

NETWORK



# Important

- I am only introducing concepts in this part of the course.
- I will discuss items in more detail later in the course - don't worry if you don't understand everything right now.





# What is a Network?

- A computer network is a digital telecommunications network for sharing resources between nodes, which are computing devices that use a common telecommunications technology.
- Data transmission between nodes is supported over data links consisting of physical cable media, such as twisted pair or fibre-optic cables, or by wireless methods, such as Wi-Fi, microwave transmission, or free-space optical communication.

\* Source: Wikipedia



# Resource example: Printer



# Resource example: File Sharing





# Sneakernet





# Sneakernet

- Sneakernet is an informal term for the transfer of electronic information by physically moving media such as magnetic tape, floppy disks, optical discs, USB flash drives or external hard drives between computers, rather than transmitting it over a computer network.
- The term, a tongue-in-cheek play on net(work) as in Internet or Ethernet, refers to walking in sneakers as the transport mechanism.

\* Source: Wikipedia





# Sneakernet





# Basic Network

- Copper Cable / Wi-Fi







# iPhone Example



Wi-Fi / Bluetooth





# What is a Server?





# What is a Server?





# What is a Server?



# What is a Server?

- In computing, a server is a computer program or a device that provides functionality for other programs or devices, called "clients".
- This architecture is called the client–server model, and a single overall computation is distributed across multiple processes or devices.

\* Source: Wikipedia





# What is a Client?



# What is a Client?





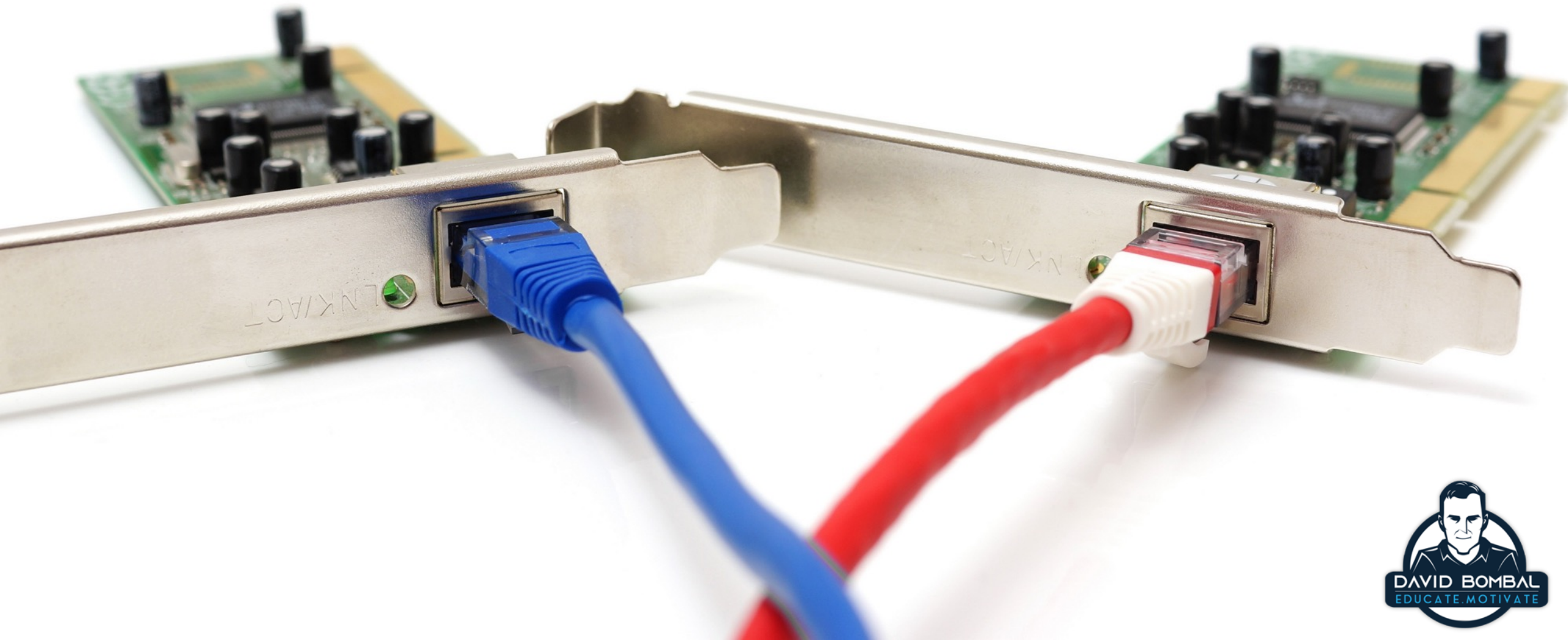
# What is a Client?

- A client is a piece of computer hardware or software that accesses a service made available by a server.
- The server is often (but not always) on another computer system, in which case the client accesses the service by way of a network.

