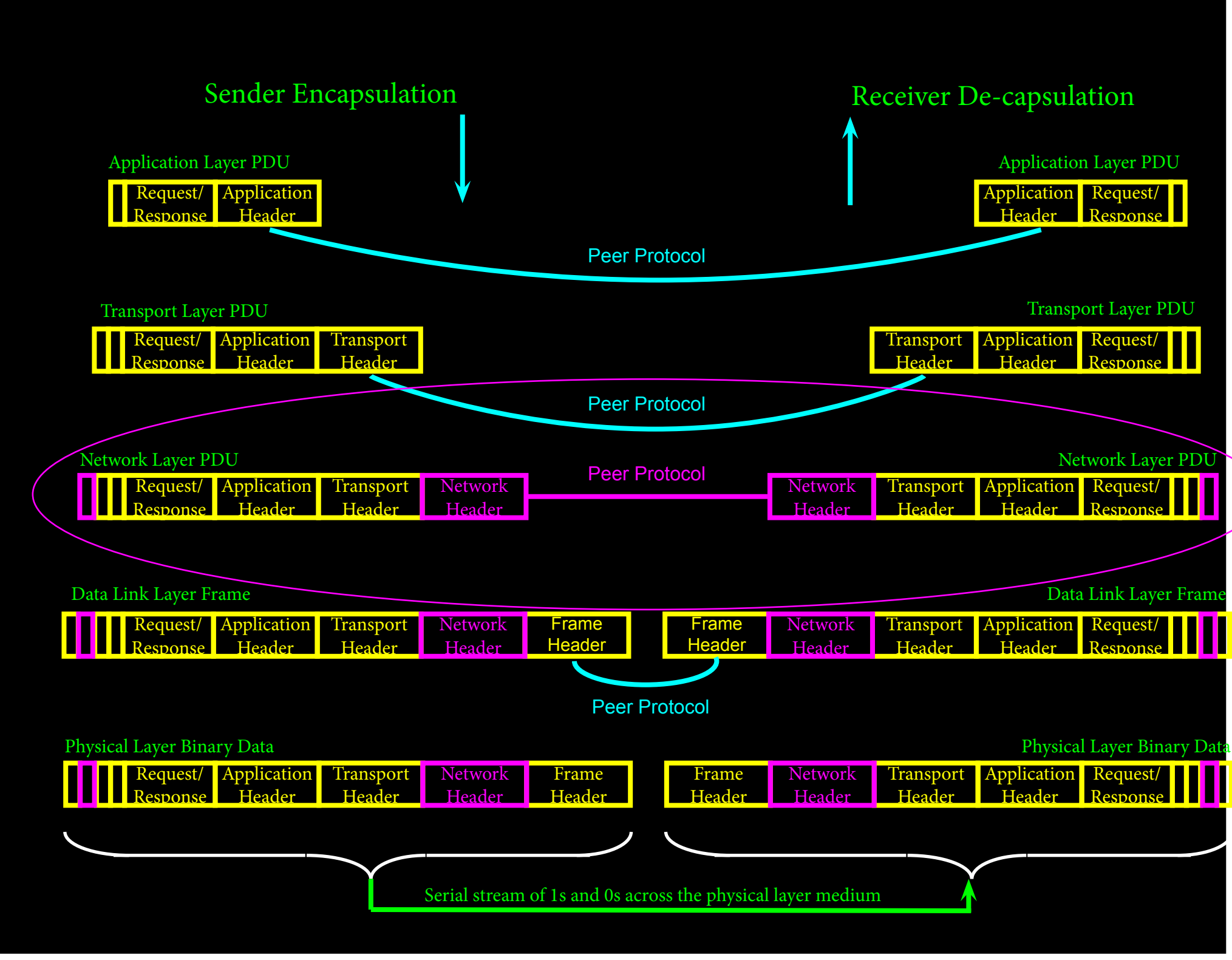
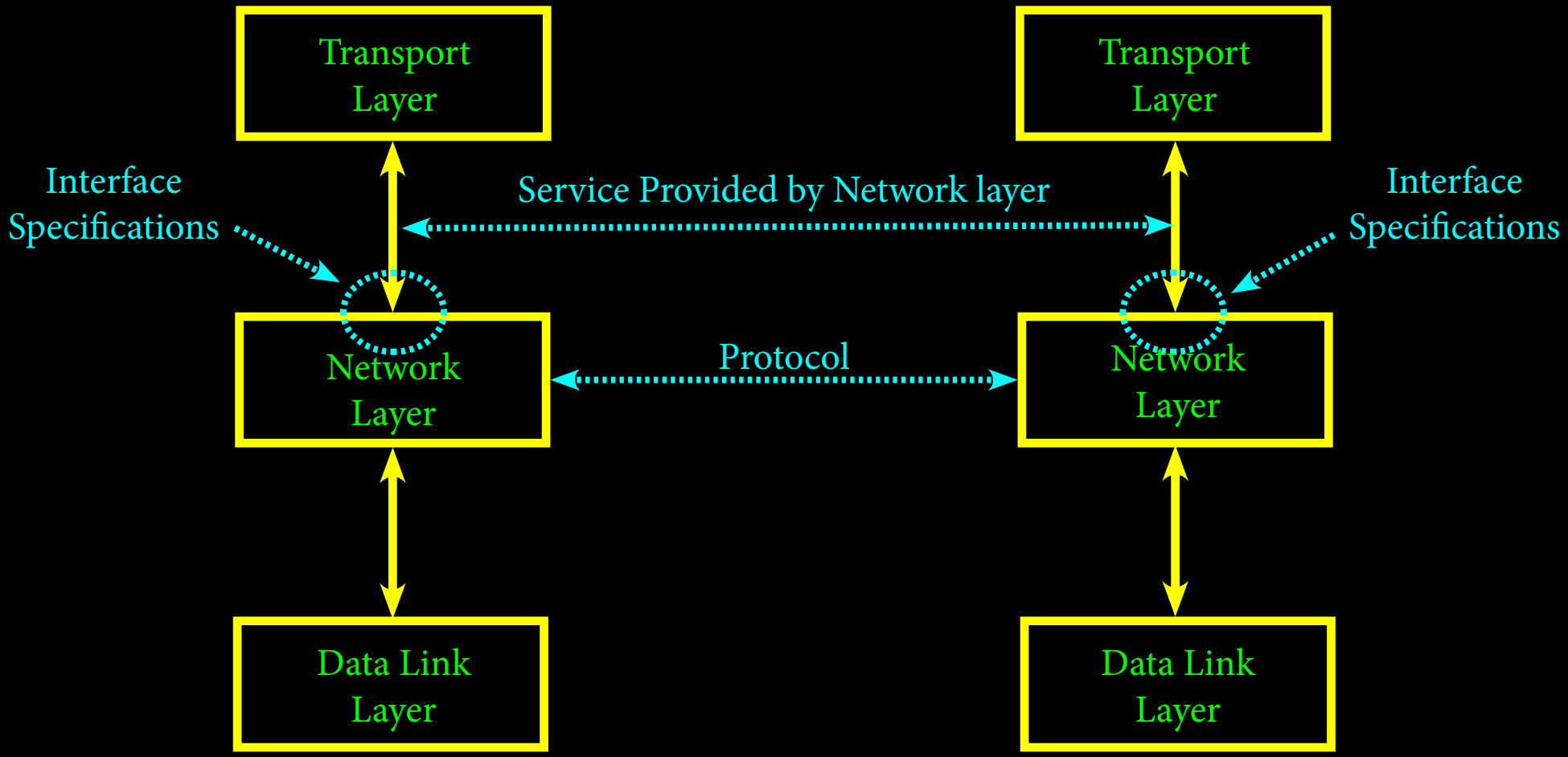
Open Systems Interconnection (OSI) Reference Model

