Data Communication and Networks Lab
Experiment 4

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CEL 51, DCCN, Monsoon 2020
Lab 4: Prototyping a Network

Objective:

Prototype a network using Packet Tracer

Background

A client has requested that you set up a simple network with two PCs connected to a switch. Verify that the hardware, along with the given configurations, meet the requirements of the client.

Some Network Devices :

1. **Hub :**

   Hubs **connect multiple computer** networking devices together. A hub also **acts as a repeater** in that it amplifies signals that deteriorate after traveling long distances over connecting cables. A hub is the simplest in the family of network connecting devices because it **connects LAN components with identical protocols**.

   A hub can be **used with both digital and analog data**, provided its settings have been configured to prepare for the formatting of the incoming data.

   Hubs **do not perform packet filtering or addressing functions**; they just send data packets to all connected devices. Hubs operate at the **Physical layer** of the Open Systems Interconnection (OSI) model.

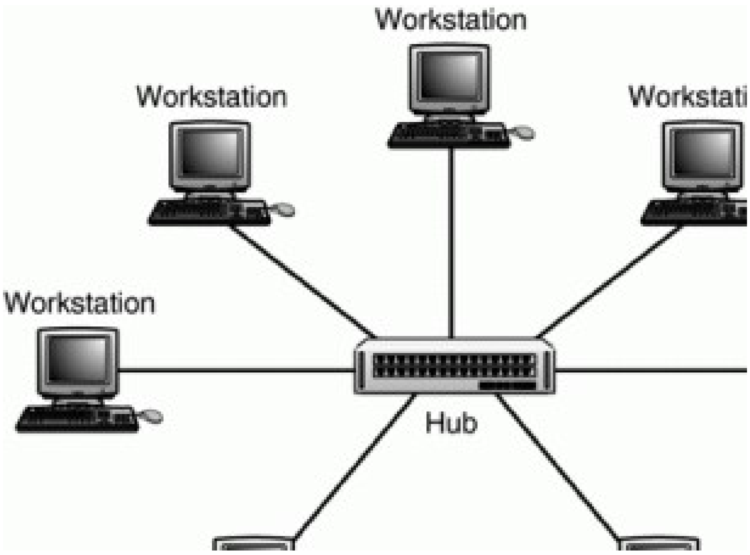
   Types of hubs:

   a. **Passive Hub:**
   These hubs are nothing more than **point contacts for the wires** that make up the physical network. An example of this is a punch-down block that is a simple plastic, unpowered box used to plug network cables into. They do not make any changes to the signal they receive.

   b. **Active Hub:**
   Active hubs are a little smarter than passive hubs. These are the hubs which have their own power supply and can **clean, boost and relay the signal** along with the network.

You might also come across the term "concentrators," which are basically active hubs that concentrate and strengthen a signal as it enters and exits the hub.
These hubs usually come in configurations of 4, 8, 16 and 24 ports, providing link and activity LED lights to show which devices are currently connected, powered on and transmitting or receiving data.
All Ethernet hubs are active hubs.

c. **Smart/Intelligent Hub:**
Smart hubs are similar to the active ones, but they also contain some type of **management software** to help determine possible network problems and isolate them. The management software loaded uses protocols like SNMP (Simple Network Management Protocol) to communicate with various network devices and obtain real-time statistics like throughput, bandwidth, uptime, routing tables and more.

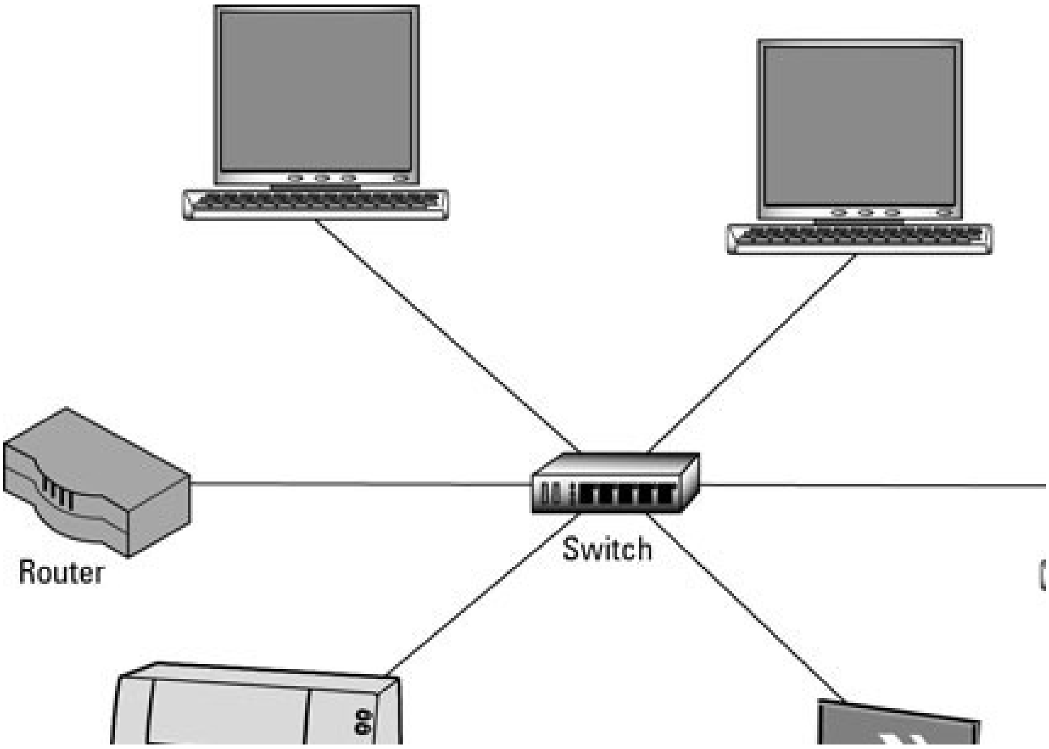


2. Switches :

Switches generally have a more intelligent role than hubs. A switch is a **multiport device that improves network efficiency**. The switch maintains limited routing information about nodes in the internal network, and it allows connections to systems like hubs or routers. Strands of LANs are usually connected using switches. Generally, switches can **read the hardware addresses of incoming packets to transmit them to the appropriate destination**.

Using switches improves network efficiency over hubs or routers because of the **virtual circuit capability**. Switches also improve network security because the **virtual circuits are more difficult to examine with network monitors**. You can think of a switch as a device that has some of the best capabilities of routers and hubs combined. A switch can work at either the **Data Link layer or the Network layer** of the OSI model. A **multilayer switch** is one that can operate at both layers, which means that it can operate as both a switch and a router. A multilayer switch is a high-performance device that supports the same routing protocols as routers.

Switches can be subject to distributed denial of service (DDoS) attacks; flood guards are used to prevent malicious traffic from bringing the switch to a halt. Switch port security is important so be sure to secure switches: Disable all unused ports and use DHCP snooping, ARP inspection and MAC address filtering.



3. **Router :**
   Routers help transmit packets to their destinations by **charting a path** through the sea of interconnected networking devices using different network topologies. Routers are **intelligent devices**, and they store **information about the networks** they're connected to. Most routers can be configured to operate as **packet-filtering firewalls** and use access control lists (ACLs). Routers, in conjunction with a channel service unit/data service unit (CSU/DSU), are also used to **translate from LAN framing to WAN framing**. This is needed because LANs and WANs use different network protocols. Such routers are known as **border routers**. They serve as the outside connection of a LAN to a WAN, and they operate at the border of your network.

   Each router interface has its own **Address Resolution Protocol (ARP) module**, its own LAN address (network card address) and its own Internet Protocol (IP) address. The router, with the help of a routing table, has knowledge of routes a packet could take from its source to its destination.

   Routers normally work at the **Network layer** of the OSI model.

4. **Bridge :**

   Bridges are used to **connect two or more hosts** or network segments together. The basic role of bridges in network architecture is **storing and forwarding frames** between the different segments that the bridge connects. They **use hardware Media Access Control (MAC) addresses** for transferring frames. By looking at the MAC address of the devices connected to each segment, bridges can forward the data or block it from crossing. Bridges can also be used to connect two physical LANs into a larger logical LAN.

   Bridges work only at the **Physical and Data Link layers** of the OSI model.

5. **Gateway**

   Gateways normally work at the **Transport and Session layers** of the OSI model. At the Transport layer and above, there are numerous protocols and standards from different vendors; gateways are used to deal with them. Gateways provide **translation between networking technologies** such as Open System Interconnection (OSI) and Transmission Control Protocol/Internet Protocol (TCP/IP). Because of this, gateways connect two or more autonomous networks, each with its own routing algorithms, protocols, topology, domain name service, and network administration procedures and policies.

   Gateways perform all of the functions of routers and more. In fact, a router with added translation functionality is a gateway. The function that does the translation between different network technologies is called a protocol converter.

6. **Modem**

   Modems (modulators-demodulators) are used to **transmit digital signals over analog telephone lines**. Thus, digital signals are converted by the modem into analog signals of different frequencies and transmitted to a modem at the receiving location. The receiving modem performs the reverse transformation and provides a digital output to a device connected to a modem, usually a computer. The digital data is usually transferred to or from the modem over a serial line through an **industry standard interface, RS-232**. Many telephone companies offer DSL services, and many cable operators use modems as end terminals for identification and recognition of home and personal users. Modems work on both the Physical and Data Link layers.

7. **Repeater**

   A repeater is an electronic device that **amplifies the signal it receives**. You can think of repeater as a device which receives a signal and retransmits it at a higher level or higher power so that the signal can cover longer distances, more than 100 meters for standard LAN cables. Repeaters work on the **Physical layer**.

8. **Access Point**

   While an access point (AP) can technically involve either a wired or wireless connection, it commonly means a wireless device. An AP works at the second OSI layer, the **Data Link layer**, and it can operate either as a bridge connecting a standard wired network to wireless devices or as a router passing data transmissions from one access point to another.

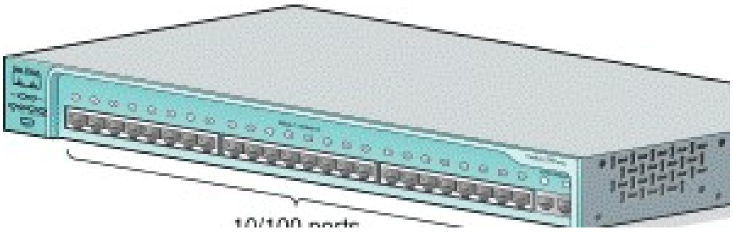
Step 1: Set up the network topology

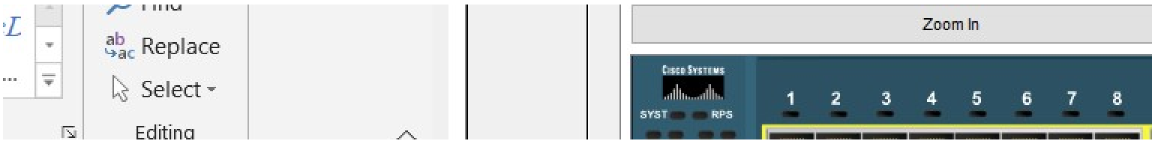
a) Add two PCs and a Cisco 2950T switch.

[redacted]

Cisco 2950-T :

The Cisco Catalyst 2950T 24 is a switch that offers an easy migration path to Gigabit Ethernet by using existing copper cabling infrastructure with 24 10/100 ports plus 2 fixed 10/100/1000BASE-T uplinks.



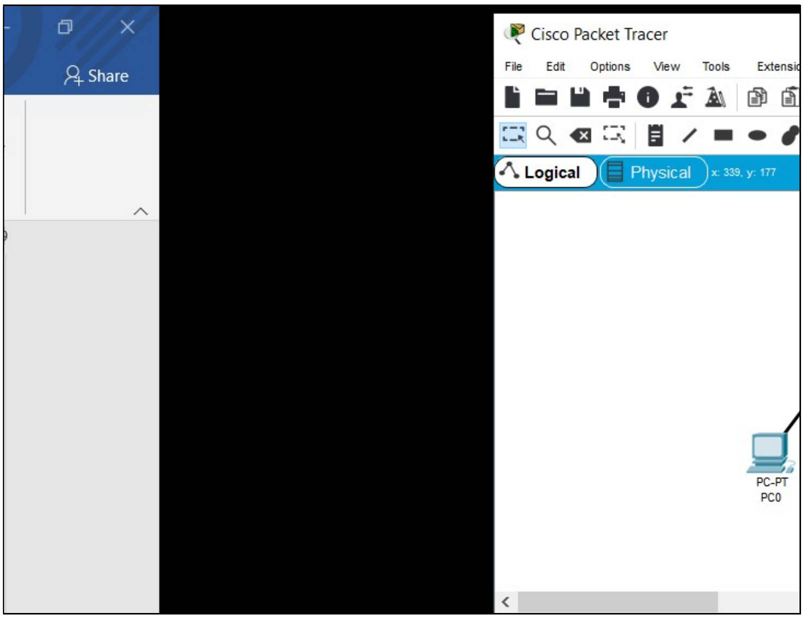


It contains :

- 24 port -10/100/1000 Base-TX ports
- 2 fixed 10/100/1000BASE-T ports.

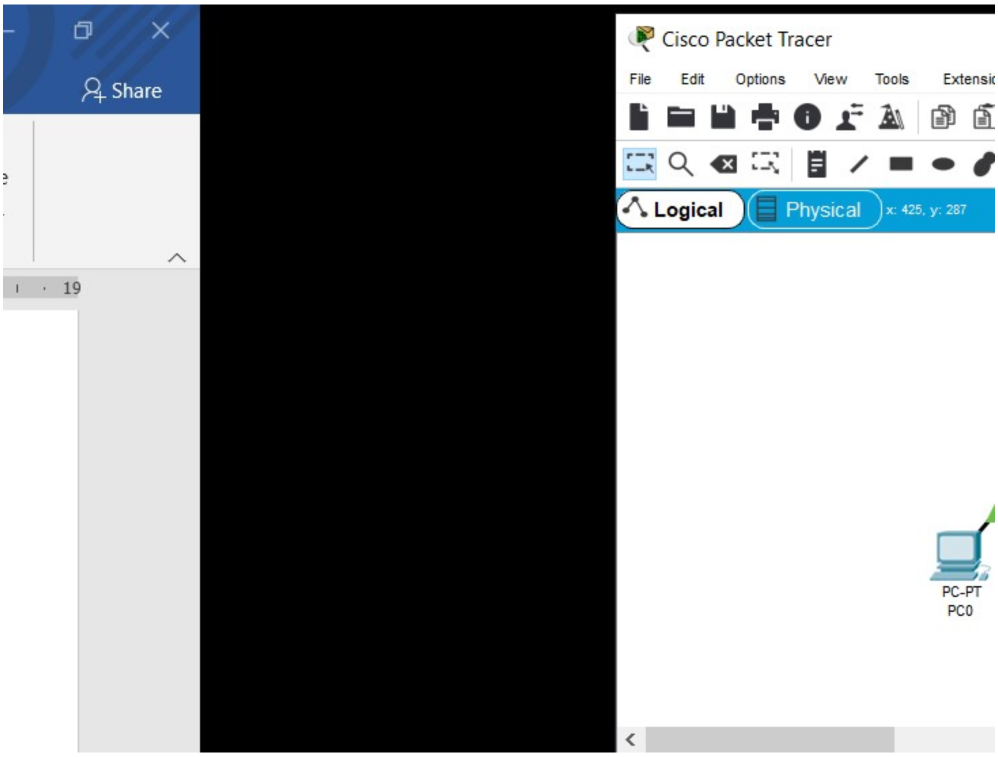
b) Using straight-through cables, connect **PC0** to interface **Fa0/1** on **Switch0** and **PC1** to interface **Fa0/2** on **Switch0**.

Straight-through cable :
Straight-through cable is a type of twisted pair copper wire cable for local area network (LAN) use for which the RJ-45 connectors at each end have the same pinout (i.e., arrangement of conductors).



In fixed interface series switch all interfaces are installed on chassis. The Catalyst 2960 / 2950 series switch supports only fixed interfaces.
Nomenclature for interface on fixed interface series switch is : (**type) (slot_#)/(port_**#).

