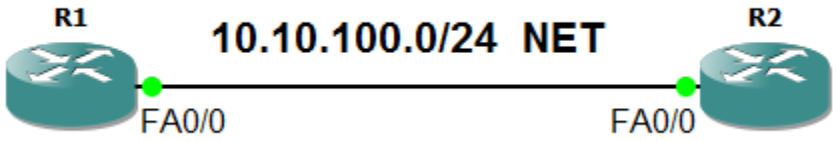
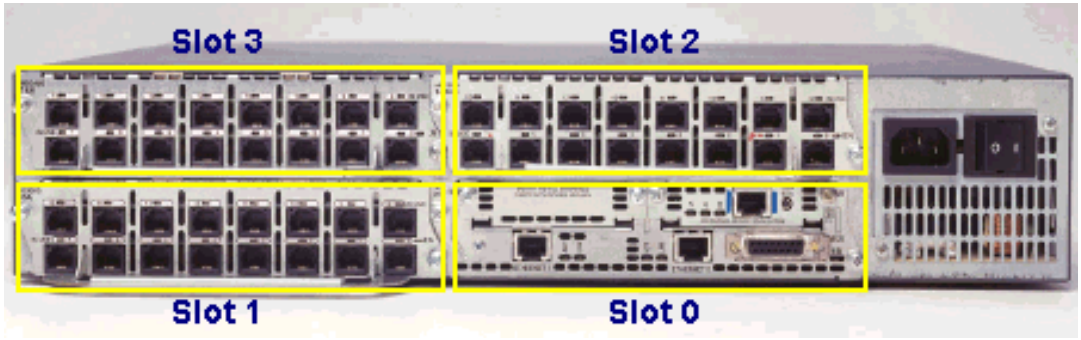
1 Overview

In this in lab study, you will work on GNS3 simulator. You are a member of a team working as networking specialists at North American University. One of the school buildings has a dedicated link to connect their Willowbrook campus to the Sugar Land campus. You are not allowed to use routing protocols because the school is paying for every single bit that's sent on the links. You need to do use static routing to get the job done and reduce the cost.



2 Router/IOS

In this in lab study, you will use the following image file c3640-jk9s-mz.124-16.bin, which corresponds to Cisco 3600 Series, Chassis 3640 Router.



Cisco 3640 Router Rear View

Each network interface on a Cisco 3600 series router is identified by a slot number and a port number. A Cisco 3600 series router chassis contains two, four, or six slots in which you can install modules. You can install any module into any available slot in the chassis.

For the Cisco 3640 router, the slots are numbered as follows:

- Slot 0 is at the bottom right (as viewed from the rear of the chassis).
- Slot 1 is at the bottom left.
- Slot 2 is at the top right, above slot 0.
- Slot 3 is at the top left, above slot 1.

Port numbers begin at 0 for each slot, and continue from right to left and (if necessary) from bottom to top. Modules and WAN interface cards are identified by interface type, slot number, a forward slash (/), and the port number, for example Ethernet 0/0.

