CS3263
Embedded Networks

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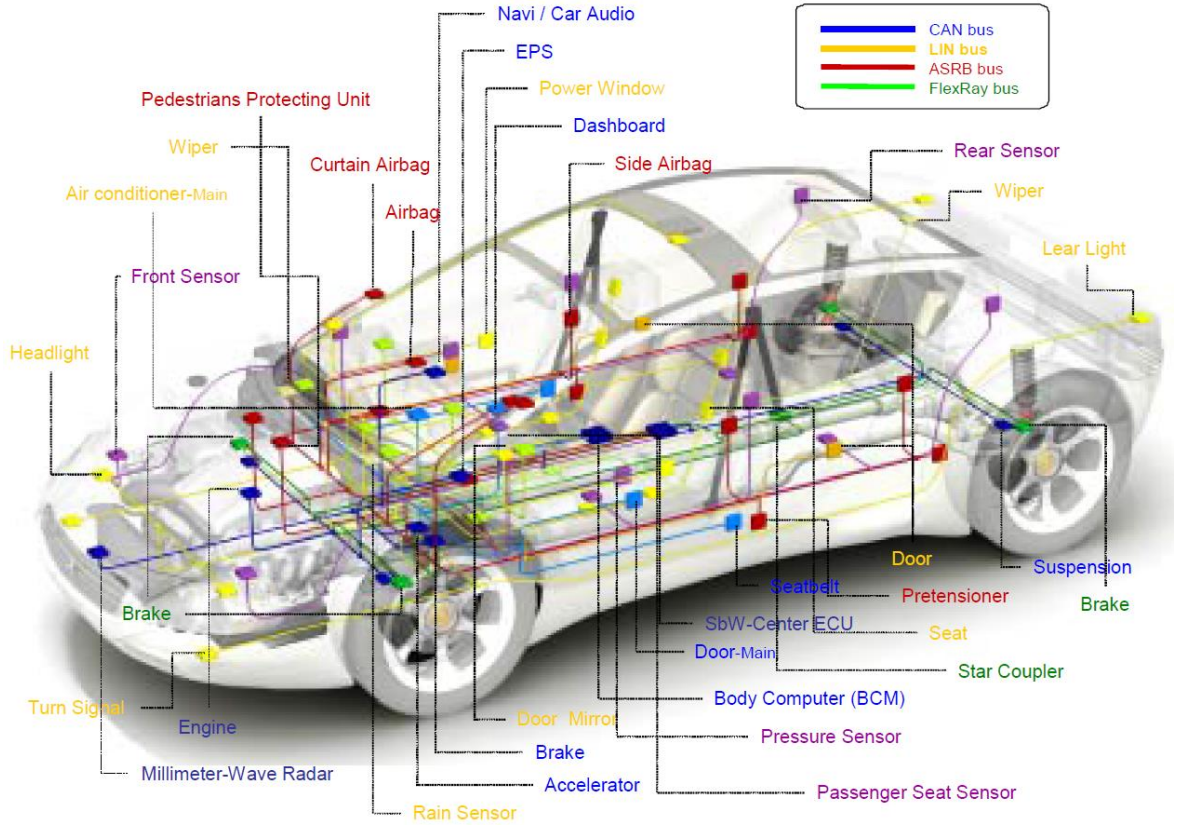
What is embedded networking?