Nomenclature	**Description**
type	Type is media type. Media types supported by switch are Ethernet, Fast Ethernet and Gigabit Ethernet.
slot_#	This is slot number.
port_#	The port number is the number of the port in the specified slot.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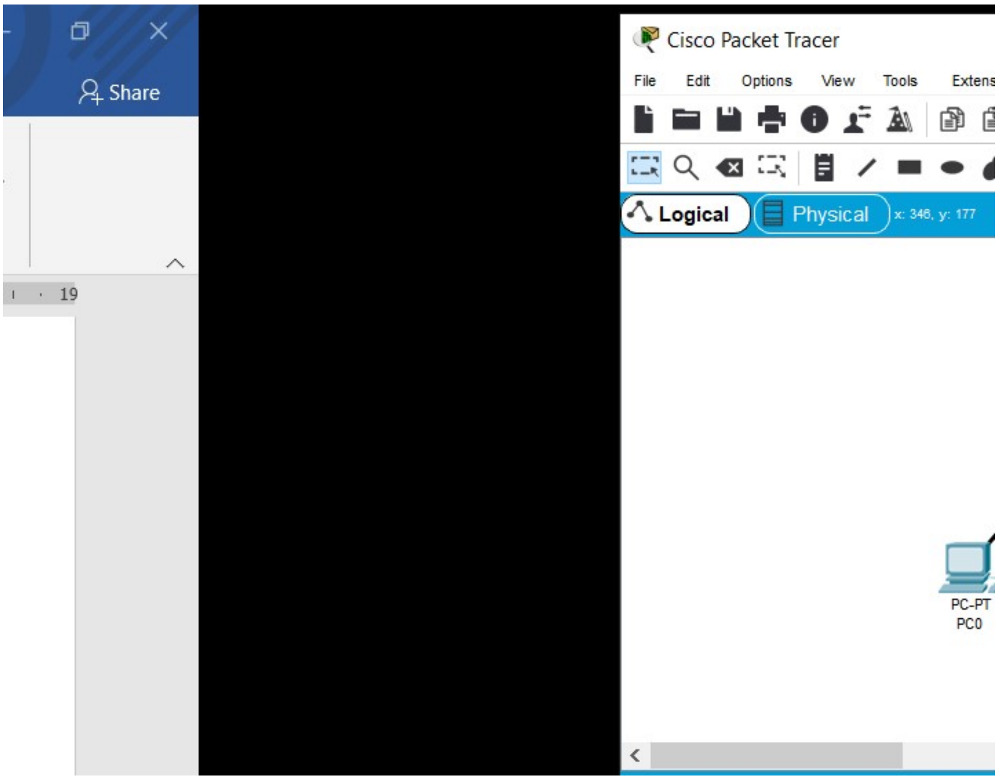
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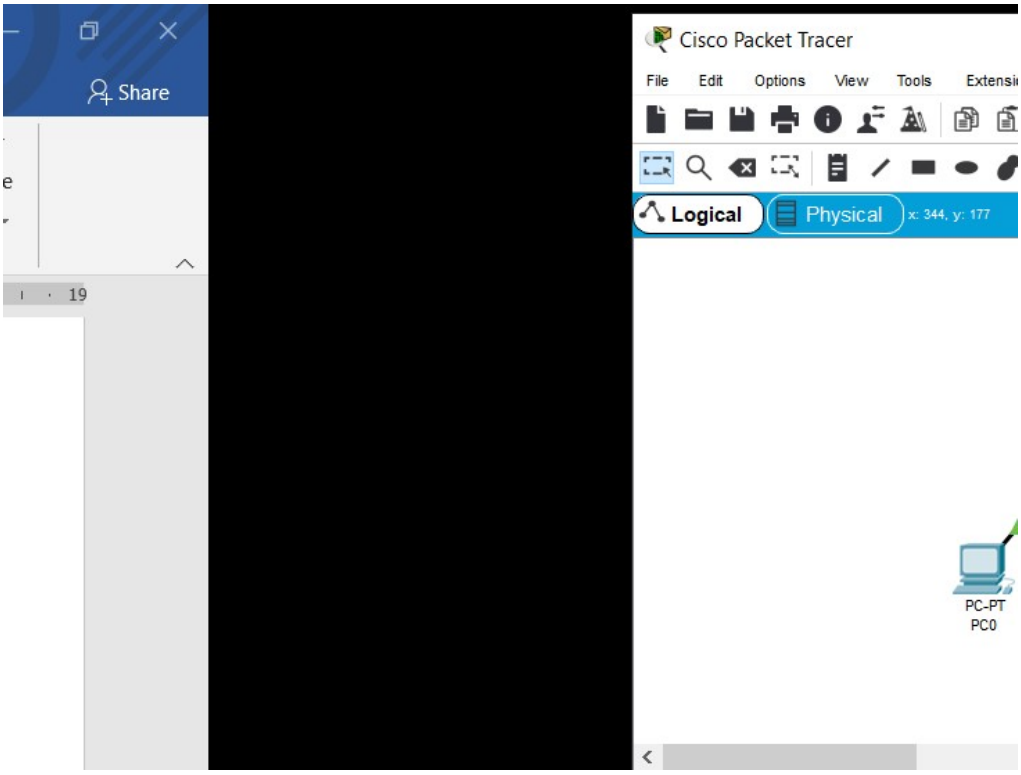
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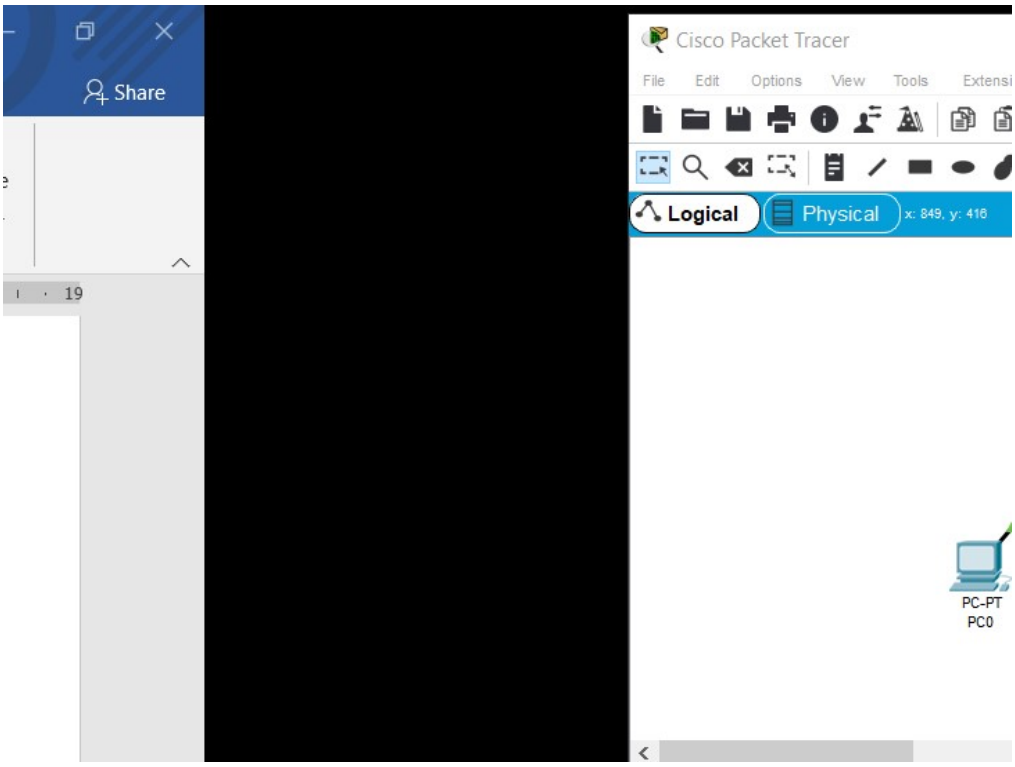
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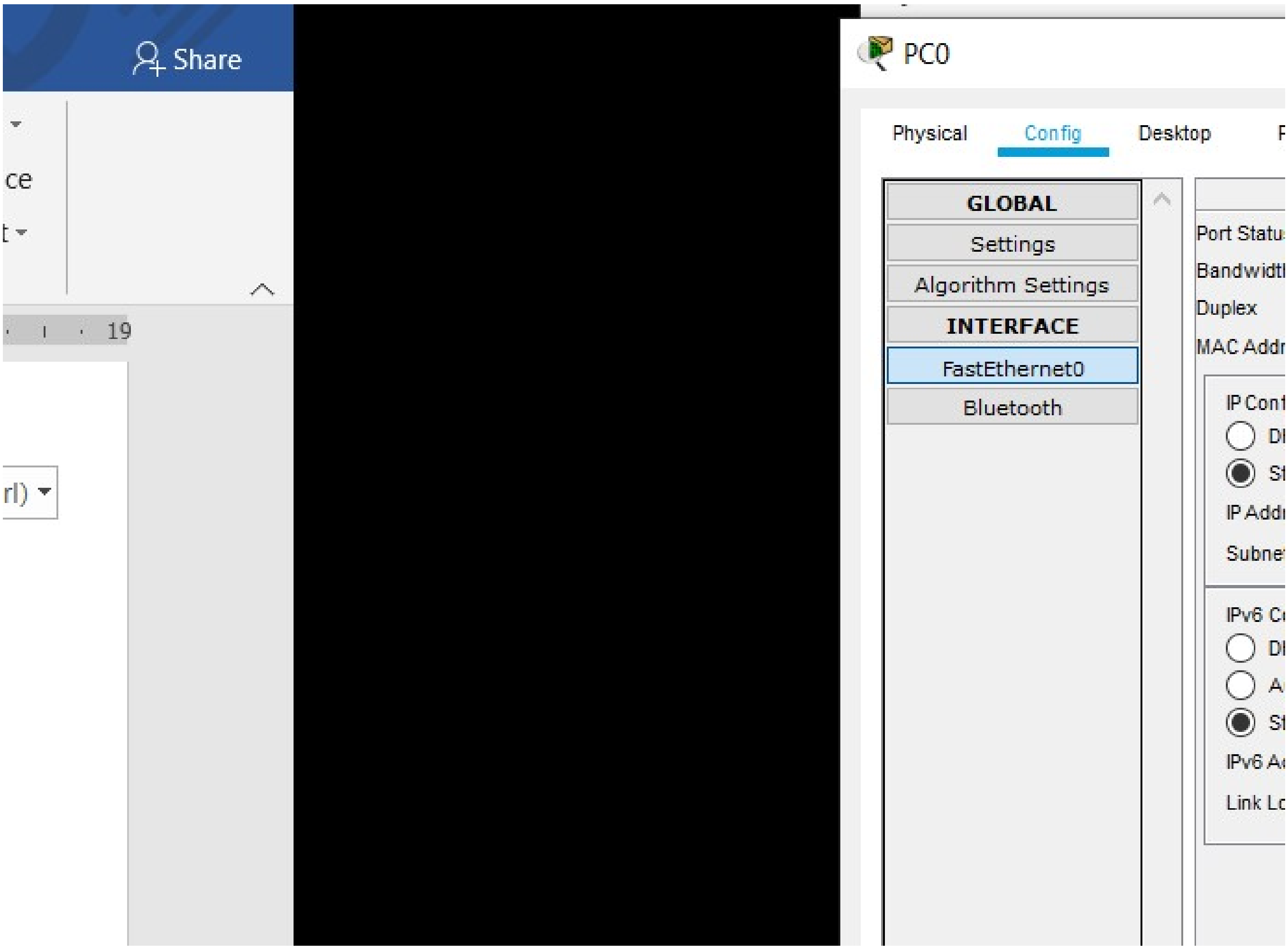
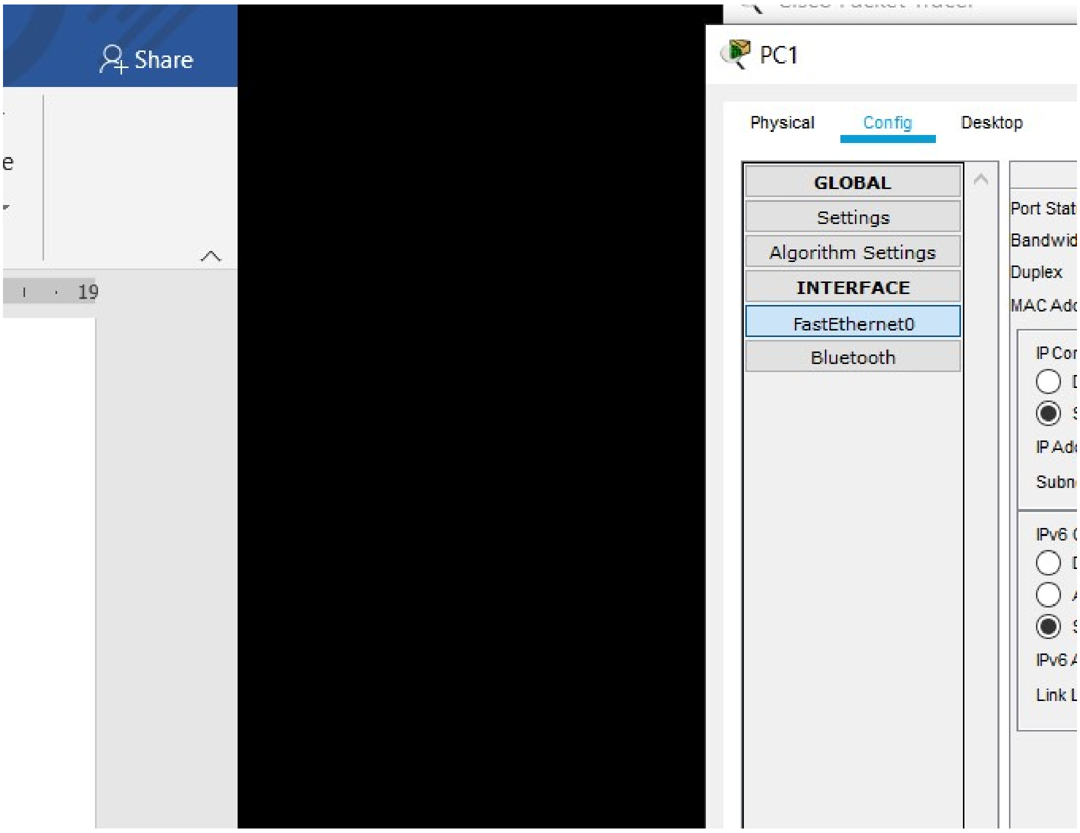
c) Configure PC0 using the **Config** tab in the PC0 configuration window:

   a. IP address: 192.168.10.10
   b. Subnet Mask 255.255.255.0



d) Configure PC1 using the **Config** tab in the PC1 configuration window

a. IP address: 192.168.10.11
b. Subnet Mask 255.255.255.0



What is a subnet mask?

An IP address has two components, the network address and the host address. A subnet mask separates the IP address into the network and host addresses (<network><host>). Subnetting further divides the host part of an IP address into a subnet and host address (<network><subnet><host>) if additional subnetwork is needed. Use the Subnet Calculator to retrieve subnetwork information from IP address and Subnet Mask. It is called a subnet mask because it is used to identify network address of an IP address by perfoming a bitwise AND operation on the netmask.

A Subnet mask is a 32-bit number that masks an IP address, and divides the IP address into network address and host address. Subnet Mask is made by setting network bits to all "1"s and setting host bits to all "0"s. Within a given network, two host addresses are reserved for special purpose, and cannot be assigned to hosts. The "0" address is assigned a network address and "255" is assigned to a broadcast address, and they cannot be assigned to hosts.