\* Source: Wikipedia

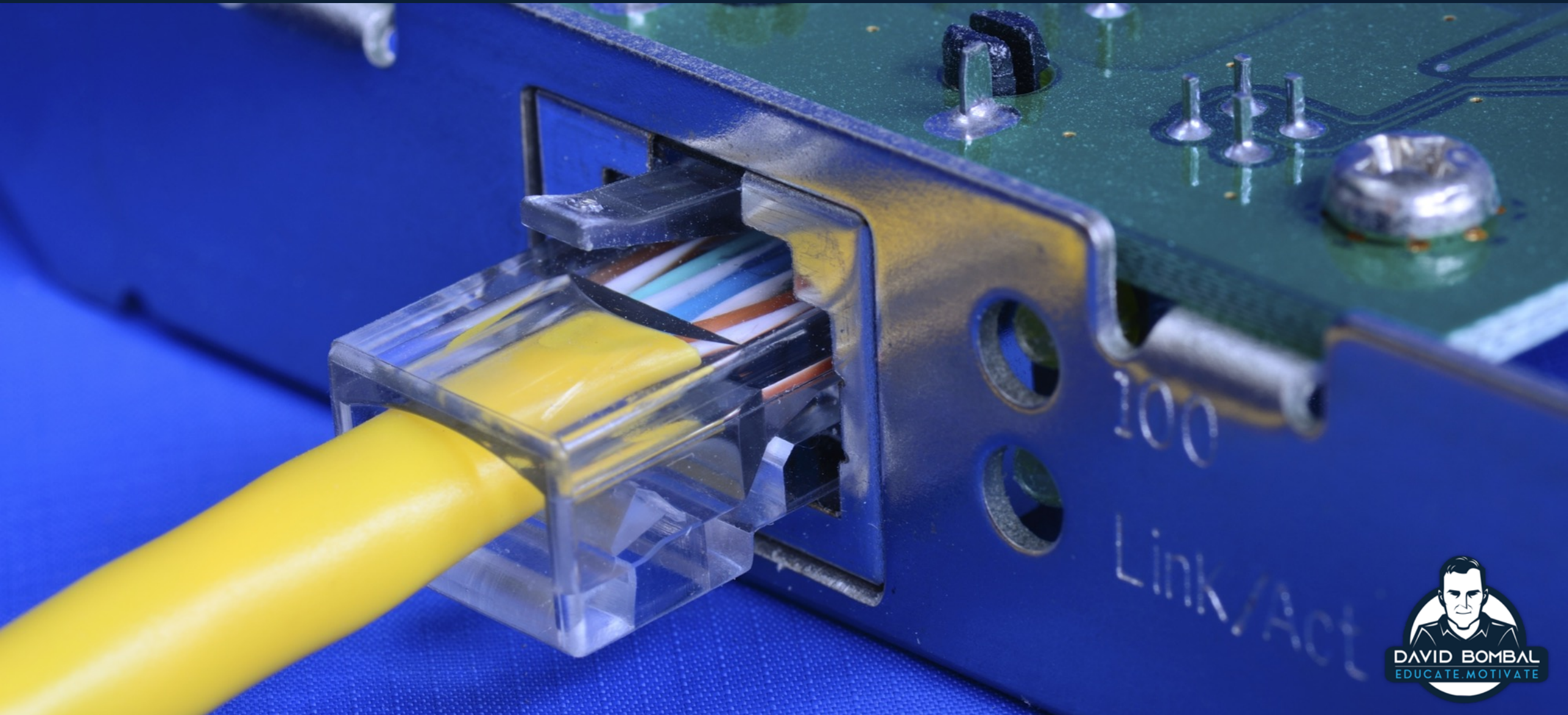


# What is a NIC?



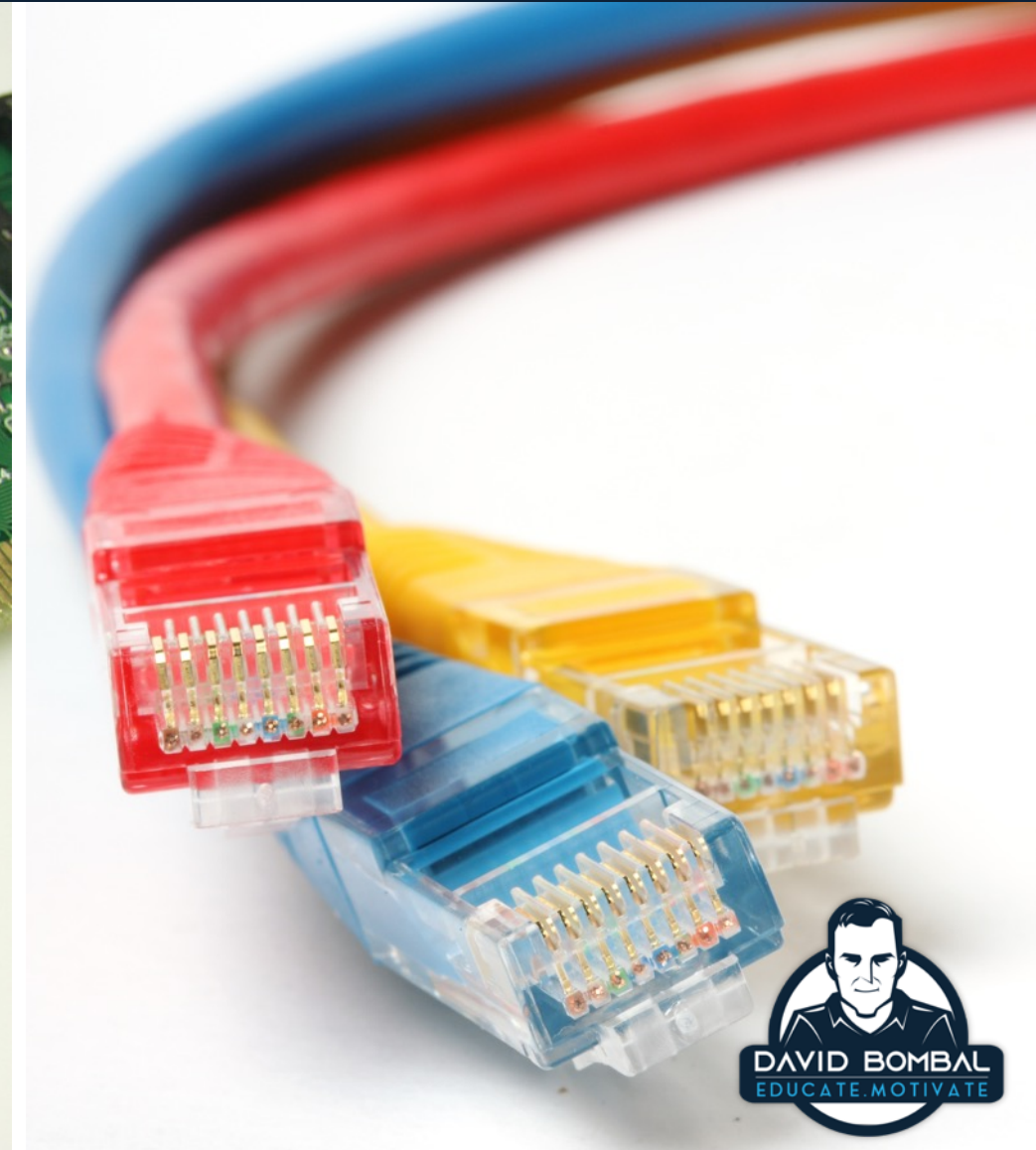
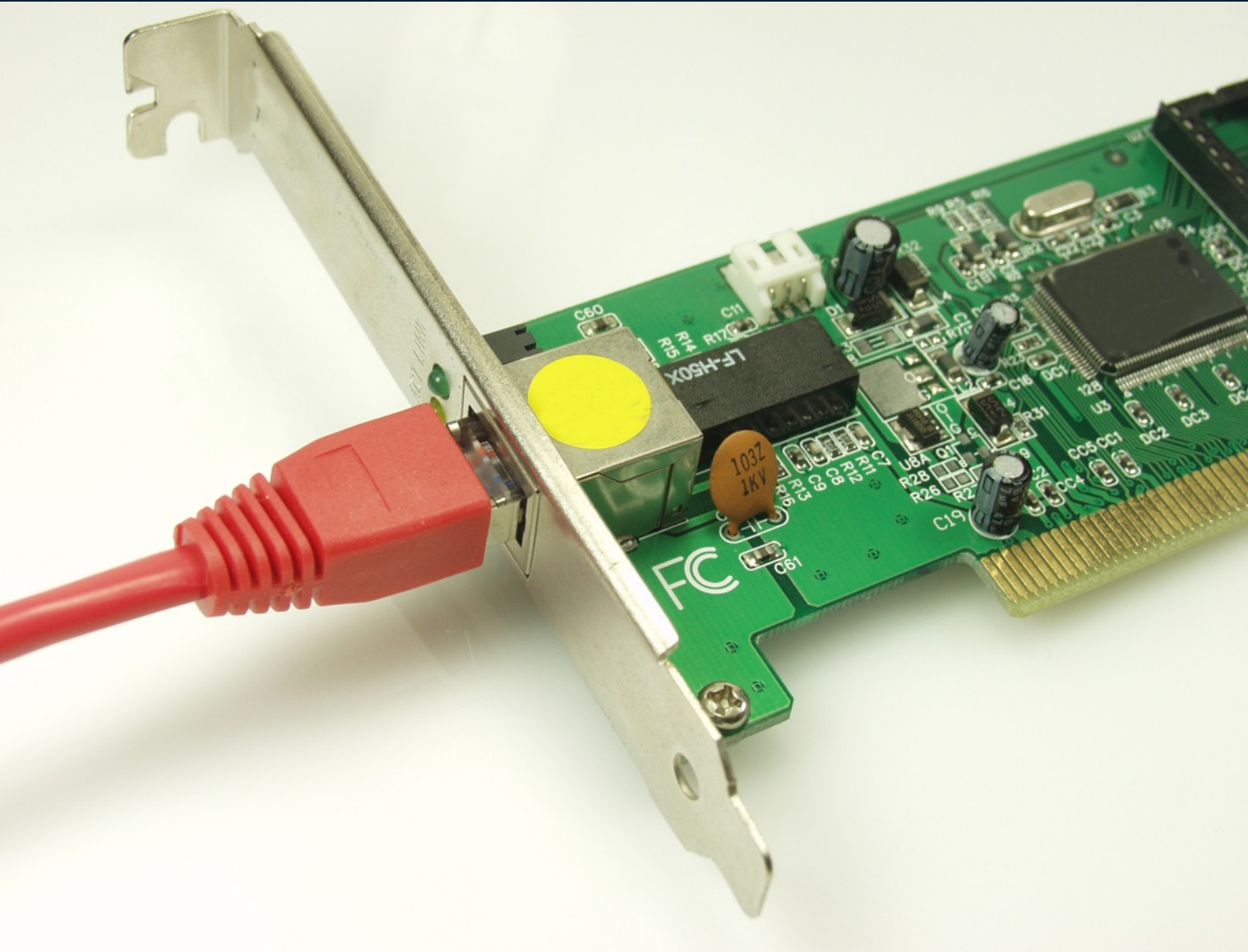


# What is a NIC?





# What is a NIC?





# What is a NIC?





# What is a NIC?



# What is a NIC?





# What is a NIC?

- A network interface controller (NIC, also known as a network interface card, network adapter, LAN adapter or physical network interface, and by similar terms) is a computer hardware component that connects a computer to a computer network.

