



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 set of computers sharing resources located on or provided by network nodes.
- Computers use common communication protocols over digital interconnections to communicate with each other.
- These interconnections are made up of telecommunication network technologies based on physically wired, optical, and wireless radio-frequency methods that may be arranged in a variety of network topologies.

* Source: Wikipedia



What is a Network?

- The nodes of a computer network can include personal computers, servers, networking hardware, or other specialized or general-purpose hosts.
- They are identified by network addresses and may have hostnames. Hostnames serve as memorable labels for the nodes and are rarely changed after initial assignment.
- Network addresses serve for locating and identifying the nodes by communication protocols such as the Internet Protocol.

* Source: Wikipedia



What is a Host?

- A network host is a computer or other device connected to a computer network. A host may work as a server offering information resources, services, and applications to users or other hosts on the network. Hosts are assigned at least one network address.
- A computer participating in networks that use the Internet protocol suite may also be called an IP host. Specifically, computers participating in the Internet are called Internet hosts. Internet hosts and other IP hosts have one or more IP addresses assigned to their network interfaces. The addresses are configured either manually by an administrator, automatically at startup by means of the Dynamic Host Configuration Protocol (DHCP), or by stateless address autoconfiguration methods.

* Source: Wikipedia



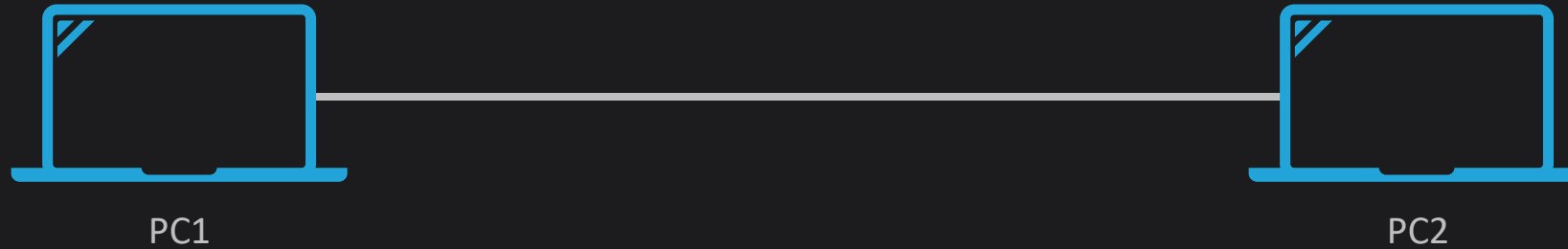
Resource example: Printer



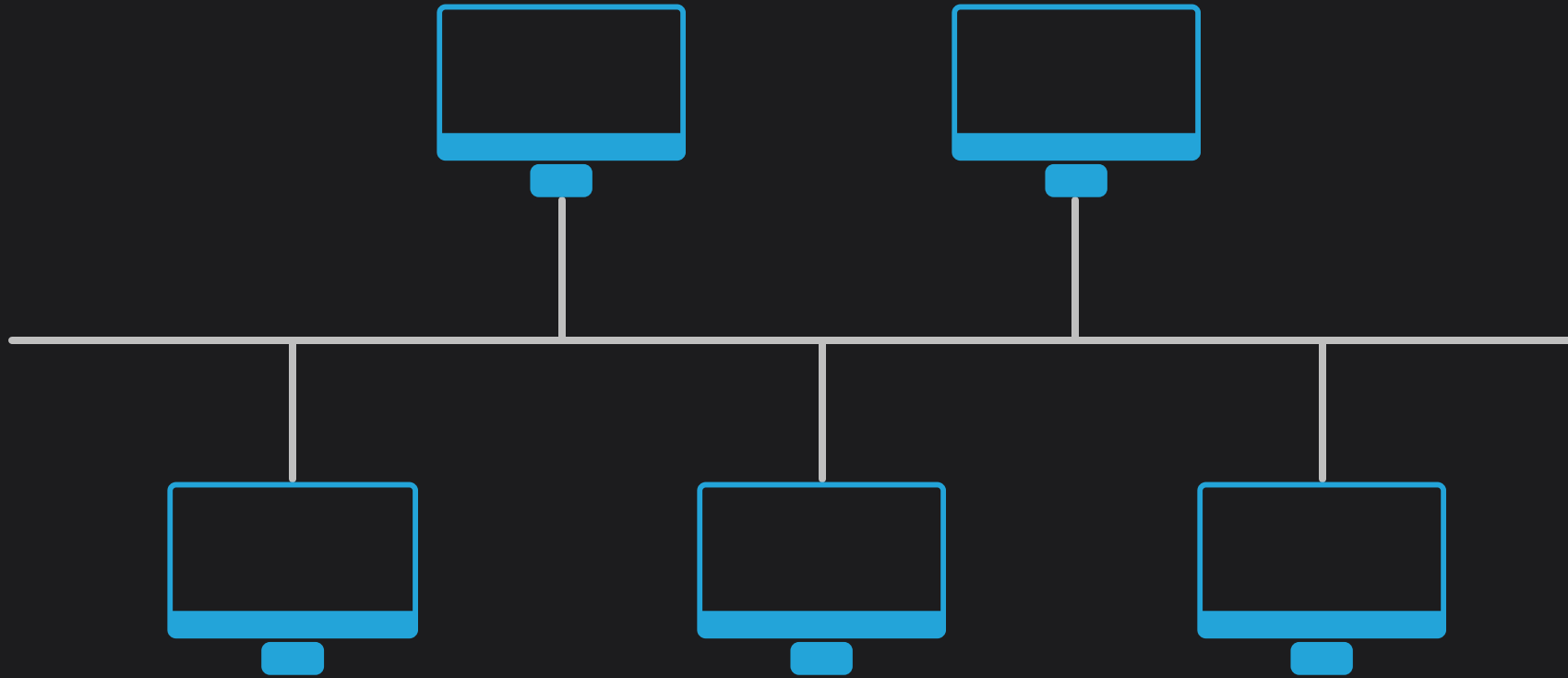
Resource example: File Sharing



Basic Network



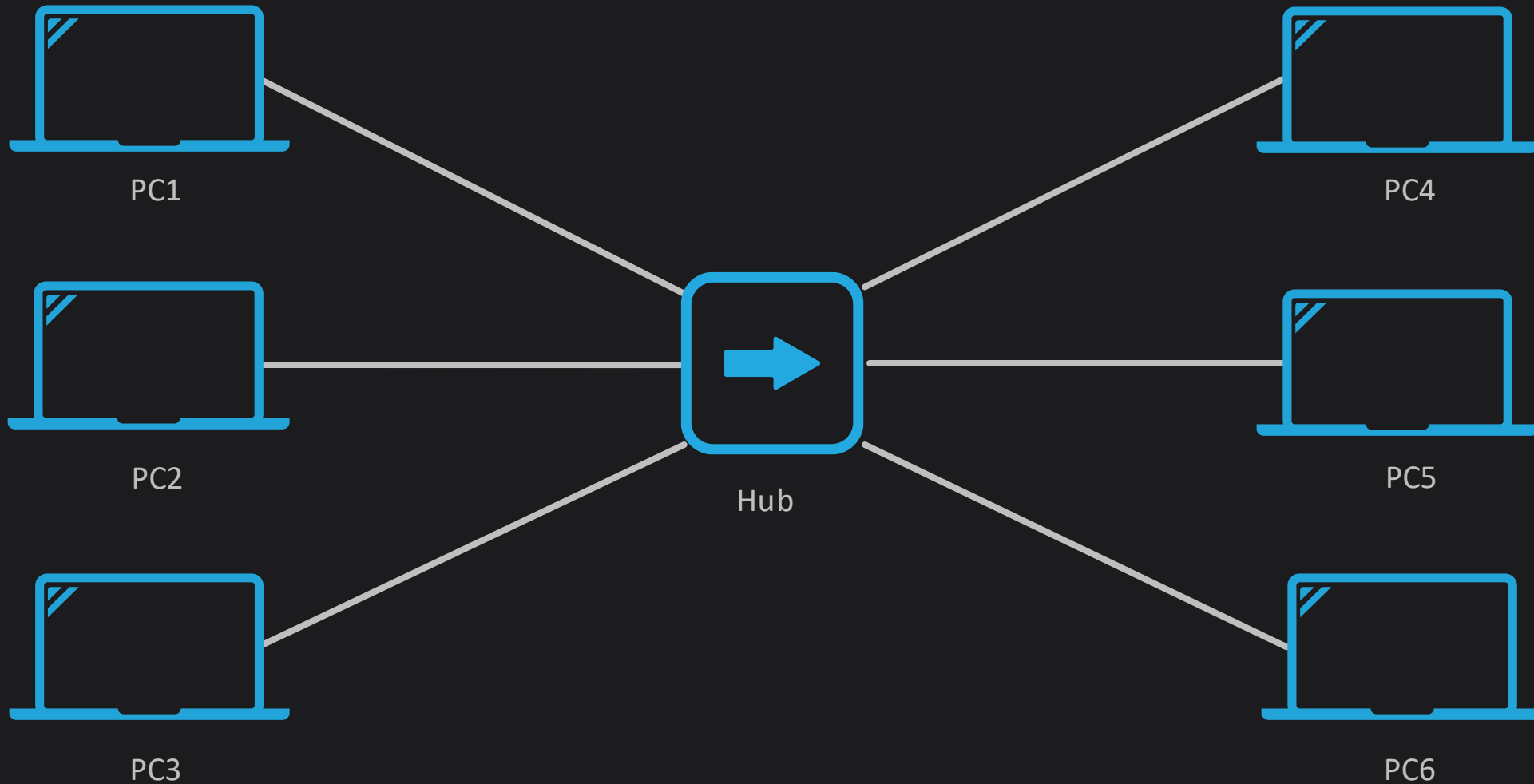
What is a bus network?