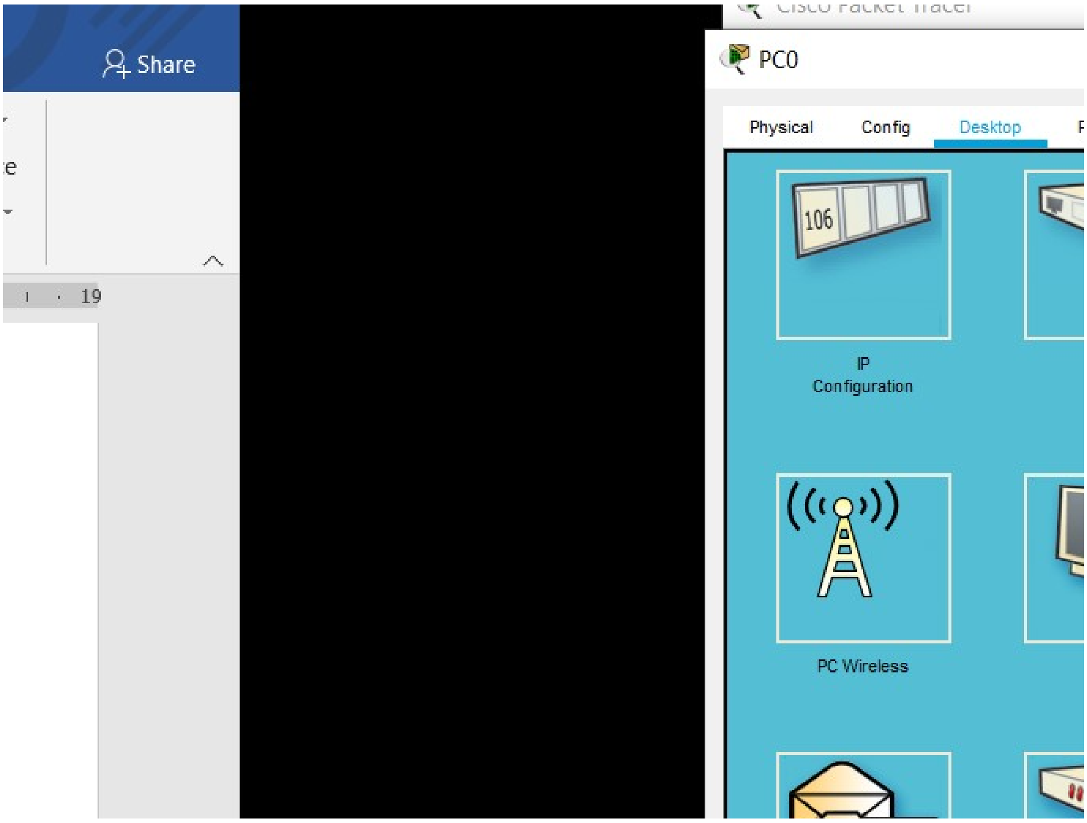
Examples of commonly used netmasks for classed networks are 8-bits (Class A) (255.0.0.0), 16-bits (Class B) (255.255.0.0) and 24-bits (Class C) (255.255.255.0)

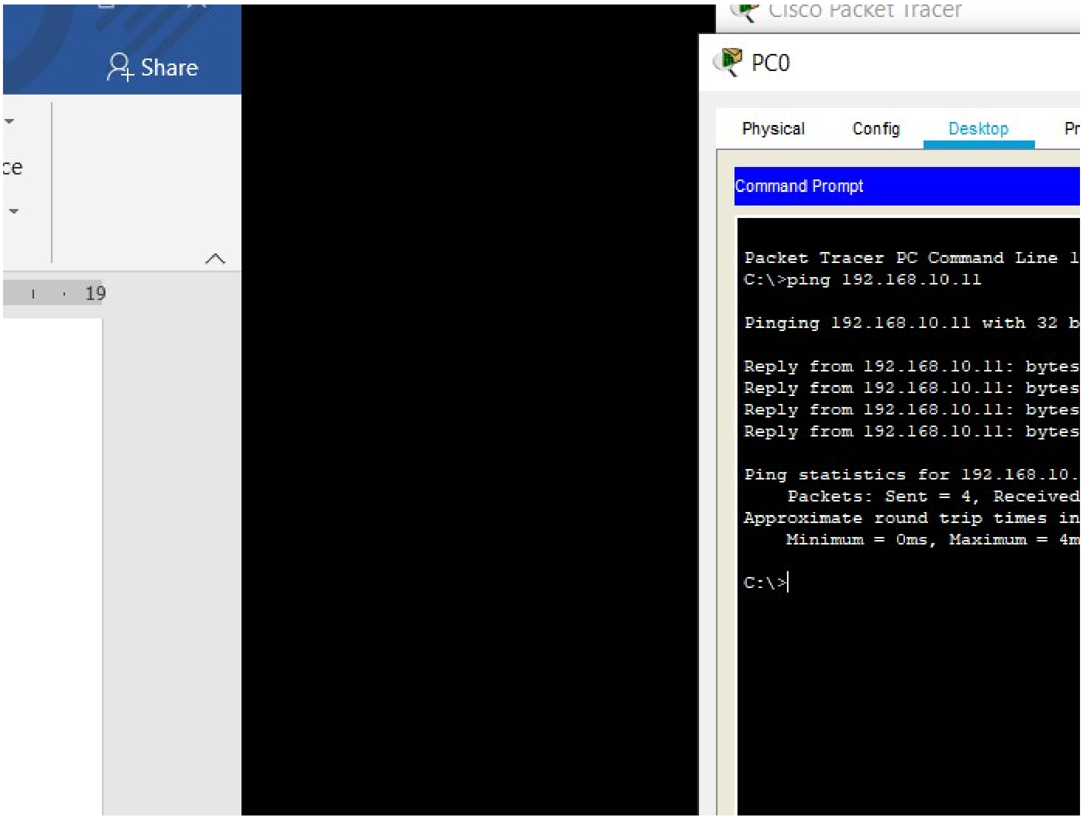
Applying a subnet mask to an IP address separates network address from host address. The network bits are represented by the 1's in the mask, and the host bits are represented by 0's. Performing a bitwise logical AND operation on the IP address with the subnet mask produces the network address. For example, applying the Class C subnet mask to our IP address 216.3.128.12 produces the following network address:

```
IP:   1101 1000 . 0000 0011 . 1000 0000 . 0000 1100  (216.003.128.012)

Mask: 1111 1111 . 1111 1111 . 1111 1111 . 0000 0000  (255.255.255.000)

      ---------------------------------------------

1101 1000 . 0000 0011 . 1000 0000 . 0000 0000  (216.003.128.000) – Network Address
0000 0000 . 0000 0000 . 0000 0000 . 0000 1100 (000.000.000.012) – Host Address
```

Step 2: Test connectivity from PC0 to PC1

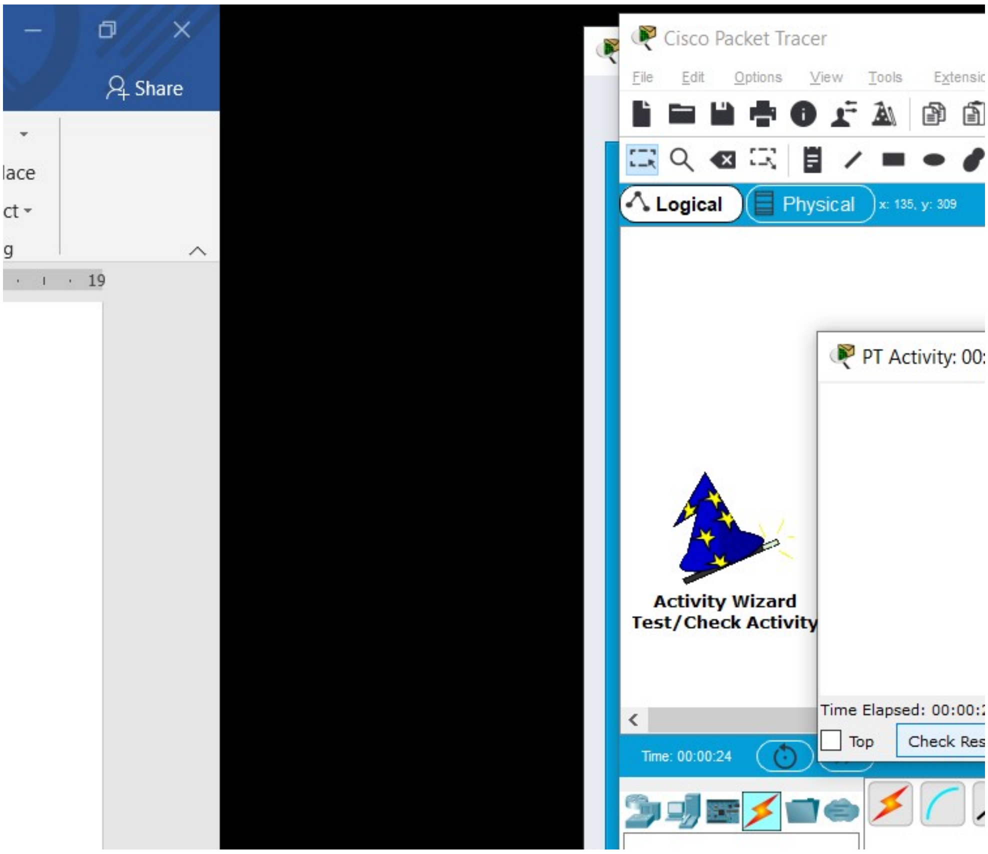
a) Use the **ping** command to test connectivity.
   a. Click PC0.
   b. Choose the **Desktop** tab.
   c. Choose **Command Prompt**.
   d. Type: **ping 192.168.10.11** and press *enter*.

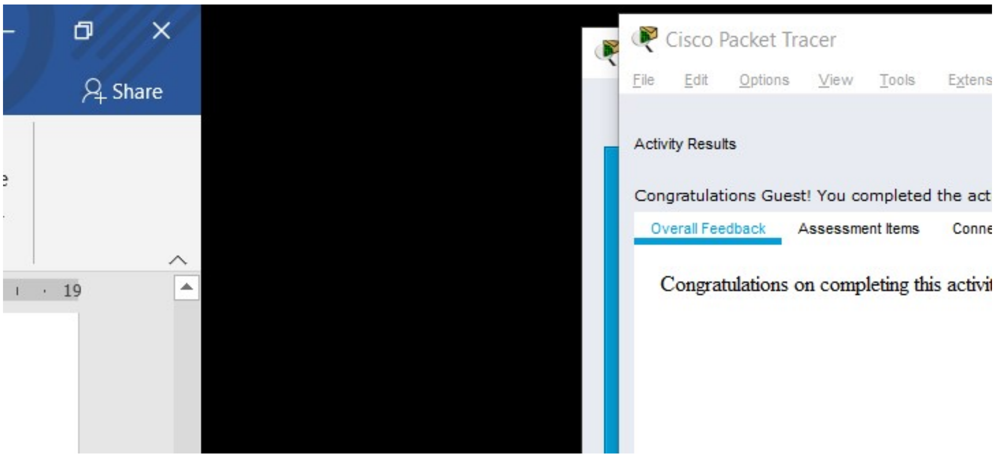




```
Packet Tracer PC Command Line 1
C:\>ping 192.168.10.11

Pinging 192.168.10.11 with 32 b

Reply from 192.168.10.11: bytes
Reply from 192.168.10.11: bytes
Reply from 192.168.10.11: bytes
Reply from 192.168.10.11: bytes

Ping statistics for 192.168.10.
    Packets: Sent = 4, Received
Approximate round trip times in
    Minimum = 0ms, Maximum = 4m

C:\>
```

b) A successful **ping** indicates the network was configured correctly and the prototype validates the hardware and software configurations.
c) Close the configuration window.
d) Click the **Check Results** button at the bottom of the instruction window to check your work..





Activity Results

Congratulations Guest! You completed the act

Congratulations on completing this activi

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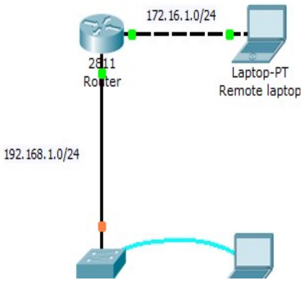
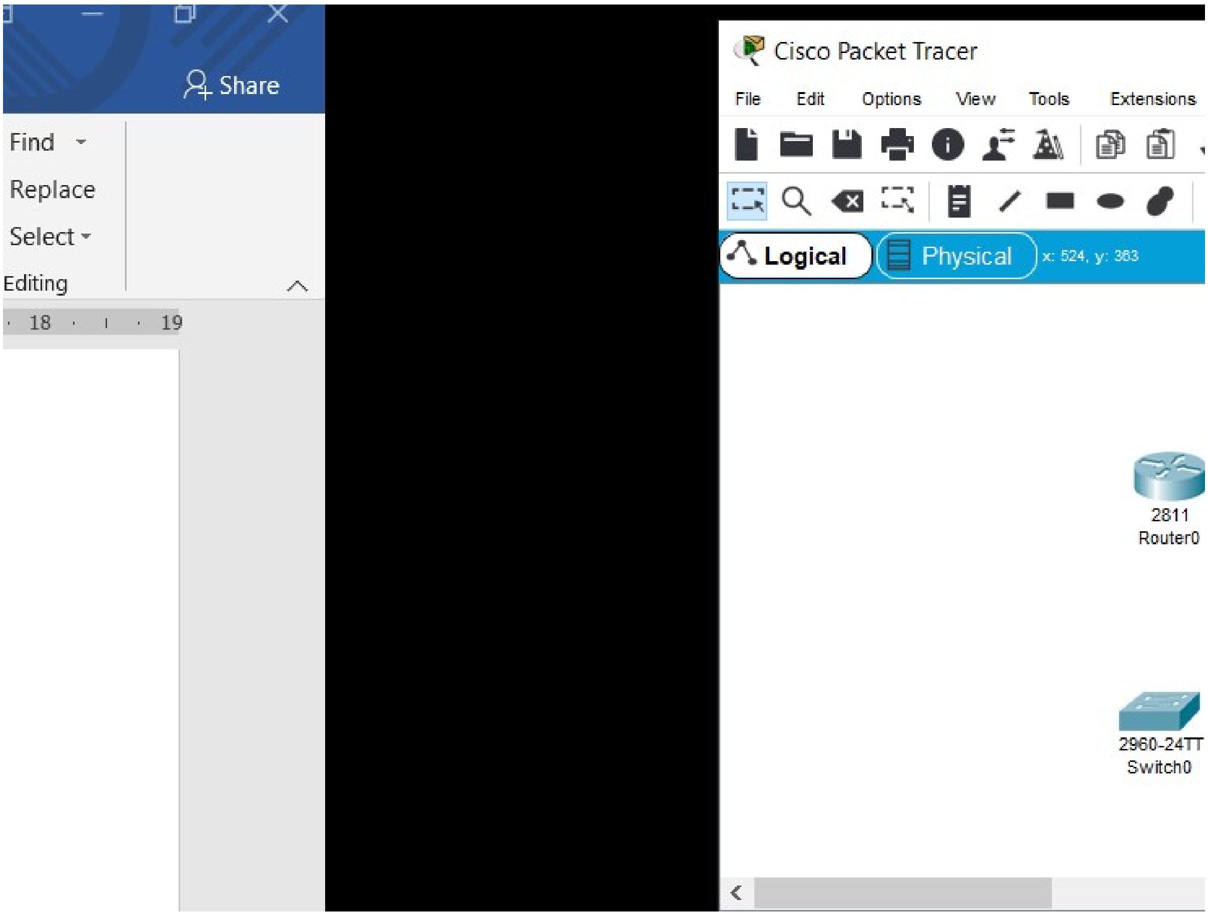
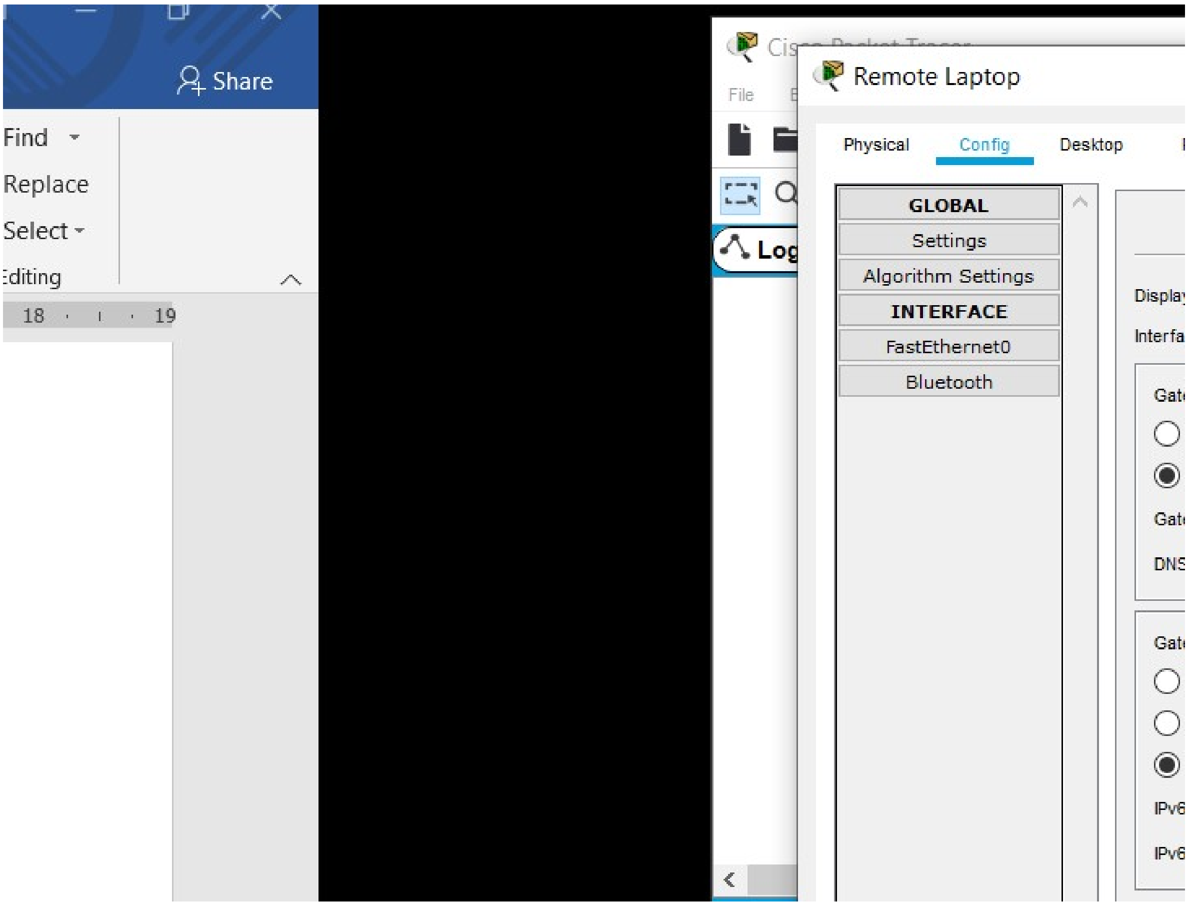
Lab 4.1: Basic configuration - hostname, motd banner, passwd etc

Objective:
This lab will test your ability to configure basic settings such as hostname, motd banner, encrypted passwords, and terminal options on a Packet Tracer 6.2 simulated Cisco Catalyst switch.