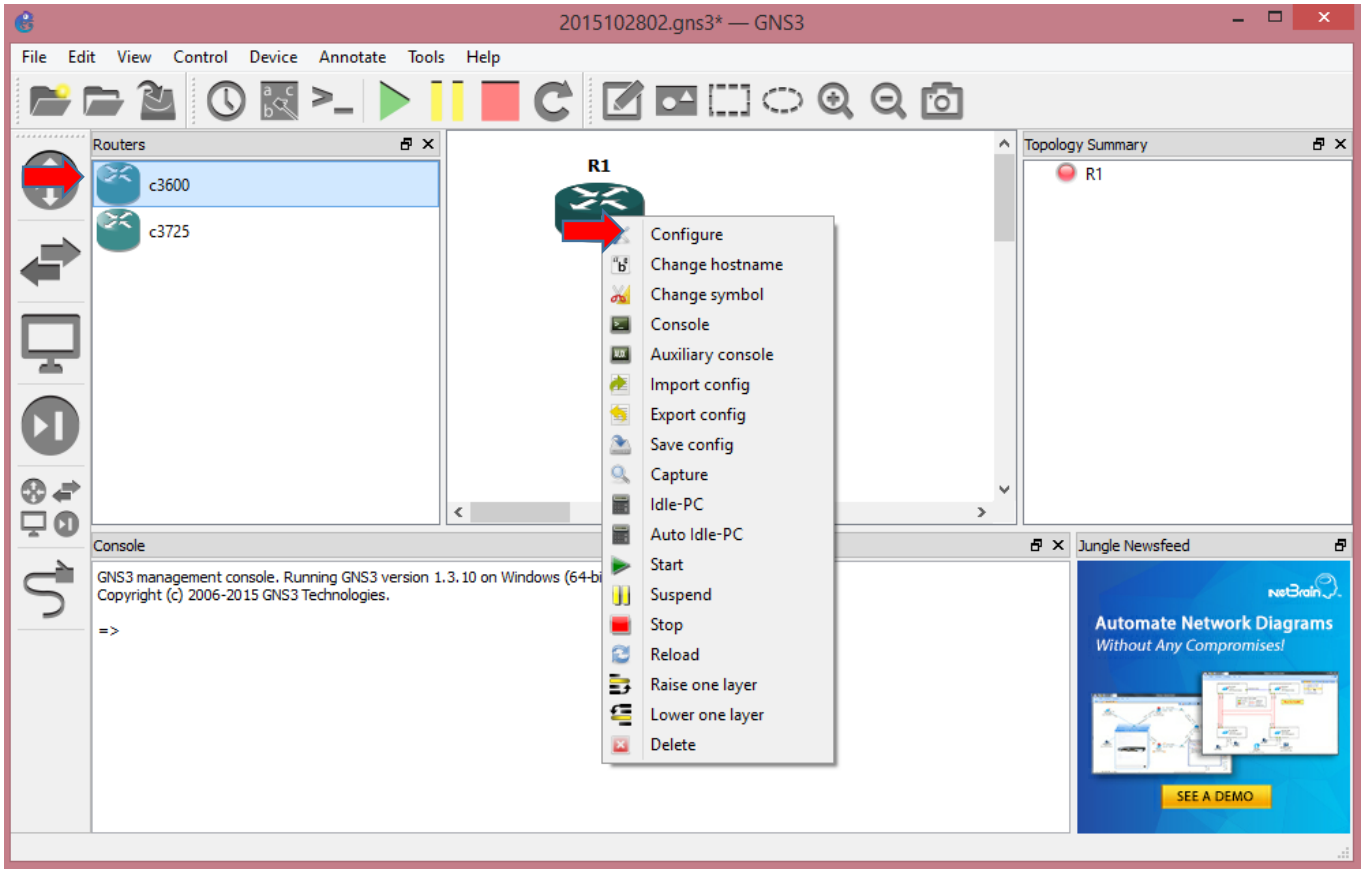
3 GNS3 Simulation Structure

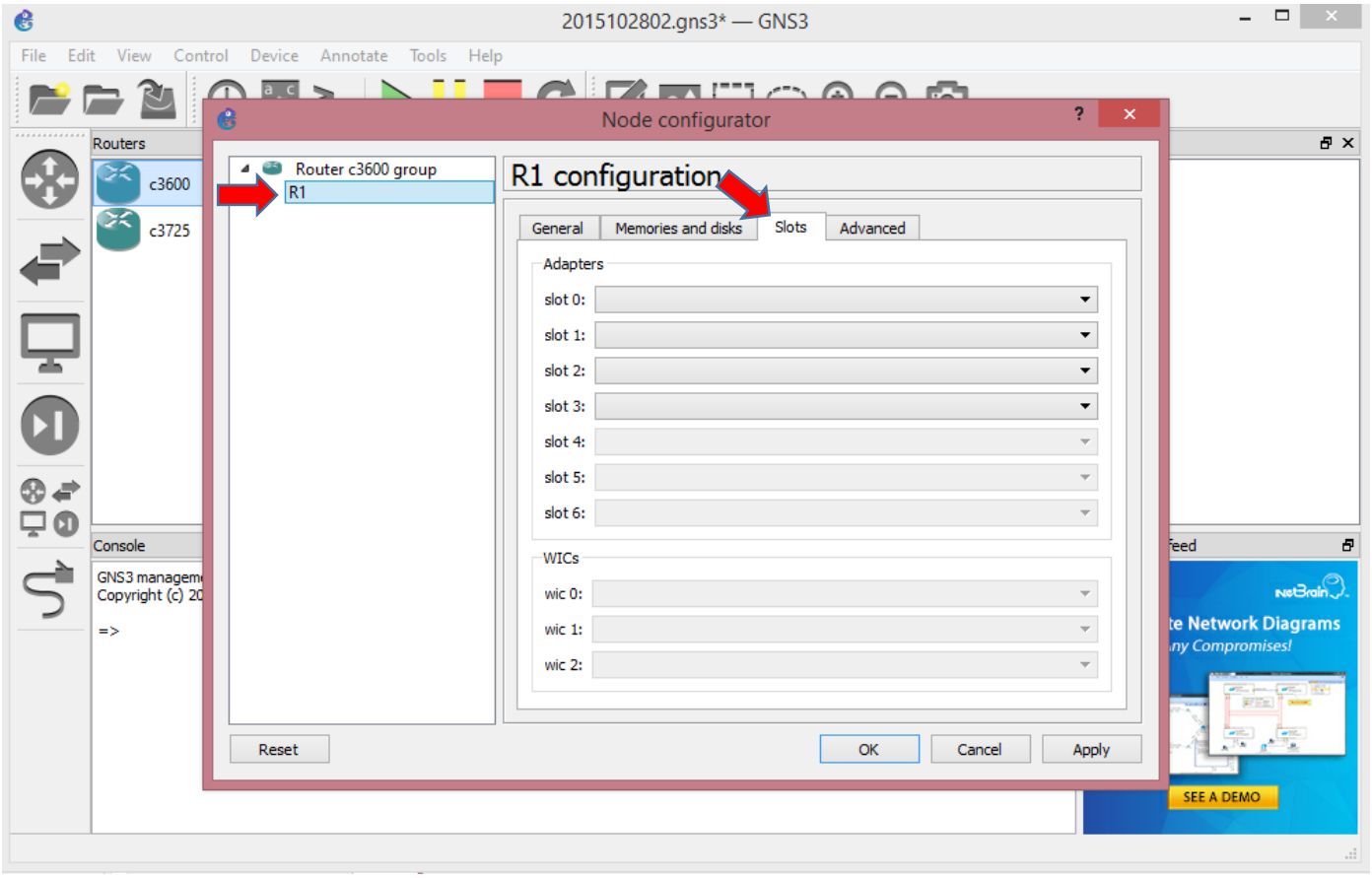
We use functions to break a problem into smaller sub-problems. This reduces program complexity. The `main` function will be the driver of the program.