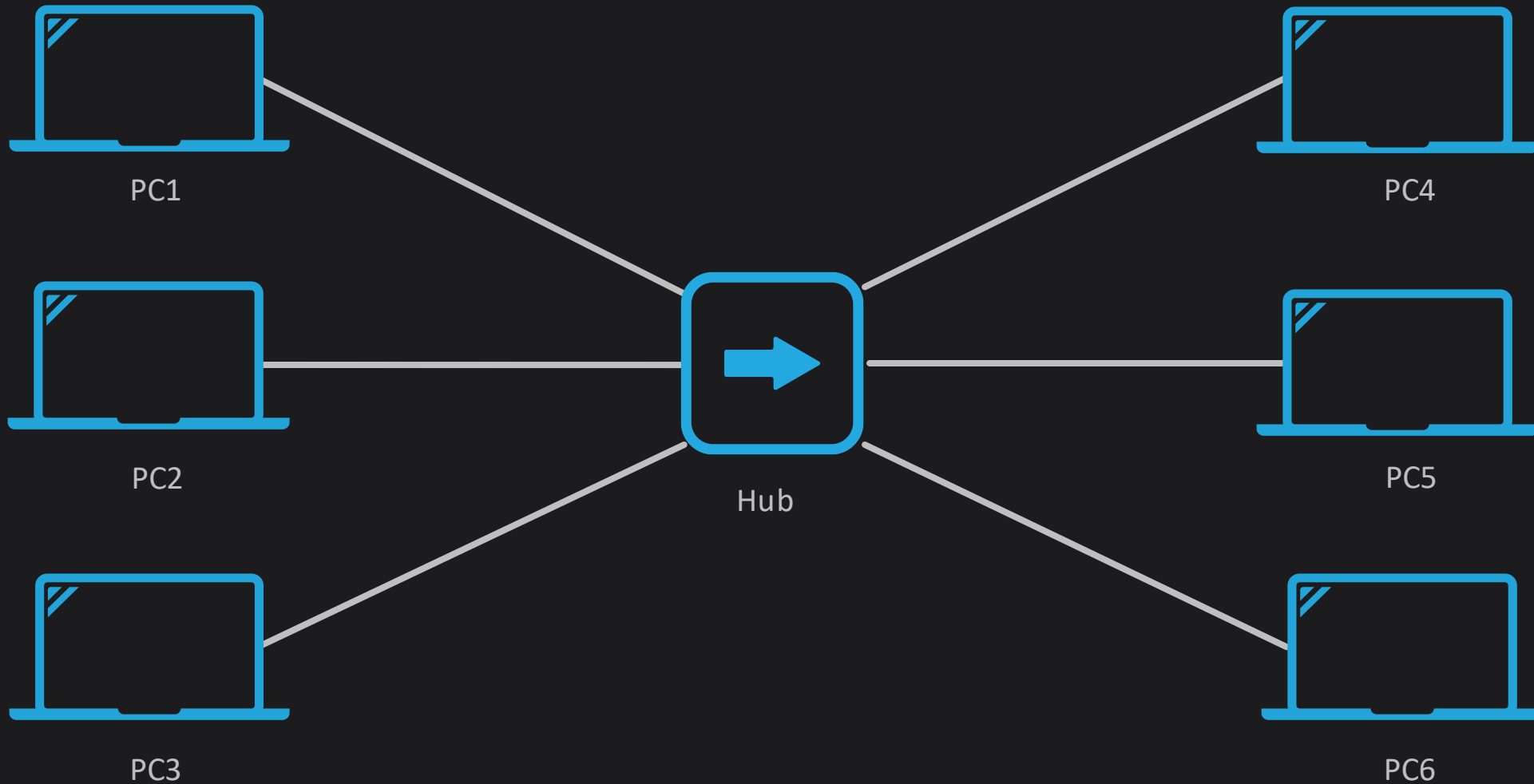
Network with Hub



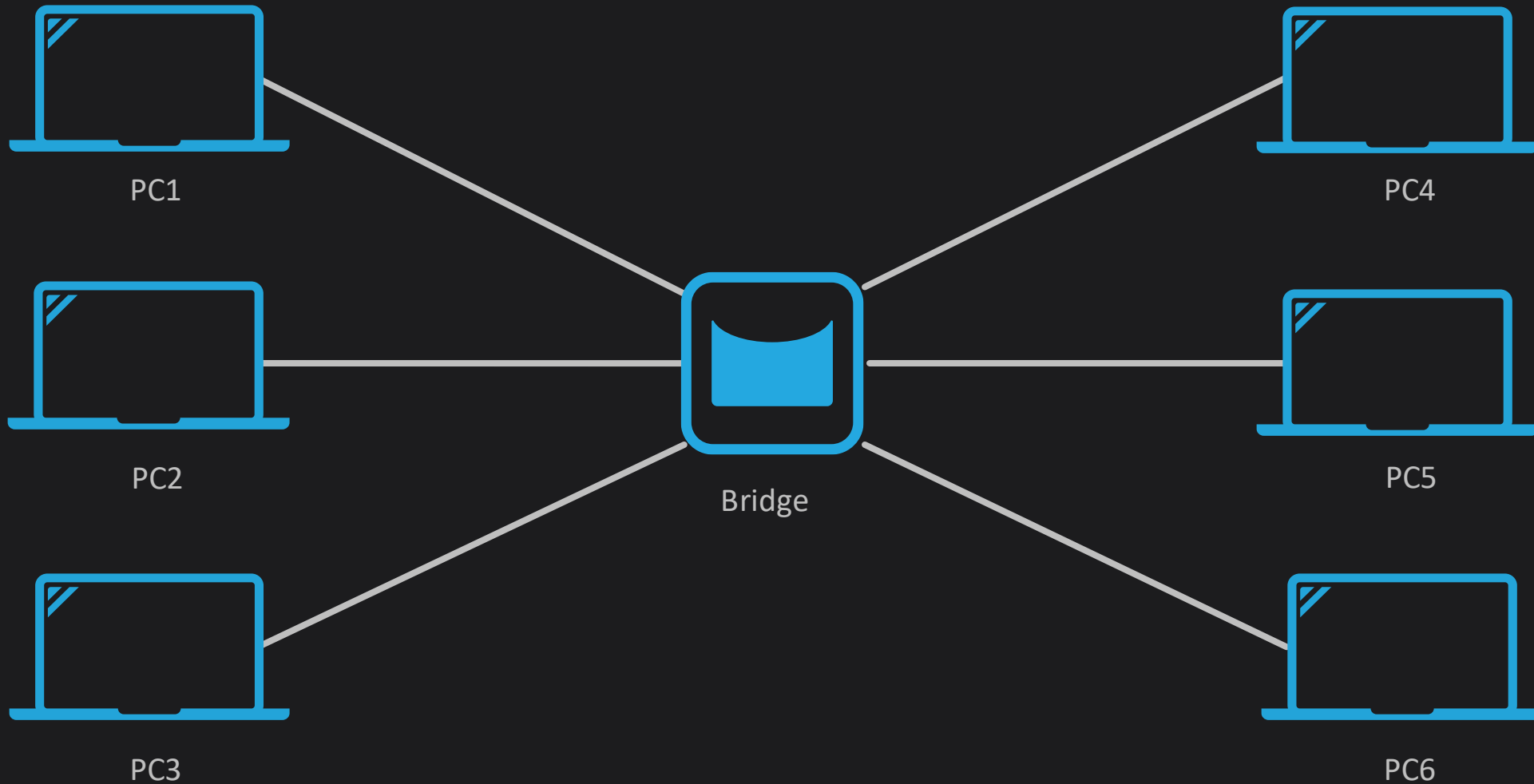
Star Topology (Hub)



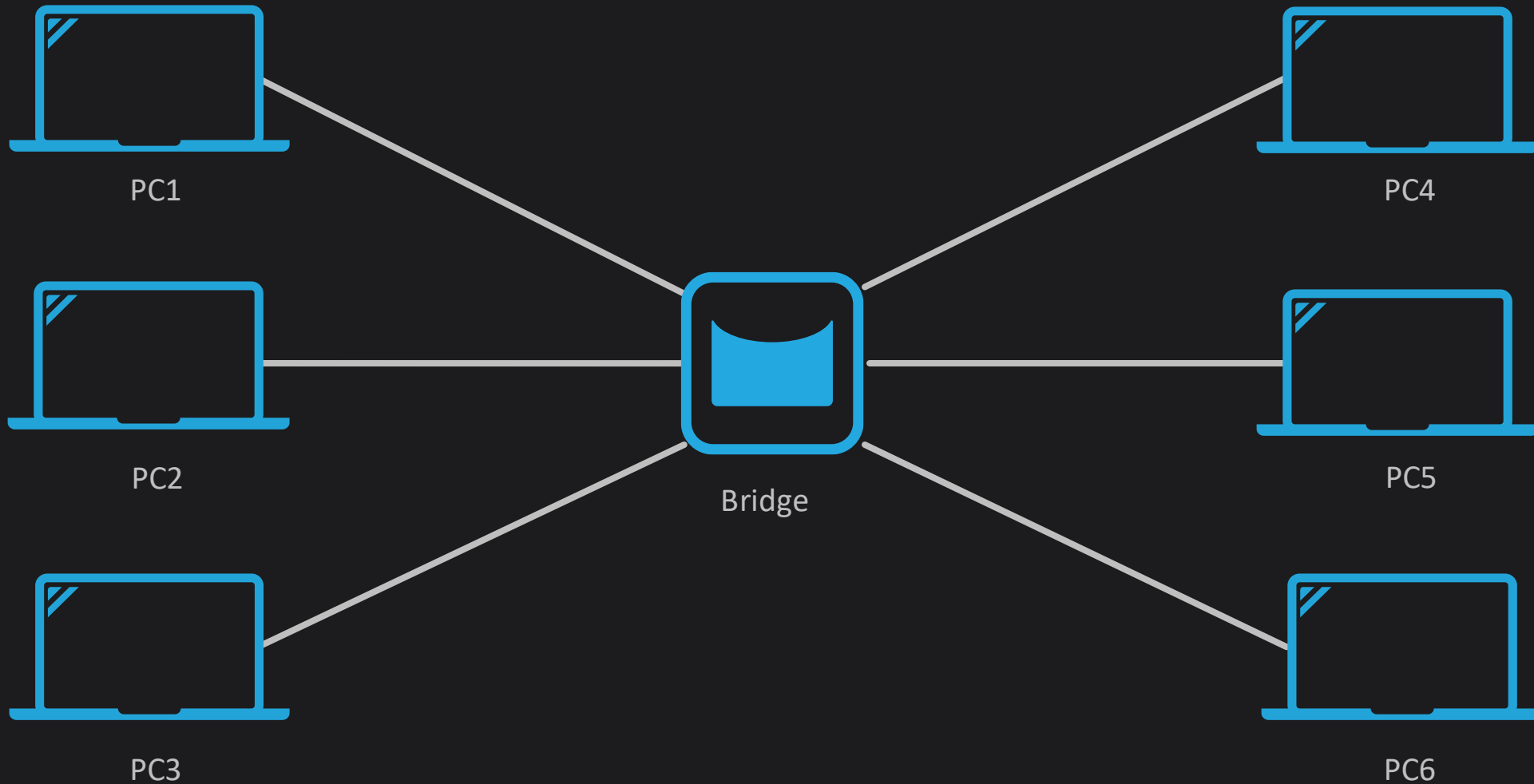
Network with Hub



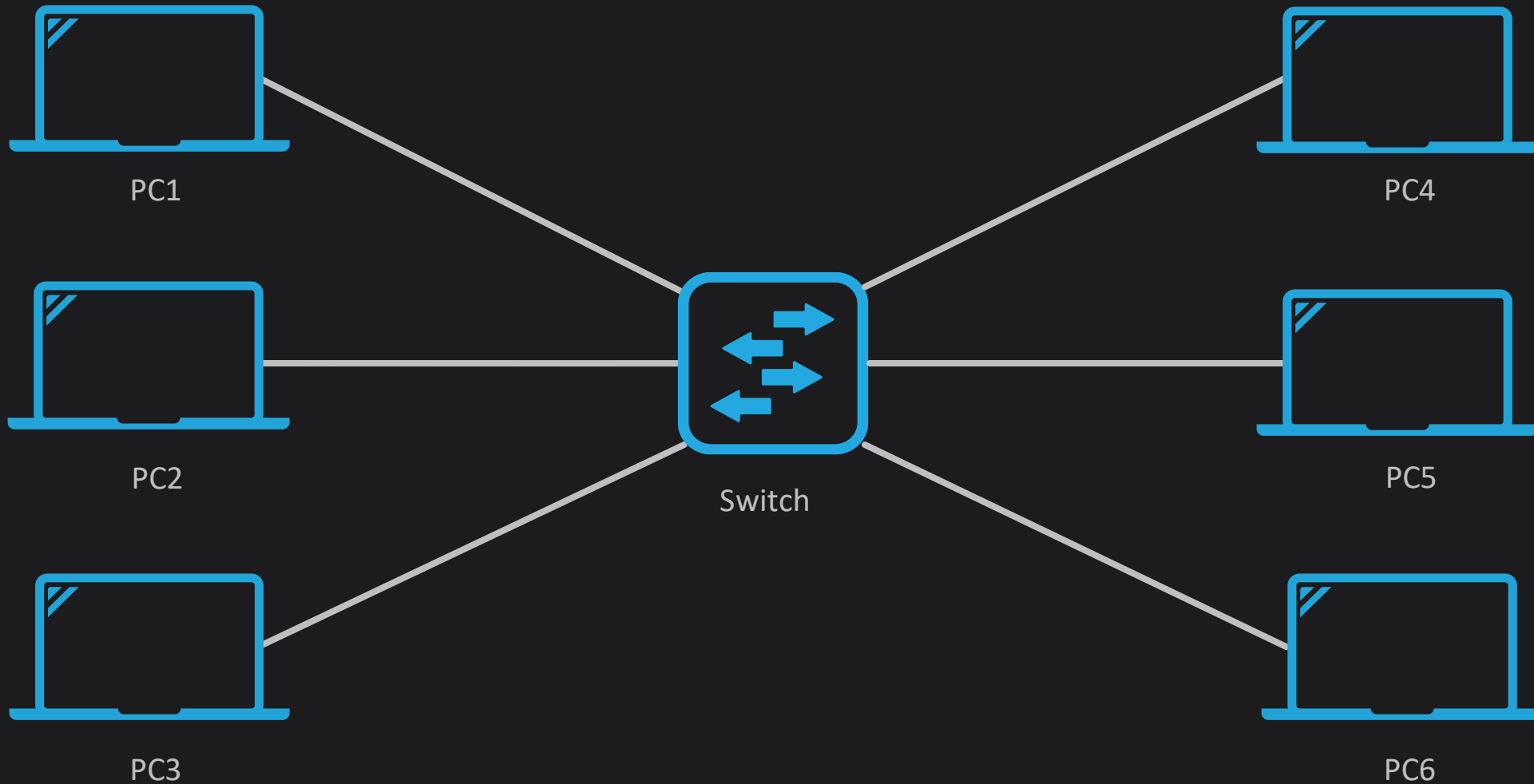
Star Topology (Bridge)