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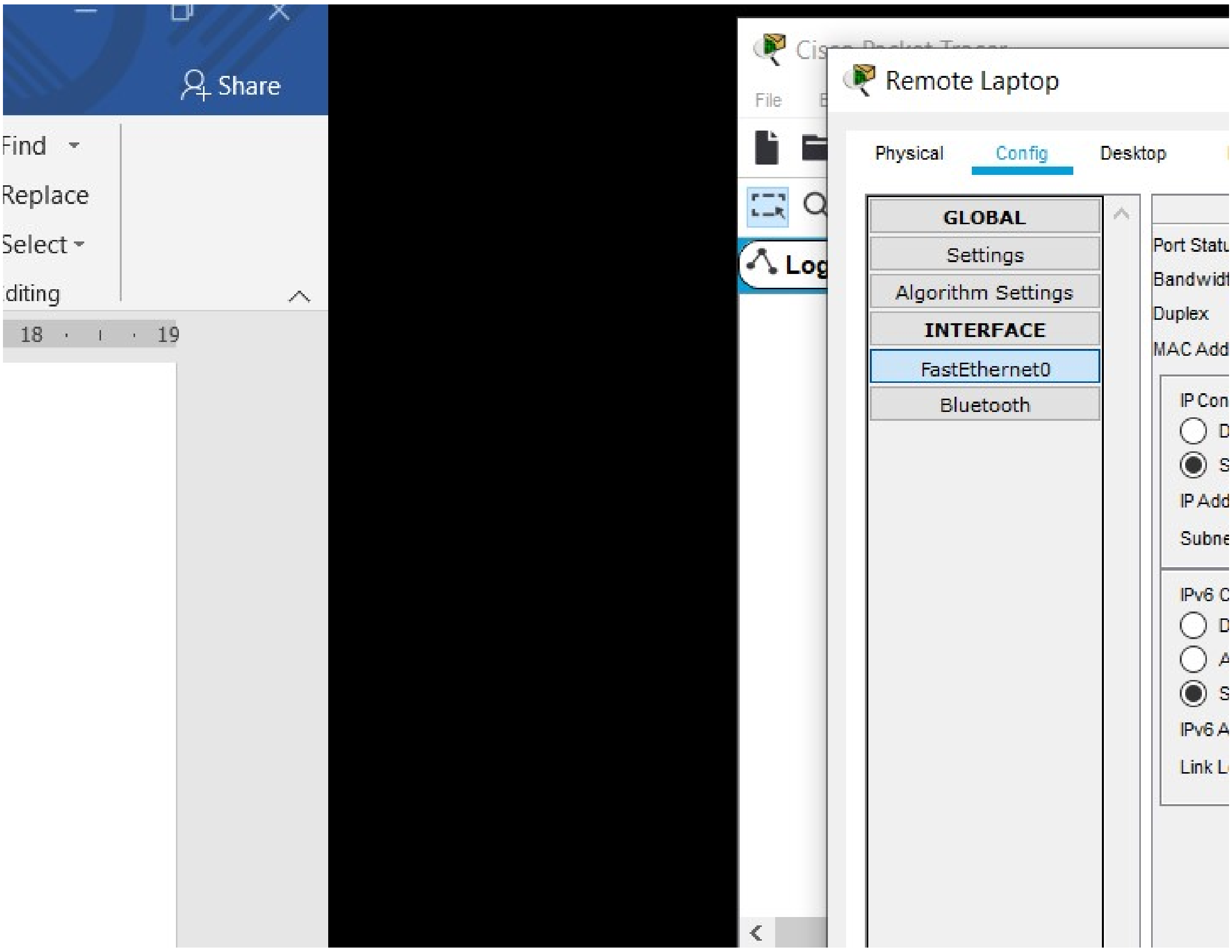
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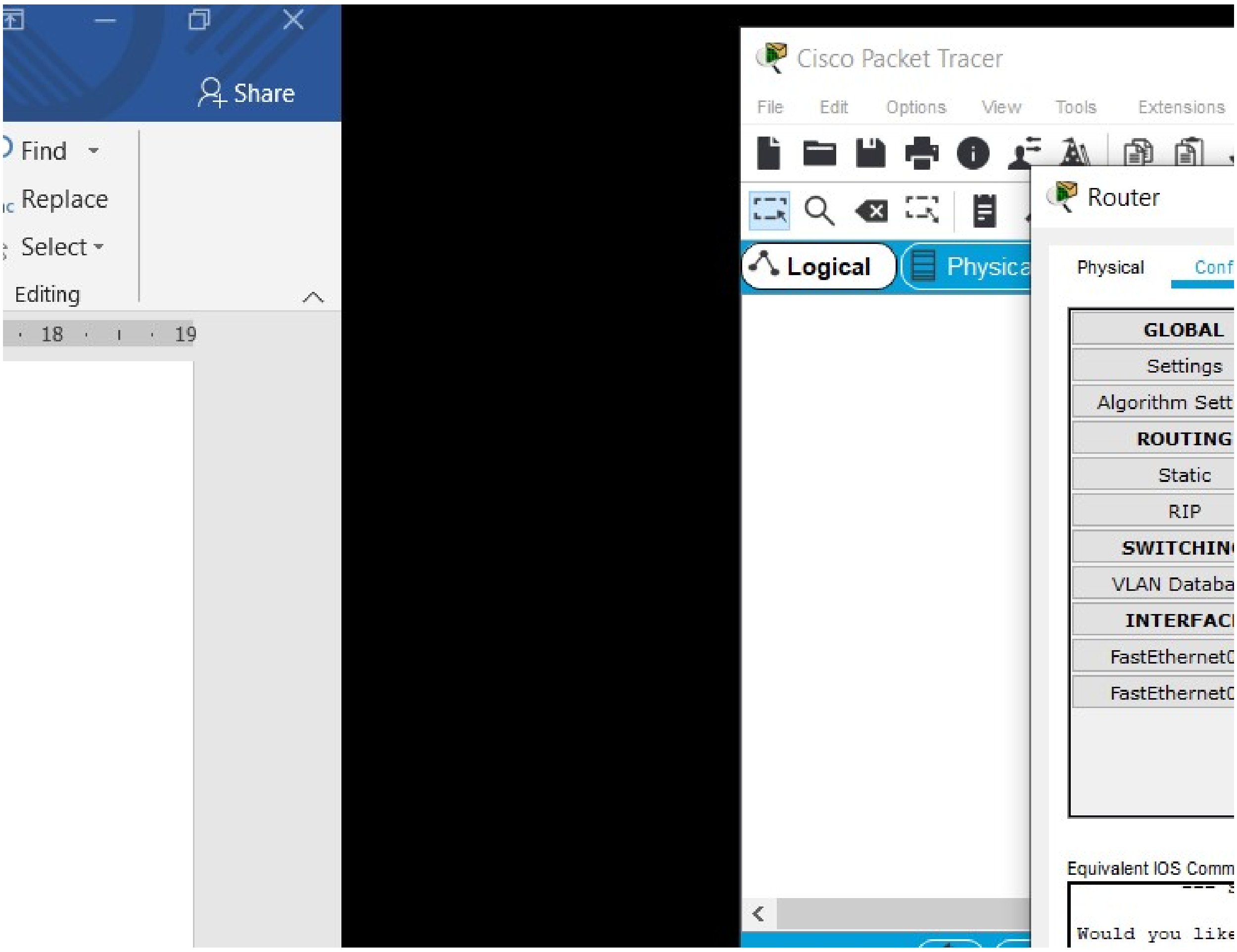

