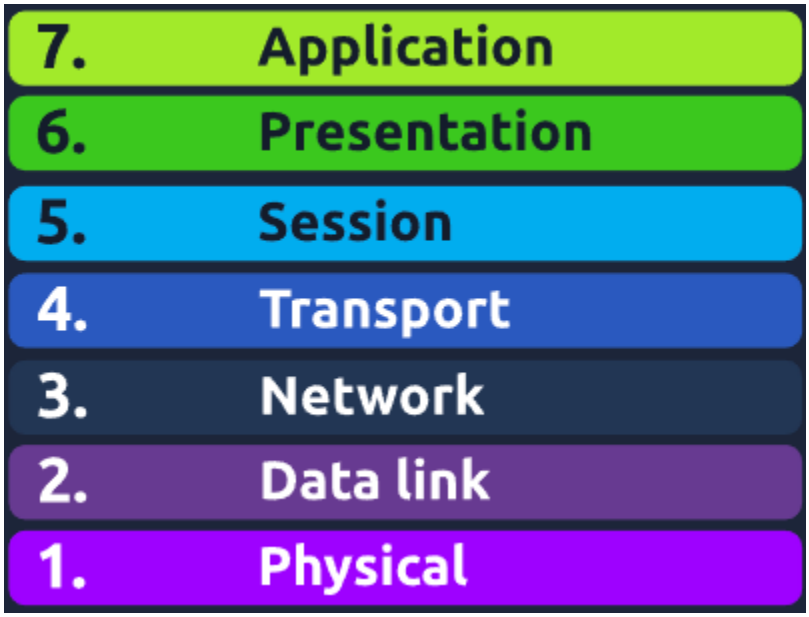
Networking Concepts

OPEN SYSTEMS INTERCONNECTION

This model is comprised of 7 layers



1. **Physical:** Binary 0 and 1, transmitted either electronically, optically or wirelessly. [2.4Ghz - 5/6Ghz]
2. **Data Link:** Protocols enabling data transfer between nodes on the network. MAC address, ethernet transfer [six bytes].
3. **Network:** Sending data between different networks via a router. Routing data to different networks.
4. **Transport:** TCP [Transfer Control Protocol (Reliable)] UDP [User Datagram Protocol (Unreliable)].
5. **Session:** Establishing, maintaining and synchronizing communication between applications running on different hosts. Network File System [NFS] or Remote Procedure Call [RPC].
6. **Presentation:** Data delivered in a form that can be understood. Encoding, encryption, eg ASCII. Other examples could be JPEG, GIF, PNG.
7. **Application:** HTTP/HTTPS request file, submit form or upload a file. Other examples could be, FTP, DNS, IMAP.

Layer Number	Layer Name	Main Function	Example Protocols and Standards
Layer 7	Application layer	Providing services and interfaces to applications	HTTP, FTP, DNS, POP3, SMTP, IMAP
Layer 6	Presentation layer	Data encoding, encryption, and compression	Unicode, MIME, JPEG, PNG, MPEG
Layer 5	Session layer	Establishing, maintaining, and synchronising sessions	NFS, RPC
Layer 4	Transport layer	End-to-end communication and data segmentation	UDP, TCP
Layer 3	Network layer	Logical addressing and routing between networks	IP, ICMP, IPSec
Layer 2	Data link layer	Reliable data transfer between adjacent nodes	Ethernet (802.3), WiFi (802.11)
Layer 1	Physical layer	Physical data transmission media	Electrical, optical, and wireless signals

TCP / IP MODEL

- **Application Layer**: The OSI model application, presentation and session layers, i.e., layers 5, 6, and 7, are grouped into the application layer in the TCP/IP model.
- **Transport Layer**: This is layer 4.
- **Internet Layer**: This is layer 3. The OSI model's network layer is called the Internet layer in the TCP/IP model.
- **Link Layer**: This is layer 2.

The table below shows how the TCP/IP model layers map to the ISO/OSI model layers.

Layer Number	ISO OSI Model	TCP/IP Model (RFC 1122)	Protocols
7	Application Layer	Application Layer	HTTP, HTTPS, FTP, POP3, SMTP, IMAP, Telnet, SSH,
6	Presentation Layer		
5	Session Layer		
4	Transport Layer	Transport Layer	TCP, UDP
3	Network Layer	Internet Layer	IP, ICMP, IPSec
2	Data Link Layer	Link Layer	Ethernet 802.3, WiFi 802.11
1	Physical Layer		

IP Address

Now an IP address consists of 4 Octets [32 bits] 1 octet = 8 bits.

ip a s

Allows us to see the format, comparing the network card IP address and how it is presented:

```
user@TryHackMe$ ip a s
[...]
4: wlo1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether cc:5e:f8:02:21:a7 brd ff:ff:ff:ff:ff:ff
    altname wlp3s0
    inet 192.168.66.89/24 brd 192.168.66.255 scope global dynamic noprefixroute wlo1
       valid_lft 36795sec preferred_lft 36795sec
    inet6 fe80::73e1:ca5e:3f93:b1b3/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

TCP:

3 Way handshake, ensures reliability. Good when we want to ensure all data packets are sent and received. Such as email.

1. SYN PACKET: Client - SYN - Server.
2. SYN-ACK PACKET: Server - SYN ACK - Client.
3. ACK PACKET: Client - ACK - Server - SYN ACK.

UDP:

Connectionless protocol, that exchanges reliability to constant data, great for streaming where the loss of some packets isn't a problem.