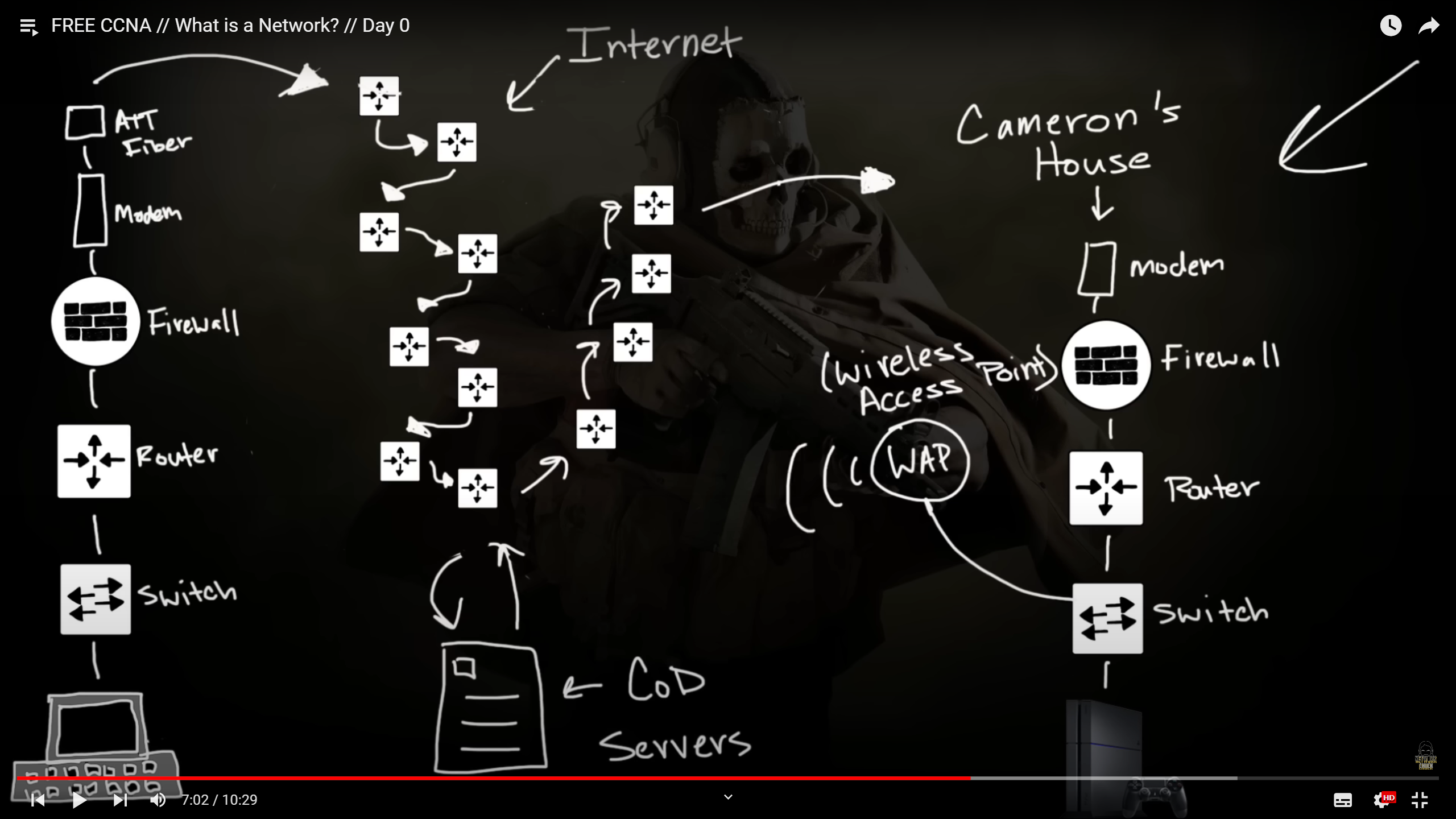
Networking



1. Switch:

* Hub is the ancestor of the switch but switch is more powerful. For example, computer A, B, C, D connects to an Hub. If computer A sends messages to computer B, Hub will receive message from A, and will send messages not only computer B but also computer C and computer D. However, if computer A sends messages to computer B, Switch will receive that message from computer A, and just send to computer B only. When respond, Hub will send to every machine, and Switch will send message from computer B to computer A.
* CAM: Content Addressable Memory
  + Whenever the device ping each other though Switch, Switch learns their MAC addresses and store them into their CAM to use it properly and faster
  + The CAM table is used by a Switch to discover the relationship between the Layer 2 address of a device and the physical port (this is the port of the switch) used to reach the device
* MAC Address: Media Access Control Address (often called Layer 2 Address)
  + This is unique identifier for every device. The Switch will base on those MAC Address to send or respond messages to correct devices
  + Source MAC Address is used by a Switch to populate the CAM table
  + Destination MAC Address is used by a Switch to make forwarding decisions. The Switch will search the CAM table for an entry that matches the Frame’s destination MAC address. If the Destination MAC Address is not found in CAM table, the Switch will forward the Frame (is represented for the message) to all its port
* Switch can only operate Layer 1,2,
* Layer 3 Address is normally an IP address of your machine such as 192.168.0.1 and the switch does not know anything about this address
* The message go through the switch are called Frame, and once the message goes to the device, it becomes Packet
* How computer A learn computer B’s MAC address to send the message?
  + Firstly, computer A ping to ip address of computer B.
  + When computer A pings the IP address of computer B, ARP (Address Resolution Protocol) is involved in mapping network addresses at the data link layer (Layer 2) to IP addresses at the network layer (Layer 3)
  + Basically, ARP is a way that computer A knows the MAC address tied with IP address of computer B. So that, computer A can get the MAC address of computer B to send the message
  + Then, it create a message at computer A before sending, the image below is its configuration

