**Basic Device Configuration**

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## Direct Communication Between PCs

On the bottom left, select End Devices and then drag in the PC. Clicking on the PC after dragging it in should open a new window. On this window, go to the Desktop tab and then select IP Configuration.

Here, we will be configuring **interfaces**. An interface is a single connection to a network. Desktop computers only have a **single interface**, labelled FastEthernet0.

In the IP Configuration section, ensure that Static is selected and enter an address in the IPv4 field. Press Enter and the Subnet Mask field will automatically be filled with the default subnet mask for the address class entered.

For example, if the IP address given is , the subnet mask will be set to , since this is a private Class A IP address. The fact that this is private means that it is **not routable** via the global Internet. All communication using this IP address must be inside its own **private network**. If we wish to communicate with the global internet, we would need to set up a **NAT router**.

Close the opened window, take a different PC and repeat the steps. For this PC, say the IP address is . It needs to be from the **same network**.

We will now connect the two PCs so that they can communicate with one another. On the bottom-left, select Connections and then select Automatically Choose Connection Type. Click on the first PC and then on the second. A connection will be made between them using their respective FastEthernet0 interfaces and a **copper cross-over wire**. Every connection requires a different cable type depending on the interfaces being used. The tool we used here automatically detects the cable type required.

It should be possible to see this information on the connection itself. If this cannot be seen, select Options from the menu bar, go to Preferences and check the box labelled Always Show Port Labels in Logical Workspace.

Now to actually prove that the PCs can communicate. Click on one of the PCs to bring up the window again and go to the Desktop tab. Select Command Prompt. A terminal should appear. In this terminal, write the following command:

ping 10.10.10.5

CMD

If there is a response, the connection was successful.

## Switches

Although we can directly connect two PCs together directly, we cannot do so for **multiple PCs**. This is because each PC has only one interface, and therefore can only have one connection to an outside entity. To deal with this, we use **switches**.

A switch has multiple interfaces with which we can connect to different devices and thus enable those devices to communicate with each other.

From the bottom-left, select Network Devices and then Switches. We will be using the first switch in the list. Drag it in.

Press the Del key. The cursor should become a **cross symbol**. Click on the existing connection between the two PCs to delete it. Press the Esc key to bring the cursor back to normal.

Next, use the same connection tool to make a connection between each of the PCs and the switch. The interfaces for the switch should show up following the pattern FastEthernet0/0, FastEthernet0/1 and so on. The connection is a **copper straight-through wire**.

Add a third PC and give it the IP address . Connect it to the switch as well.

There is no need to configure the switch. All the PCs will be able to communicate now.

## Routers

The PCs we added above were all part of the **same network**. If we want to communicate with a PC that is a part of a **different network**, we need a **router**.

Add a fourth PC with the IP address . We will be unable to communicate with this PC, even if we connect it to the switch, since it is part of a different logical network.

### Command Line Interface

Before getting started with the setup for the router, we need to look at configuration modes. Every device has **multiple configuration modes**. To make things less complicated, we will be looking at the configuration modes from the existing switch instead of adding our router just yet. Note however, that we do not actually need to do this in the switch at all. The switch will work without any manual configuration.

Click on the switch to open up a new window. In this window, go to the CLI tab. The actual interface configuration we will be doing on the router will also work from the Config tab, but accessing the different configuration modes and setting up **security features** requires us to use the CLI.

In the CLI, press Enter. We should be able to type now. Initially, we are in the **User Execution Mode**. This is indicated by the > sign before the input prompt.

From here, we can enter the **Privileged Mode** by entering the following command in the CLI and pressing Enter.

enable

CLI

We can tell we are in the privileged mode if the input prompt symbol has changed to #. We can go back to the User Execution Mode by entering exit in the CLI and pressing Enter.

In the privileged mode, entering ? will cause a list of all possible commands to appear. This works in every configuration mode.

