

Layers and Wording

7	Application	Data
6	Presentation	Data
5	Session	Data
4	Transport	Segments/Datagram
3	Network	Packets
2	Data-Link	Frames
1	Physical	Bits

1. Physical

Function	transmission of bits across network
Representation	Electrical voltage on wires -> 1 or 0
- NRZ	0 volt = 0, +/-5 volts = 1
- Transition Modulation	during a clock cycle, no change = 0, change = 1
Topology	see cheatsheet 1/20
Async comm.	use of <i>start bits</i> and <i>stop bits</i> to indicate when transm. occurs
Sync comm.	use of a reference clock to coordinate transm.
Broadband bandwidth	divides bw into separate channels (ex Cable TV)
Baseband bandwidth	uses different freqs on a cable & a ref clock to coordinate transm.
Baseband Multiplexing	TDM, StatTDM, FDM are ways to allocate time slots and freqs over channels
ex	cables, radio freqs, devices (hubs, WAP, converters, ...)

2. Data-Link

MAC	48-bit -> Network Interface Card (NIC) / 1st 24bits : manufacturer, 2nd 24bits : unique device value
LLC	<i>Logical Link Control</i> Reliable transmission of data Segmentation & addressing Flow and Error control (checksum)
Syncro	Isochronous, Synchronous or Asynchronous
Devices	NIC, bridges, switches

3. Network

Function	forwards traffic with logical address
Logical address	IPv4, IPv6, IPX, AppleTalk
<i>Packet switching</i>	divides data into packets and forward
<i>Circuit switching</i>	dedicated comm link
<i>Message switching</i>	divides data into storable messages which can be stored and forwarded later
Routers	routing table based on IP address, static or dynamic route protocol RIP, OSPF, EIGRP
Flow control	regulates data flow/speed
Packet reordering	thanks to numbering and sequencing, packets can be sent across multiple routes
ICMP	Internet Control Message Protocol send error msg & ops info about an IP, uses ping and traceroute
ex:	routers, multilayer switches, IPv4, IPv6, ICMP



4. Transport

TCP Transmission Control Protocol
connection oriented reliable, resend lost segments, acknowledge (3-way handshake)

UDP User Datagram Protocol
connectionless unreliable, no retransmission, faster due to low overhead

Windowing adjust amount of data, based on retransmission reception quantity

Buffering router allocates memory to store segments
 buffer overflow = segments dropped

ex: TCP, UDP, WAN accelerators, load balancers, firewalls

5. Session

Function setup a conversation

Setting up check credentials, session id, services needed and who starts

Maintaining transfer data, reestablish connection, acknowledge data receipt

Tearing Down on mutual agreement or other party disconnecting

ex: **H.323/264** (voice/video streaming), **NetBIOS** (file exchange)

6. Presentation

Function format data for readability, encrypt and secure data

Data Formatting for compatibility purposes, readability (ASCII, JPG, etc)

compression, conversion

Encryption scrambles data, provide confidentiality (TLS)

6. Presentation (cont)

ex: programming languages, text formats, pict extensions, protocols like TLS, SSL

7. Application

Function interface user <-> computer

App. Services File transfer, sharing, email, remote access, NW mgmt, cl/srv processes

Advertisement service initiating a service offer to a NW

ex: POP3, IMAP, SMTP / HTTP-S / DNS / FTP-S / Telnet, SSH / SNMP

Encapsulation & Decapsulation

Function "enveloping" data with **headers**

PDU Protocol Data Unit. ex: L3PDU->Packet

Flags

SYN initiates synchronization of connection

ACK acknowledges during 3-WSH and packet reception

FIN initiates termination of connection

RST when client or server receives a non expected packet

PSH gives priority to data (for sender)

URG gives priority to data (for recipient)

MAC physical address of a NIC

EtherType identify the protocol used (IPv4/v6)

from L7 to L1

at L4 +TCP/UDP header (source & dest ports)

at L3 +IP header (source & dest addresses)

at L2 +MAC+LLC ---- +FCS

at L1 transmit L2 in bits (0 and 1)