Embedded networks (def): narrowly defined closed communication system

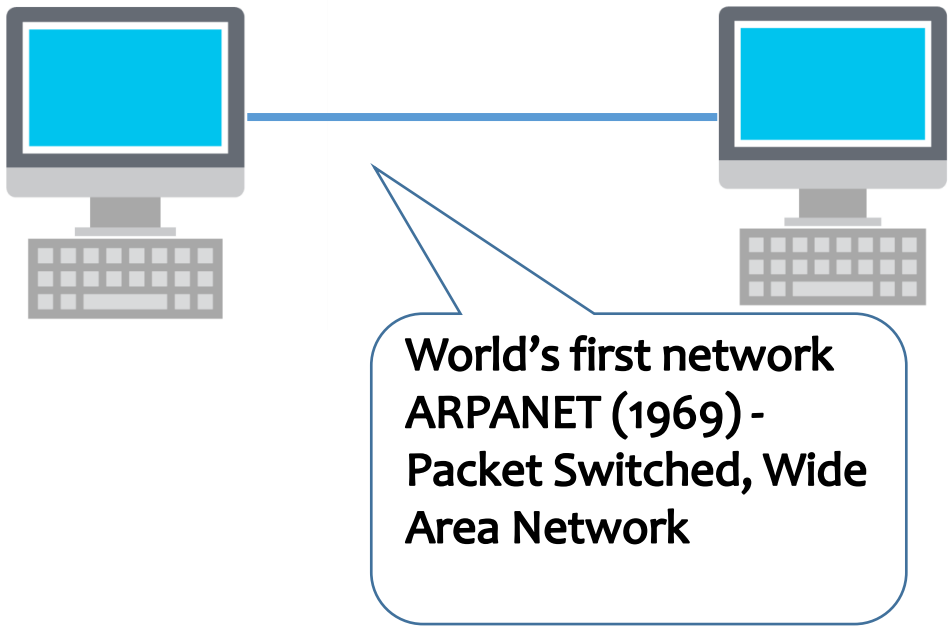


E.g. modern automobile device network

Learning Outcomes

1. Describe the functionalities and scope of protocols in different layers in network reference models
2. Set up a local area network and configure basic routing in a simple wide area network
3. Program a TCP/UDP server and a client
4. Select suitable communication protocols for internal and external communication for an embedded system
5. Design a basic IoT solution for a given example scenario

Networking



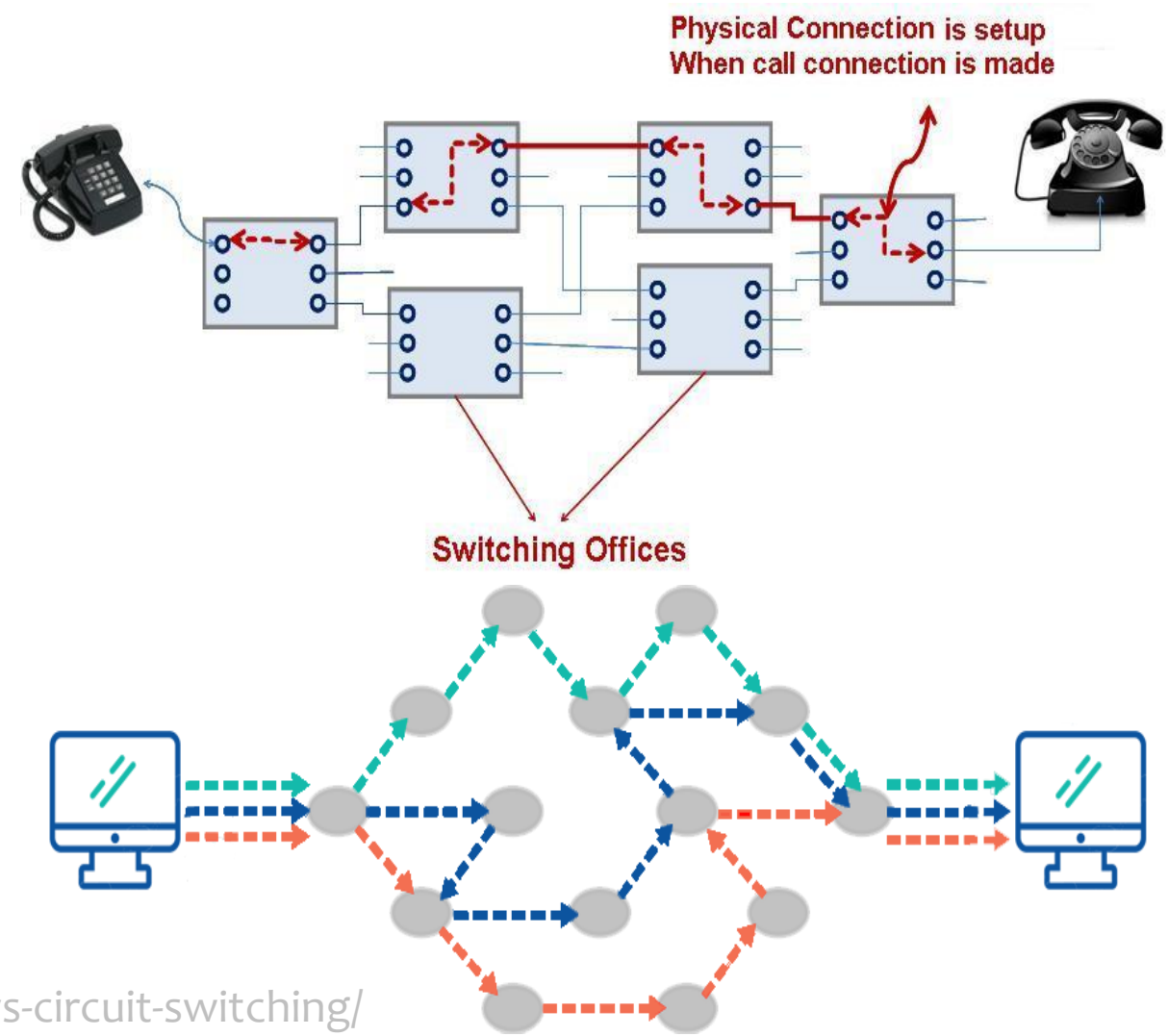
http://63052261.weebly.com/key-individuals.html