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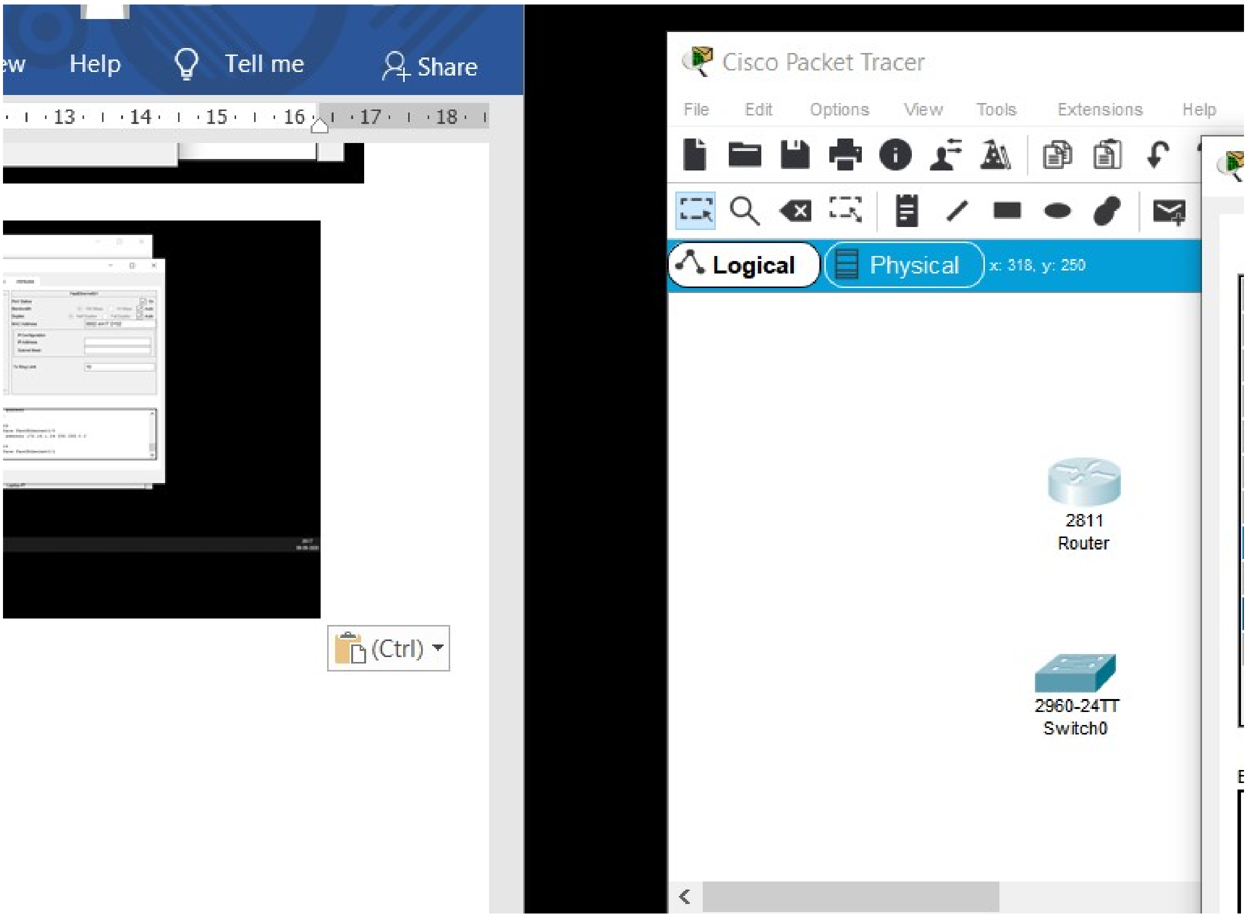
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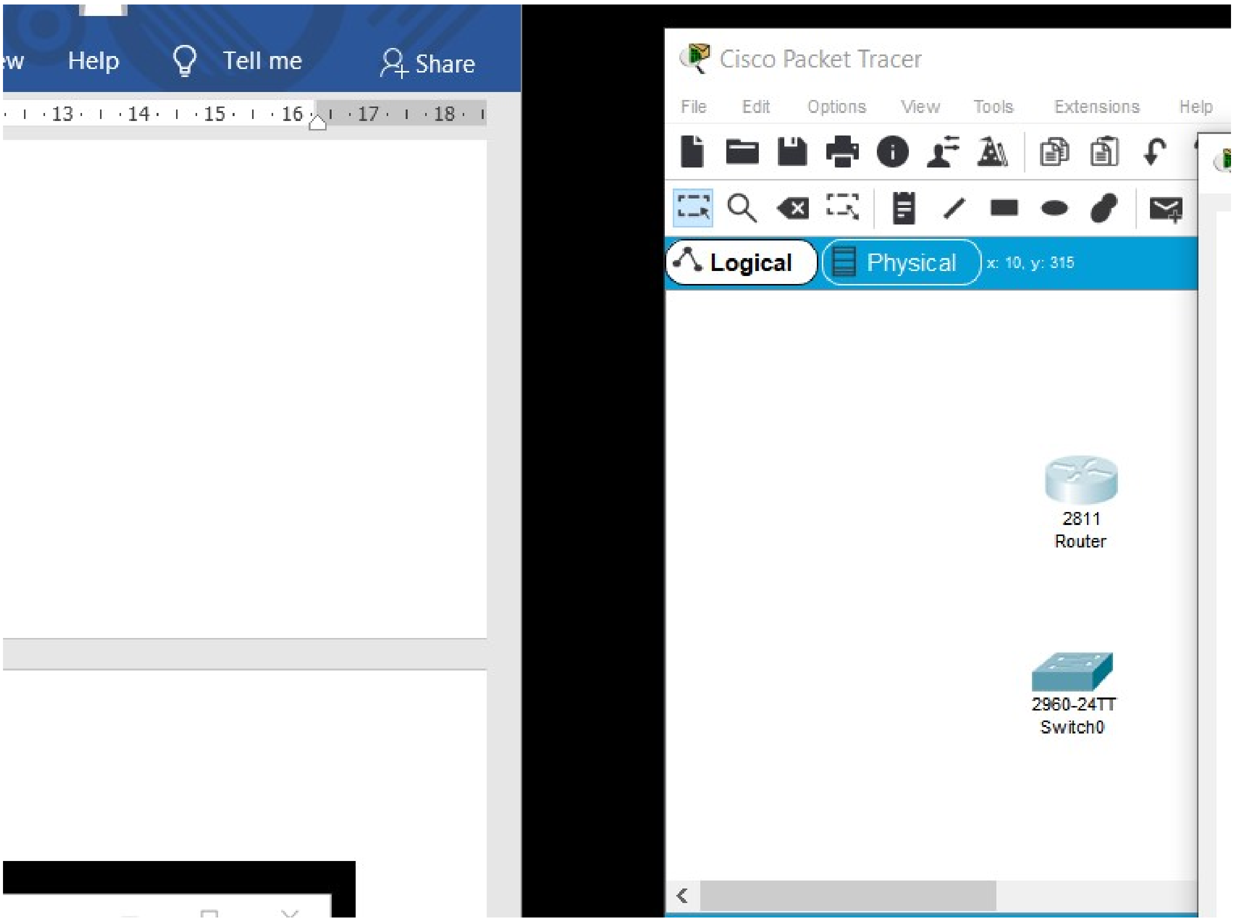
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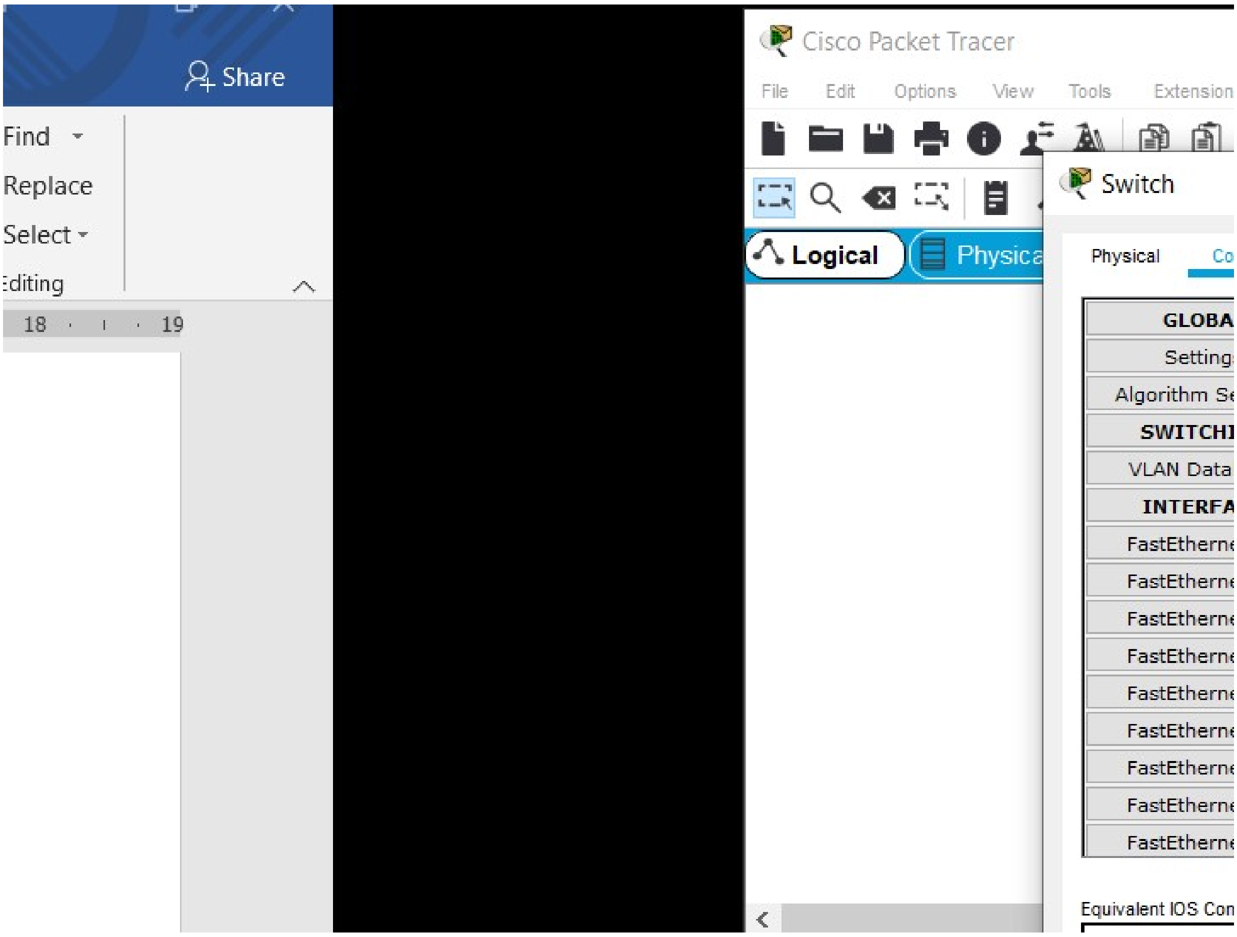
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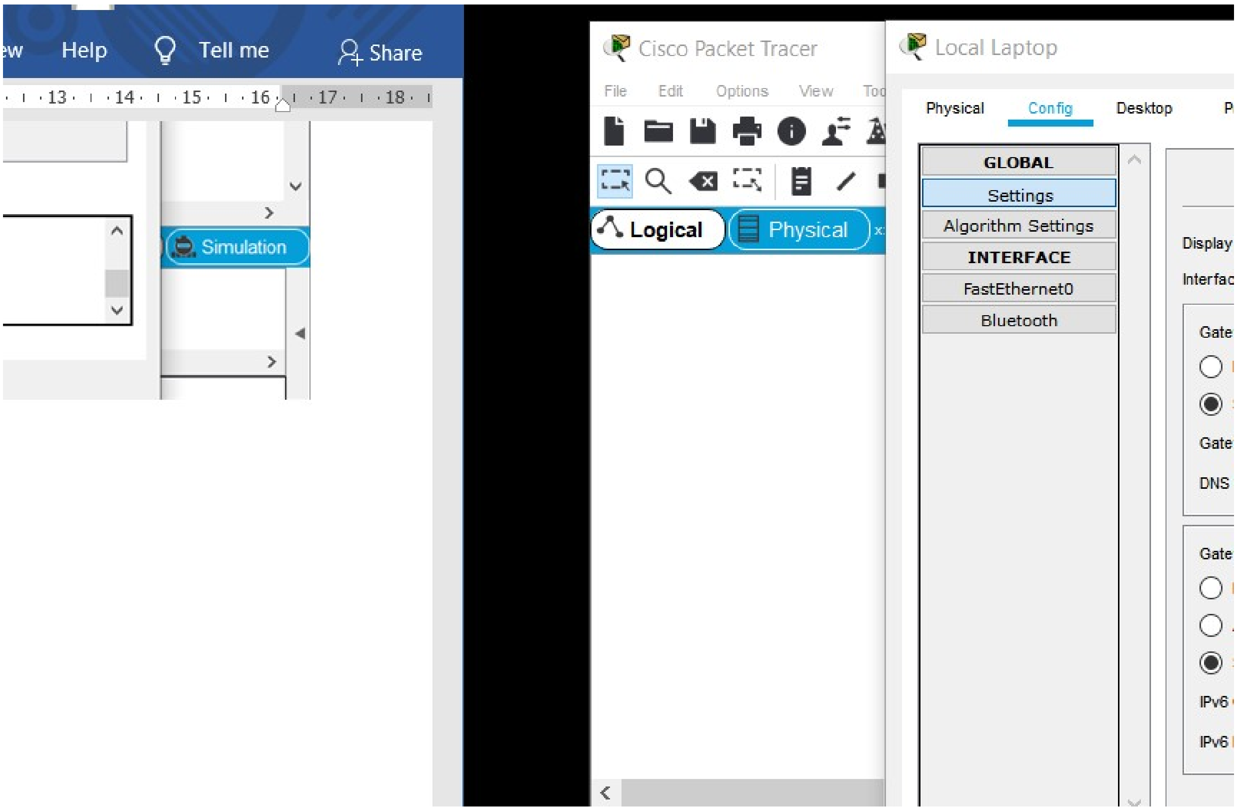
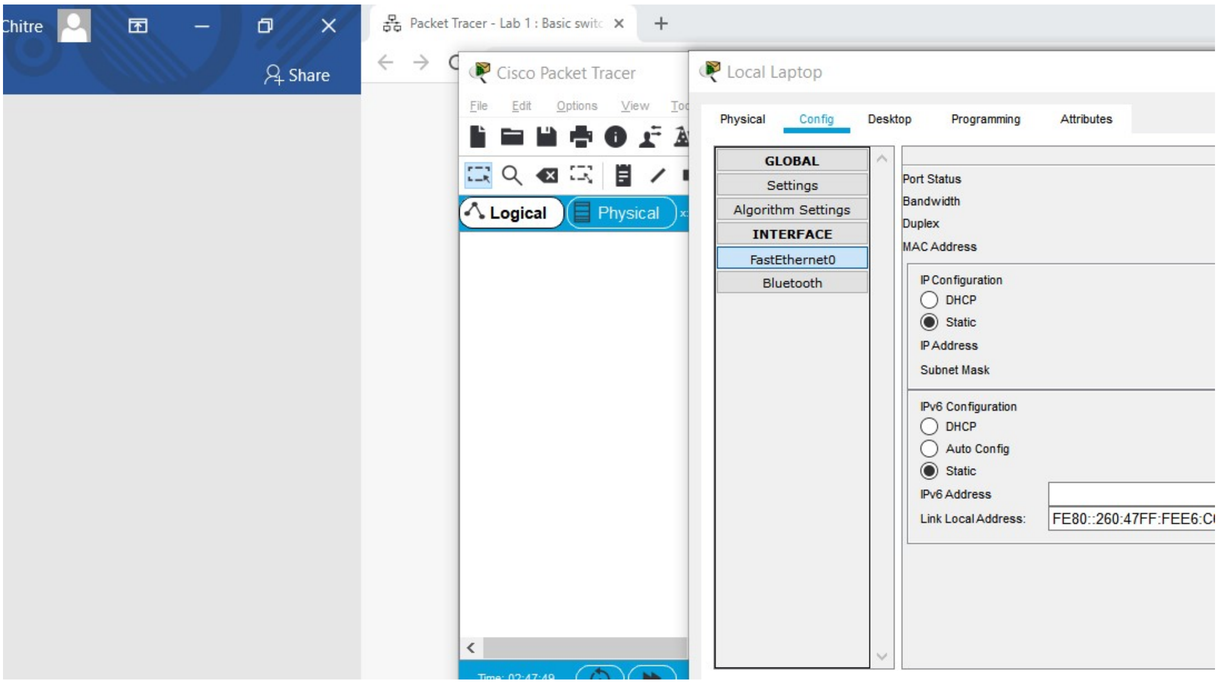
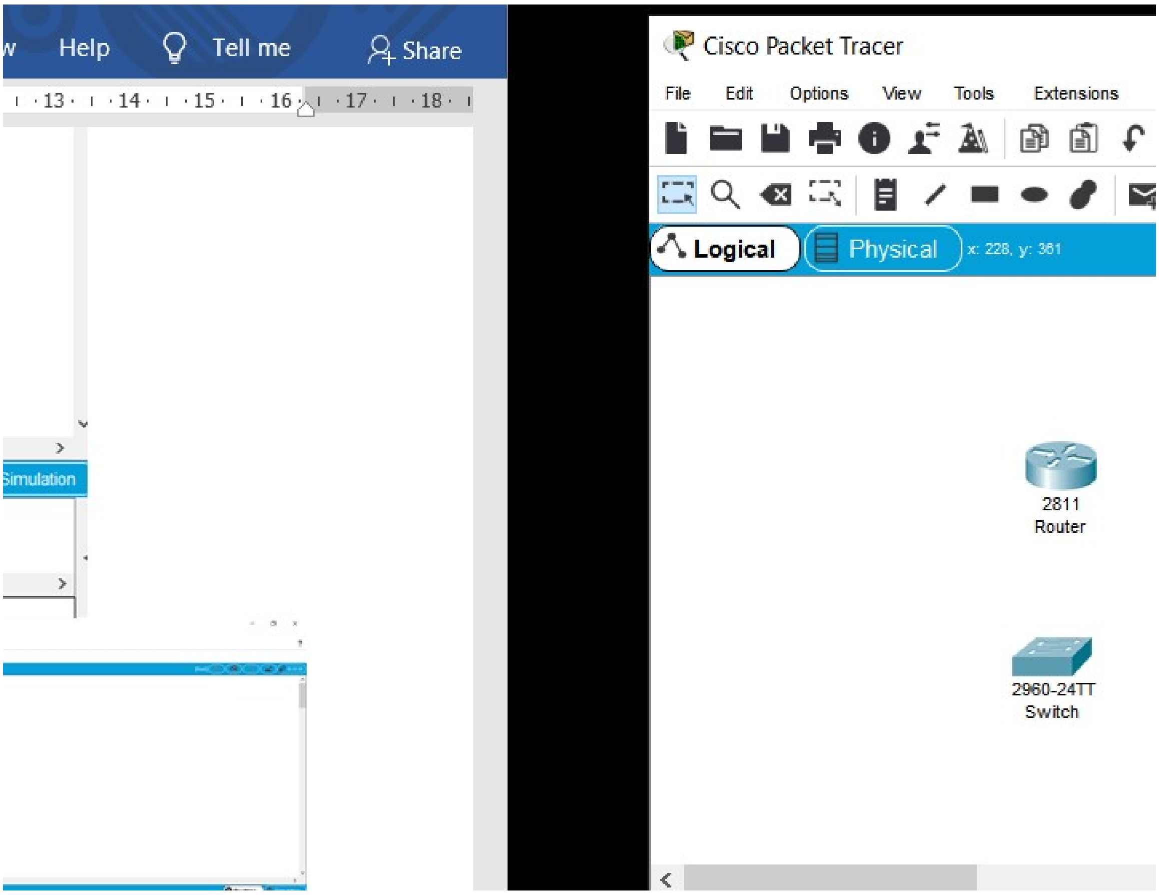