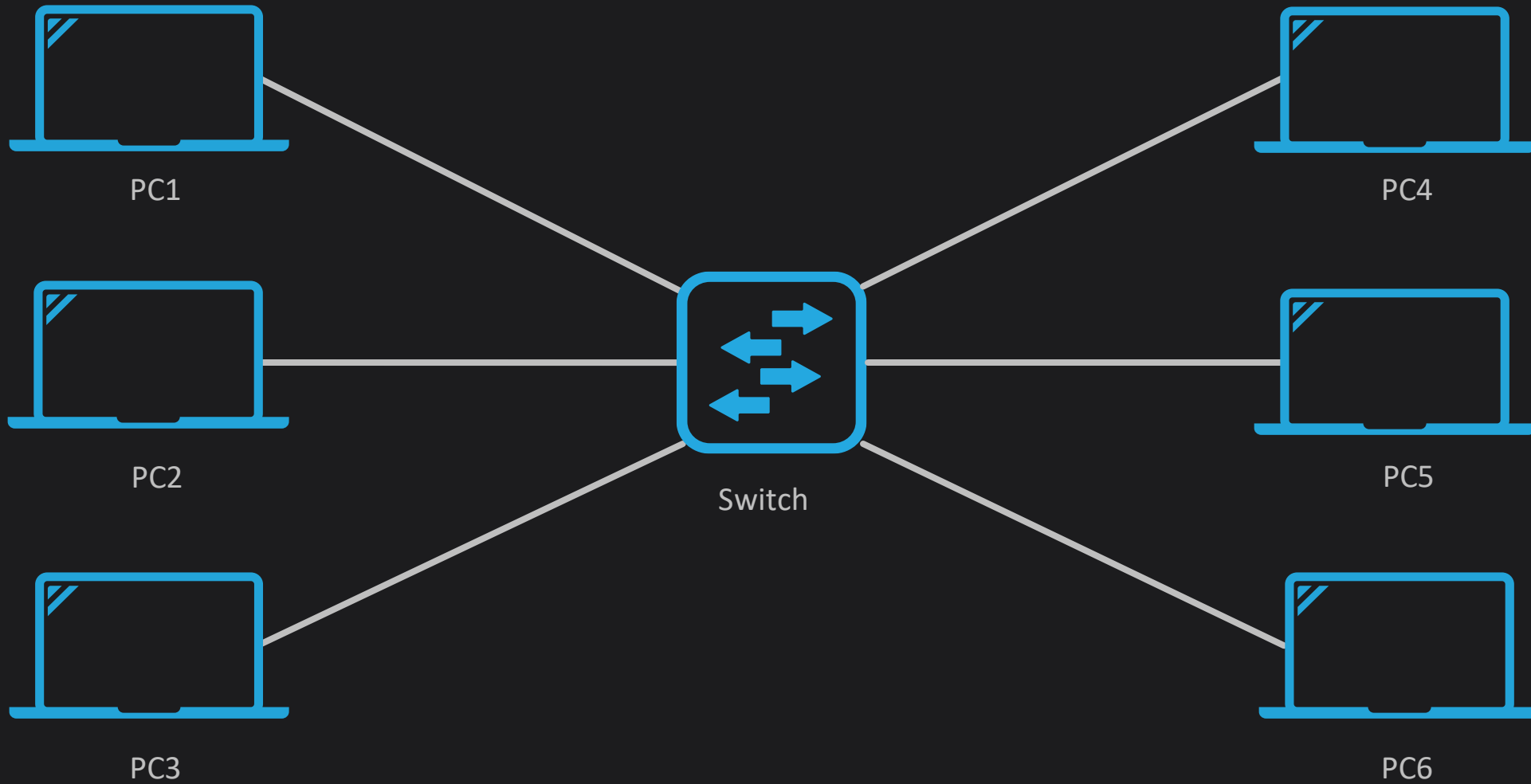
Bridged Network



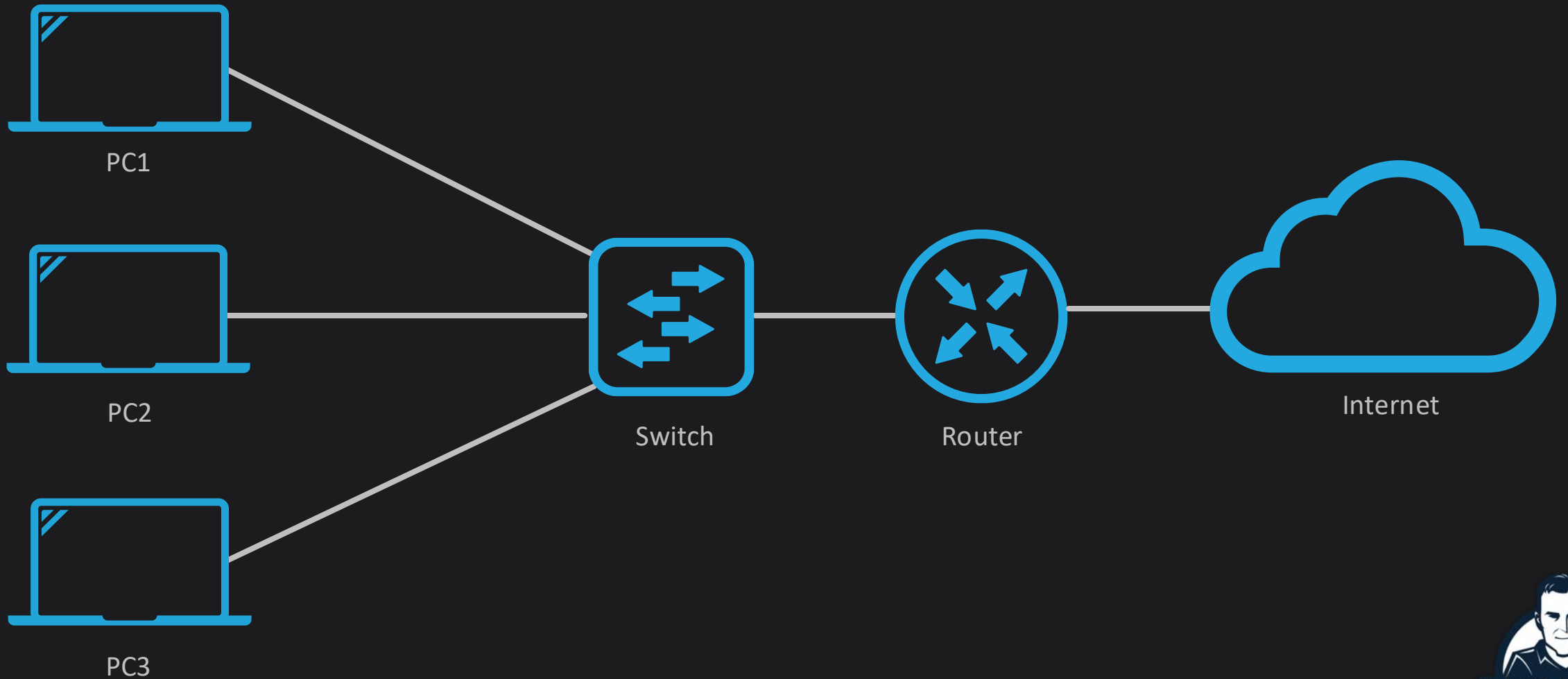
Star Topology (Switch)