- Heterogeneous hardware and Computer's own language!
- Network Working Group→ RFC
- First Host to Host protocol (1970)

Packet Switching

Circuit Switching Vs Packet Switching

Circuit Switching	Packet Switching
Physical path between source and destination	No physical path
All packets use same path	Packets travel independently
Reserve the entire bandwidth in advance	Does not reserve
Bandwidth Wastage	No Bandwidth wastage
No store and forward transmission	Supports store and forward transmission



https://www.apposite-tech.com/blog/packet-switching-vs-circuit-switching/

Internetting

Defense Advanced Research Projects Agency (1973)

- To interlink Packet Networks
- To develop communication protocols ➔ Internetting Project
  - transparent communication
  - across multiple
  - heterogeneous networks

Result: System of Networks ➔ Internet

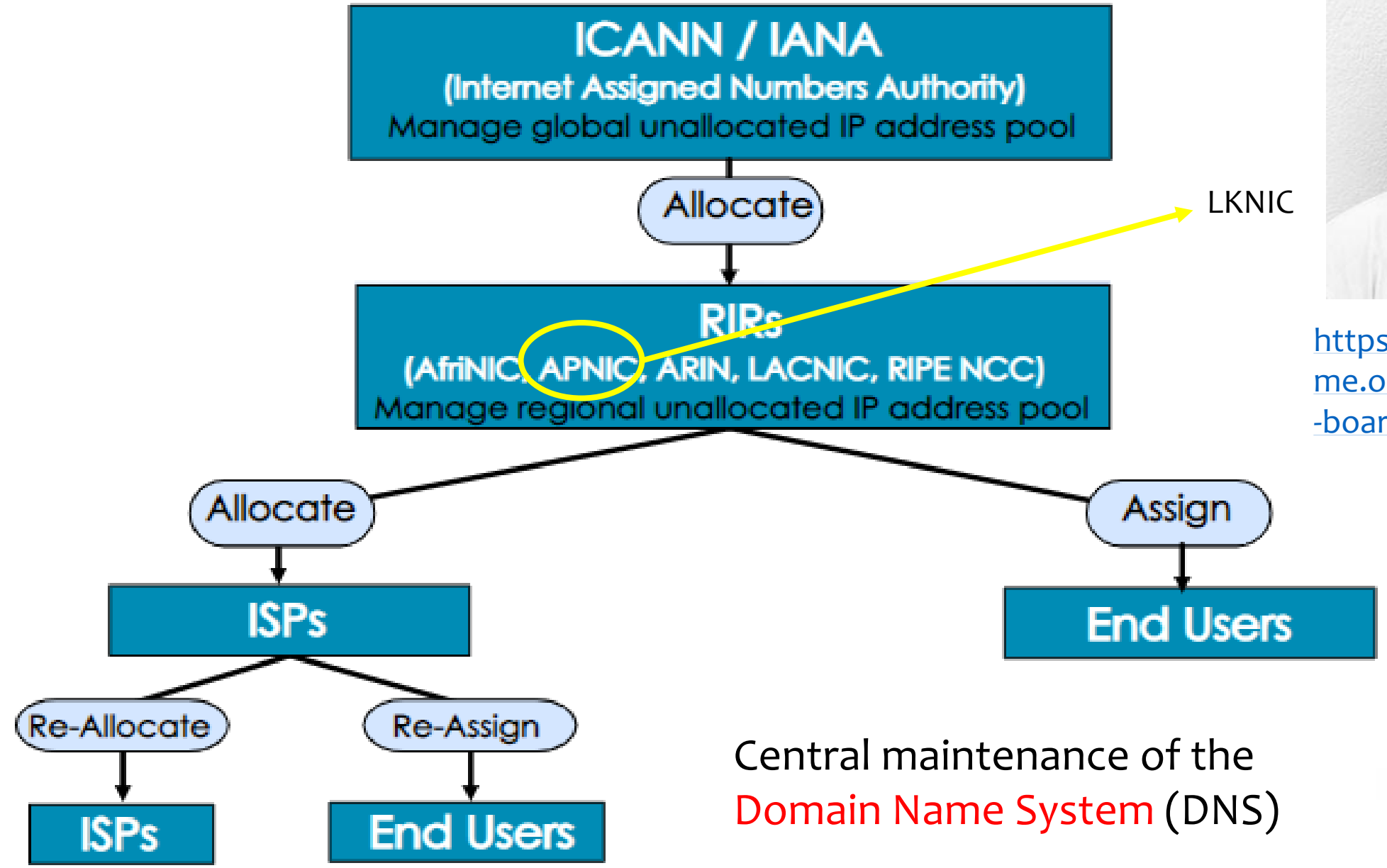
System of protocols ➔ TCP/IP Protocol Suite