3.1 Topology

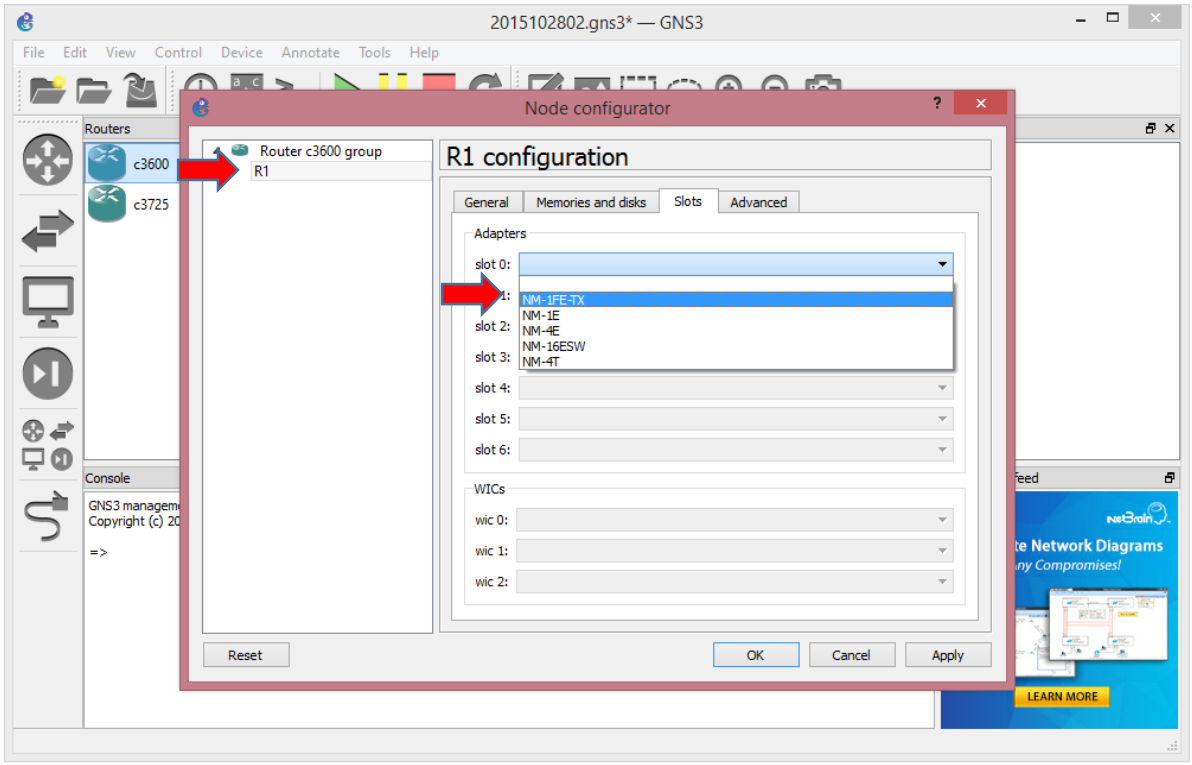
Let's build the topology shown with two routers. Start GNS3. Drag two routers running an IOS you have configured into the workspace. GNS3 gives each router a default name beginning with R. If you would like to