Port Status
Bandwidth
Duplex
MAC Address

IP Configuration
○ DHCP
● Static
IP Address
Subnet Mask

IPv6 Configuration
○ DHCP
○ Auto Config
● Static
IPv6 Address
Link Local Address: FE80::260:47FF:FEE6:C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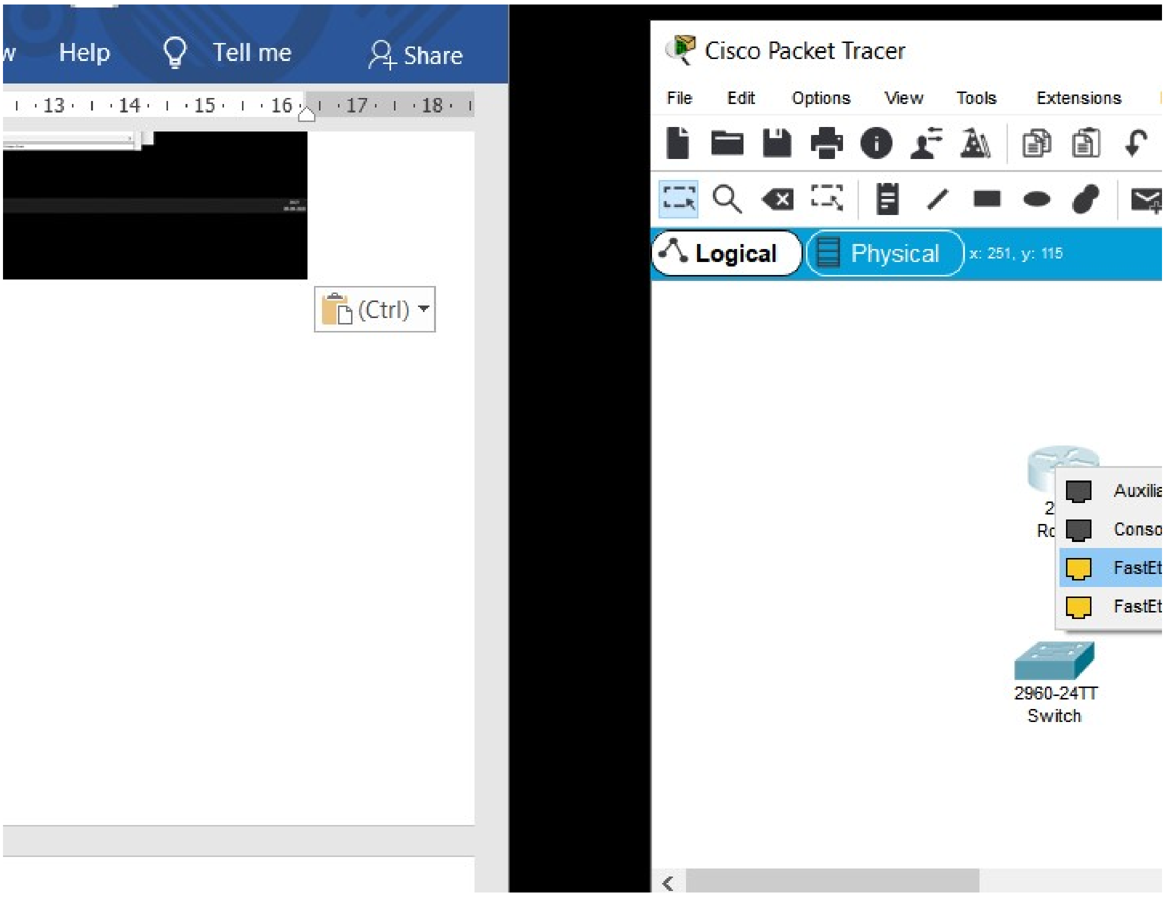
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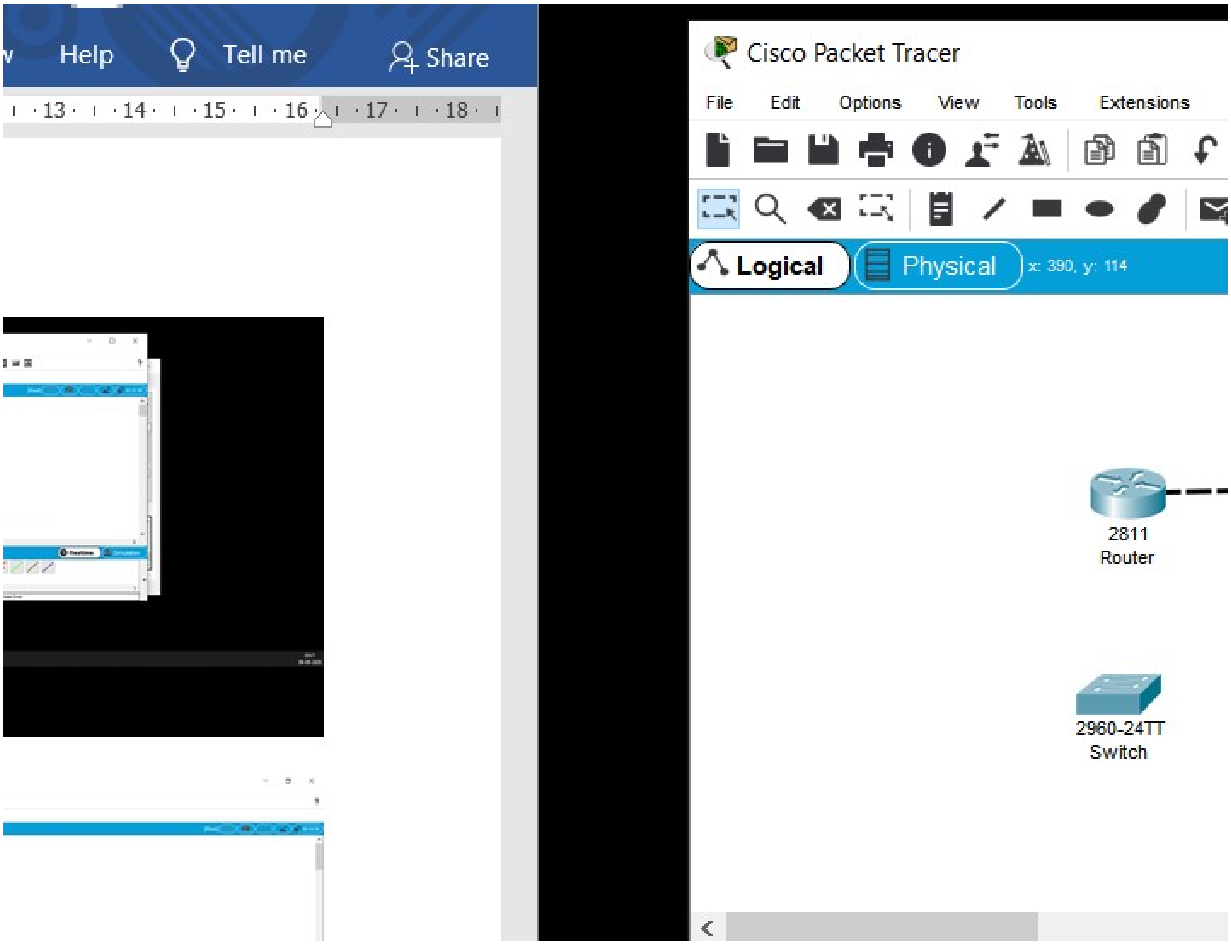
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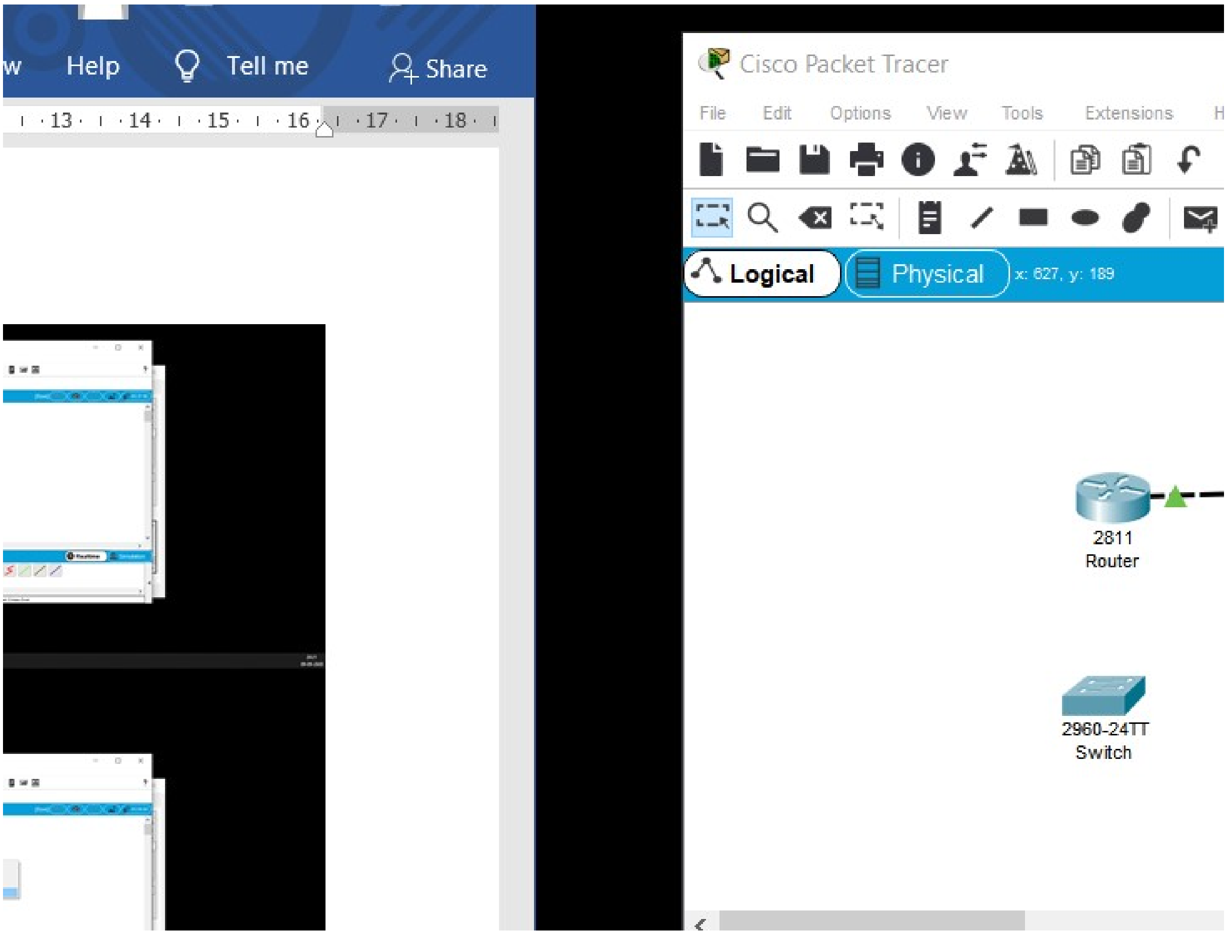
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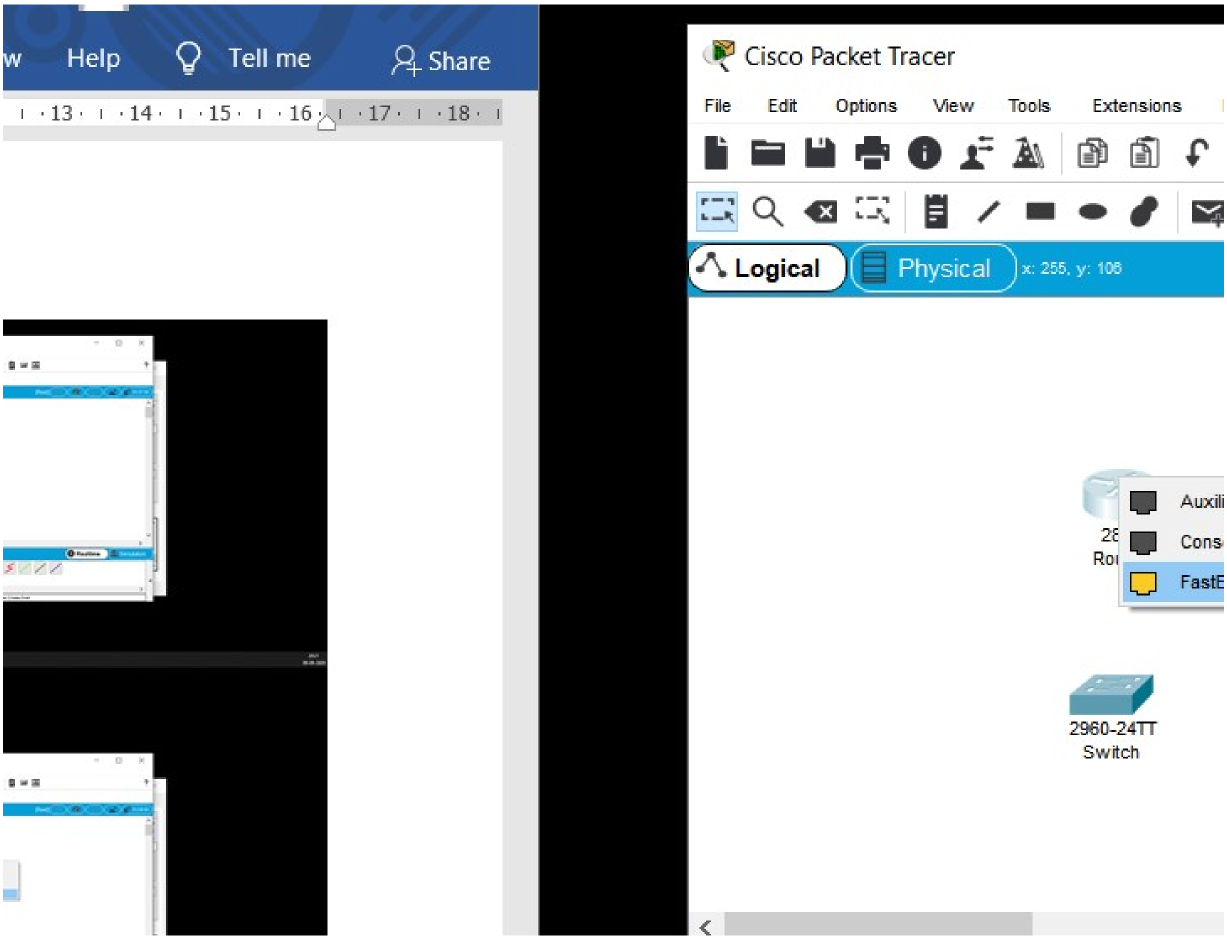
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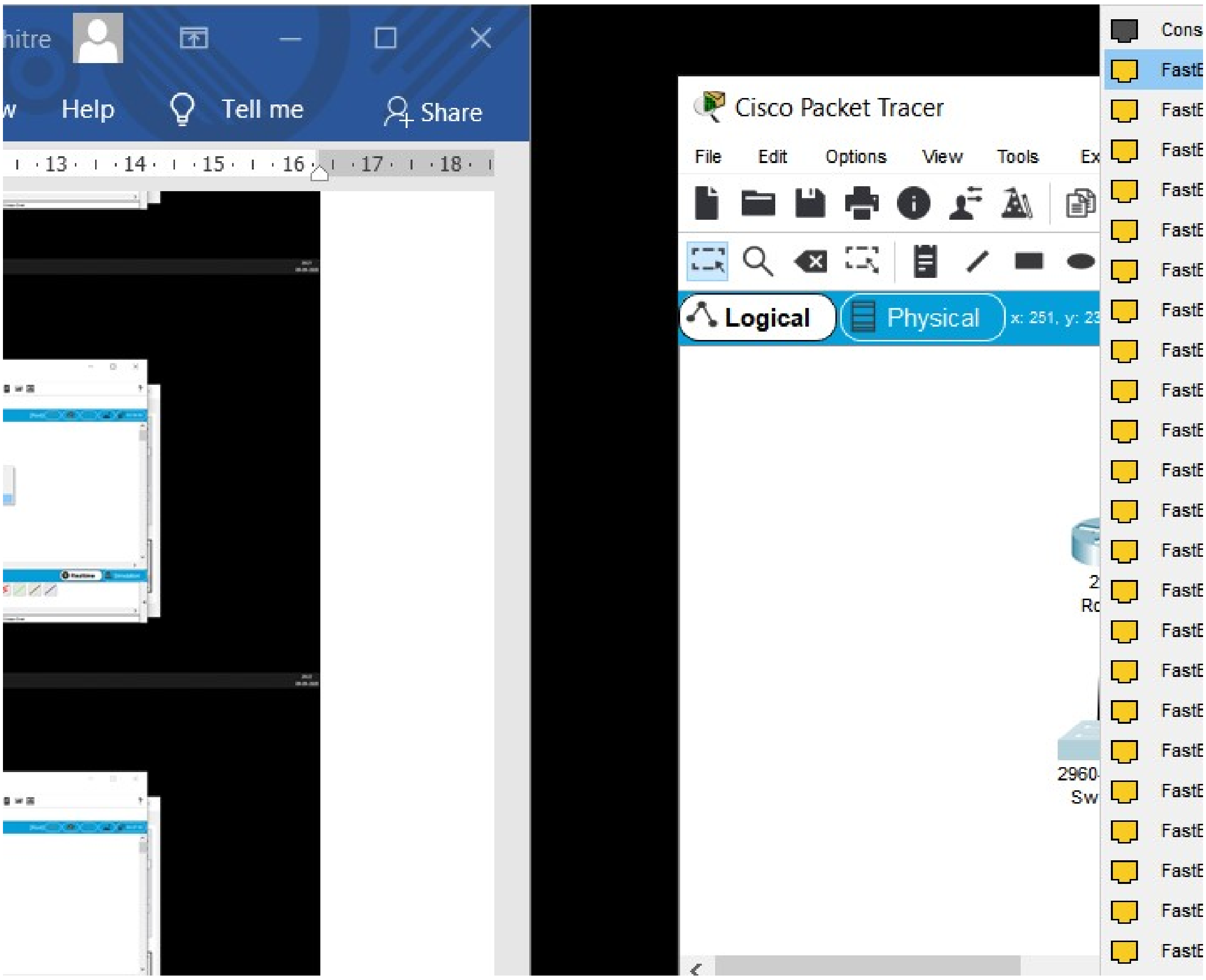