https://www.internetsociety.org/internet/history-internet/brief-history-internet-related-networks

Multi protocol integration

- Support for different protocol suites
- Reference Models
  - TCP/IP reference model
  - ISO OSI model
- Management
  - Internet Activity Board (IAB)
  - IAB ➔ Internet Engineering Task Force (IETF) – publish RFCs, Internet Research Task Force
  - Identifiers for protocol operation by Internet Assigned Numbers Authority (IANA)

https://www.internetsociety.org/internet/history-internet/brief-history-internet-related-



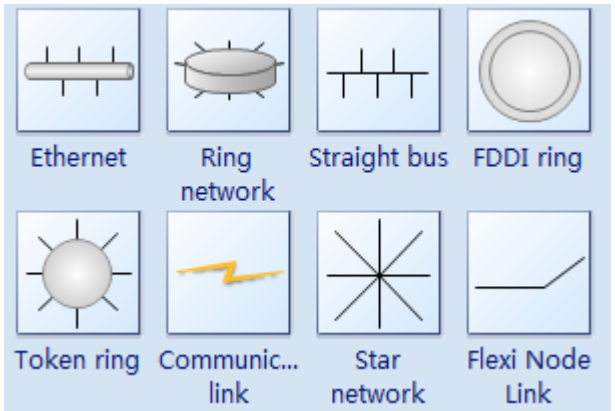
LKNIC

https://internethalloffame.org/about/advisory-board/gihan-dias

Central maintenance of the Domain Name System (DNS)

https://www.arin.net/

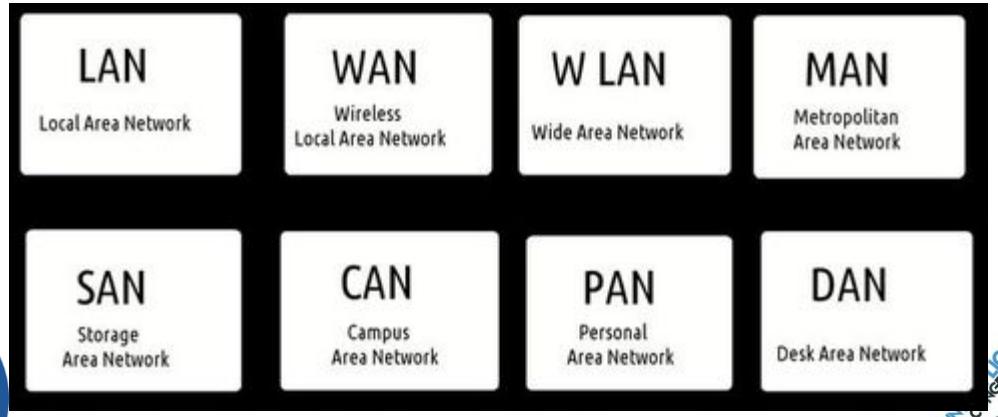

route
Metric
R2
history
Next
network
Status
vpnv4
Stale
damped
192.168.46.6
Weight
ip
via
22
Path
codes
using
table
vrf
entries
config-router-af
IGP
32768
bgp
router
number
path
best
192.168.25.5
4.4.4.4/32
56
R5
R4
memory
EGP
local
Hop
2.2.2.2
valid
config-router
neighbor
version
suppressed
UPDATE
route-map
as-override
bytes
cache
RIB-failure
LocPrf
routing
command
2.2.2.2/32
show
incomplete
nexthop
prefixes
internal
192.168.46.4
BGP
Total
Wi Fi
SPF
Open Shortest Path First