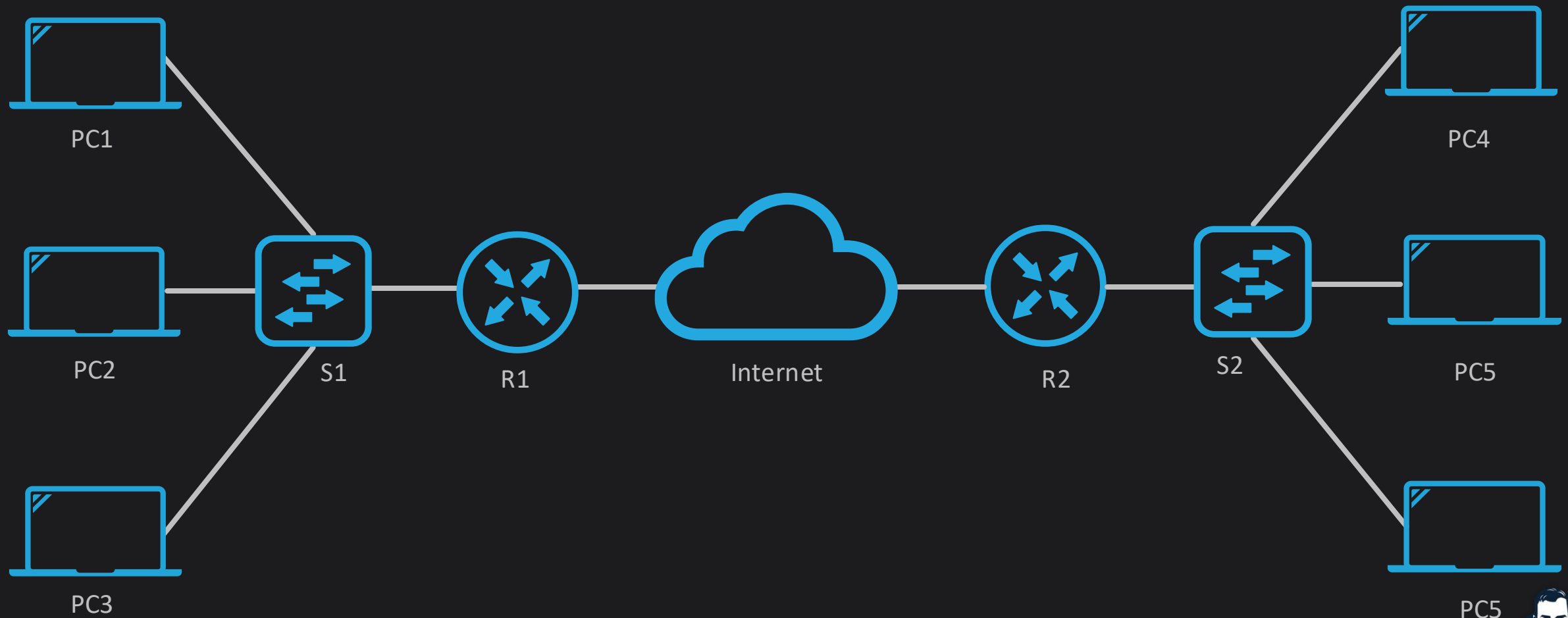
Switched Network



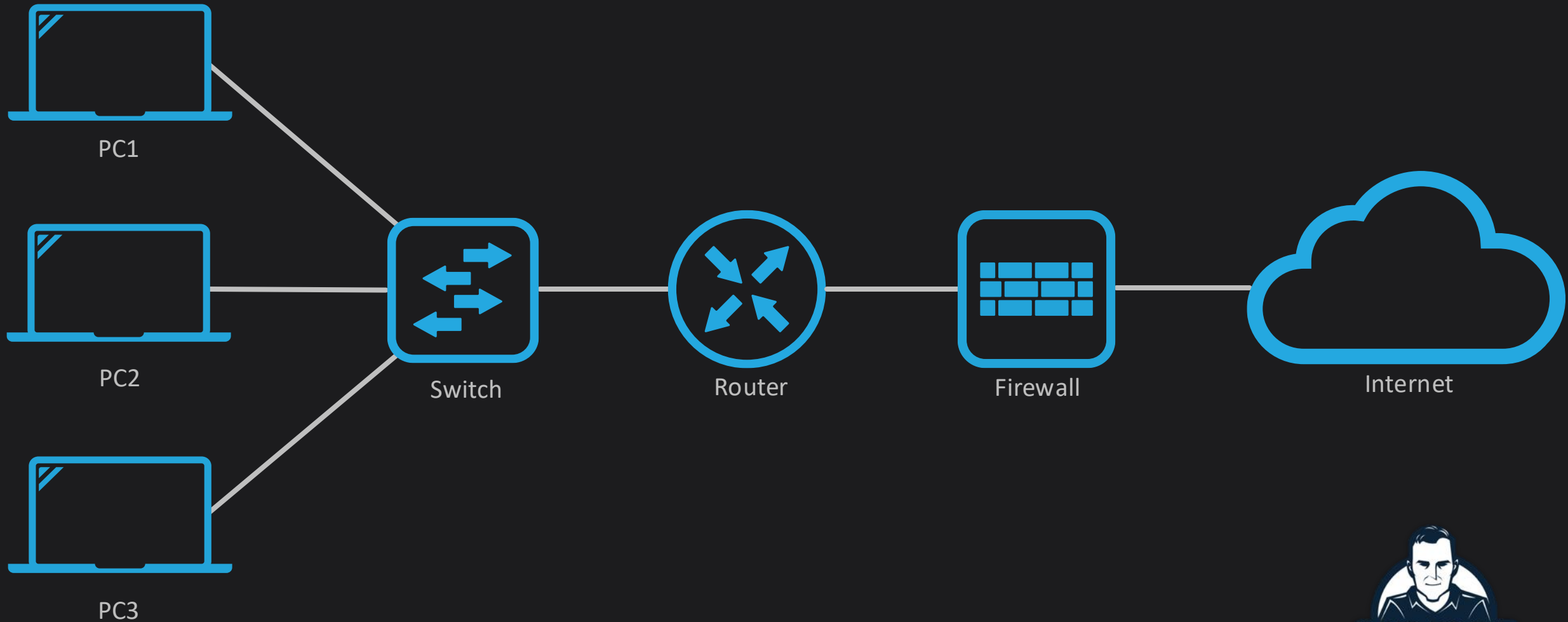
Routed Network



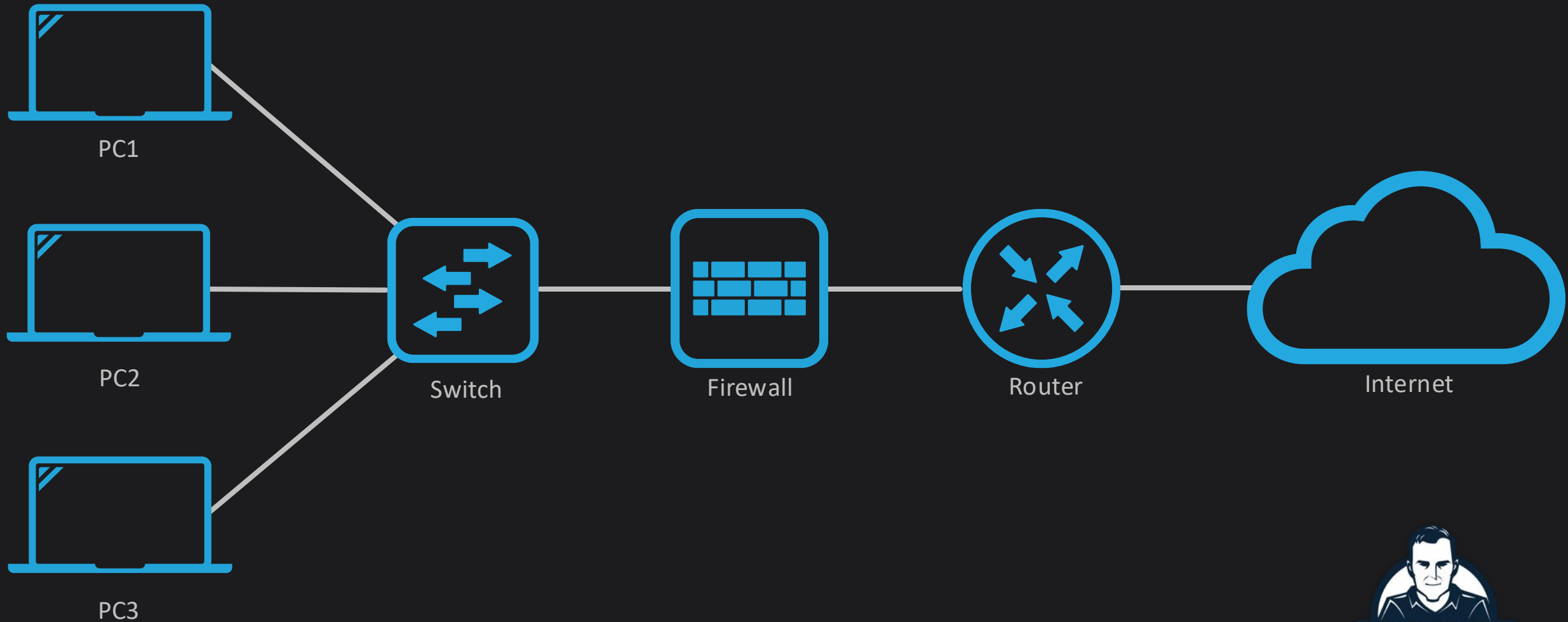
Routed Network



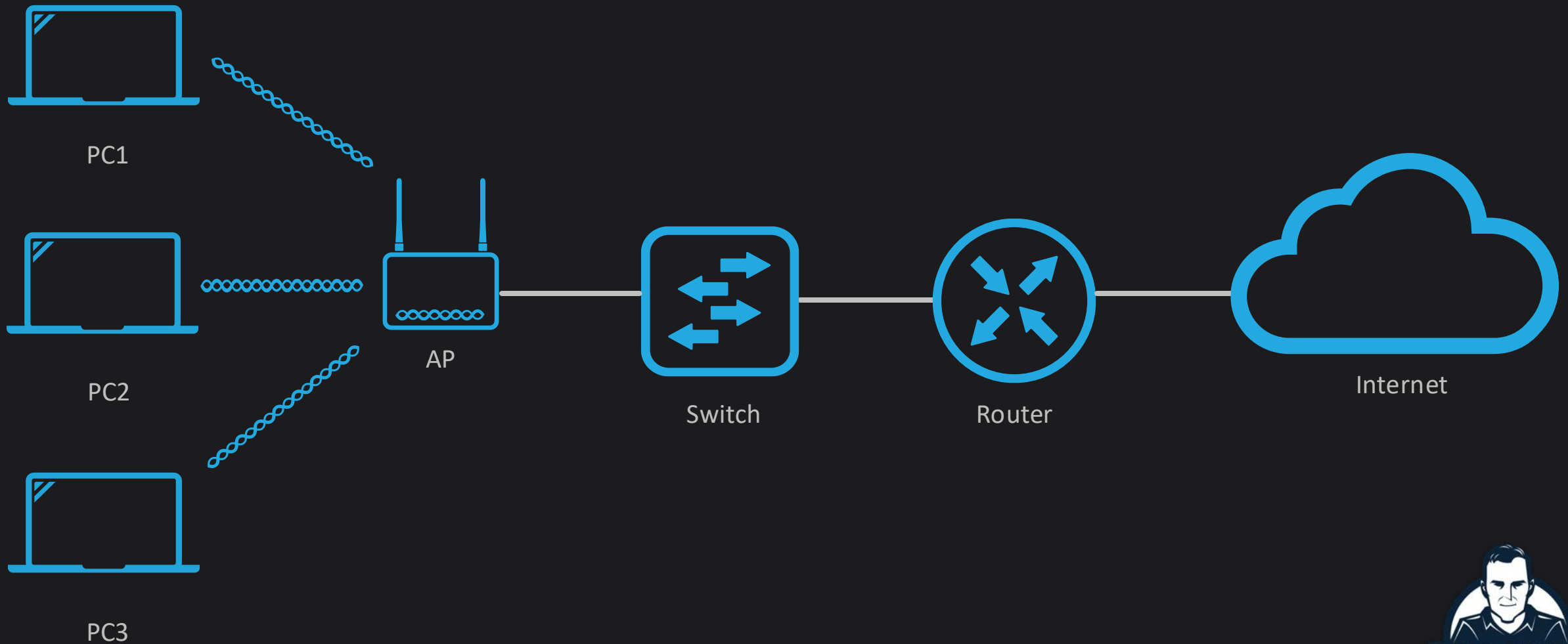
Firewall



Firewall



Wi-Fi



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?

- A server is a computer that provides information to other computers called "clients" on computer network.
- This architecture is called the client–server model. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients or performing computations for a client.
- A single server can serve multiple clients, and a single client can use multiple servers.

* Source: Wikipedia



What is a Server?

A server is a computer that provides information to other computers called "clients" on computer network. This architecture is called the client–server model.

* Source: Wikipedia



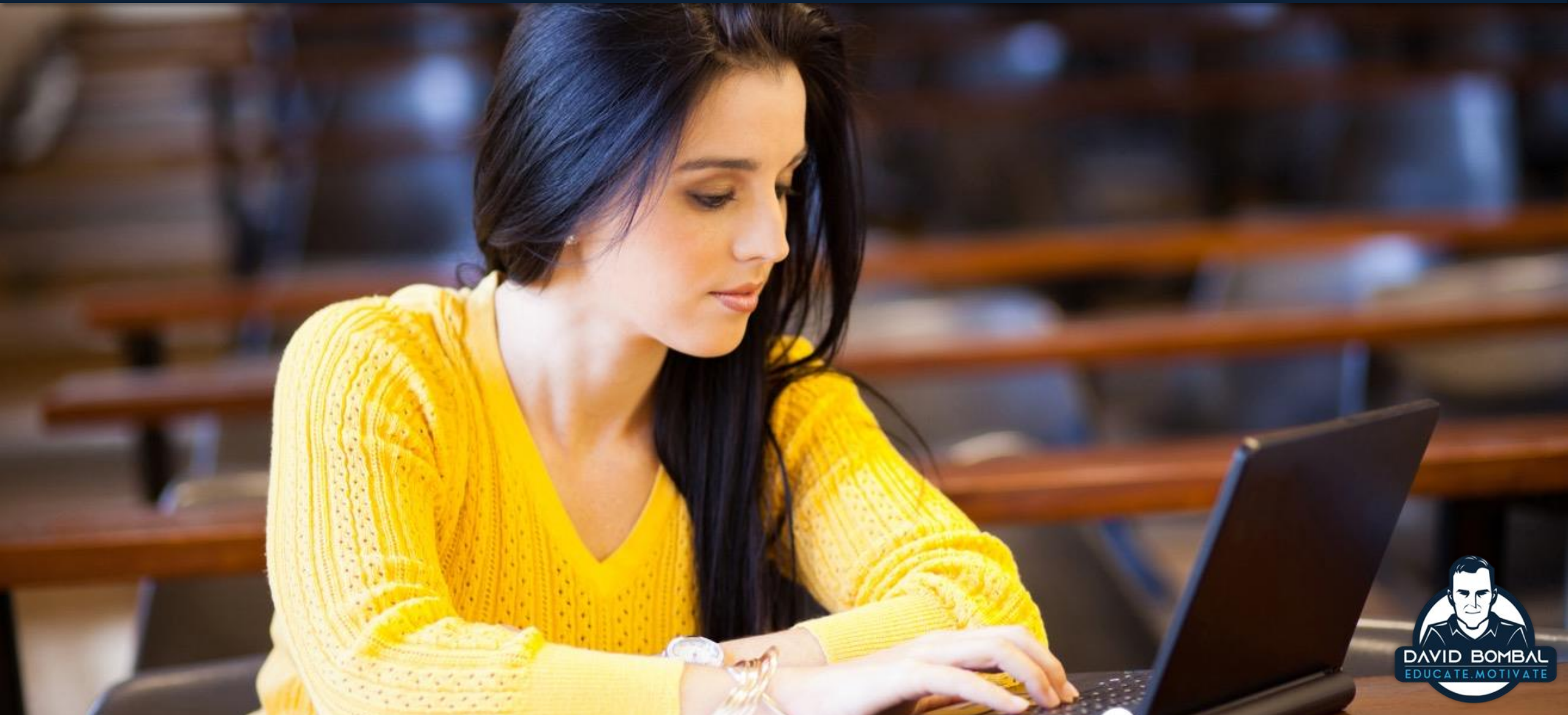
What is a Server?

- 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?



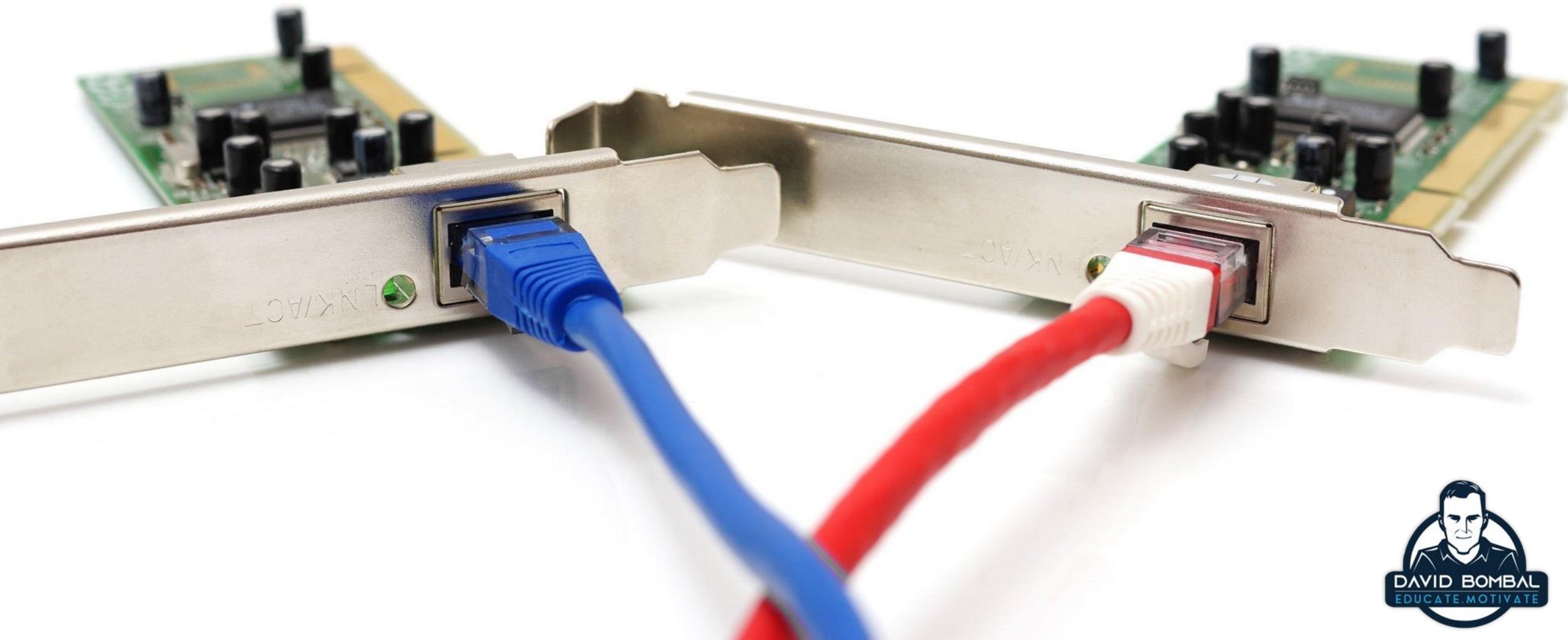
What is a Client?

- 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.