\* Source: Wikipedia



# What is a MAC address?



Recycle Bin



VMware  
Workstati...

Command Prompt

```
Connection-specific DNS Suffix . : lan
Description . . . . . : Realtek 8822BE Wireless LAN 802.11ac PCI-E NIC
Physical Address. . . . . : 0E-11-22-33-44-55
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2001::1(Preferred)
IPv6 Address. . . . . : fd66:628c:6006:0:b97b:99f9:d25b:ee12(Preferred)
Temporary IPv6 Address. . . . . : fd66:628c:6006:0:5c36:b00d:e609:6b62(Preferred)
Link-local IPv6 Address . . . . . : fe80::b97b:99f9:d25b:ee12%21(Preferred)
IPv4 Address. . . . . : 10.0.0.184(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : 31 March 2020 16:40:36
Lease Expires . . . . . : 02 April 2020 13:10:44
Default Gateway . . . . . : 2001::123
                             10.0.0.2
DHCP Server . . . . . : 10.0.0.2
DHCPv6 IAID . . . . . : 131921157
DHCPv6 Client DUID. . . . . : 00-01-00-01-25-C6-4D-77-00-11-22-33-44-55
DNS Servers . . . . . : fd66:628c:6006::1
```





# What is a MAC address?

- A media access control address (MAC address) is a unique identifier assigned to a network interface controller (NIC) for use as a network address in communications within a network segment.
- This use is common in most IEEE 802 networking technologies, including Ethernet, Wi-Fi, and Bluetooth.
- MAC addresses are recognizable as six groups of two hexadecimal digits, separated by hyphens, colons, or without a separator.

\* Source: Wikipedia



# What is a MAC address?

- MAC addresses are primarily assigned by device manufacturers, and are therefore often referred to as the burned-in address, or as an Ethernet hardware address, hardware address, and physical address.
- Each address can be stored in hardware, such as the card's read-only memory, or by a firmware mechanism. Many network interfaces, however, support changing their MAC address.
- The address typically includes a manufacturer's organizationally unique identifier (OUI). MAC addresses are formed according to the principles of two numbering spaces based on Extended Unique Identifiers (EUI) managed by the Institute of Electrical and Electronics Engineers (IEEE): EUI-48.

\* Source: Wikipedia





# What is modulation?

- In electronics and telecommunications, modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a modulating signal that typically contains information to be transmitted. Most radio systems in the 20th century used frequency modulation (FM) or amplitude modulation (AM) for radio broadcast.
- A modulator is a device that performs modulation. A demodulator (sometimes detector or demod) is a device that performs demodulation, the inverse of modulation. A modem (from modulator–demodulator) can perform both operations.

\* Source: Wikipedia

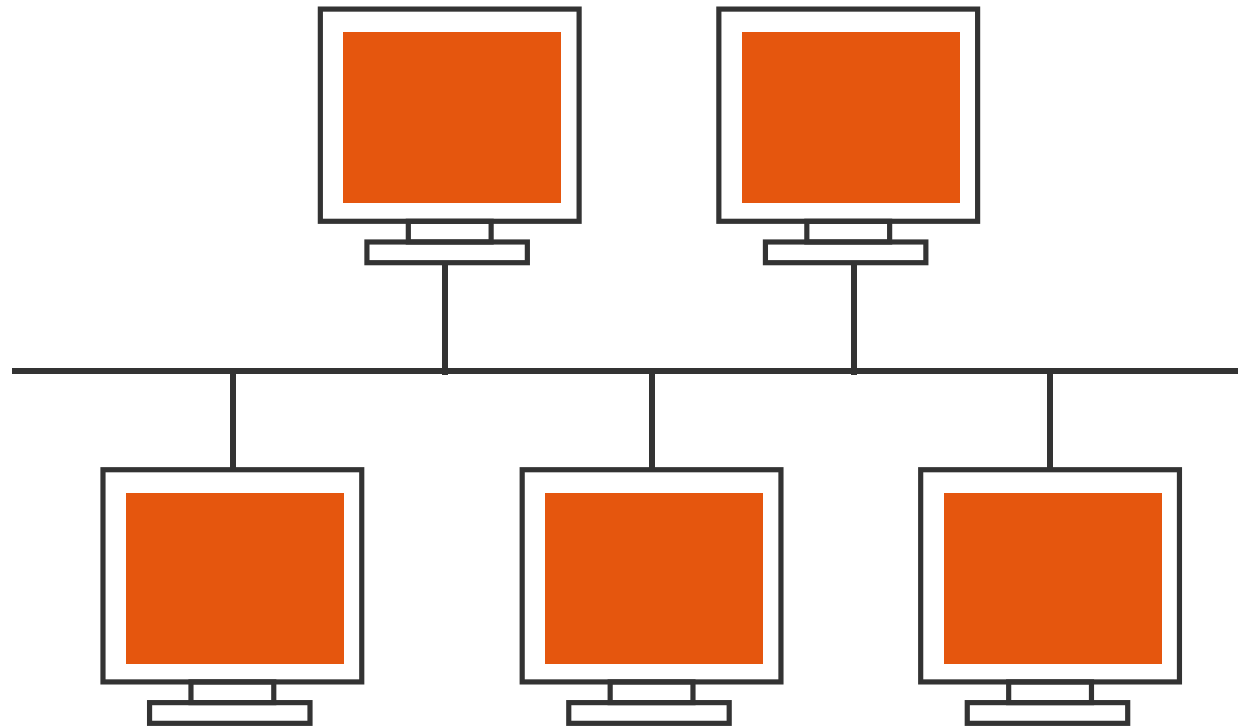


# What is a bus network?





# What is a bus network?



# What is a bus network?

- A bus network is a network topology in which nodes are directly connected to a common half-duplex link called a bus.
- A host on a bus network is called a station. In a bus network, every station will receive all network traffic, and the traffic generated by each station has equal transmission priority.
- A bus network forms a single network segment and collision domain. In order for nodes to share the bus, they use a medium access control technology such as carrier-sense multiple access (CSMA) or a bus master.
- If any link or segment of the bus is severed, all network transmission may fail due to signal reflection caused by the lack of electrical termination.

