

Introduction to Networks and Distributed Computing  
CECS 327  
Spring 2022  
Assignment 4  
Due Date: Monday, April 11, 2022 @ 10:00 PM PST

**Notes:**

- This is an individual assignment.
- You have to demo your work with Sara in order to receive full credit.
- There will be different “demo time slots” announced on Beachboard to accommodate different schedules. Make sure to demo your work during these slots so you can get a full credit.

**Assignment 4: Router Configuration**

**Installation Guide**

This section provides instructions for downloading and installing GNS3 as well as additional software required for this assignment.

**Installing GNS3**

1. Navigate to the GNS3 [website](#).
2. Download the appropriate software for your operating system.

**Note: You will need to create a GNS3 account.**

3. Install the software



**Note: For Windows, when prompted for “Choose Components”, please uncheck “SolarWinds Response Time Viewer”.**


**Installing Routers**

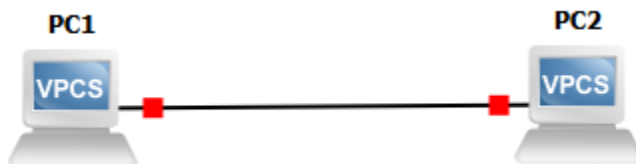
1. Download the Cisco IOS image [here](#)  
**Note: We will use both C2600 and C2691 for this assignment. Therefore, you will need to follow these instructions twice.**
2. You will need software to “unzip” the .rar files, I recommend you install 7-Zip or WinRAR.
3. Unzip/Extract the .rar files you downloaded
  - a. With 7-Zip, right-click the file and select “7-Zip”, then extract.
  - b. With WinRar, right-click and click extract.
4. Open the GNS3 application
5. Add the router to GNS3
  - a. Click on “**Edit**”, then “**Preferences**”.
  - b. Under “**Dynamips**”, click on “**IOS routers**”
  - c. Click on “**New**”
  - d. Select the extracted image and click “**Next**”
  - e. If you are adding a cs2600 router, choose “**2611XM chassis**”
  - f. Click “**Next**” until you get to the “WIC modules” section. Choose “**WIC-1T**” for wic 0.
  - g. Click on “**Next**”, until you are finished with the setup.


### Example Project

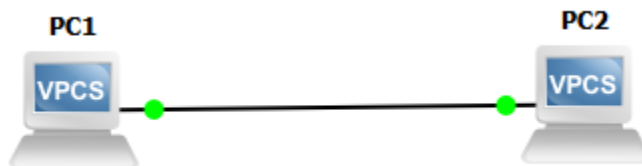
This part of the lab describes how to create GNS3 projects, place virtual PC simulators on the desktop, start them, console into it, and test the configured topology.

1. Creating a GNS3 project
  - a. Open the GNS3 application
  - b. Enter a project name, and click “OK”.
2. Adding virtual PC simulators
  - a. Click on  in the left-hand side of the GNS3 application.
  - b. Click and drag on VPCS and drag it into the center panel. Add one more VPCS.
3. Link the VPCS together
  - a. Click on  in the left-hand side of the GNS3 application.

Note: The icon will change to  when selected.
  - b. Click on PC1 and select “Ethernet0”.
  - c. Click on PC2 and select “Ethernet0”.
  - d. You should see a link between two VPCSs with two red dots.



- e. Click on  to deactivate the “add a link” feature.
4. Starting the VPCS
  - a. Right-click on PC1 and click “Start”
  - b. Right-click on PC2 and click “Start”
  - c. You should see that the red dots turn into green dots.



Note: The color of the dots indicates the status of the devices.

Note: The “Start”, “Pause”, and “Stop” icons on the top bar can start/pause/stop all devices in the current project at once.

5. Assigning IP addresses
  - a. Make sure the dots on the link are green (VPCSs are on).
  - b. Right-click on PC1 and select “Console”.
  - c. Run the following command to set the IP address.

```
ip 10.0.1.1
```
  - d. Right-click on PC2 and select “Console”.