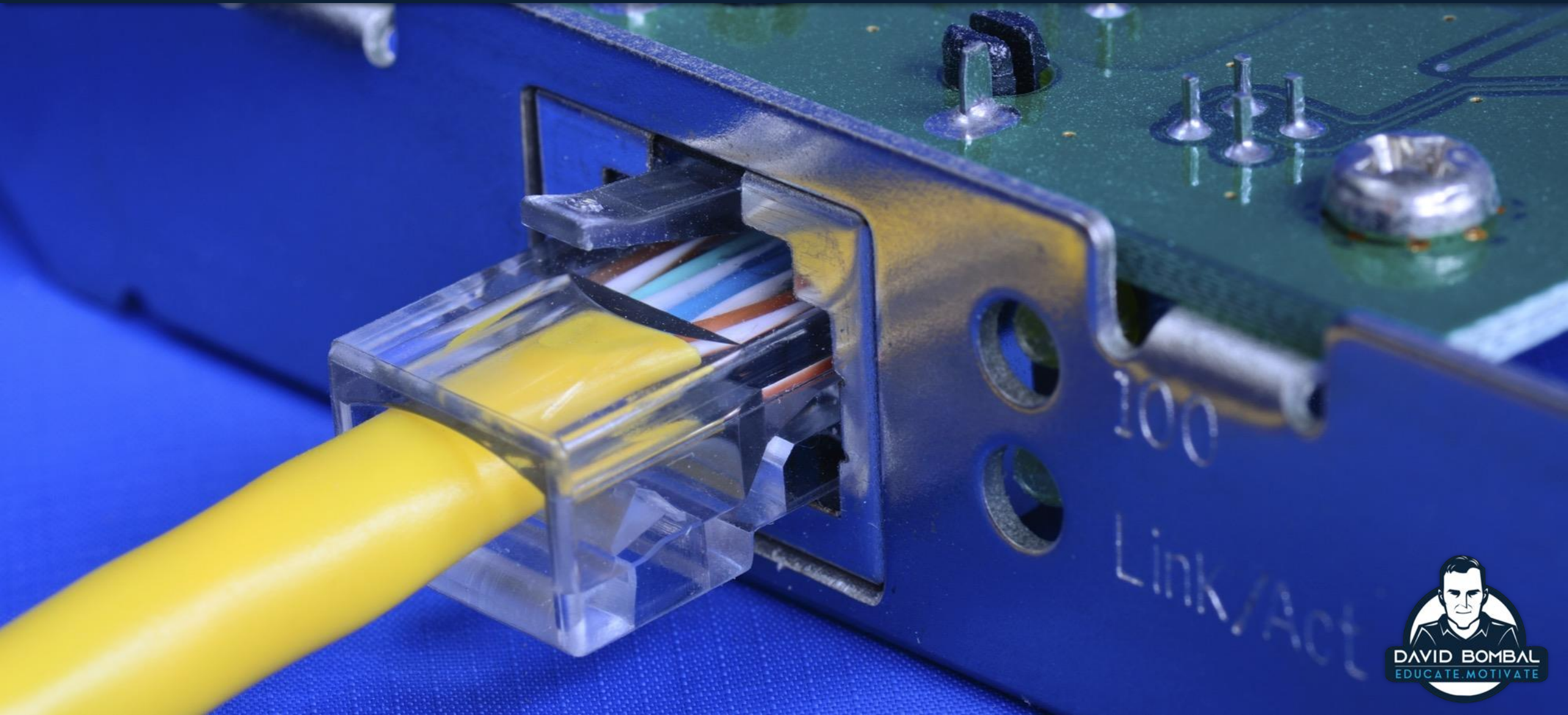
* Source: Wikipedia



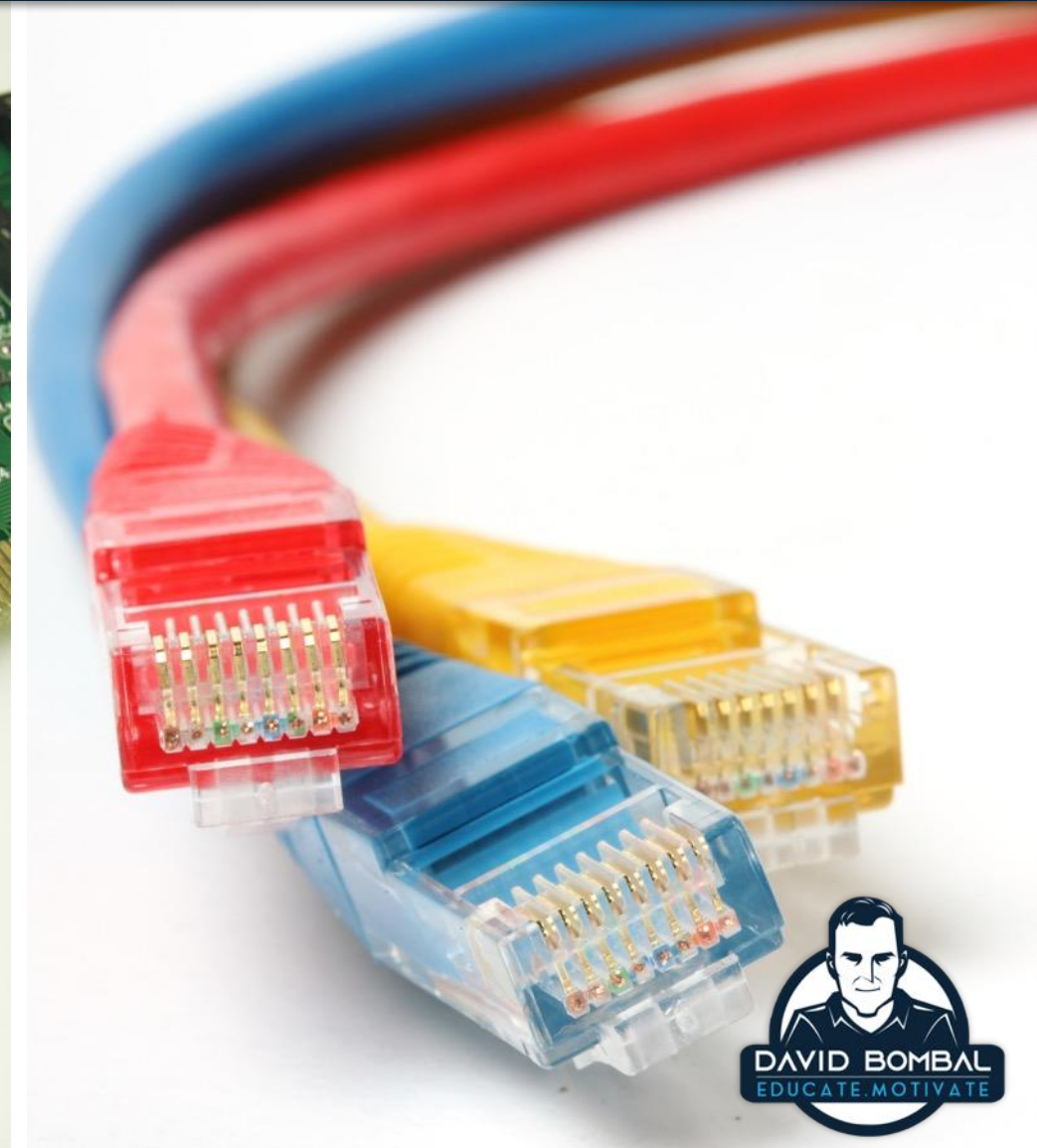
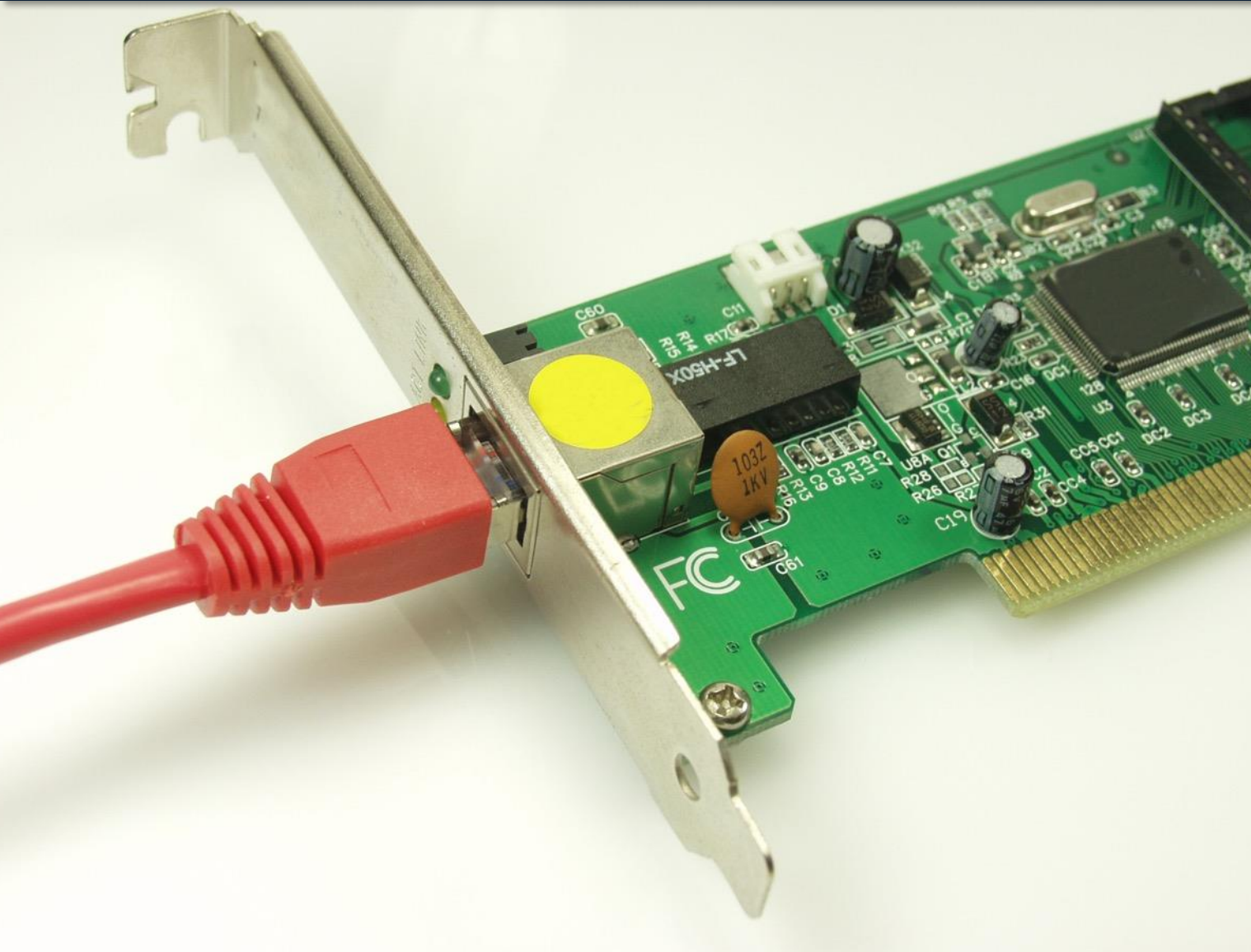
What is a NIC?