\* Source: Wikipedia





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\* Source: Wikipedia



# 10Base5 transceiver





# 10Base5, 10Base2, 10BaseT



10BaseT

10Base2

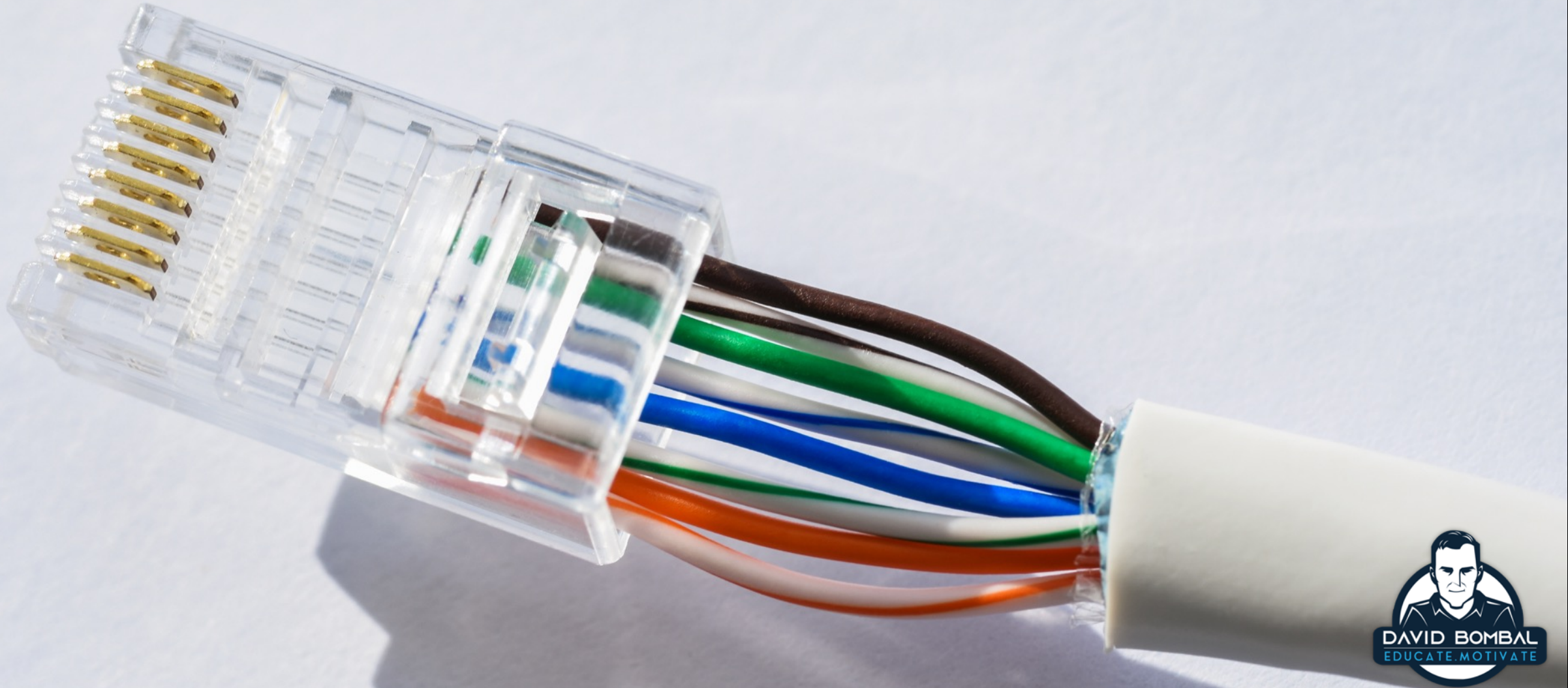
10Base5

# RJ45





# RJ45



# RJ45

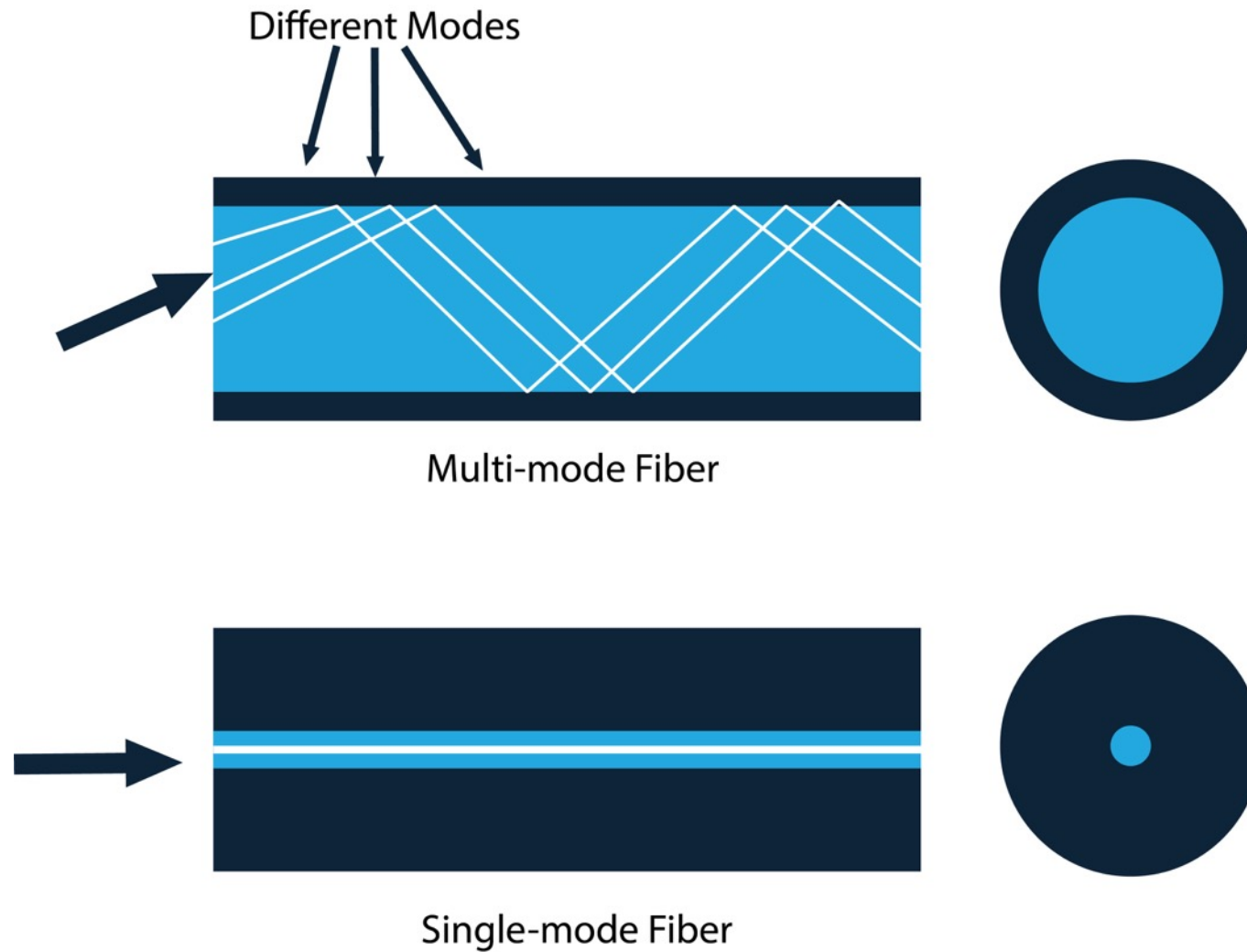




# RJ45

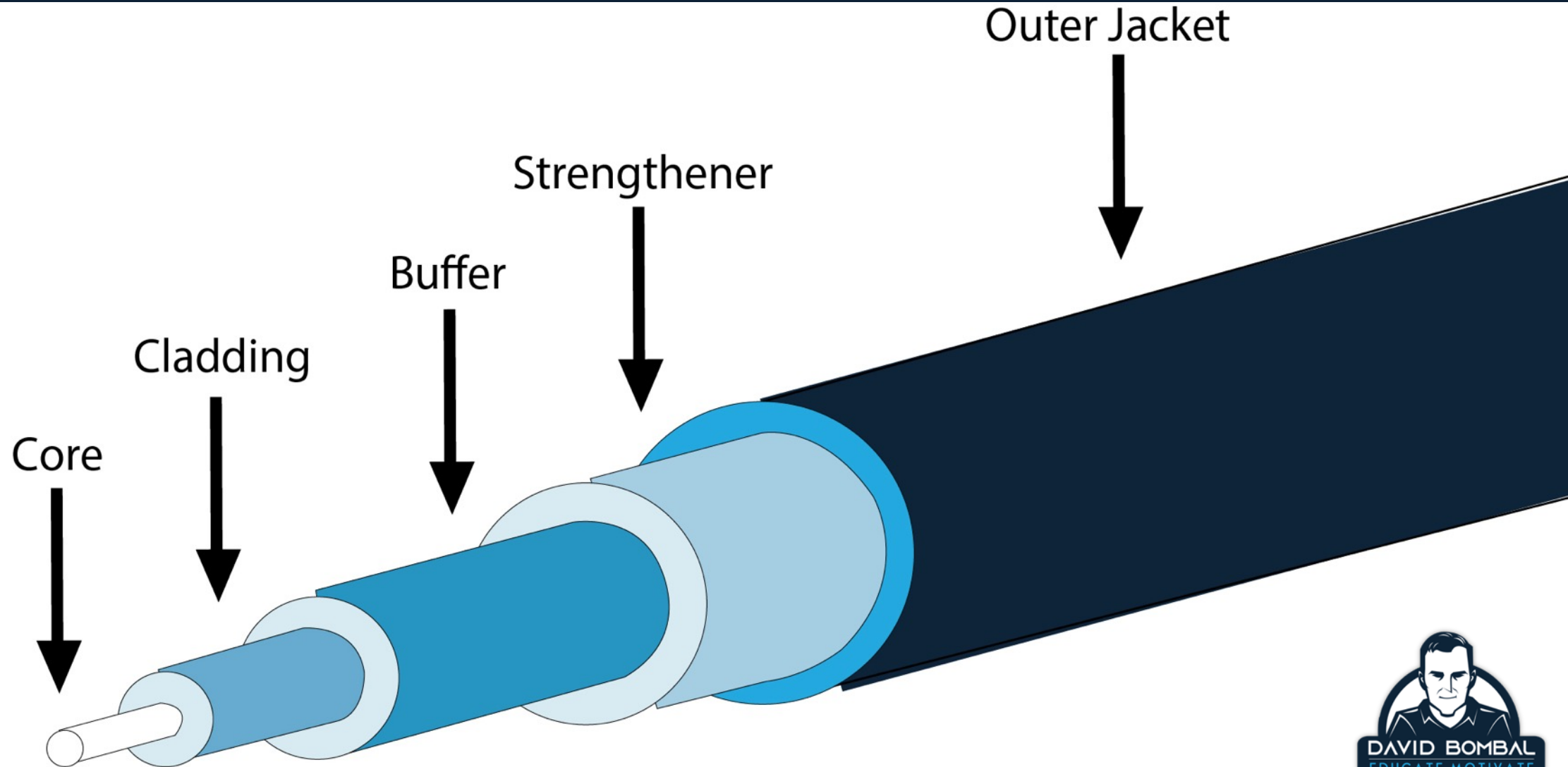


# Fiber

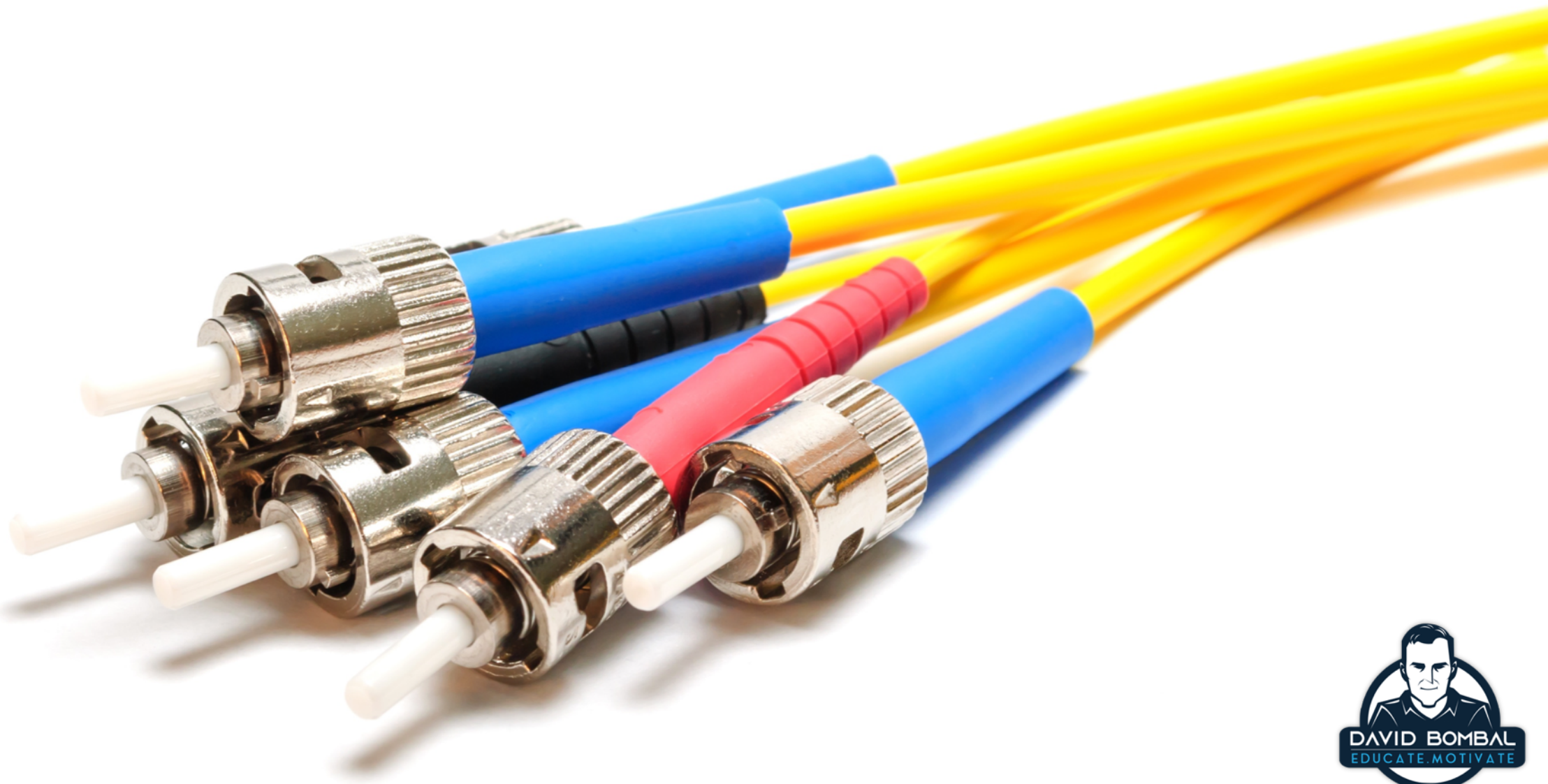




# Fiber

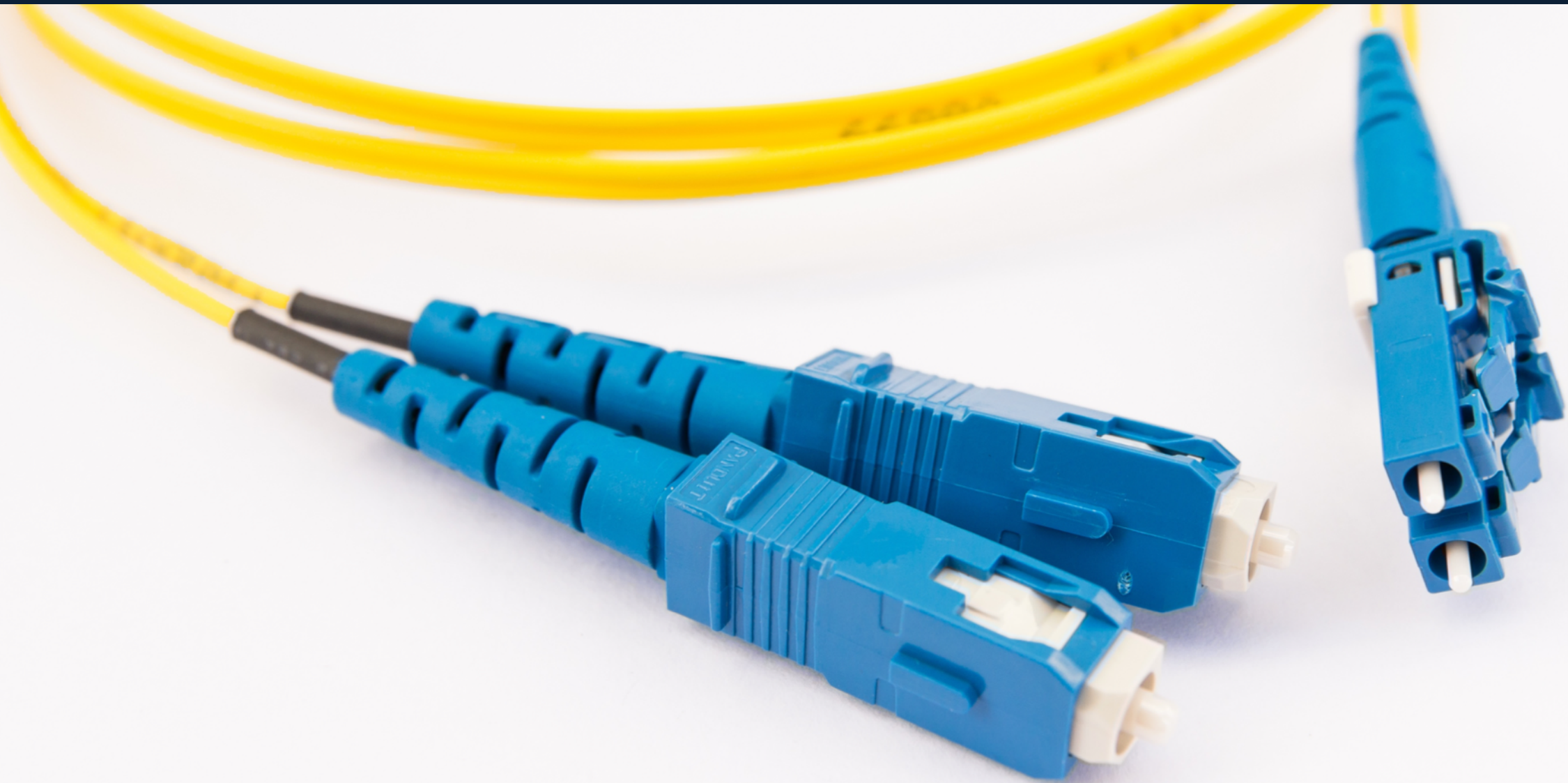


# Fiber





# Fiber



# What is DHCP?

- The Dynamic Host Configuration Protocol (DHCP) is a network management protocol used on Internet Protocol networks whereby a DHCP server dynamically assigns an IP address and other network configuration parameters to each device on a network so they can communicate with other IP networks.

\* Source: Wikipedia





# What is DHCP?

- In the absence of a DHCP server, a computer or other device on the network needs to be manually assigned an IP address.

\* Source: Wikipedia



# What is a Repeater?



# What is a Repeater?

- In telecommunications, a repeater is an electronic device that receives a signal and retransmits it.
- Repeaters are used to extend transmissions so that the signal can cover longer distances or be received on the other side of an obstruction.