- e. Run the following command to set the IP address

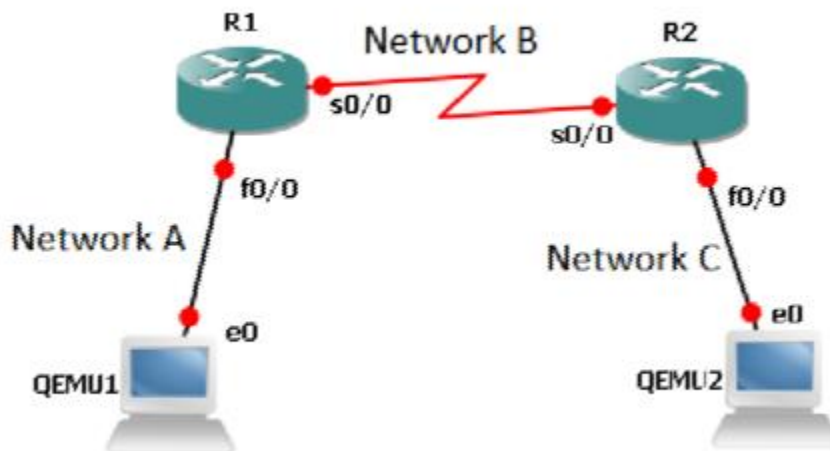
ip 10.0.1.2

6. Testing your network

- From each terminal, try to ping the other. For example, on PC1's console type: ping 10.0.1.2 to ping PC2.
- Use **Ctrl + C** to stop pinging.

### Building a Network in GNS3

In this tutorial, you will create a network in GNS3 between two routers, and each router will have one host connected to it. The ultimate goal is to route data between network A and C so that two hosts will be able to communicate with one another. However, you will not configure the host in this lab. If everything is correct, the router R1 should be able ping the f0/0 interface of the router R2. Below is the topology for what this network will look like:



#### 1. Configuring Interfaces for R1

GNS3 allows you to add cards to different slots on a router. This portion of the tutorial will describe how to configure the slots, as well as the Cisco commands to set up the interfaces. By default, Cisco network interfaces are disabled and you must turn them on before they can be used. You will notice that in this section of the assignment, we use the C2691 router. This is because the C2600 router does not support the NM-4T module. The NM-4T module is an additional interface we can add to the router that includes 4 serial ports. This gives us the ability to connect up to 4 routers at once.

- Open the GNS3 application and create a new project named **“network”**.

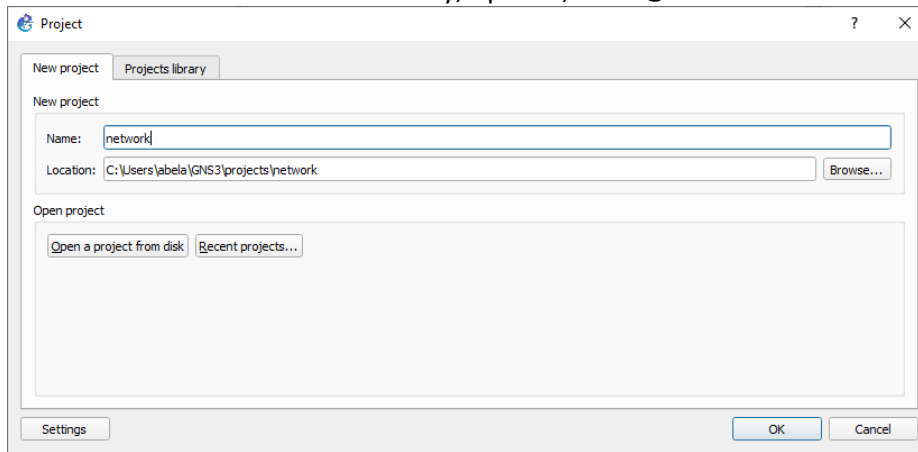
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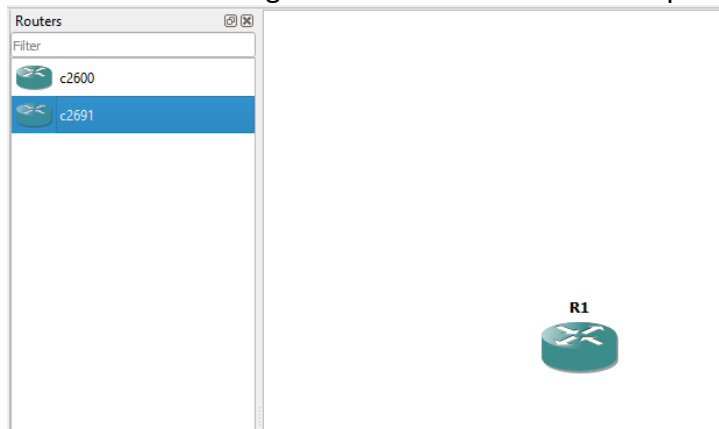
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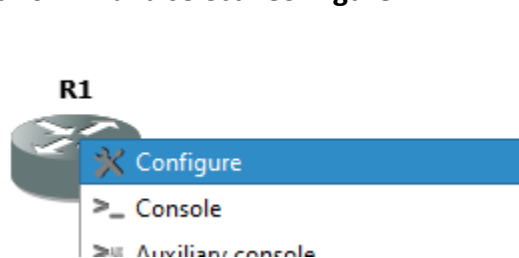


- b. Click on  and drag a C2691 router to the center panel.