A screenshot of a computer

Description automatically generated

* + - They communicate together by ARP
    - As you can see, Layer 2 has the source IP address which is of computer A “10.1.1.3”
    - Destination IP Address which is of computer B “10.1.1.2”
    - The “00D0.9752.8936” is the MAC address of computer A
    - Because computer A doesn’t know the MAC address of computer B, so by default, it sets to **broadcast address** “FFF.FFFF.FFFF”. Broadcast address (you can check definition below) is used to send the message to the Switch and then send to all devices attached to the switch
  + Next, when the message is sent to the Switch, this is the message’s configuration: (In Layers is the received message, Out Layers is the sending message)

A screenshot of a computer

Description automatically generated

* + - * + Layer 1 (Physical Layer): it sends the message to all ports on the Layer 1
        + And if the message is sent to the device that doesn’t have the ip address is 10.1.1.2, it will deny the message
        + But if it’s correct Ip address, the message’s configuration will be like this

A screenshot of a computer

Description automatically generated

* + Then thanks to the ARP, computer B respond back the message to switch. This is message’s configuration at Switch

A screenshot of a computer

Description automatically generated

* + Then Switch send the message to computer A. So, now computer A knows the MAC address of computer B

A screenshot of a computer

Description automatically generated

1. Broadcast Address:

* Broadcast address is an address used to indicate that information being sent out should be delivered to every client on the local area network

1. ARP: Address Solution Protocol

* The Address Resolution Protocol (ARP) is a communication protocol used for discovering the link layer address (Layer 2), such as a MAC address, associated with a given internet layer address, typically an IPv4 address (ip address Layer 3)

1. WAP: Wireless Access Point: This device the function like Switch because it can recognize the MAC address of sending device, but it is stupid because after receiving messages from computer A example, it will send to every other device including the computer B (which should be the only computer receiving that message)
2. Router:

* A router is a device that connects two or more packet-switched networks or subnetworks
* Router’s job is to connect networks
* We cannot connect two switches (to replace a router) because it will have problem with their ip address

A screenshot of a computer screen

Description automatically generated

* Gateway in most of the case is “router”. But they have some differences:
  + A router is a device that helps direct data between different networks. For example, it helps send data between your home network and the internet.
  + A gateway is a point of entry or exit between two networks ( is a point where one network meets another network). When you're connecting your home network to the internet, the router acts as the gateway
* Router can only operate Layer 1,2,3
* How to connect computer A (Ip address 10.1.1.3) of switch 1 to computer B (ip address 23.227.38.65) of switch 2 with the router (ip address 10.1.1.1)

A diagram of a network

Description automatically generated

* + For the first time connection: Firstly, computer A will ping to ip address (this is one of many ways to connect to computer B. There is a lots of way to send message, request to another devices, such as ping, access the DNS,…)



* + Then, it will create 2 frames (messages) at computer A which its configuration is:

A screenshot of a computer screen

Description automatically generated

A screenshot of a computer

Description automatically generated

* + - First frame is the destination ip address which is computer B, and the source ip address of computer A
    - The second frame is different because the computer A knows that there is no IP address 23.227.38.65 on his network. Therefore, it will send to his default gateway instead which is 10.1.1.1
  + Then, because the router has the ip address is 10.1.1.1, so after the first time computer A send the message to every devices attached to the switch, router respond that “he has ip address 10.1.1.1”

A diagram of a person's face

Description automatically generated

* + Next, router send the messages back to the Switch 1

A screenshot of a computer

Description automatically generated

* + The switch 1is sending the message back to the computer Ad

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

* + Then the computer A sends the message to switch 1

A computer screen shot of a computer

Description automatically generated

* + After sending the message to router from switch 1, there is error packet at router. This is its configuration

A computer screen shot of a computer

Description automatically generated

* + - As you can see, the message received by router (In Layers) has the necessary information, but the sending message (Out Layers) has only Layer 3 because Router doesn’t where he is at Layer 2, and he can’t tell the switch 2 to get the message from him
    - There is a solution that he creates another message and send it broadcast address, which sent to all the devices attached to switch 2, and try to find the ip address of computer B

A computer screen shot of a computer

Description automatically generated

* + Then the message is sent to the switch 2 with configuration is

A computer screen shot of a diagram

Description automatically generated

* + Then from the switch 2, it will send the message to computer B based on

A computer screen shot of a diagram

Description automatically generated

* + Next, the computer B respond back the message to computer A by sending to the switch 2

A computer screen shot of a network

Description automatically generated

* + Then send to Router

A computer screen shot of a network

Description automatically generated

* + Then to the Switch 1

A computer screen shot of a computer

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* + And back to computer A

A computer screen shot of a computer

Description automatically generated

* + If there is a message send between computer A and B, they no longer need to use broadcast address to send everyone, because all their MAC addresses and Ip addresses is already remembered
* The messages on Layer 2 called Frame.
* The messages on Layer 3 called Packet.

1. WAN: Wide Area Network
2. LAN: Local Area Network
3. Firewall
4. Server
5. Network Controller
6. Cisco Command:

* Show mac-address-table: To find the MAC Address of all device connect to Switch. Make sure go to the CLI command of the switch