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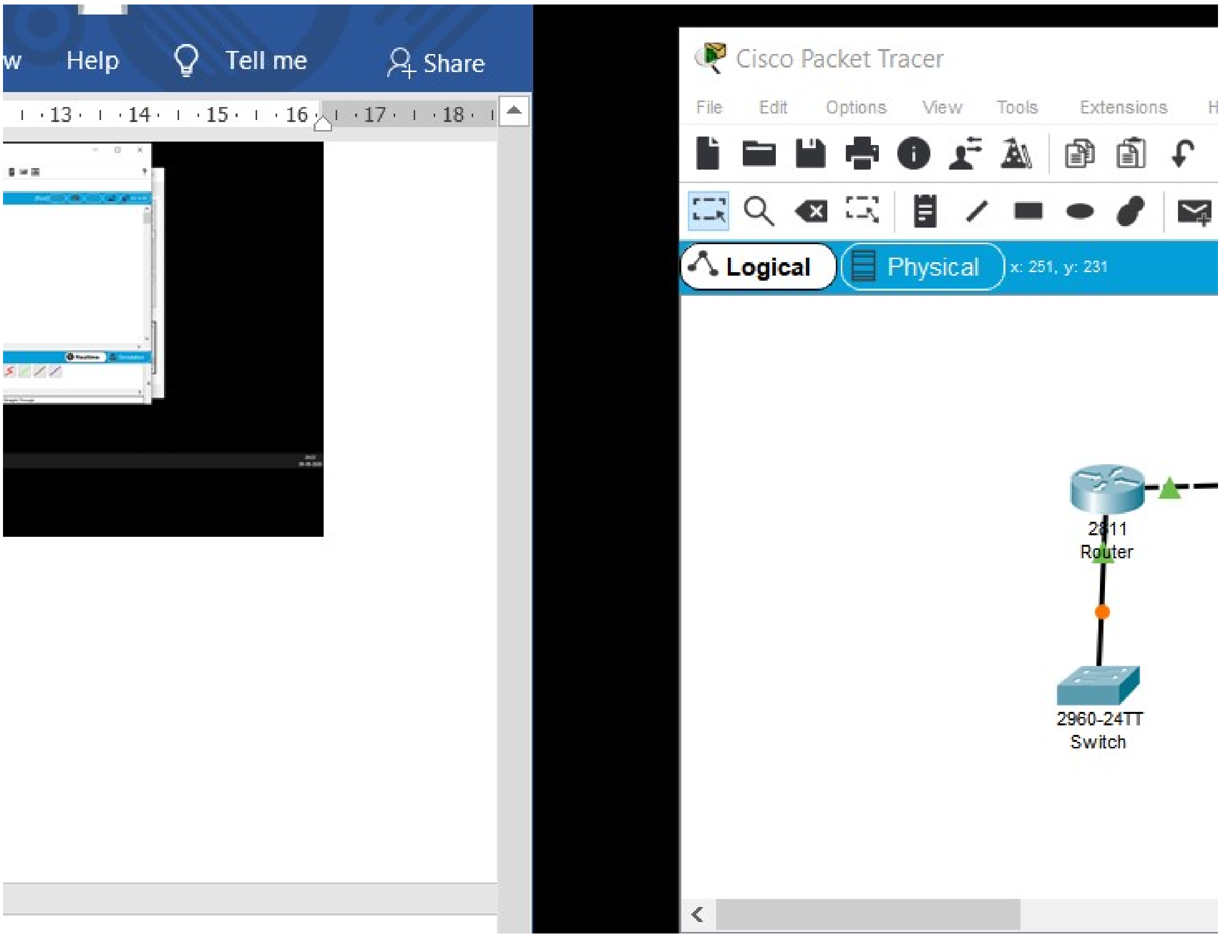
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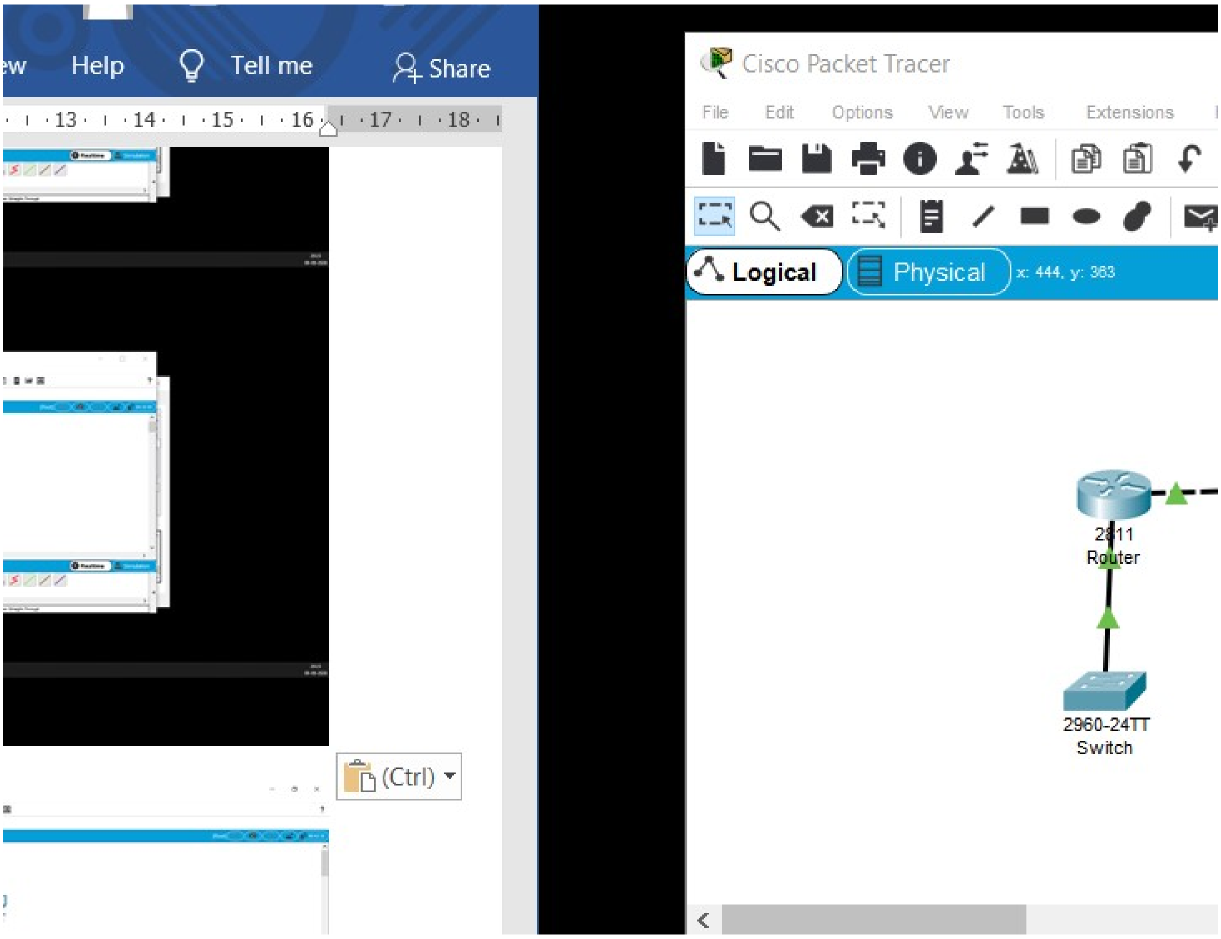
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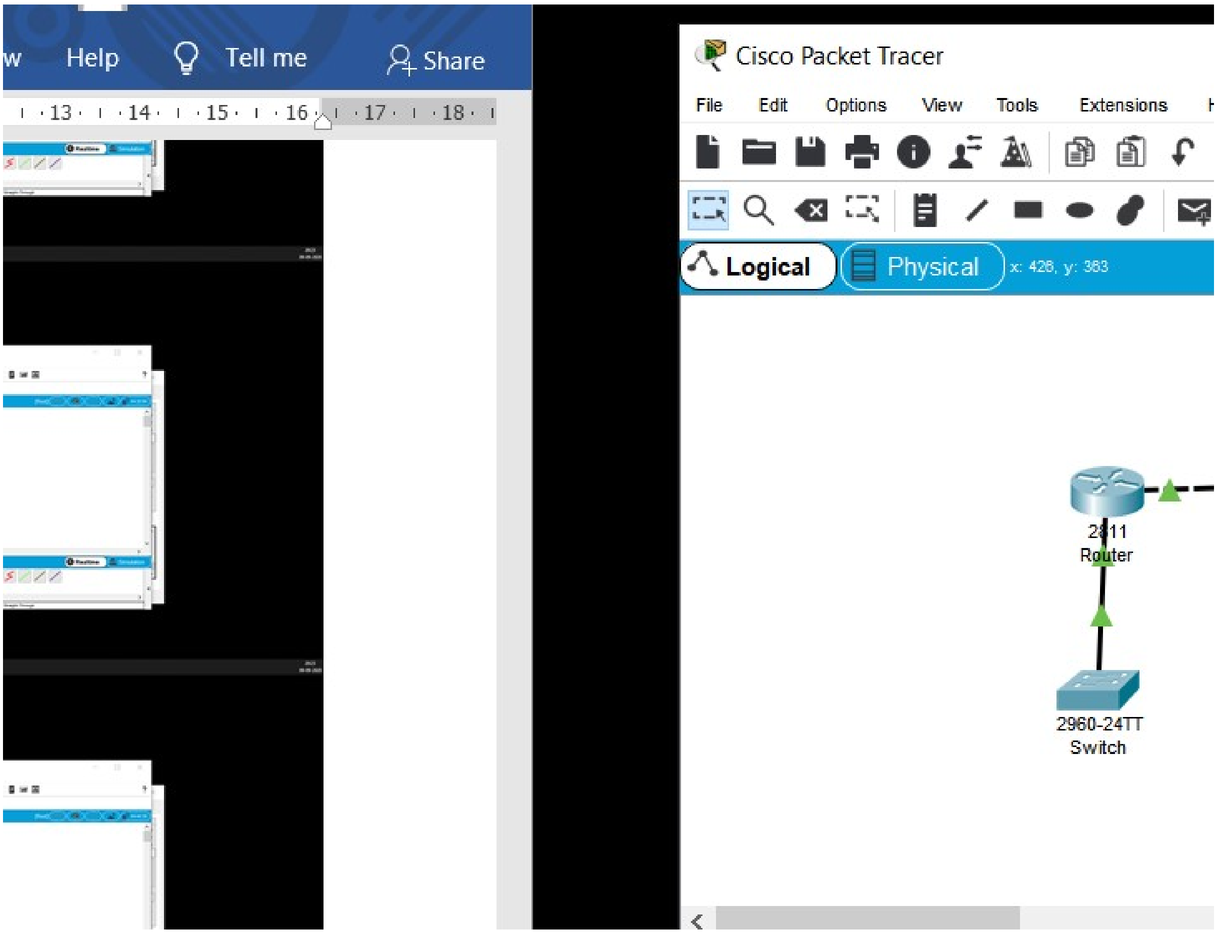
View
Tools
Extensions
Logical
Physical
x: 444, y: 363
2811
Router
2960-24TT
Switch


w
Help
Tell me
Share
13
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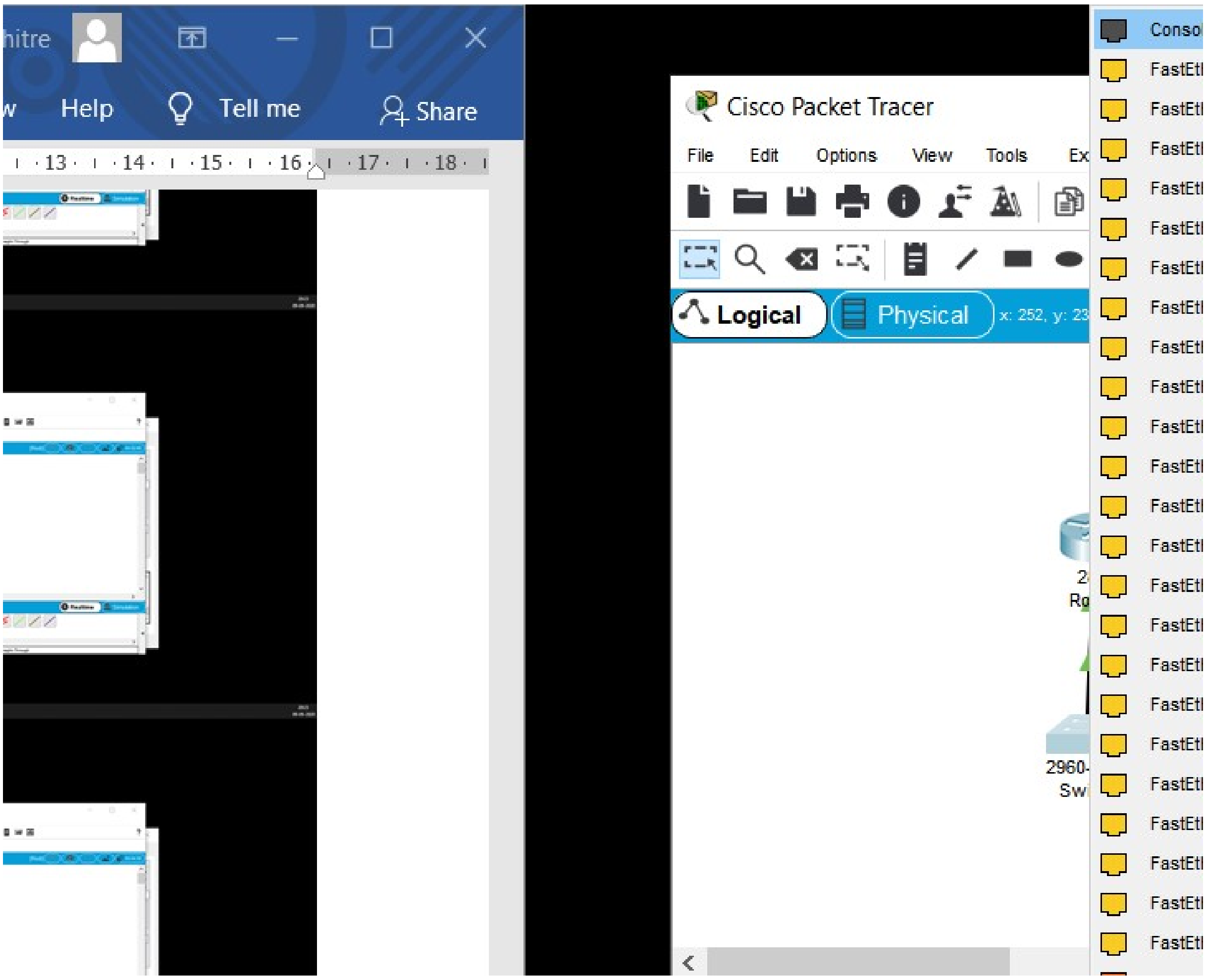
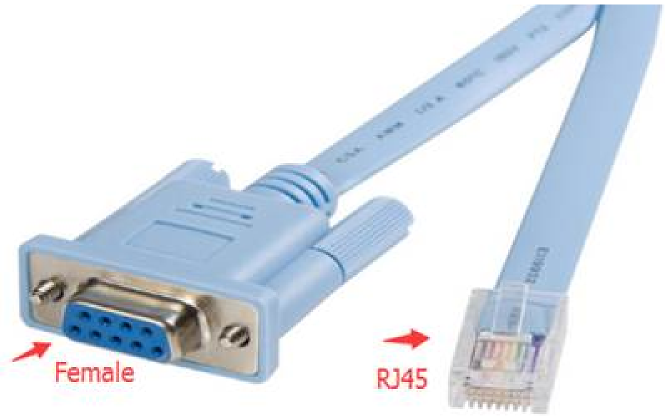
18
Cisco Packet Tracer
File
Edit
Options
View
Tools
Extensions
Logical
Physical
x: 428, y: 383
2811
Router
2960-24TT
Switch

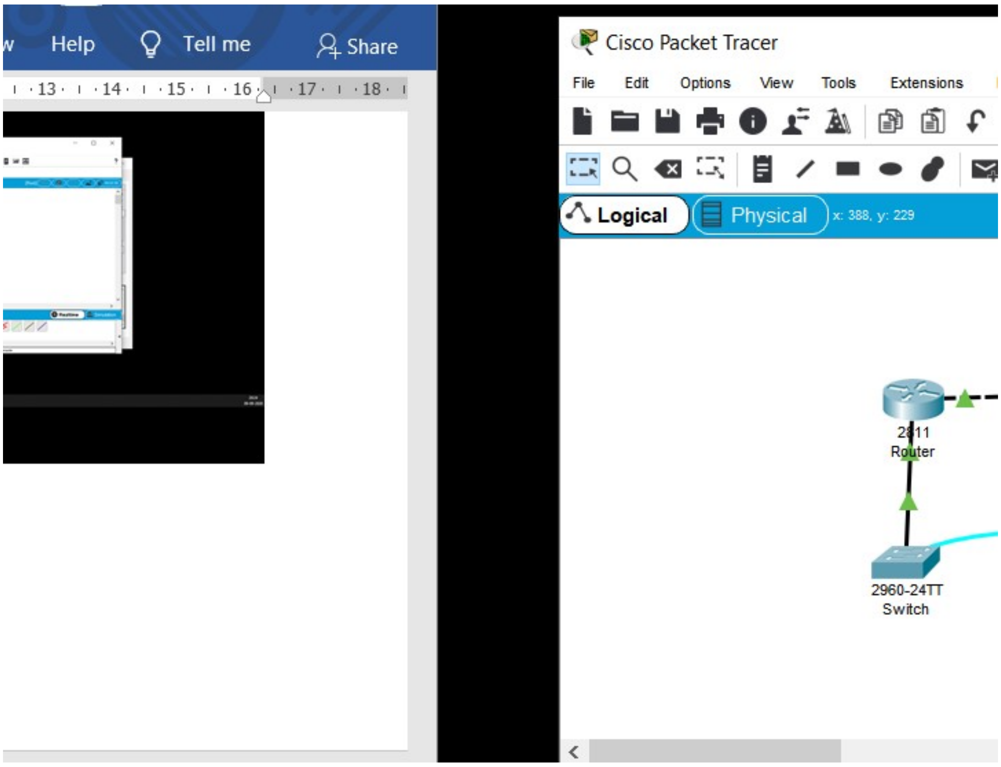


Console Cable :
The Console Cable is used for the serial connection between your computer's serial port and the console port on your TP-Link switch or router to access the CLI (Command Line Interface) of the device.