(by the ISO)




Sender Encapsulation
Receiver De-capsulation
Application Layer PDU
Request/ Response
Application Header
Application Layer PDU
Application Header
Request/ Response
Peer Protocol
Transport Layer PDU
Request/ Response
Application Header
Transport Header
Transport Layer PDU
Transport Header
Application Header
Request/ Response
Peer Protocol
Network Layer PDU
Request/ Response
Application Header
Transport Header
Network Header
Peer Protocol
Network Layer PDU
Network Header
Transport Header
Application Header
Request/ Response
Data Link Layer Frame
Request/ Response
Application Header
Transport Header
Network Header
Frame Header
Data Link Layer Frame
Frame Header
Network Header
Transport Header
Application Header
Request/ Response
Peer Protocol
Physical Layer Binary Data
Request/ Response
Application Header
Transport Header
Network Header
Frame Header
Physical Layer Binary Data
Frame Header
Network Header
Transport Header
Application Header
Request/ Response
Serial stream of 1s and 0s across the physical layer medium

OSI Reference Model *Network* Layer Attributes



Network Layer Attribute Detail

Service Attribute:

1. Address Resolution
2. Routing
3. Congestion Control
4. Quality of Service
5. NAT

Network Layer Attribute Detail

Protocol Attribute:

Popular Network Layer Protocols:
IPv4
IPv6
ARP
MPLS

For a complete list, visit the IANA table:

http://www.iana.org/assignments/protocol-numbers/protocol-numbers.xhtml#protocol-numbers-1

Network Layer Attribute Detail

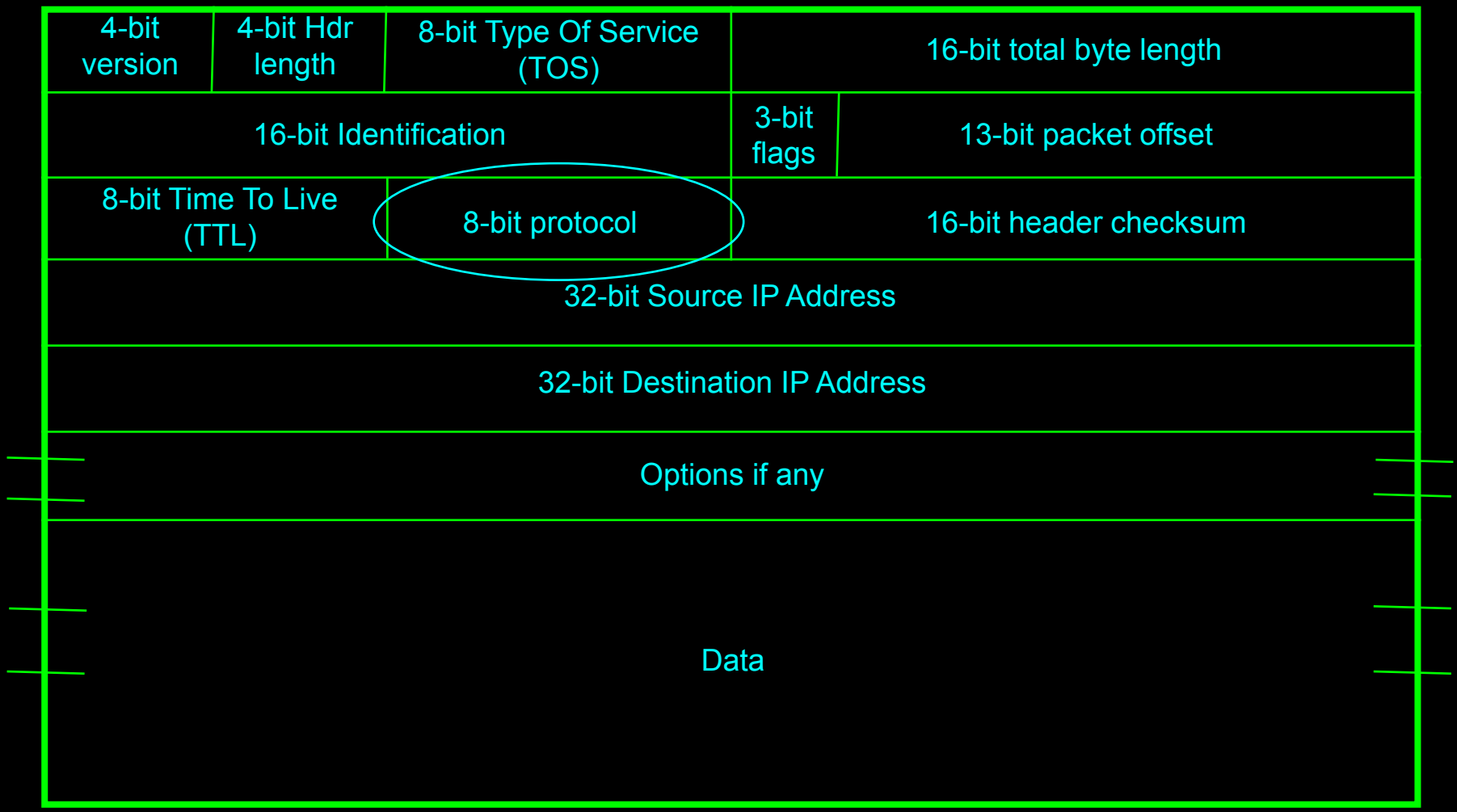
Interface Attribute:

1. Encapsulating (sending):
    a. From upper transport layer:
        Transport layer protocol number
    b. To lower data link layer:
        Network protocol number

2. De-capsulating (receiving):
    a. From lower data link layer:
        Network layer protocol number
    b. To upper transport layer:
        Transport layer protocol number

Network Protocol Attributes
Intra- and Inter- Networking Protocols

IP Header Format



Router Protocols
RIP, OSPF, BGP
and IMCP

1. RIP, OSPF, and BGP are application layer protocols

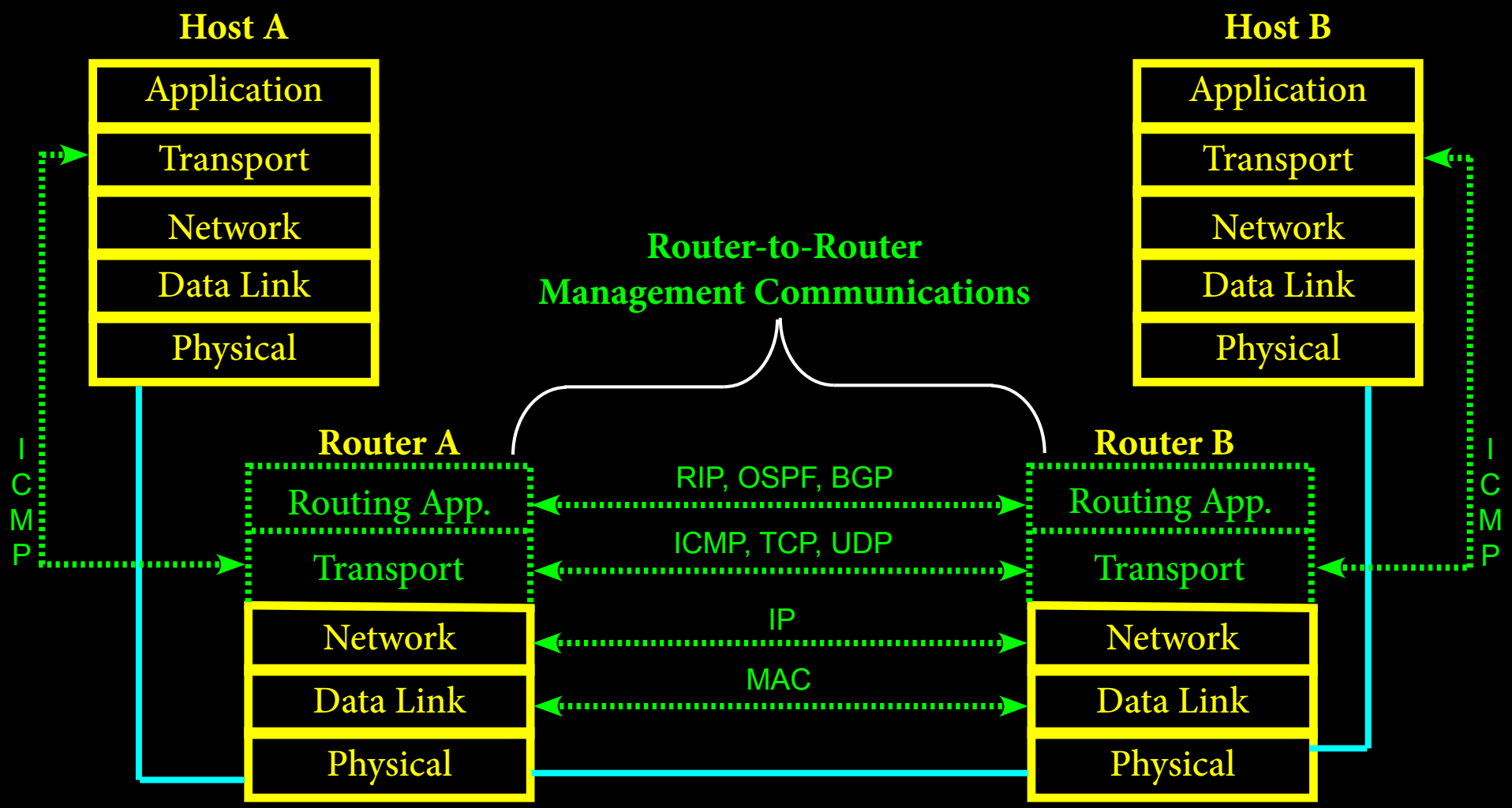
2. ICMP is a transport layer protocol

1. Routing protocols are integral to layer 3, the network layer. Why then are routing protocols a layer 5, application layer, protocol?