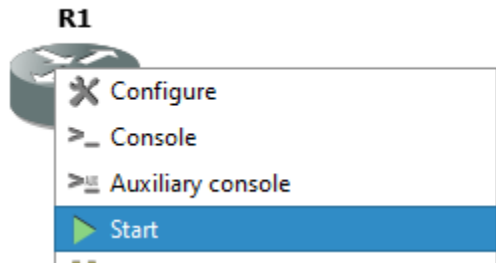
**Note:** By default, this router is referred to as R1.

- c. Right click on R1 and select **“Configure”**.



- d. Navigate to the Slots tab, and click on the drop-down menu for slot 1.  
**Note:** You need to do that while the router is off.
- e. Choose the **NM-4T** adapter. The router originally had two Fast Ethernet ports, but by modifying slot 1, it now has four additional serial ports. Click **“OK”**. Again, the serial port will be used to connect the two routers and the Fast Ethernet ports will be used to connect hosts to routers.
- f. Right-click on R1 and click **“Start”**, then wait a couple of seconds for it to boot.

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- g. Right-click on R1 and click “**Console**”
- h. Type enable to enter privileged mode

R1#enable

- i. Then, type “**config terminal**” to enter the configuration mode.

R1# config terminal

```
R1#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#
```

- j. From here, interfaces can be configured. Type “**int s1/0**”, which will enter the configuration for serial interface 0/0. In this exercise, you will use a serial connection to connect the two routers.

R1 (config)# interface s1/0

```
R1(config)#interface s1/0
R1(config-if)#
```

- k. To enable the interface, type “**no shutdown**”. Shortly after doing so, the router should post that the interface is now up.

R1 (config)# no shutdown

```
R1(config-if)#no shutdown
R1(config-if)#
*Mar  1 00:02:18.615: %LINK-3-UPDOWN: Interface Serial1/0, changed state to up
R1(config-if)#
*Mar  1 00:02:19.619: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/0, changed state to up
R1(config-if)#
```

- l. Set the IP address of s1/0 to 192.168.100.1 with the subnet mask 255.255.255.252, type the following command:

R1 (config-if)# ip address 192.168.100.1 255.255.255.252

- m. Press **Ctrl + C** to return back the privileged (or you can type exit twice).
- n. Before saving the new configuration, type “**show running**”, which will display the running configuration.