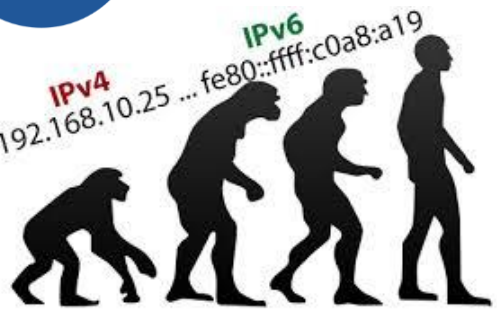

Ethernet
Ring network
Straight bus
FDDI ring
Token ring
Communic... link
Star network
Flexi Node Link


VPN

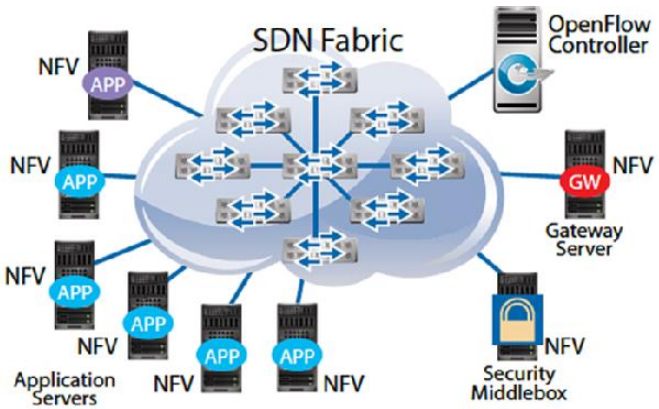
I²C
BUS


TCP/IP


LAN
Local Area Network
WAN
Wireless Local Area Network
W LAN
Wide Area Network
MAN
Metropolitan Area Network
SAN
Storage Area Network
CAN
Campus Area Network
PAN
Personal Area Network
DAN
Desk Area Network


IPv4
192.168.10.25 ...
IPv6
fe80::ffff:c0a8:a19


DHCP


SDN Fabric
OpenFlow Controller
NFV
APP
Gateway Server
GW
Application Servers
Security Middlebox