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 Workstation

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



10Base5, 10Base2, 10BaseT



10BaseT

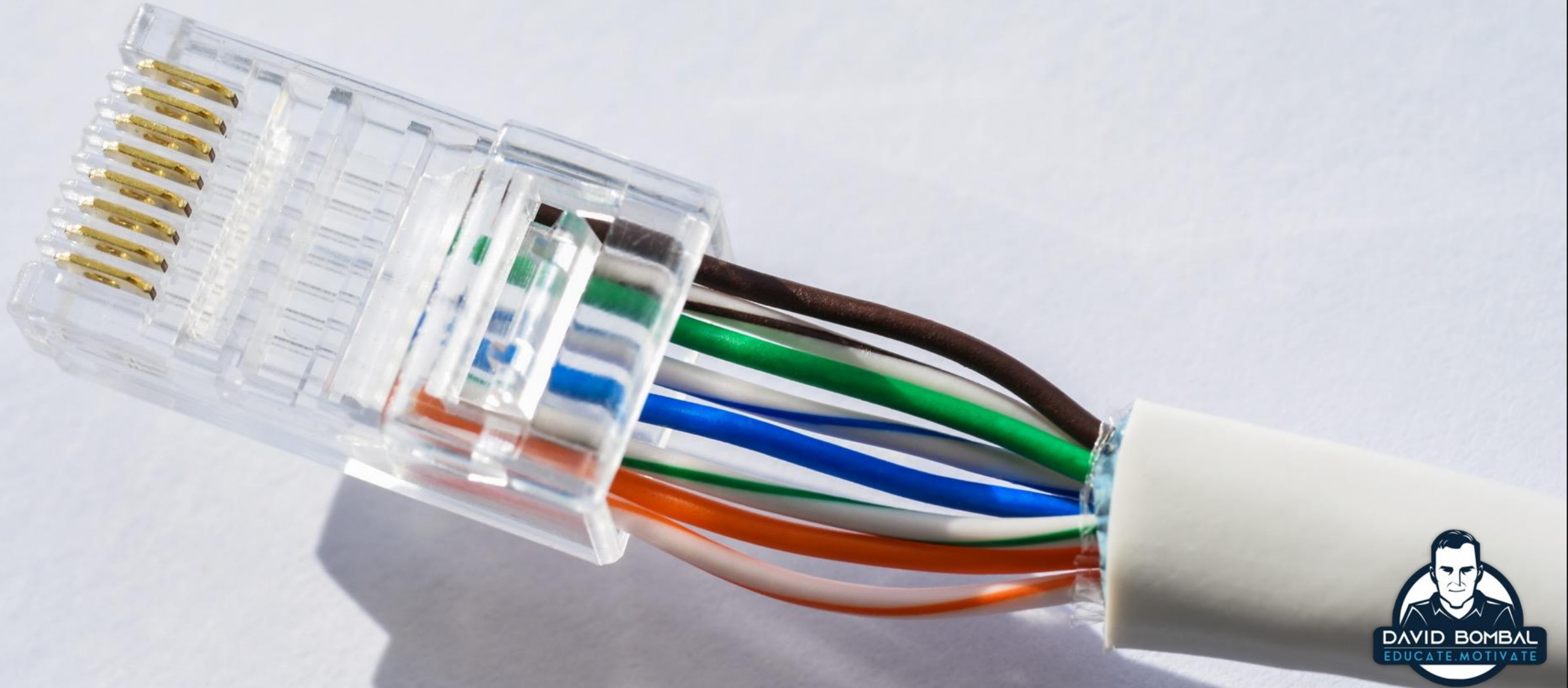
10Base2

10Base5

RJ45



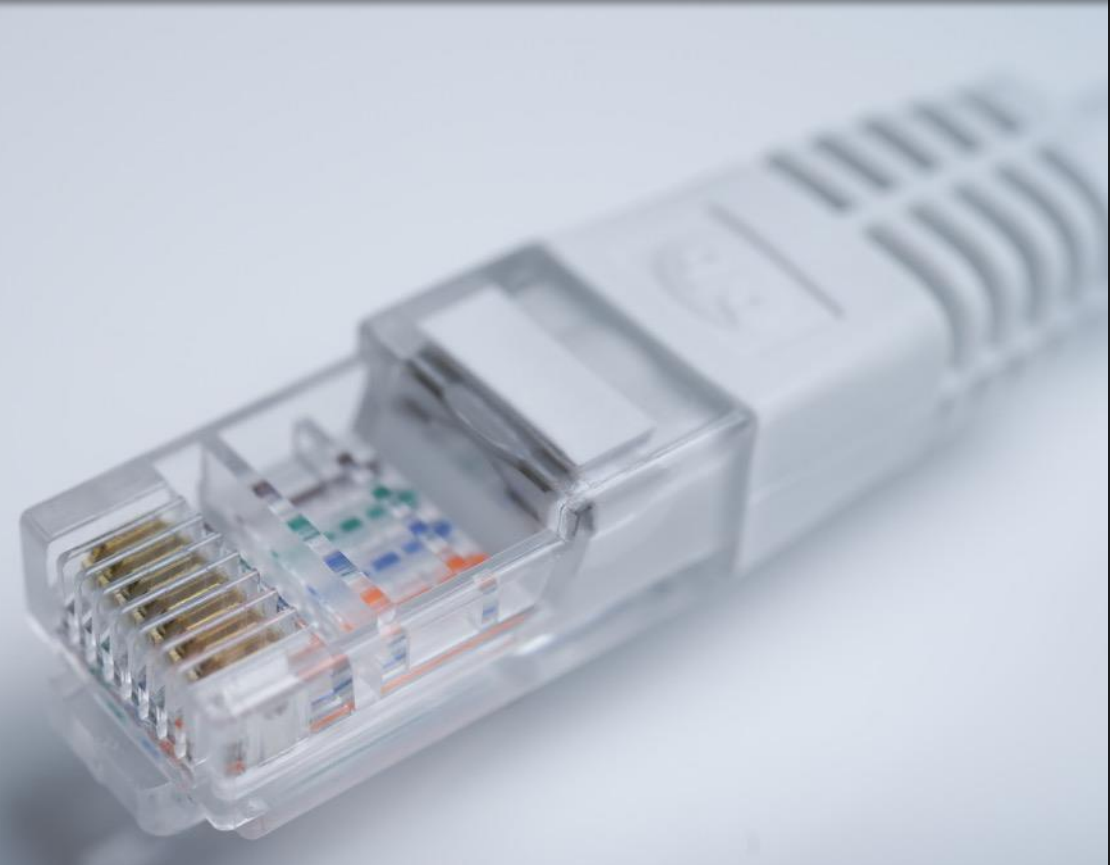
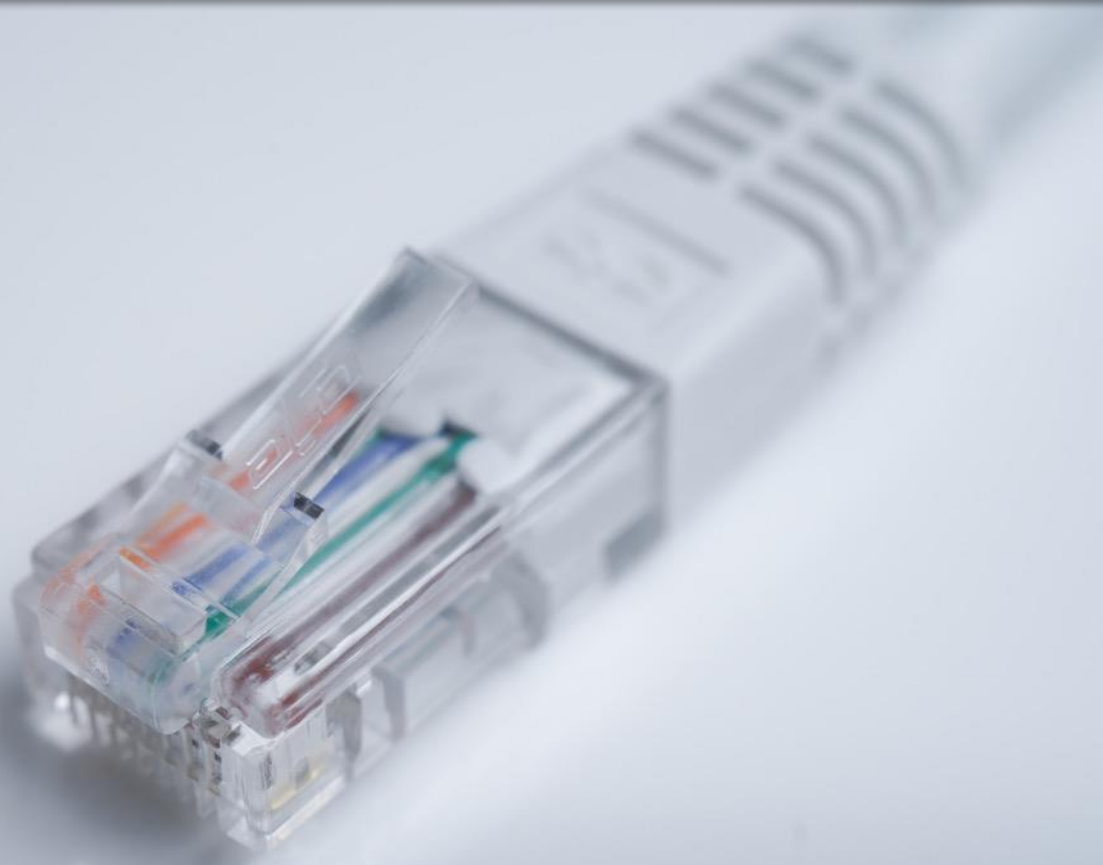
RJ45