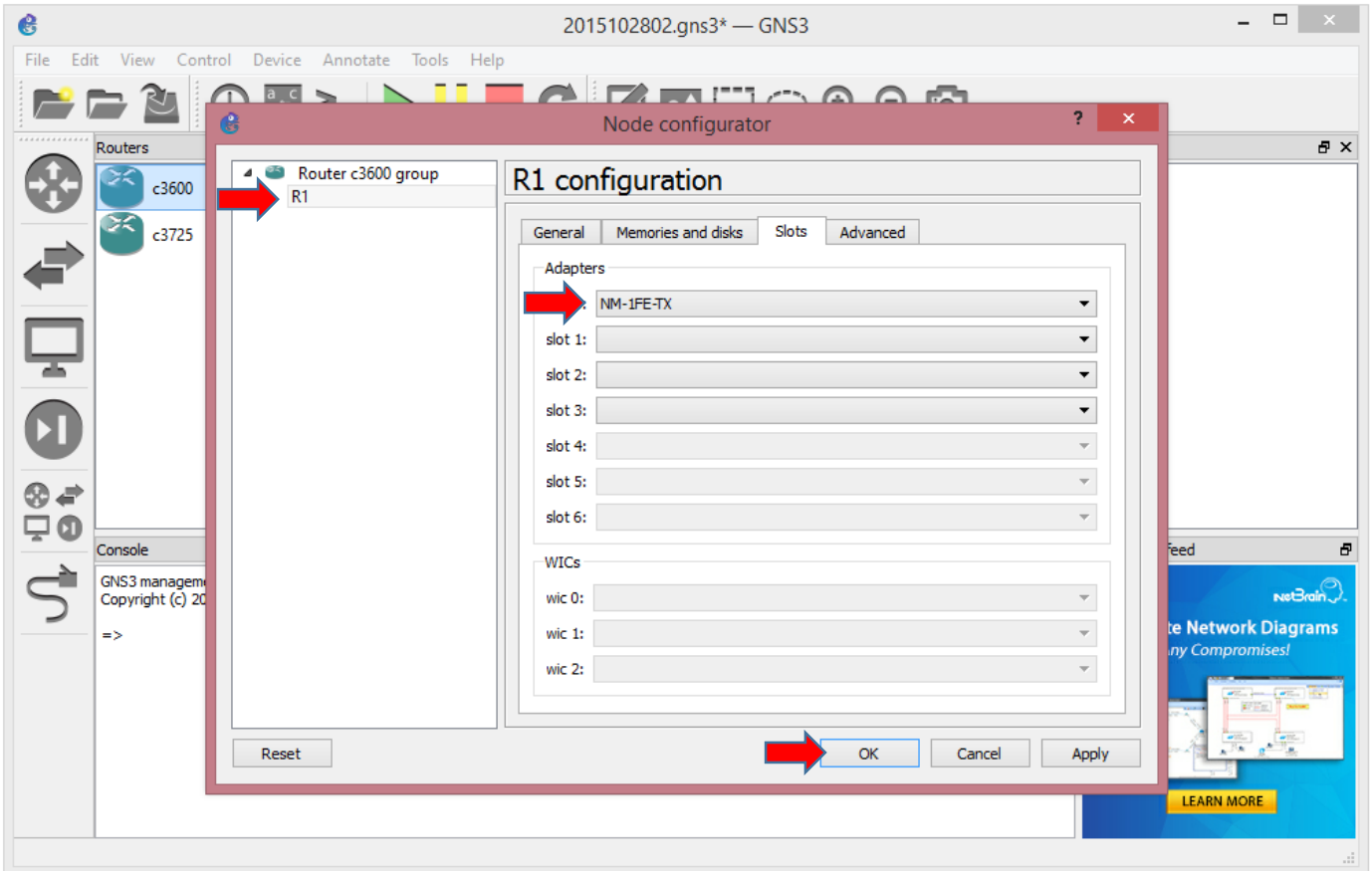
change the name, right-click on a router and choose Change the hostname.Right-click the router and choose Configure.