R1# show running

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```
interface FastEthernet0/0
  no ip address
  shutdown
  duplex auto
  speed auto
!
interface Serial0/0
  no ip address
  shutdown
  clock rate 2000000
!
interface FastEthernet0/1
  no ip address
  shutdown
  duplex auto
  speed auto
!
interface Serial1/0
  ip address 192.168.100.1 255.255.255.252
--More--
```

**Note:** Press spacebar to view the next segment of data.

*Look for the s1/0 interface – does it have the settings you specified?*

- o. Your changes have taken effect immediately, but if the router is shut down, the changes will disappear. To save what you have done, type “**copy running-config startup-config**”, then press **Enter** to confirm. By doing so, your current configuration becomes the configuration that is loaded whenever the router is booted up.

R1# copy running-config startup-config

- p. Now, you will configure fast ethernet interface (fa 0/0). Type the following commands back to back to enter the interface configuration.

R1# config terminal

R1(config)# interface fa 0/0

- q. Then, type “**no shutdown**” to bring the interface up and press **Enter** once more to enable the interface.

R1 (config)# no shutdown

- r. Type the following command to set R1’s Fast Ethernet address to 192.168.101.1

R1(config-if)# ip address 192.168.101.1 255.255.255.0

- s. Press **Ctrl + C** to return back the privileged (or you can type exit twice).
- t. Before saving the new configuration, type “**show running**”, which will display the running configuration.

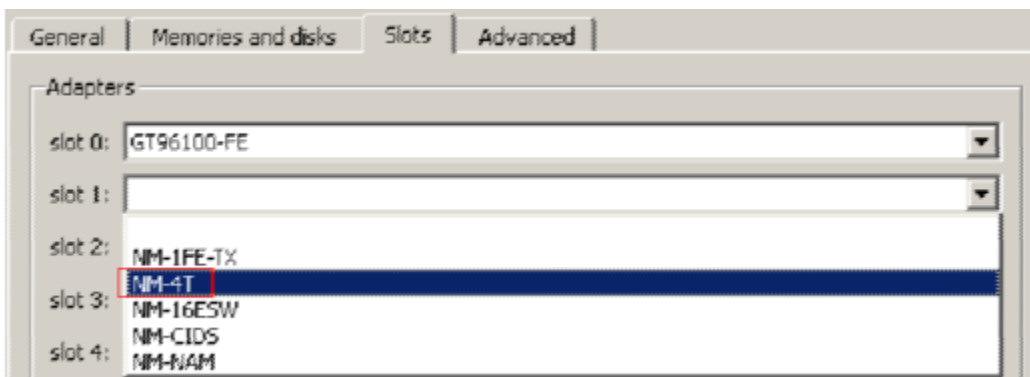
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R1# show running

- u. To save what you have done, type **"copy running-config startup-config"**, then press **Enter** to confirm.

R1# copy running-config startup-config

## 2. Configuring Interfaces for R2

- a. Drag a c2691 router from the Nodes Types column to the empty workspace. By default, this router is referred to as "R2".
- b. Right-click R2 and select **"Configure"**. In the tree to the left, select **"R2"**. Navigate to the Slots tab, and click on the drop-down menu for slot 1.
- c. For this exercise, choose the **NM-4T** adapter. The router originally had two Fast Ethernet ports, but by modifying slot 1, it now has four additional serial ports. Click **"OK"**. Again, the serial port will be used to connect the two routers and the Fast Ethernet ports will be used to connect hosts to routers.





- d. Right-click R2 and click **"Start"**, then click **"Console"**. The router will boot and a console window to the router will open. You need to repeat the configuration steps in part A and configure the interfaces as follows:

S 1/0 192.168.100.2 / 255.255.255.252

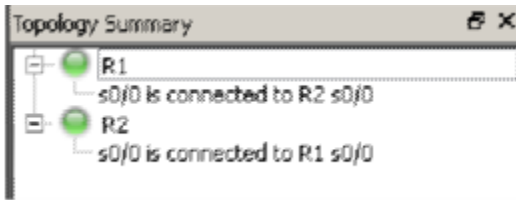
Fa 0/0 192.168.102.1 / 255.255.255.0


## 3. Connecting Nodes

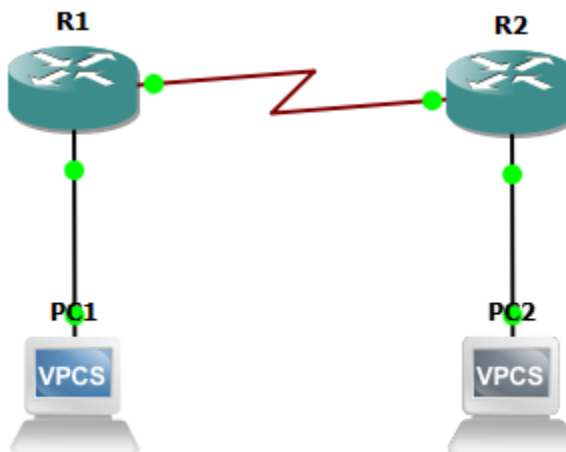
- a. Minimize the console windows so that the GNS3 workspace is visible. At the side bar, click on the  icon.
- b. Click on the icon and select **"Serial"**. This will allow you to attempt to create a serial connection between two nodes. Click on R1 and then click on R2, which will create a red line connecting the two nodes. To exit the Link feature, click on .

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- c. To the right, under Topology Summary, expand the trees for R1 and R2. More details are given regarding the connection that is in place.



- d. From the Nodes Types column to the left, click and drag two **VPCS** hosts to the workspace. These devices are running microcore Linux OS, and they will be used as hosts in this exercise.
- e. In the top bar, click on the connector icon again and select FastEthernet. Click on R1 and then click on Qemu1 and select "e0" to create a connection between the router and host. When finished, exit the Link feature by clicking .
- f. Repeat the previous step, but this time, draw the connection from R2 to PC2.





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**Deliverable**

**Instructions: Please answer the following questions and include screenshots in order to receive a full grade.**

1. Now that the routers have been “physically” connected, they must be tested to see if the serial connection is running successfully. On the privileged console for R1 and R2, try the following and fill the table below with the results:

	Router 1	Success ? (y/n)	Router 2	Success ? (y/n)
1	R1# ping 192.168.102.1		R2# ping 192.168.101.1	
2	R1# ping 192.168.100.2		R2# ping 192.168.100.1	
3	R1# ping 192.168.101.1		R2# ping 192.168.102.1	

2. Discuss why some pings are successful, but others are not.
3. Type “show ip route” on R1 and R2 and explain the results in your own words.
4. From PC1 try to ping PC2? Do you get successful ping results? If no, what do you need to do in order to make the ping work?

**Hint: You will need to use “ip route”.**