- Some types of repeaters broadcast an identical signal, but alter its method of transmission, for example, on another frequency or baud rate.
- There are several different types of repeaters; a telephone repeater is an amplifier in a telephone line, an optical repeater is an optoelectronic circuit that amplifies the light beam in an optical fiber cable; and a radio repeater is a radio receiver and transmitter that retransmits a radio signal.

\* Source: Wikipedia





# What is a Hub?



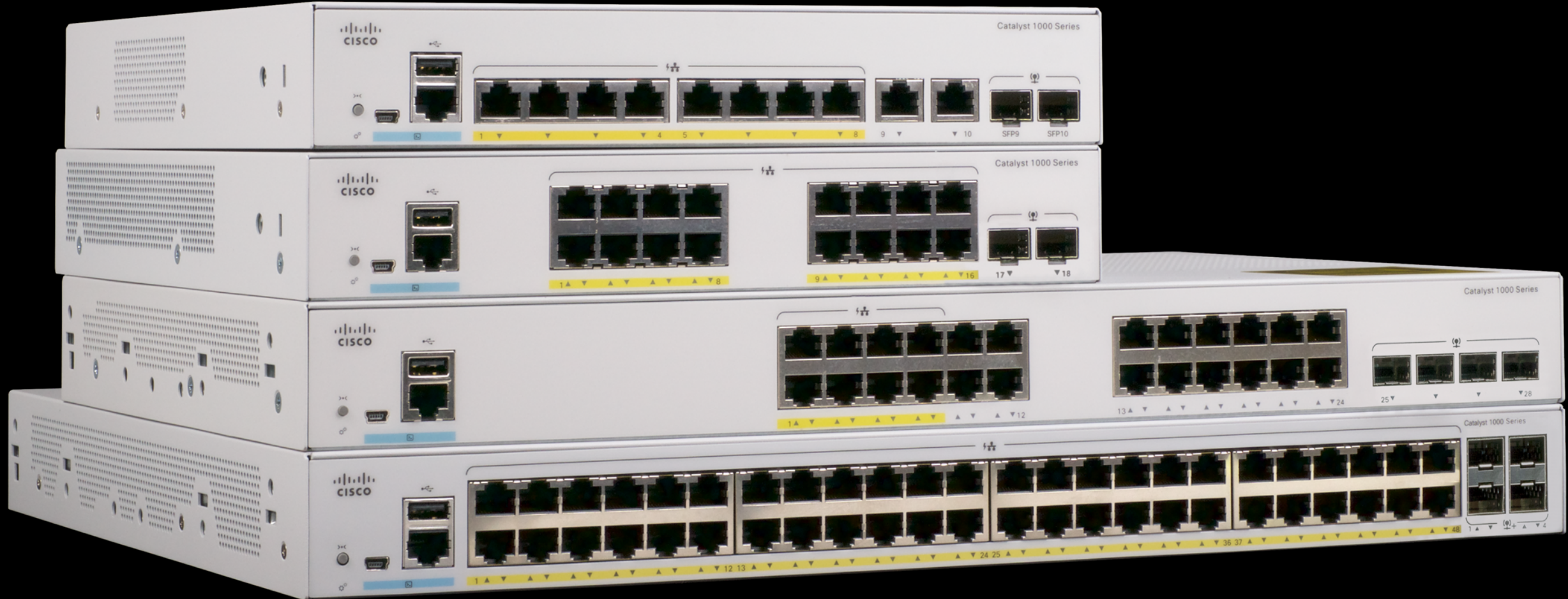
# What is a Hub?

- An Ethernet hub, active hub, network hub, repeater hub, multiport repeater, or simply hub is a network hardware device for connecting multiple Ethernet devices together and making them act as a single network segment.
- It has multiple input/output (I/O) ports, in which a signal introduced at the input of any port appears at the output of every port except the original incoming.
- A hub works at the physical layer (layer 1) of the OSI or TCP/IP model. A repeater hub also participates in collision detection, forwarding a jam signal to all ports if it detects a collision.

\* Source: Wikipedia



# What is a Switch?





# What is a Switch?

- A network switch is networking hardware that connects devices on a computer network by using frame switching to receive and forward data to the destination device.
- A network switch is a multiport network bridge that uses MAC addresses to forward data at the data link layer (layer 2) of the OSI or TCP/IP model. Some switches can also forward data at the network layer (layer 3) by additionally incorporating routing functionality. Such switches are commonly known as layer-3 switches or multilayer switches.

\* Source: Wikipedia



# What is a Router?





# What is a Router?



\* Source: Wikipedia





# What is a Router?

- A router is a networking device that forwards data packets between computer networks.
- Routers perform the traffic directing functions on the Internet. Data sent through the internet, such as a web page or email, is in the form of data packets. A packet is typically forwarded from one router to another router through the networks that constitute an internetwork (e.g. the Internet) until it reaches its destination node.
- A router is connected to two or more data lines from different IP networks. When a data packet comes in on one of the lines, the router reads the network address information in the packet header to determine the ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey.