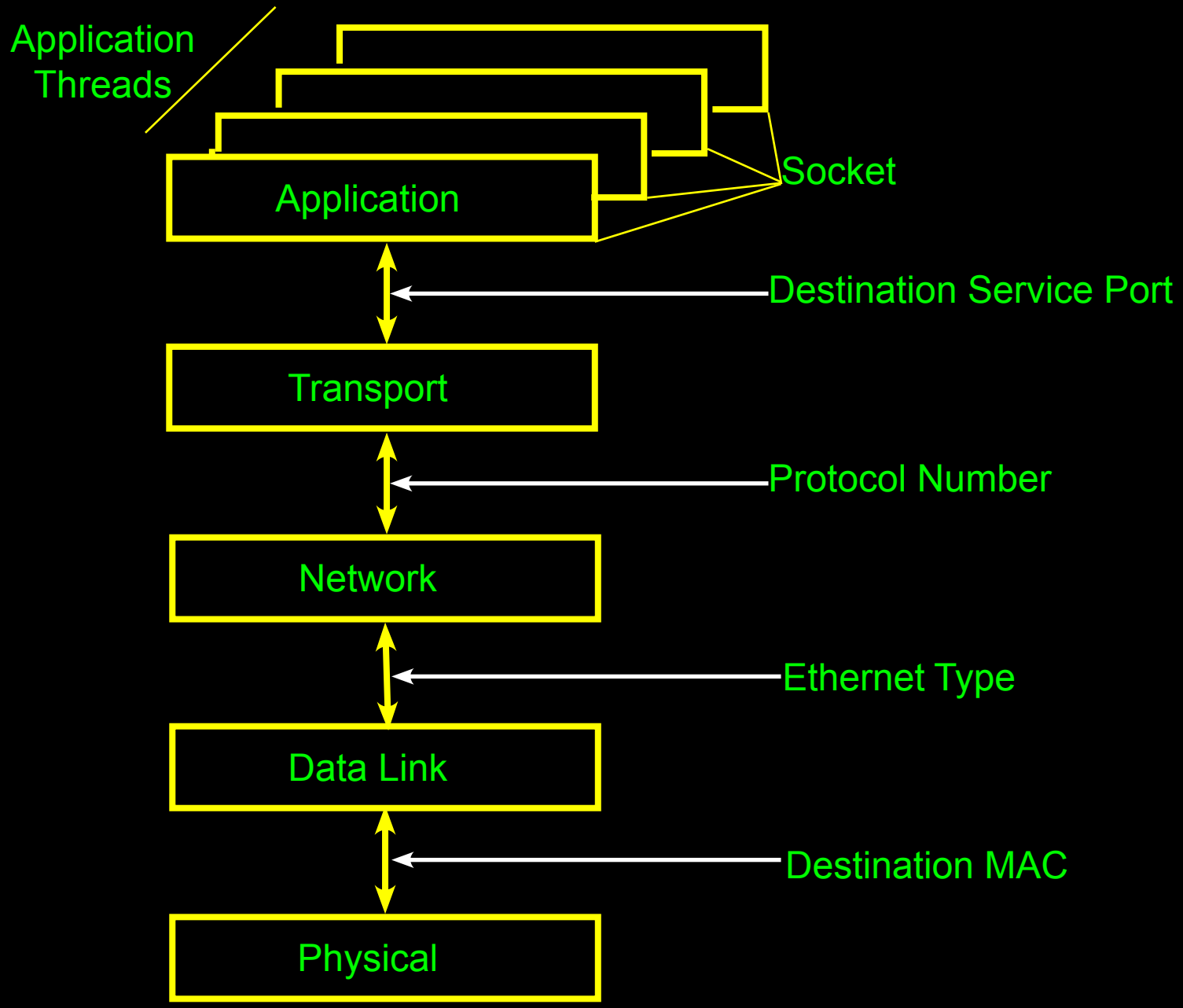
2. ICMP is integral to layer 3, the network layer. Why then is ICMP a layer 4, transport layer, protocol?