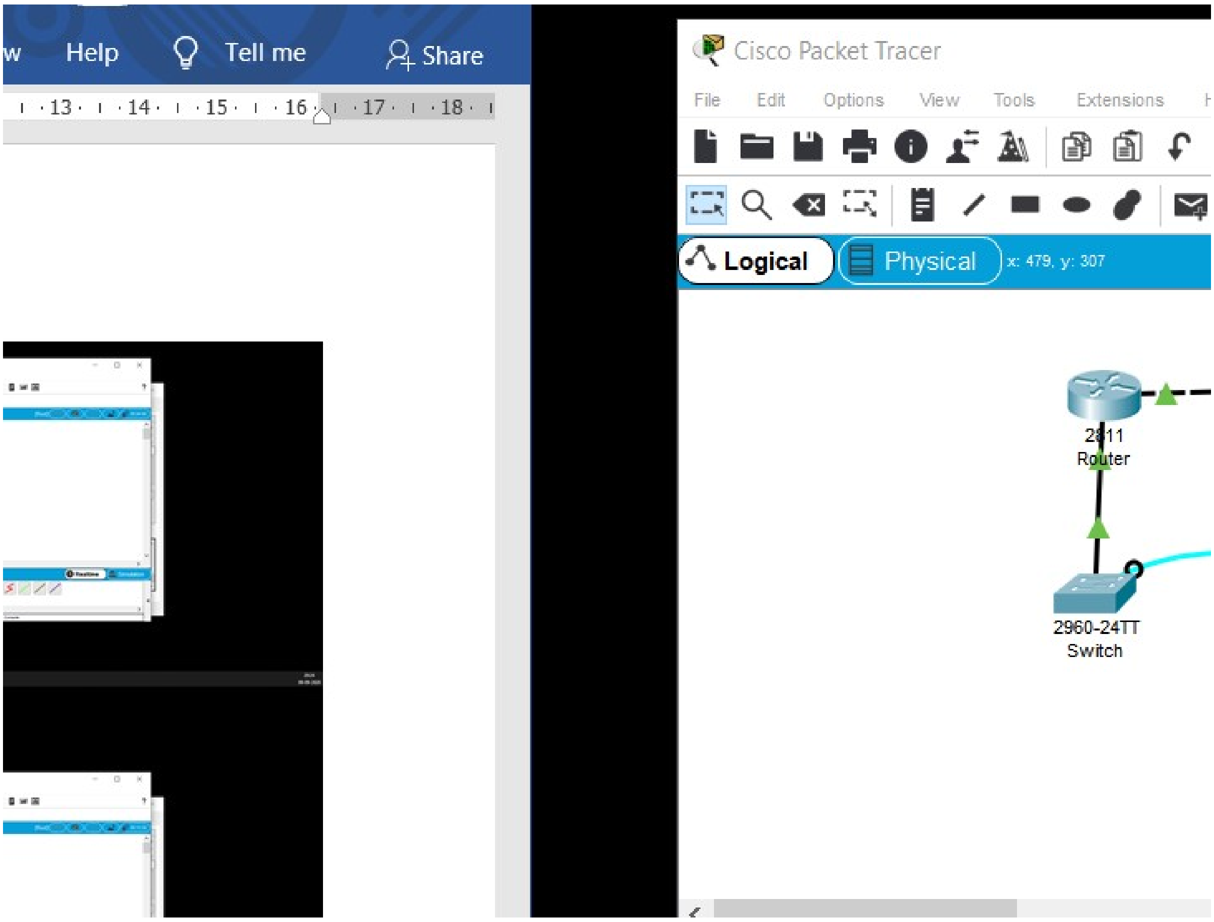
Console port is used to **connect a computer directly to a router or switch and manage the router or switch since there is no display device for a router or switch** . The console port must be used to initially to install routers onto because there is no network connection initially to connect using SSH, HTTP or HTTPS. Normally router console port is a RJ45 port. The following picture shows a console port on a router.

RS232 DB9 Female Head <--> RJ45 connector





RS232 is a standard protocol used for **serial** communication, it is used for connecting computer and its peripheral devices to allow **serial** data exchange between them. These connectors are known as the DB-9 Connector as a **serial port** and they are of two type's Male connector (DTE) & Female connector (DCE).


w
Help
Tell me
Share
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Cisco Packet Tracer
File
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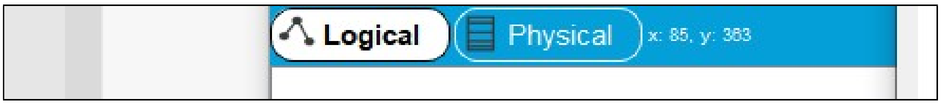
Tools
Extensions
Logical
Physical
x: 479, y: 307
2811
Router
2960-24TT
Switch

1. Use the local laptop connect to the switch console.

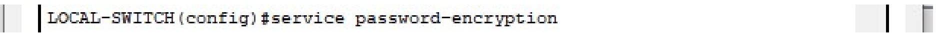
2. Configure Switch hostname as LOCAL-SWITCH



3. Configure the message of the day as "Unauthorized access is forbidden"

4. Configure the password for privileged mode access as "cisco". The password must be md5 encrypted

5. Configure password encryption on the switch using the global configuration command



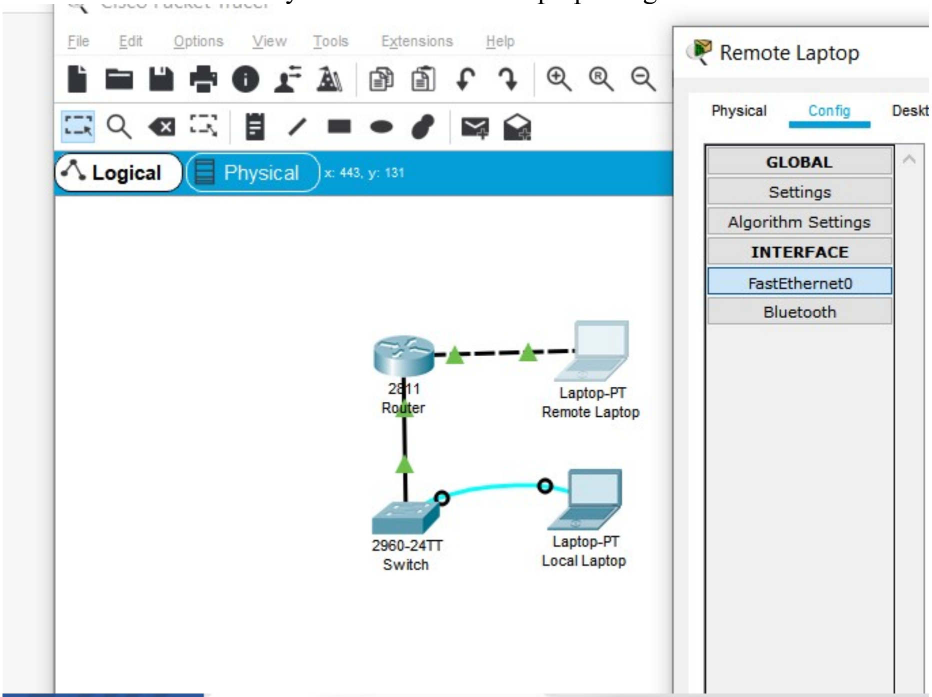
```
LOCAL-SWITCH(config)#service password-encryption
```

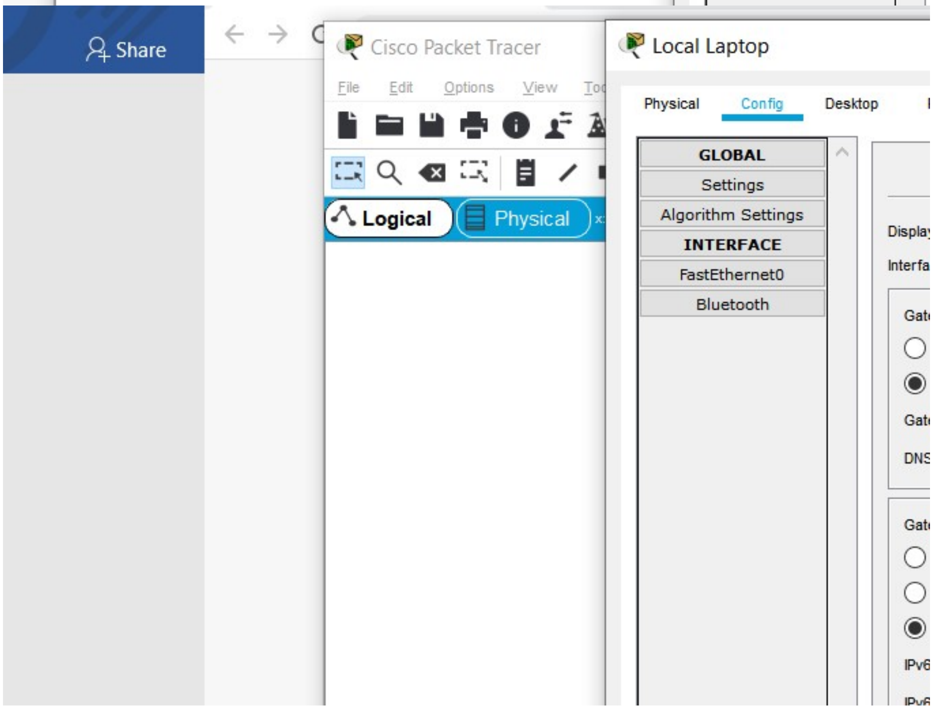
6. Configure CONSOLE access with the following settings :
- Login enabled
- Password : whatever you like
- History size : 15 commands
- Timeout : 6'45"
- Synchronous logging

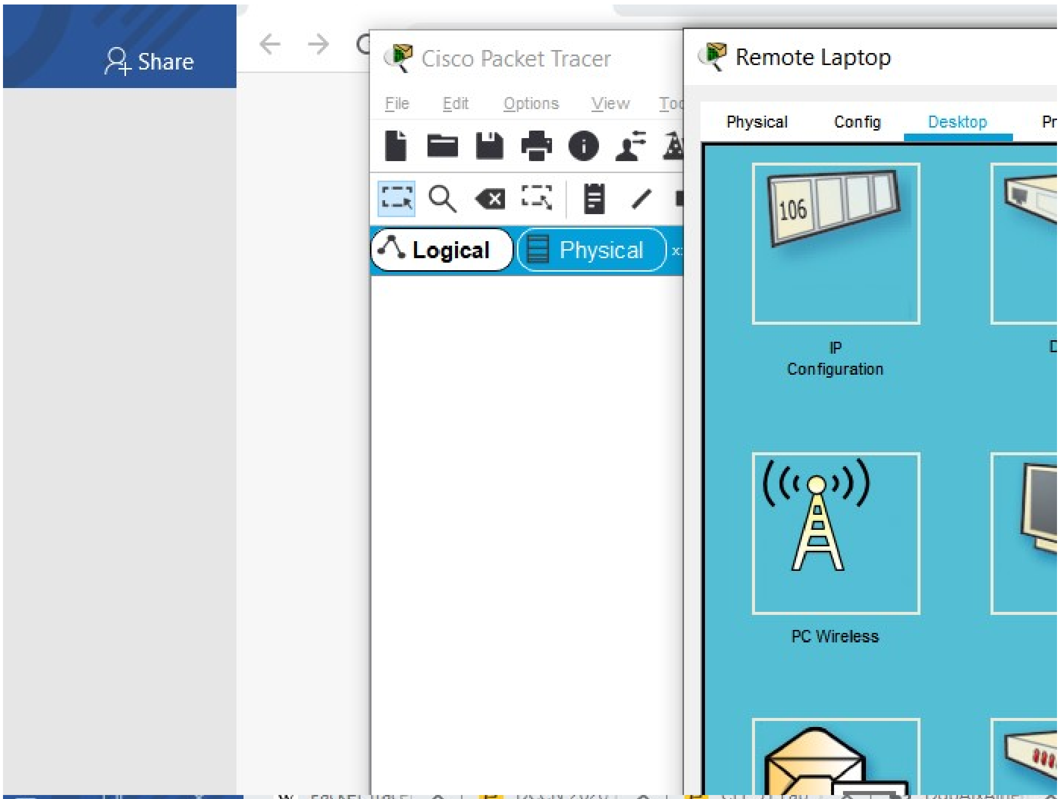
6. Configure TELNET access with the following settings :
- Login enabled
- Password : whatever you like
- History size : 15 commands
- Timeout : 8'20"
- Synchronous logging

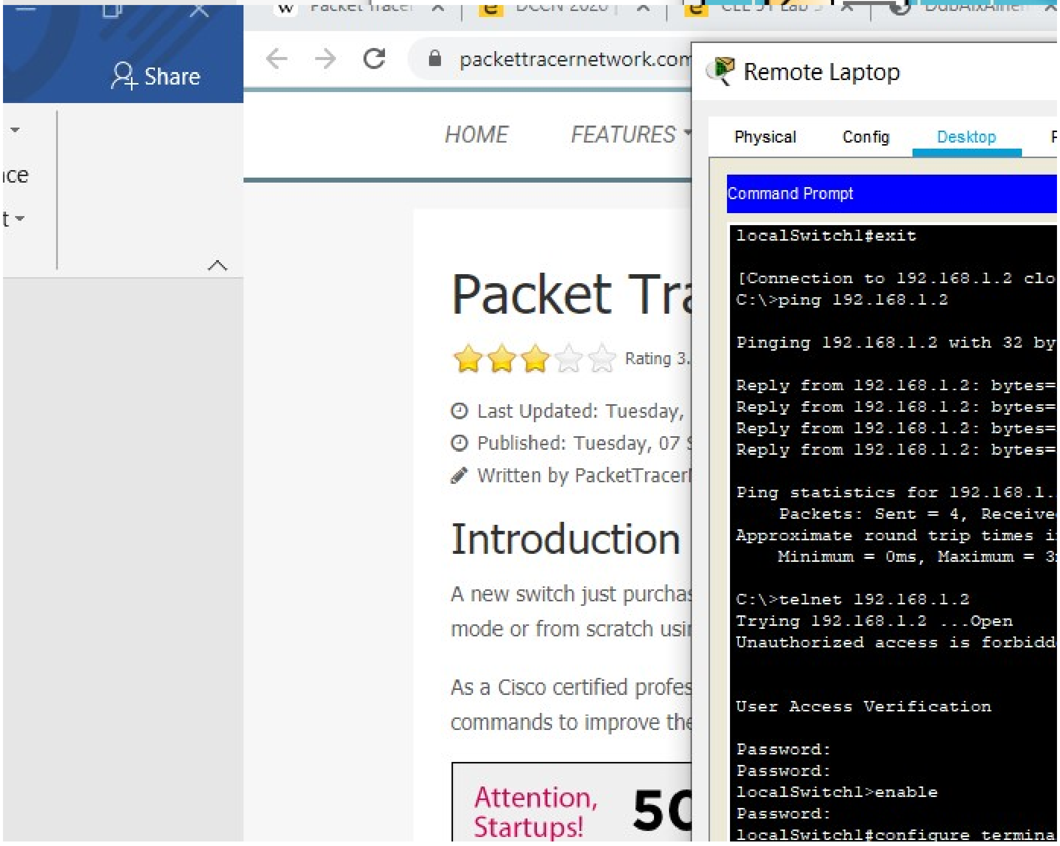
7. Configure the IP address of the switch as 192.168.1.2/24 and it's default gateway IP (192.168.1.1).

8. Test telnet connectivity from the Remote Laptop using the telnet client.









Packet Tra

Rating 3.

Last Updated: Tuesday,

Published: Tuesday, 07 S

Written by PacketTracerN

Introduction

A new switch just purchas
mode or from scratch usi

As a Cisco certified profes
commands to improve the

Attention, Startups! 50

```
localSwitch1#exit

[Connection to 192.168.1.2 clo
C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 by

Reply from 192.168.1.2: bytes=
Reply from 192.168.1.2: bytes=
Reply from 192.168.1.2: bytes=
Reply from 192.168.1.2: bytes=

Ping statistics for 192.168.1.
    Packets: Sent = 4, Receive
Approximate round trip times i
    Minimum = 0ms, Maximum = 3

C:\>telnet 192.168.1.2
Trying 192.168.1.2 ...Open
Unauthorized access is forbidd


User Access Verification

Password:
Password:
localSwitch1>enable
Password:
localSwitch1#configure termina
```

Conclusion :

I have understood a lot about how networks are set up and many network devices.