\* Source: Wikipedia

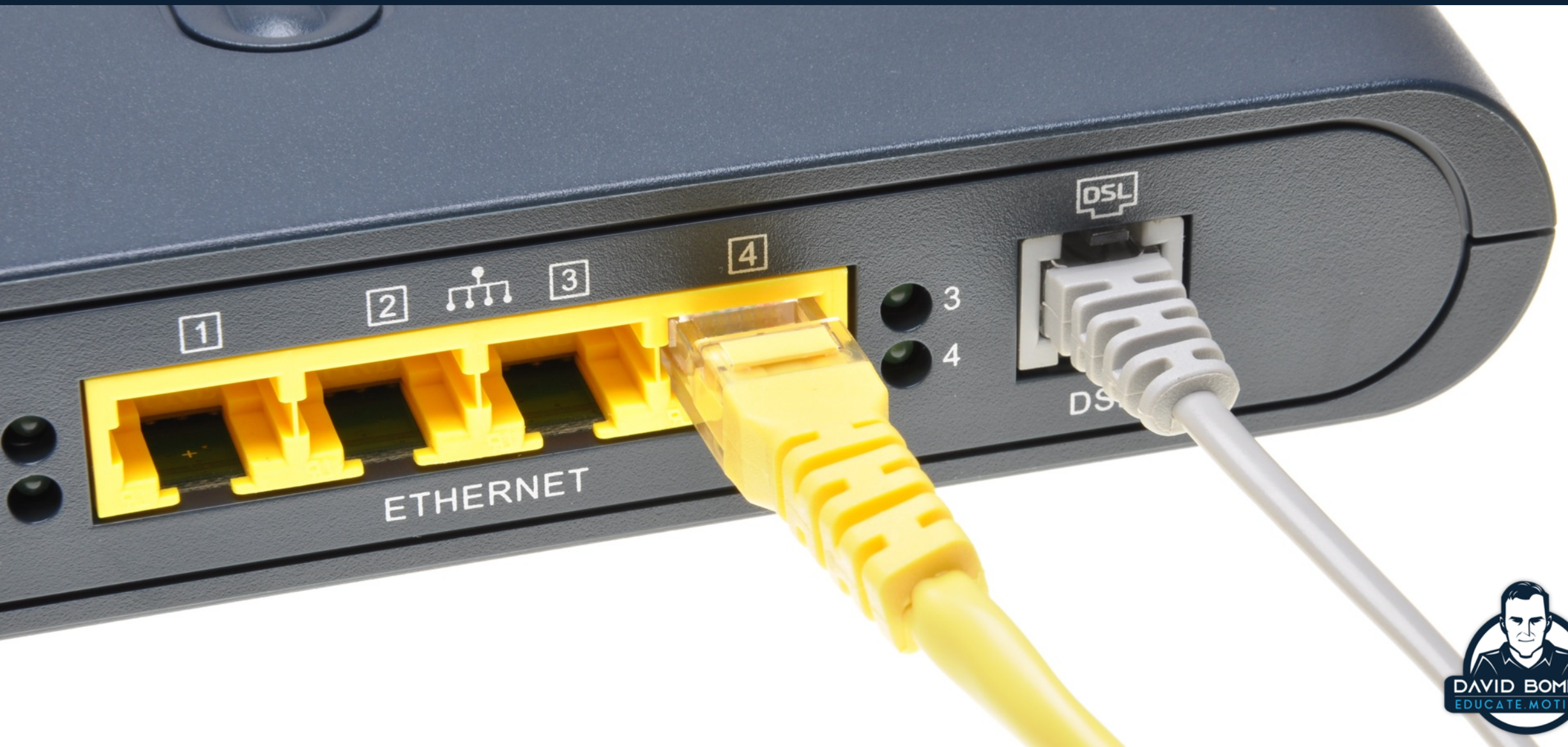


# What is a LAN?





# What is a LAN?







# What is a LAN?

- A local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building.
- By contrast, a wide area network (WAN) not only covers a larger geographic distance, but also generally involves leased telecommunication circuits.
- Ethernet and Wi-Fi are the two most common technologies in use for local area networks.

\* Source: Wikipedia



# What is a WAN?

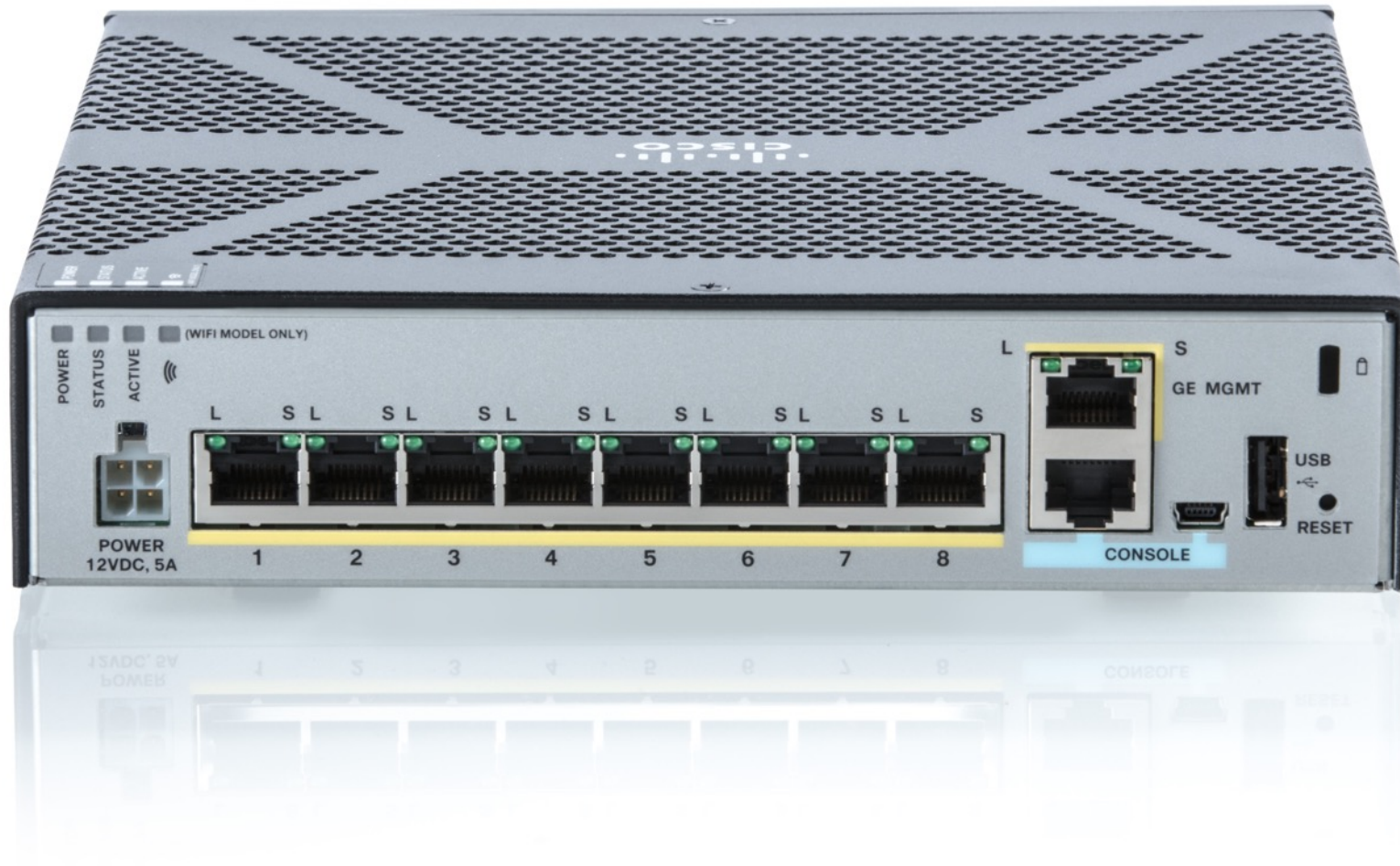
- A wide area network (WAN) is a telecommunications network that extends over a large geographical area for the primary purpose of computer networking.
- The textbook definition of a WAN is a computer network spanning regions, countries, or even the world.