TCP/IP Reference Model

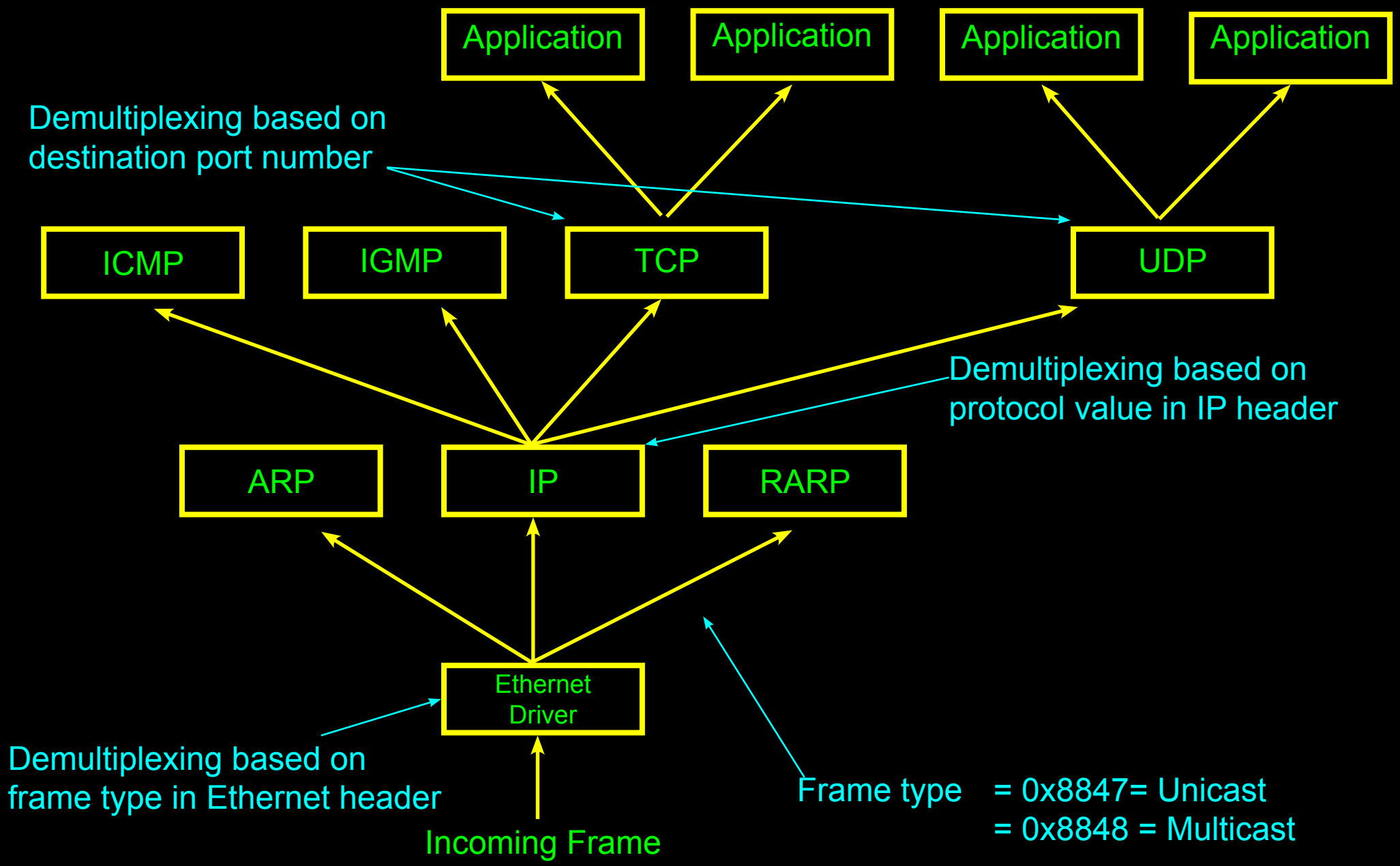
Layer-by-Layer Protocols for Router-to-Router Management Communications