SNMP

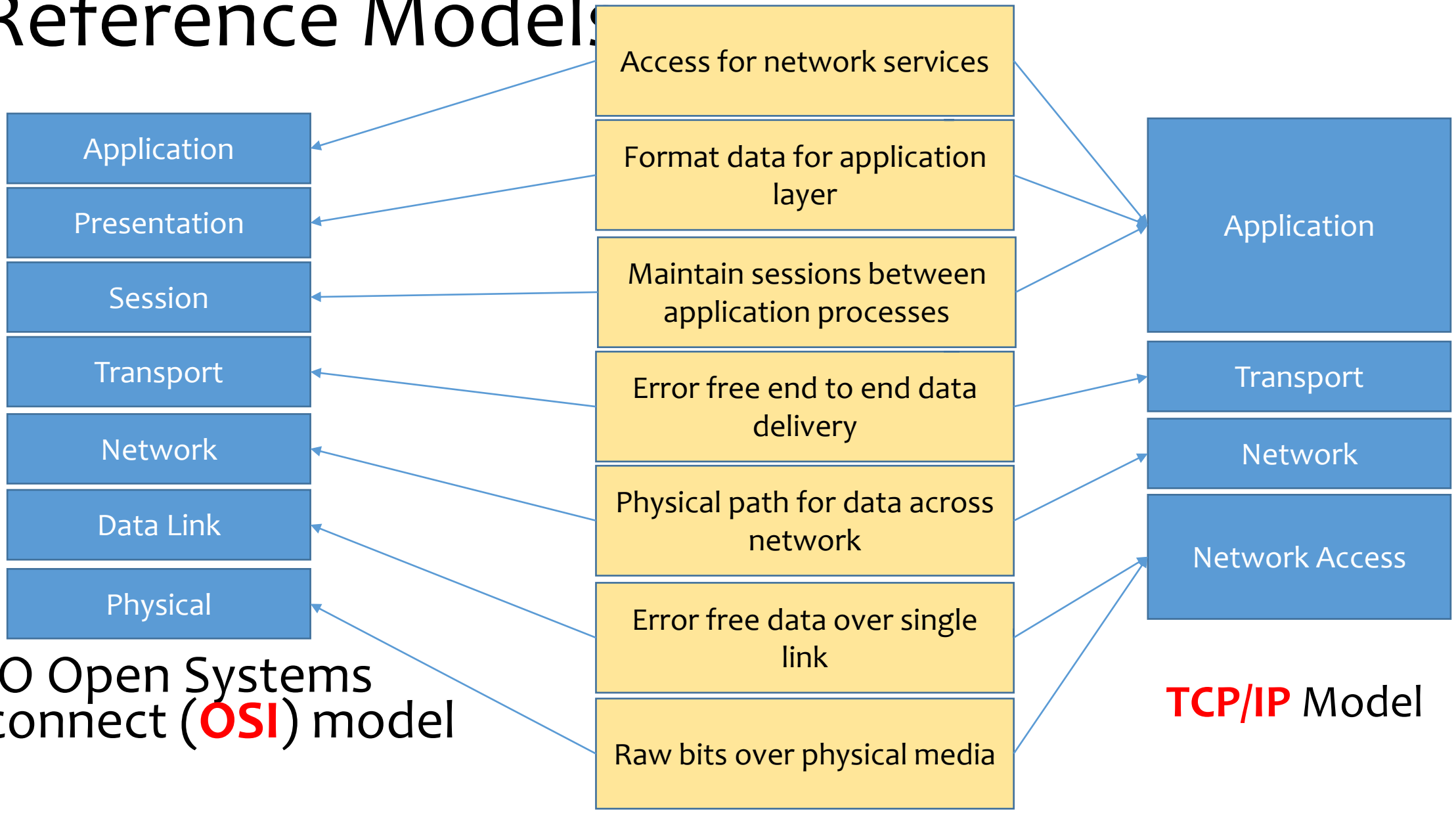

SESSION
INITIATION
PROTOCOL


HTTP
@


USER
DATAGRAM
PROTOCOL
TRANSMISSION
COMPUTATION
STATELESS
LAYER
LOSS
DATAGRAM
REAL
INELASTIC
TUNNELING
NODE
CORRECTION
PROTOCOL
EPHEMERAL
CALCULATION
OPTIONAL
MESSAGE
INTEGER
VOICE
DESTINATION
RETRANSMISSION
LOST
NEEDED
CHECKSUM
DATAGRAMS
TRAFFIC
DESIGNED
MEDIA
DOCUMENTED
MULTIPLEXING
PORT
HOST
SOURCE
HEADER
PACKET
BYTEBUFFERS
REQUIRES
ASSUMED
RELIABILITY
UNRELIABILITY
MECHANISM
UNIDIRECTIONAL
INFORMATION
BROADCAST


NAT

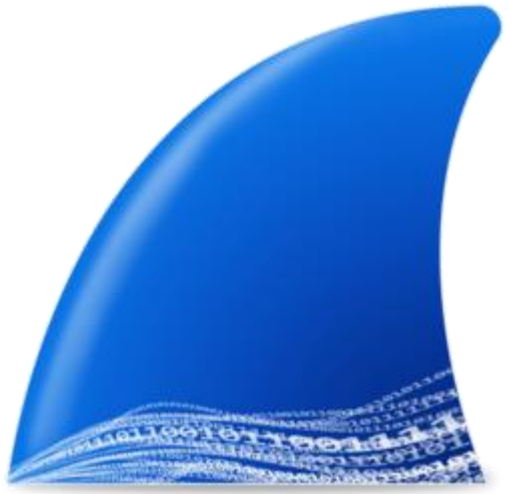
Reference Models



ISO Open Systems Interconnect (**OSI**) model

TCP/IP Model

Take home



- Install Wireshark in your computer
- Capture some PDUs when you are online
- Briefly explain function of five protocols in your capture
- Pick a PDU of an application layer protocol
- Explain what happens in each layer of that PDU

Submit your answers with relevant screenshots as a 5-page pdf in Moodle by 5am on 2nd Feb 2024

Same/similar submissions get ZERO!, late submissions are penalized

Thank you