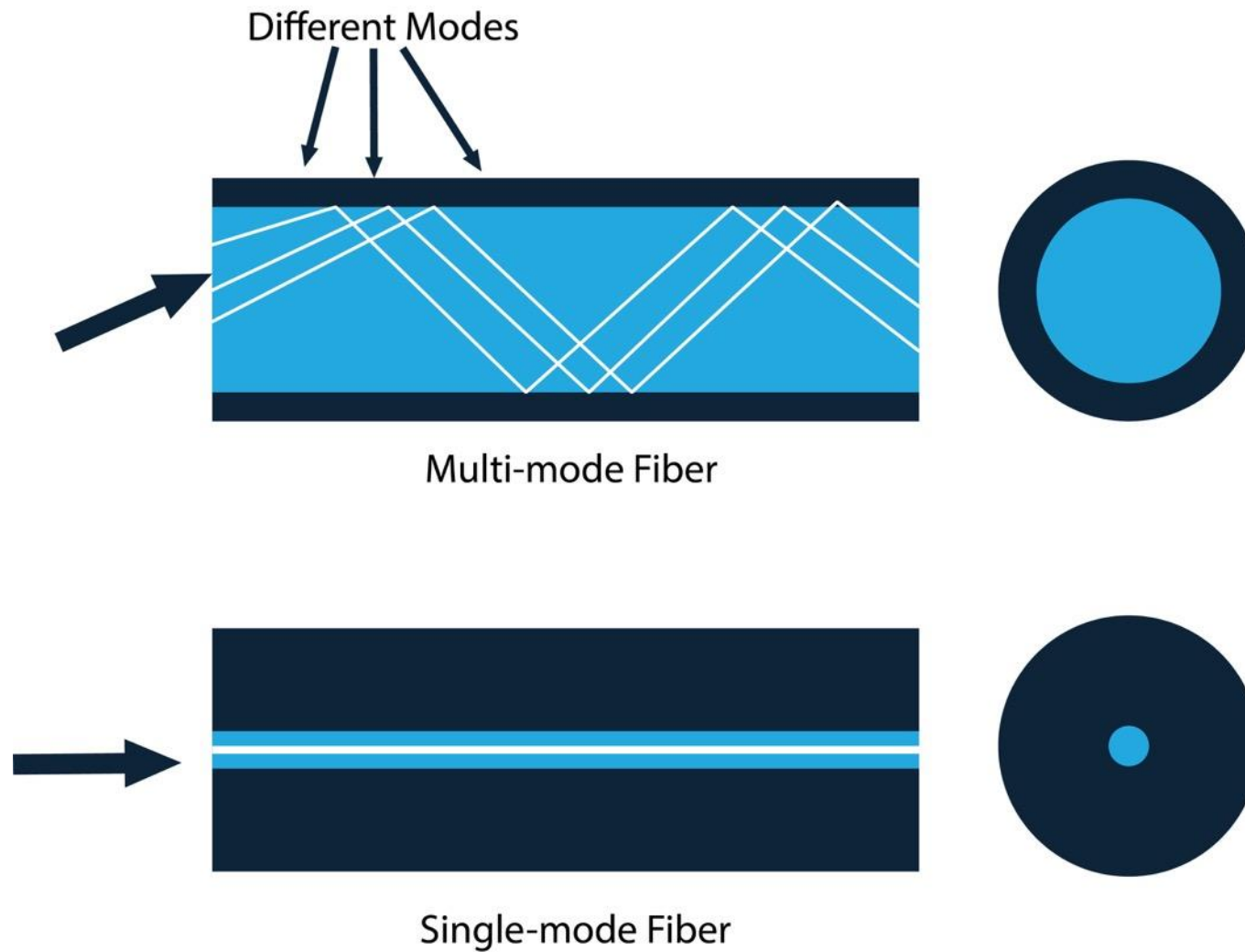
RJ45



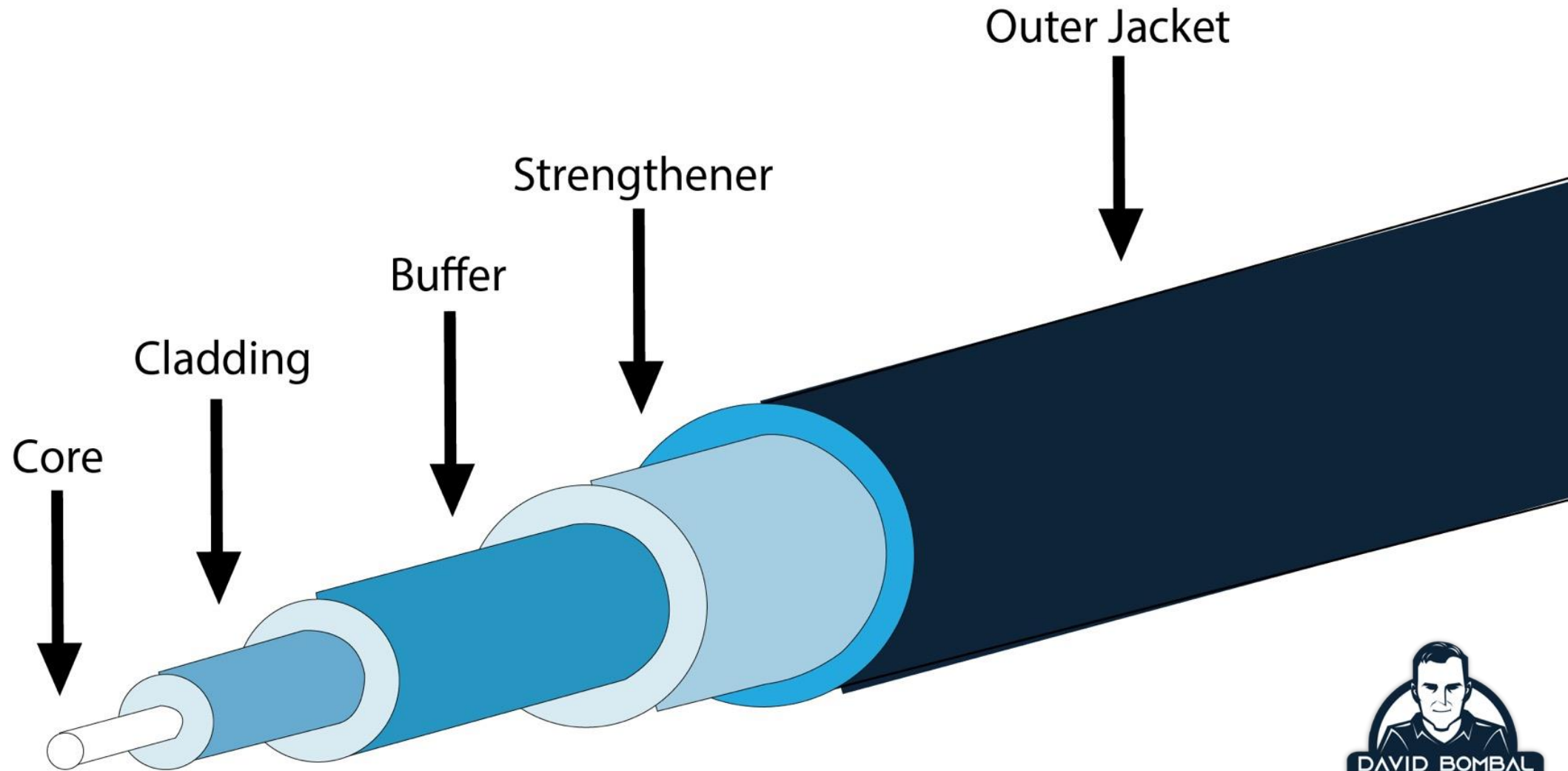
RJ45



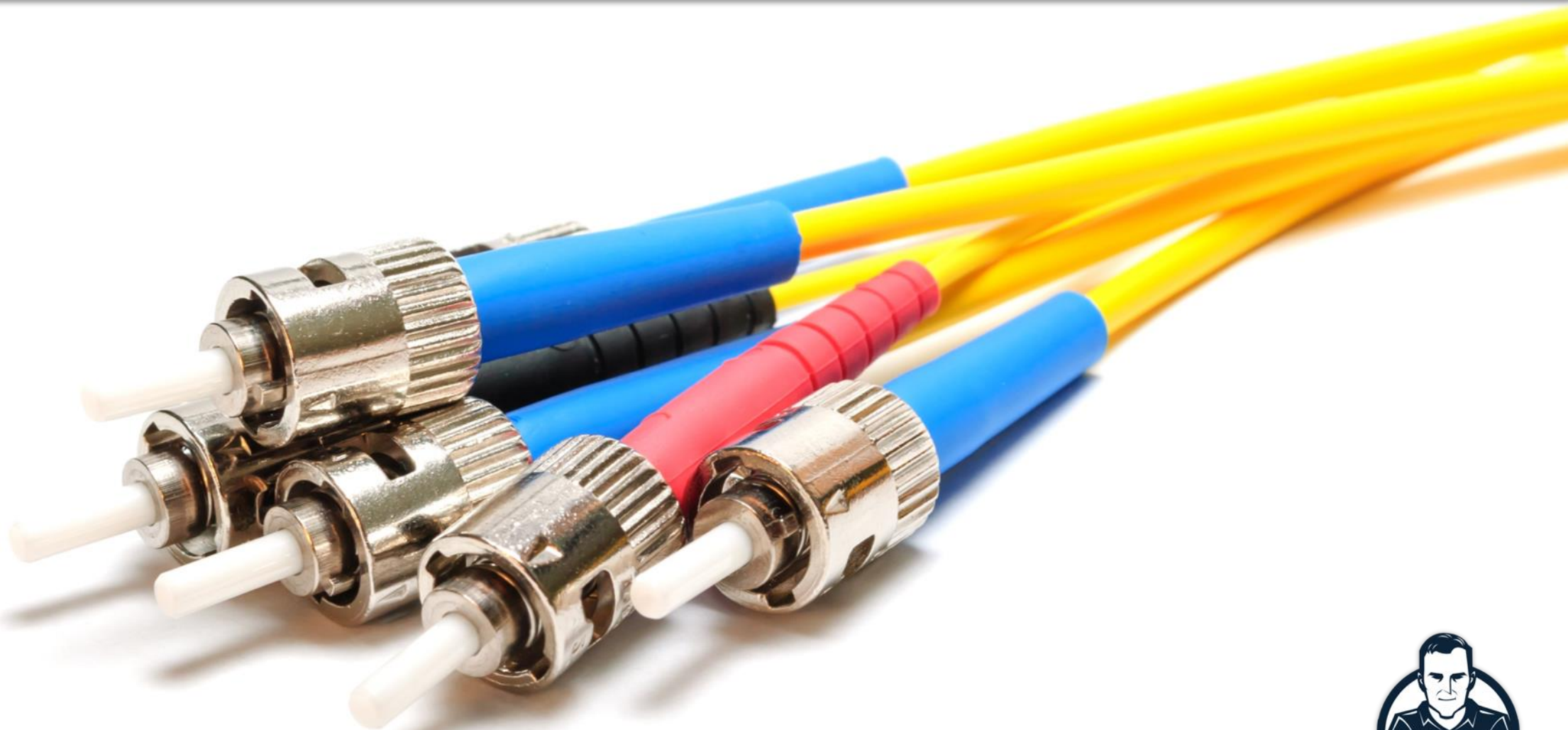
Fiber



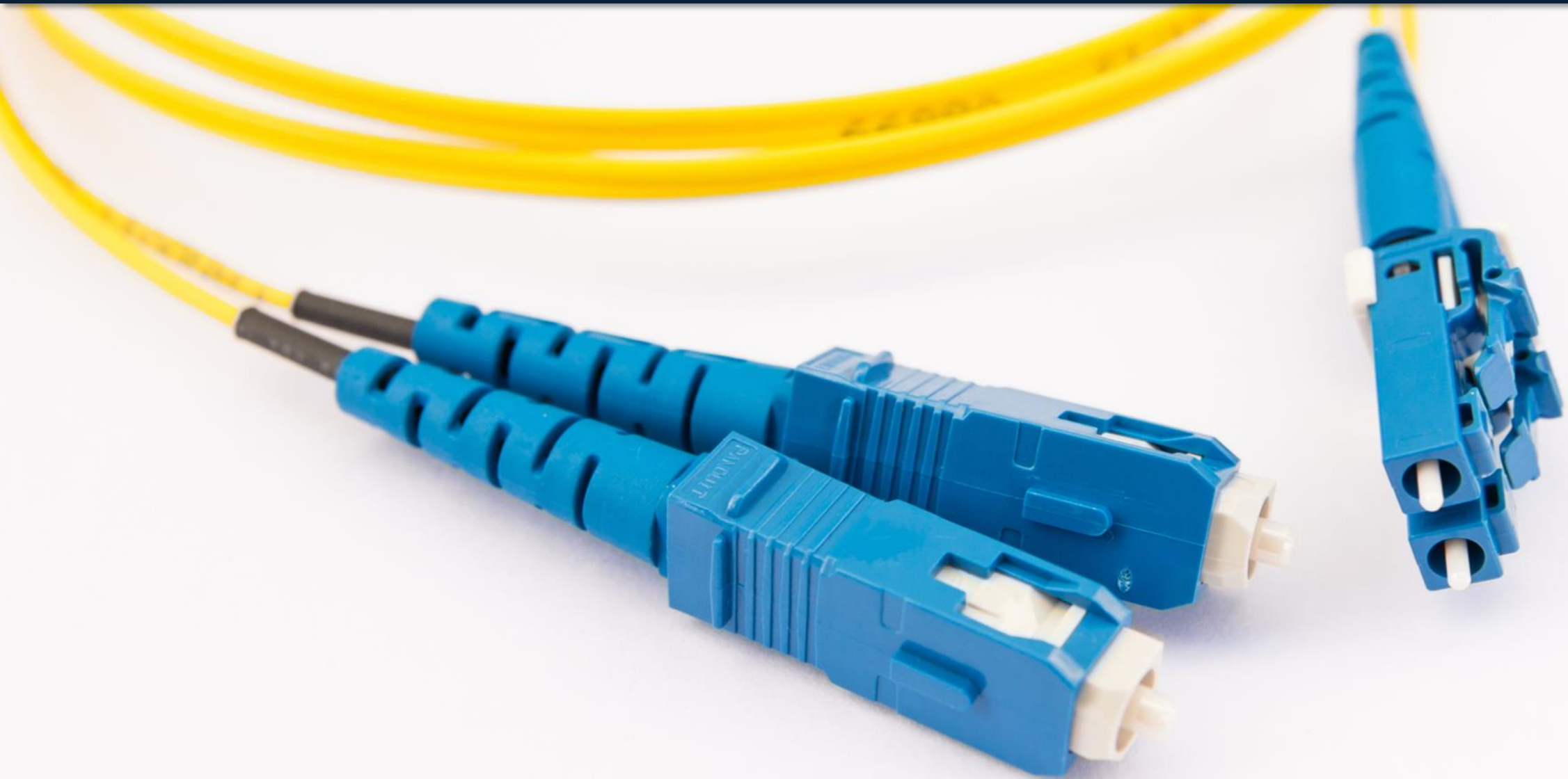
Fiber



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?



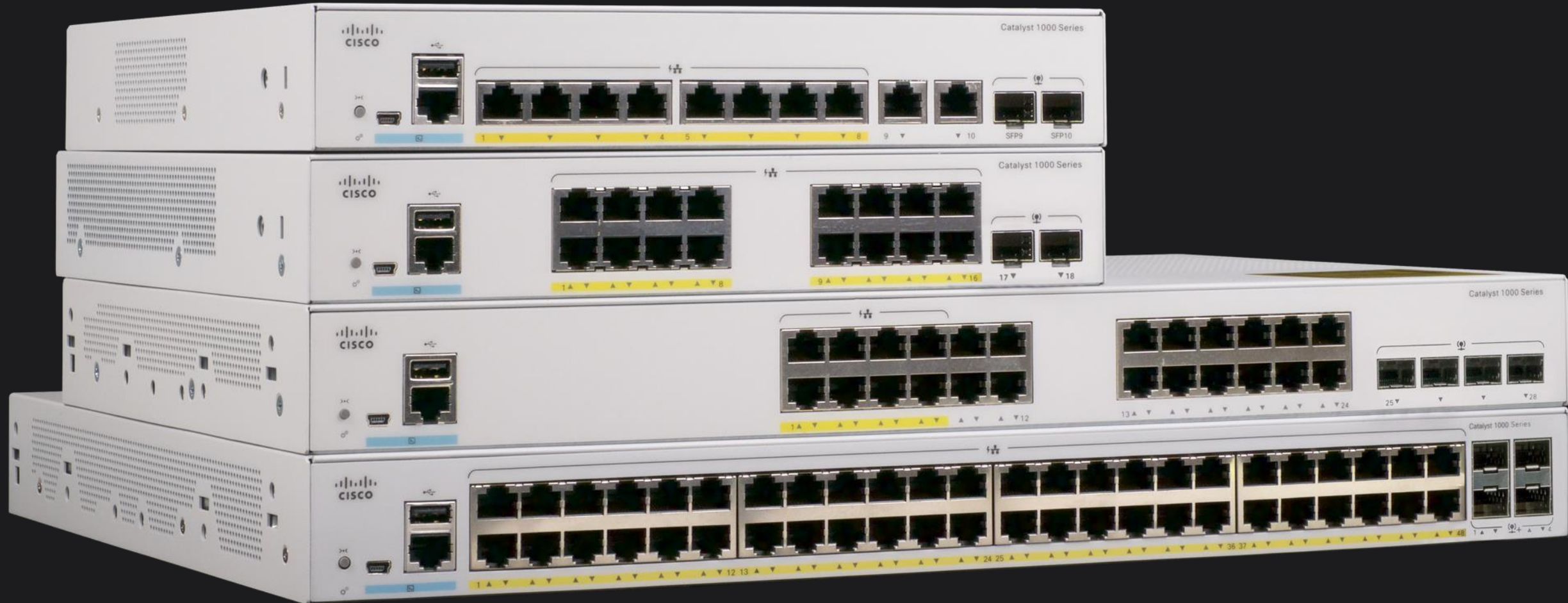
What is a Hub?

- 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?



The image displays two Cisco 4321 routers. The top router shows the front panel, which includes a power button, status LEDs, and management ports (S, GE 0/0/1, AUX, GE 0/0/0, and CONSOLE). The bottom router shows the rear panel, featuring various network and service modules (NIM 1, NIM 2, NIM 3, NIM-SSD) and ports (S, GE 0/0/0, POE, GE 0/0/1, GE 0/0/2, GE 0/0/3, and CONSOLE).