One of the possible commands is this:

configure terminal

CLI

This will take us into the **Global Configuration Mode**, indicated by the prompt becoming (config) #. Alternatively, we can also use conf t, as shorthand. If the command is **not ambiguous**, the CLI understands **shorthand**. Pressing Tab after writing a part of a word in a command can also **autocomplete** the command if the command is unambiguous.

In the Global Configuration Mode, we can change some information about the device. For example, we can change its **hostname**. This is different from the device name that shows up in the diagram.

hostname someSwitch

CLI

We can also enable a **password**, that will be required when we enter the privileged mode.

enable password somePass

CLI

However, this password is being stored in **plaintext**, which is insecure. We can also **encrypt** the password using an MD5 hash before storing it.

enable secret somePassword

CLI

From the Global Configuration Mode, we can enter the following command to enter the **Interface Configuration Mode** for that particular interface.

interface fastEthernet0/1

CLI

If we are uncertain about what interfaces are available to use, we can check all the interfaces and their connection information using this command from the Privileged Mode.

show ip interface brief

CLI

From the Global Configuration Mode, we can enter the following command to enter the **Line Configuration Mode**.

line console 0

CLI

All the changes we make to our configuration is stored to the **running config file**. This file is stored on the device’s RAM and will be lost if we turn off the device (which can be done from the Physical tab). To be able to retain the changes, we need to store it to the **start-up config file**, which is stored on the device’s NVRAM (non-volatile RAM). To do this, from the Privileged Mode, enter the following command:

copy running-config startup-config

CLI

### Router Setup

From the bottom-left, go to Network Device and then Routers. Select the router labelled 2911 and drag it into the workspace. Connect it to the switch using the automatic connection tool. The connection should use a **copper straight-throught wire** and the interface on the router’s side should be GigabitEthernet0/0.

Connect the fourth PC to the router using the automatic connection tool. This connection should use a **copper cross-over wire**.

Click on the router and go to the CLI tab. There should be a prompt that says:

Would you like to enter the initial configuration dialog [yes/no]:

CLI

Enter n. We will be performing the initial configuration for the router manually.

In the Global Configuration Mode, set a hostname for the router and enable an encrypted password.

### Configuring Interfaces

In the CLI for the router, enter the following commands:

interface gigabitEthernet 0/0  
ip address 10.10.10.1 255.0.0.0

CLI

Essentially, we entered the interface configuration mode for a specific interface and gave that interface an IP address as well as a subnet mask. We could also have done this from the Config tab.

Notice that the IP address is for the network connected to the switch. By convention, for any subnetwork, the **first address** in that network is used for the **router’s interface**. It is possible to use a different one, but we would be breaking convention.

By default, the connection on a router’s interface is in **shutdown mode**. We need to activate it using the following command:

no shutdown

CLI

Next, use the exit command to go back to the Global Configuration Mode. We need to set up the other interface next.

interface gigabitEthernet 0/1  
ip address 192.168.10.1 255.255.255.0  
no shutdown

CLI

Copy the running config to the start-up config and close the window.

We still aren’t done. If we try to ping the fourth PC, it won’t work. Since the PCs are on two different networks, the switch will be unable to understand where to forward data. We need to set up the **default gateway** for each of the PCs. This will tell the switch to set the data to the router if it cannot find the destination IP address within its own network.

Click on the first PC and go to the Desktop tab. Select IP Configuration. Beneath the IP address and Subnet Mask we entered earlier, there is a field labelled Default Gateway. Here, enter the IP address for the interface of the router that is connected to this network. It should be .

Repeat this for all the other PCs. For the fourth PC, the Default Gateway value should be , since that is the IP address of the router’s interface connected to that network.

Pings will work now. However, the first attempt may still fail, since initially, a broadcast takes place to locate all the device. From the second attempt onwards, pings should work.

## Visualizing Communication

It is possible to visualize the pings we are performing. On the bottom-right, click on Simulation. On the top-left, click on the closed envelope icon, labelled Add Simple PDU. Then click on the two PCs that must communicate. In the Simulation Panel, click the next button to play the events one at a time.