\* Source: Wikipedia





# What is a Firewall?



# What is a Firewall?



# What is a Firewall?

- In computing, a firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules.
- A firewall typically establishes a barrier between a trusted internal network and untrusted external network, such as the Internet.

\* Source: Wikipedia





# What is a Firewall?

- Firewalls are often categorized as either network firewalls or host-based firewalls.
- Network firewalls filter traffic between two or more networks and run on network hardware.
- Host-based firewalls run on host computers and control network traffic in and out of those machines.

\* Source: Wikipedia



# What is an IDS?



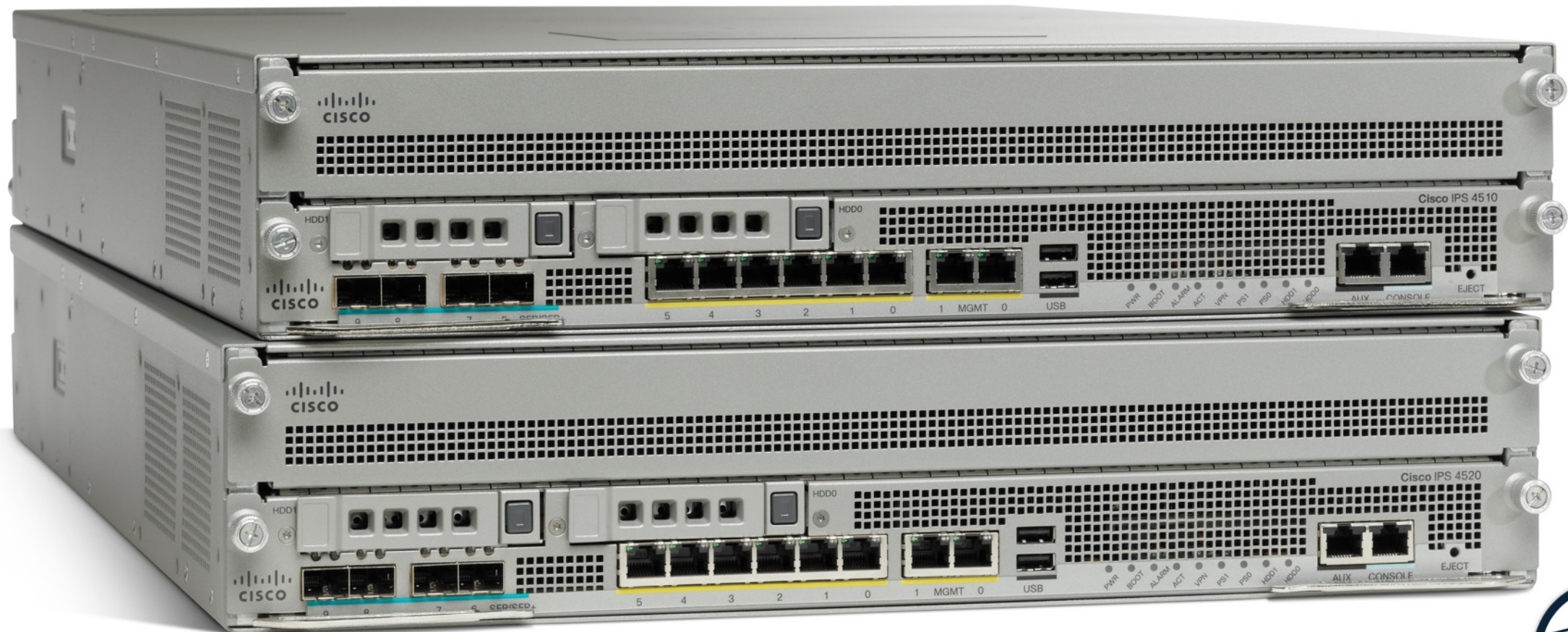


# What is an IPS?





# What is an IPS?



# What is an IPS?

- An intrusion detection system (IDS) is a device or software application that monitors a network or systems for malicious activity or policy violations.
- Any intrusion activity or violation is typically reported either to an administrator or collected centrally using a security information and event management (SIEM) system.

\* Source: Wikipedia



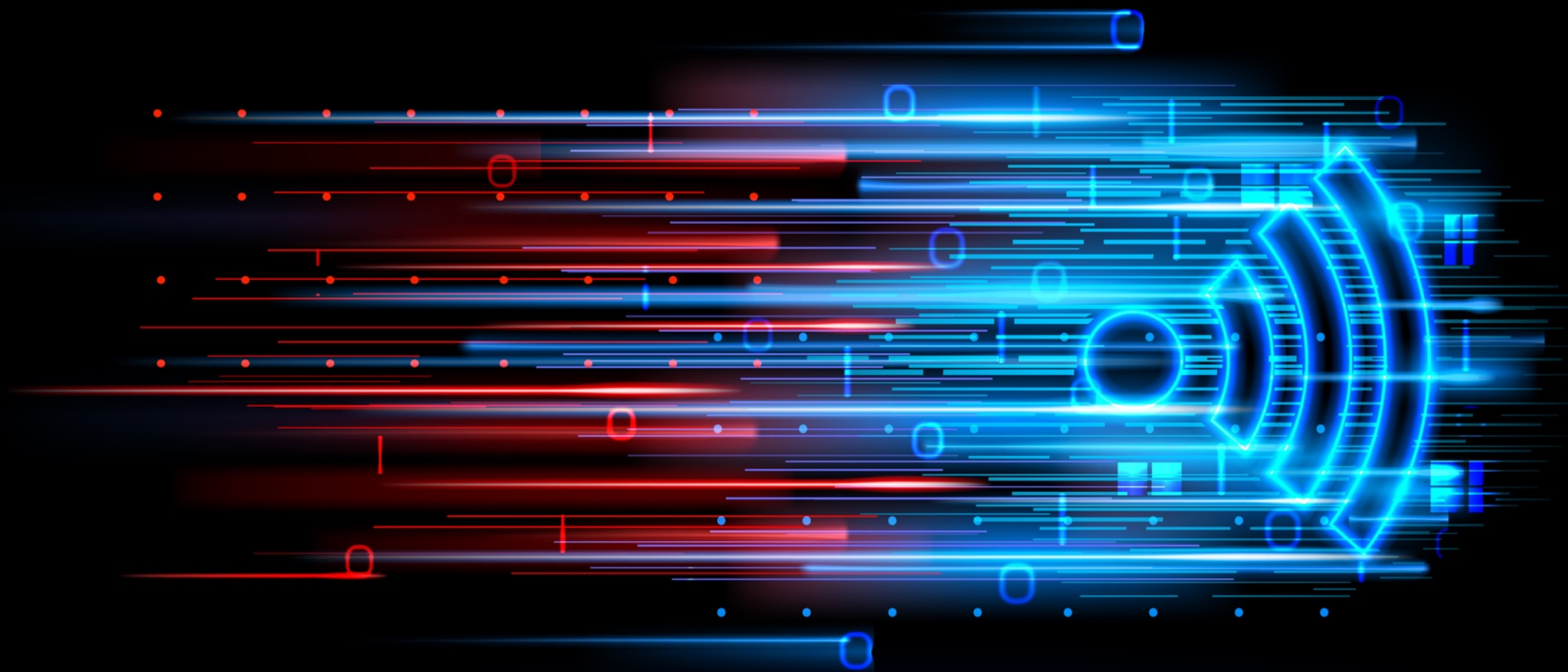
# What is an IPS?

- Intrusion prevention systems (IPS), also known as intrusion detection and prevention systems (IDPS), are network security appliances that monitor network or system activities for malicious activity.
- The main functions of intrusion prevention systems are to identify malicious activity, log information about this activity, report it and attempt to block or stop it

\* Source: Wikipedia







NETWORK