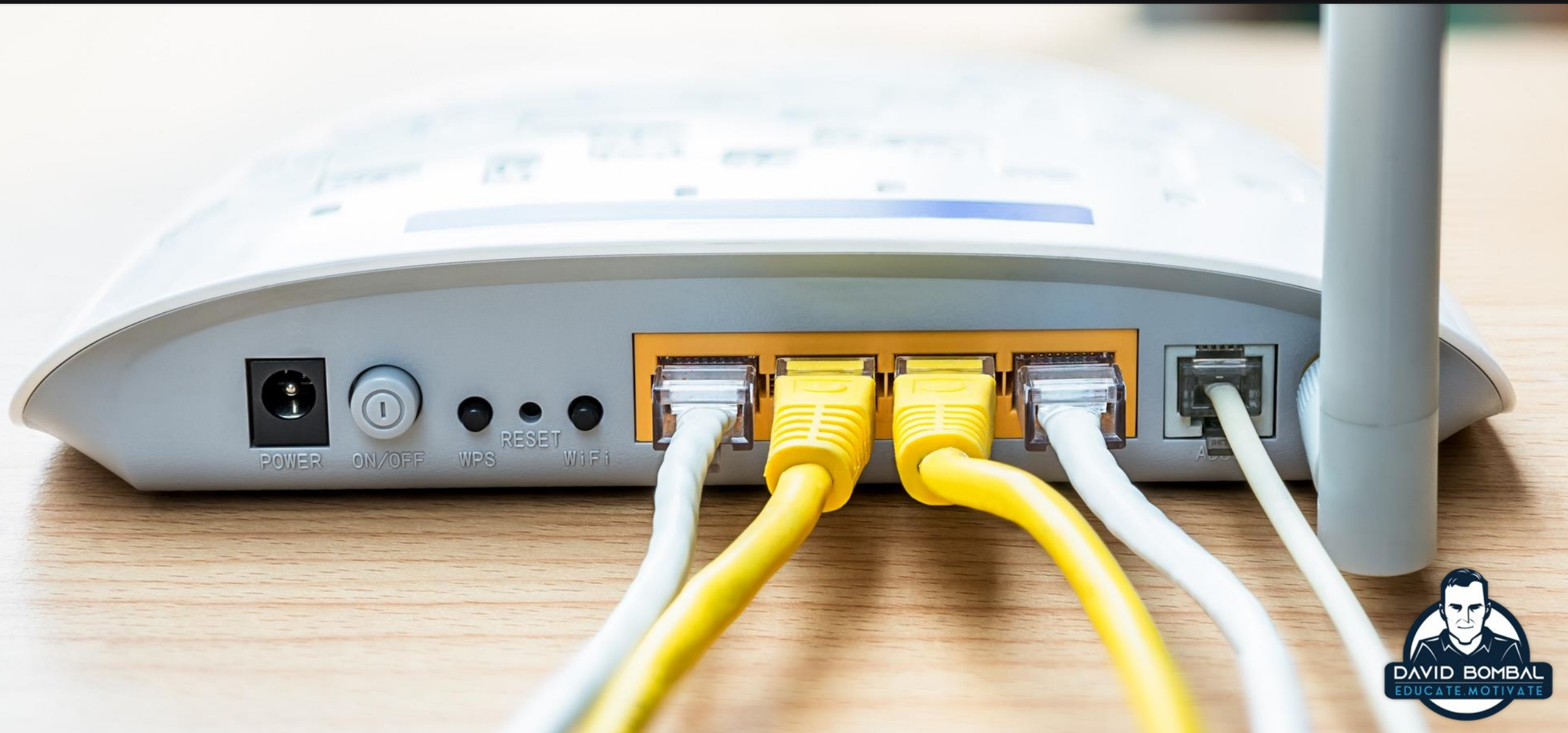
What is a Router?

- 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.

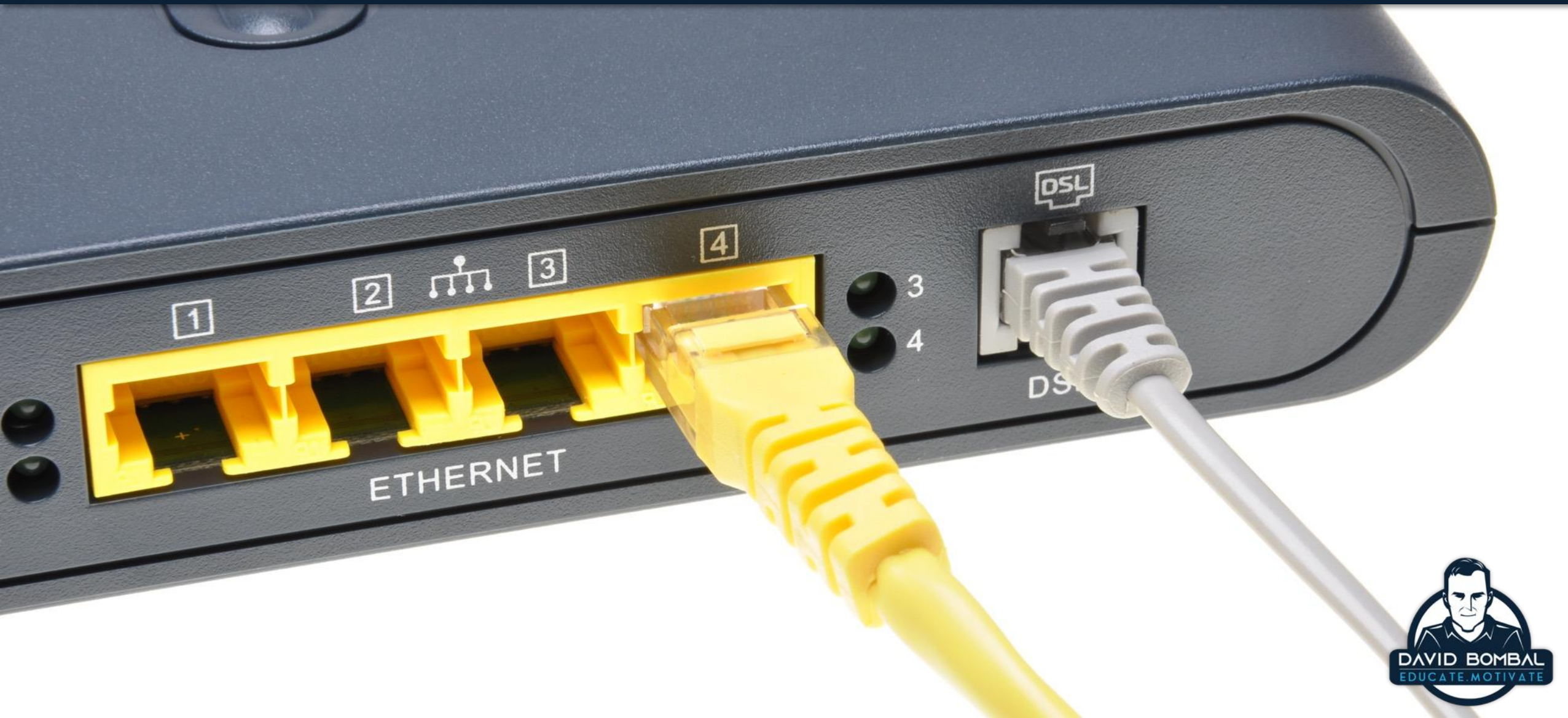
* Source: Wikipedia



What is a LAN?



What is a LAN?



What is a LAN?



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



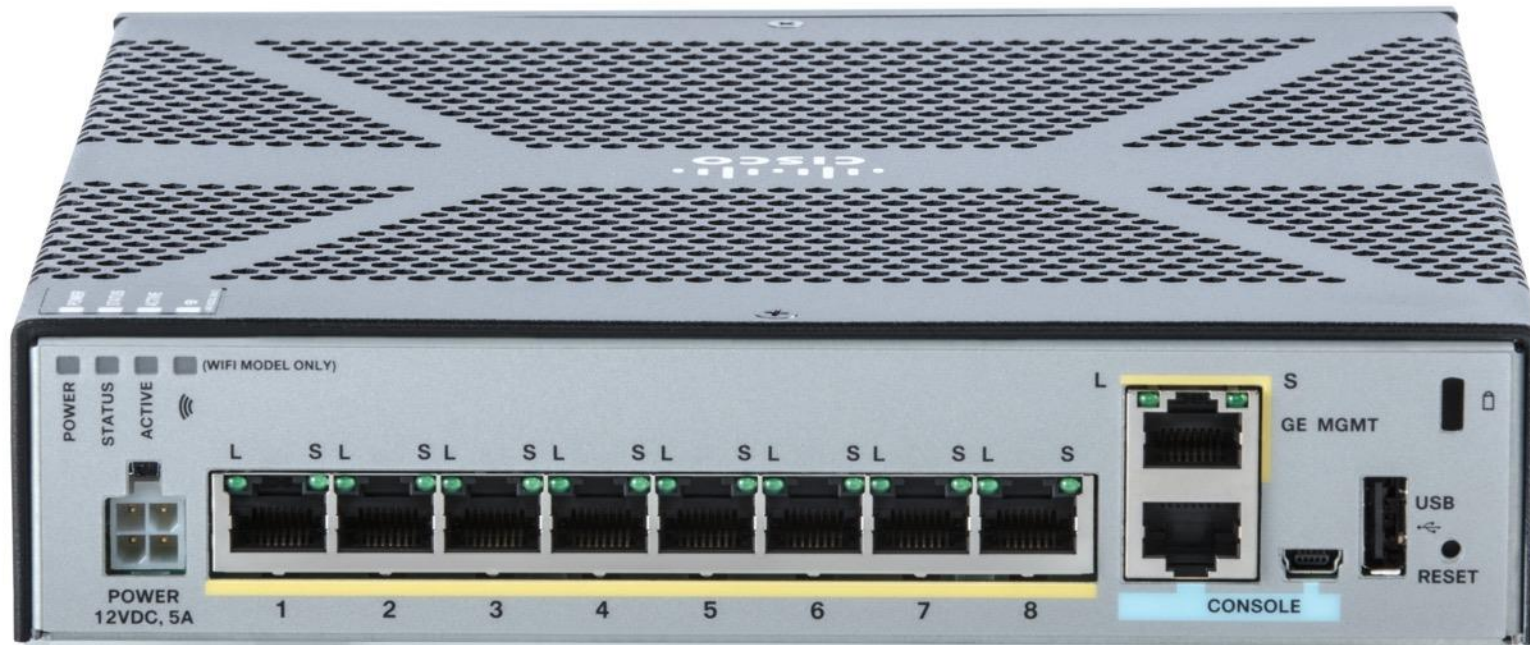
What is a WAN?

- 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



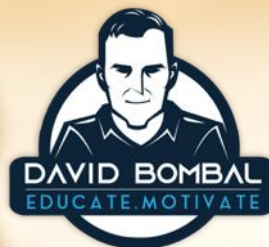
What is a Firewall?

- 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



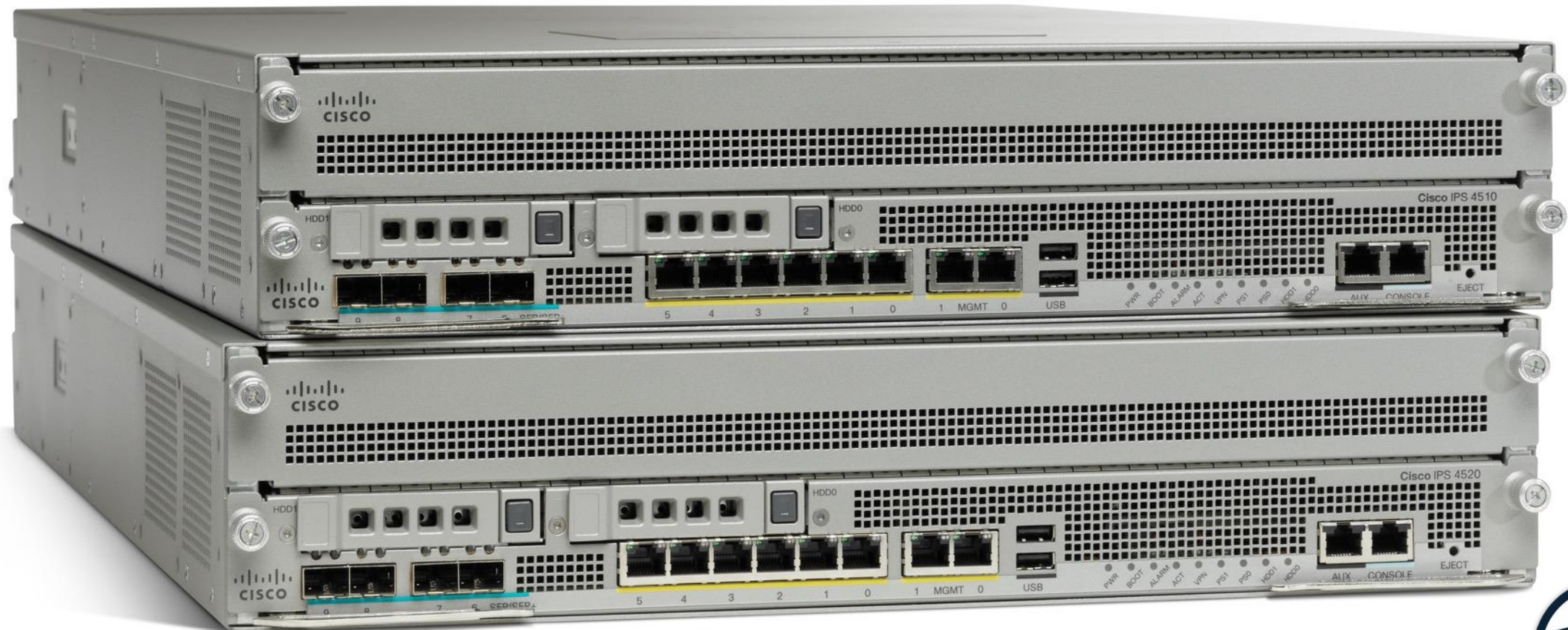
What is an IDS?



What is an IPS?



What is an IPS?



What is an IDS?

- 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