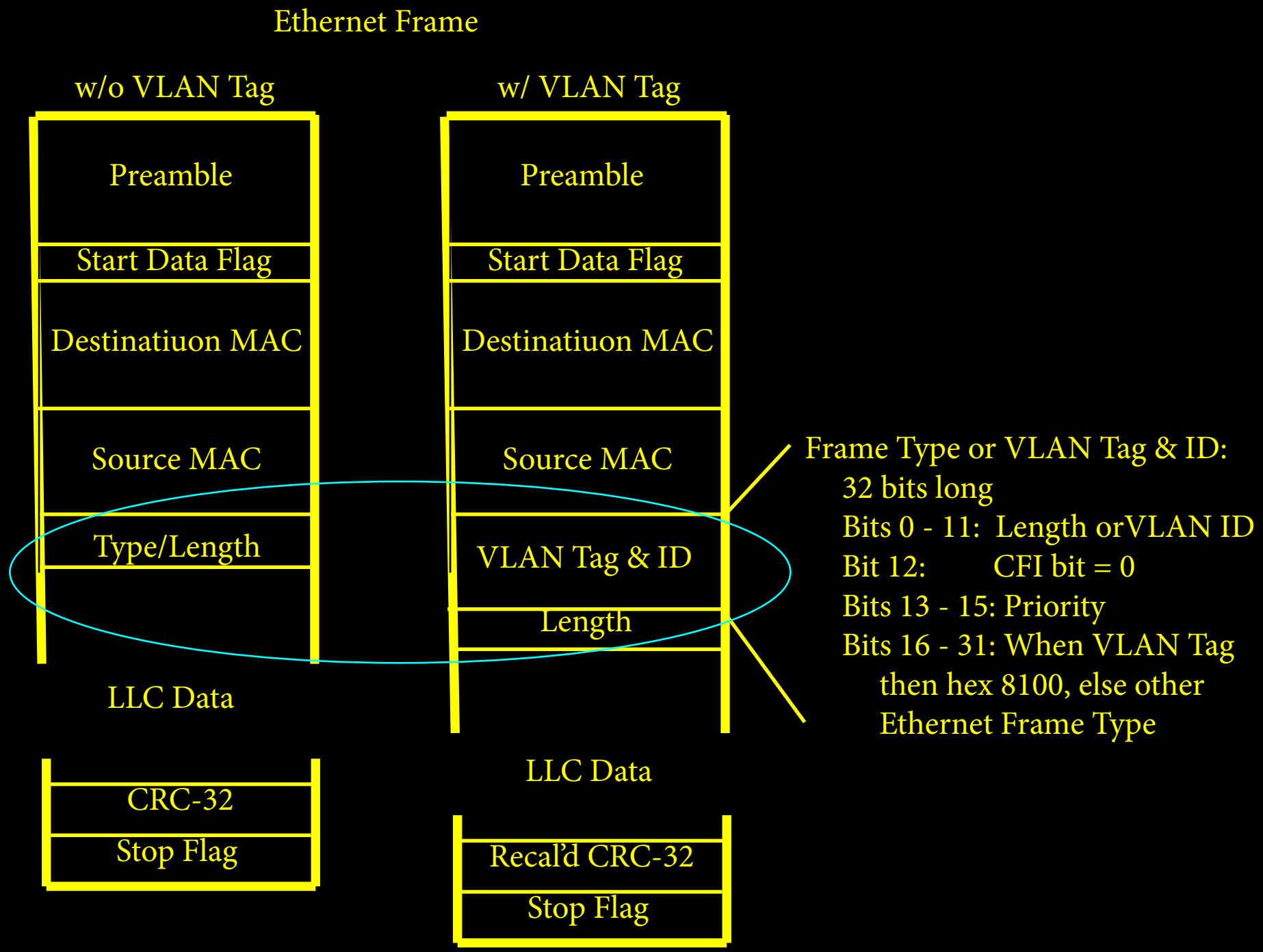


TCP/IP Layer-to-Layer Interface Identifications
aka The Demultiplexing of an Ethernet Frame



Demultiplexing of received Ethernet frame




Ethernet Frame
w/o VLAN Tag
w/ VLAN Tag
Preamble
Start Data Flag
Destinatiuon MAC
Source MAC
Type/Length
LLC Data
CRC-32
Stop Flag
Preamble
Start Data Flag
Destinatiuon MAC
Source MAC
VLAN Tag & ID
Length
LLC Data
Recal'd CRC-32
Stop Flag
Frame Type or VLAN Tag & ID:
32 bits long
Bits 0 - 11: Length orVLAN ID
Bit 12: CFI bit = 0
Bits 13 - 15: Priority
Bits 16 - 31: When VLAN Tag
then hex 8100, else other
Ethernet Frame Type

IANA.org References

1. Ethernet Types (2 bytes):
   http://www.iana.org/assignments/ieee-802-numbers

   AKA: Network Layer Protocol Numbers

   Hex 0000 - 05DC ==> Frame length values (w/ a few exceptions)

   Examples:
   - 0800 ==> IPv4
   - 0BAD ==> Banyan Vines
   - 809B ==> Appletalk
   - 8100 ==> 802.1Q, VLAN tagged frame
   - 86DD ==> IPv6
   - 8847 ==> MPLS

Typical Implementation of Physical, Data Link, Network and Transport Layers