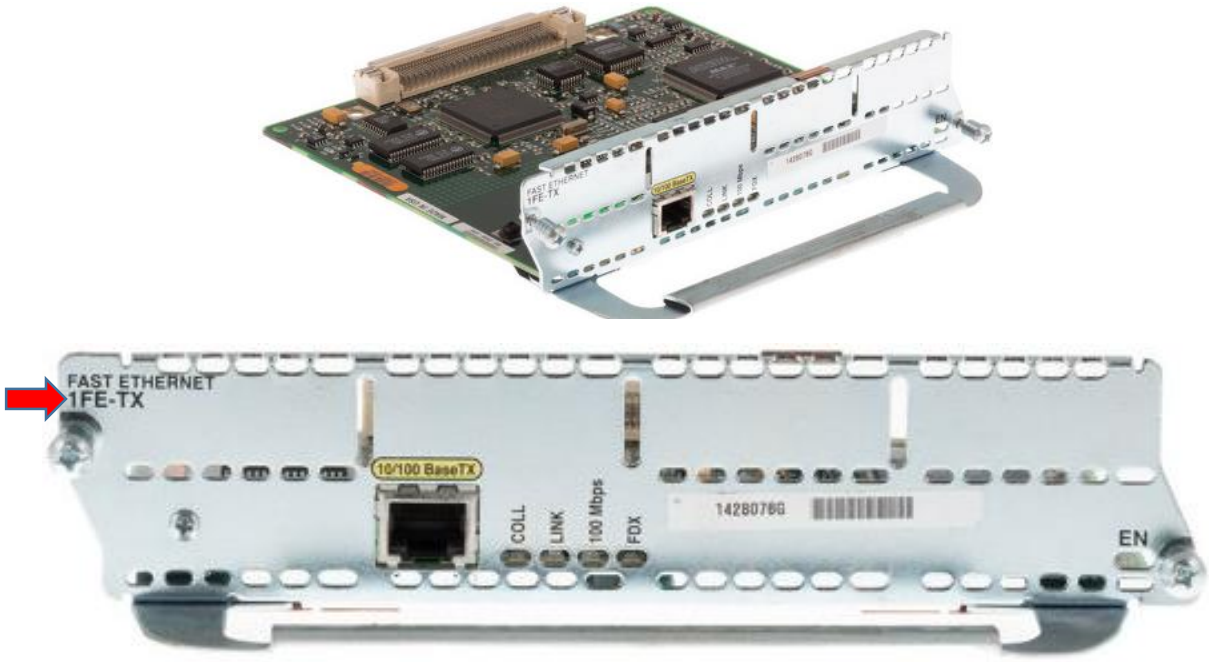
Click on R1 and then the Slots tab. Click the drop-down arrow next to slot0 and choose an adapter that includes FE. As you notice, only first 4 slots are selectable as expected.





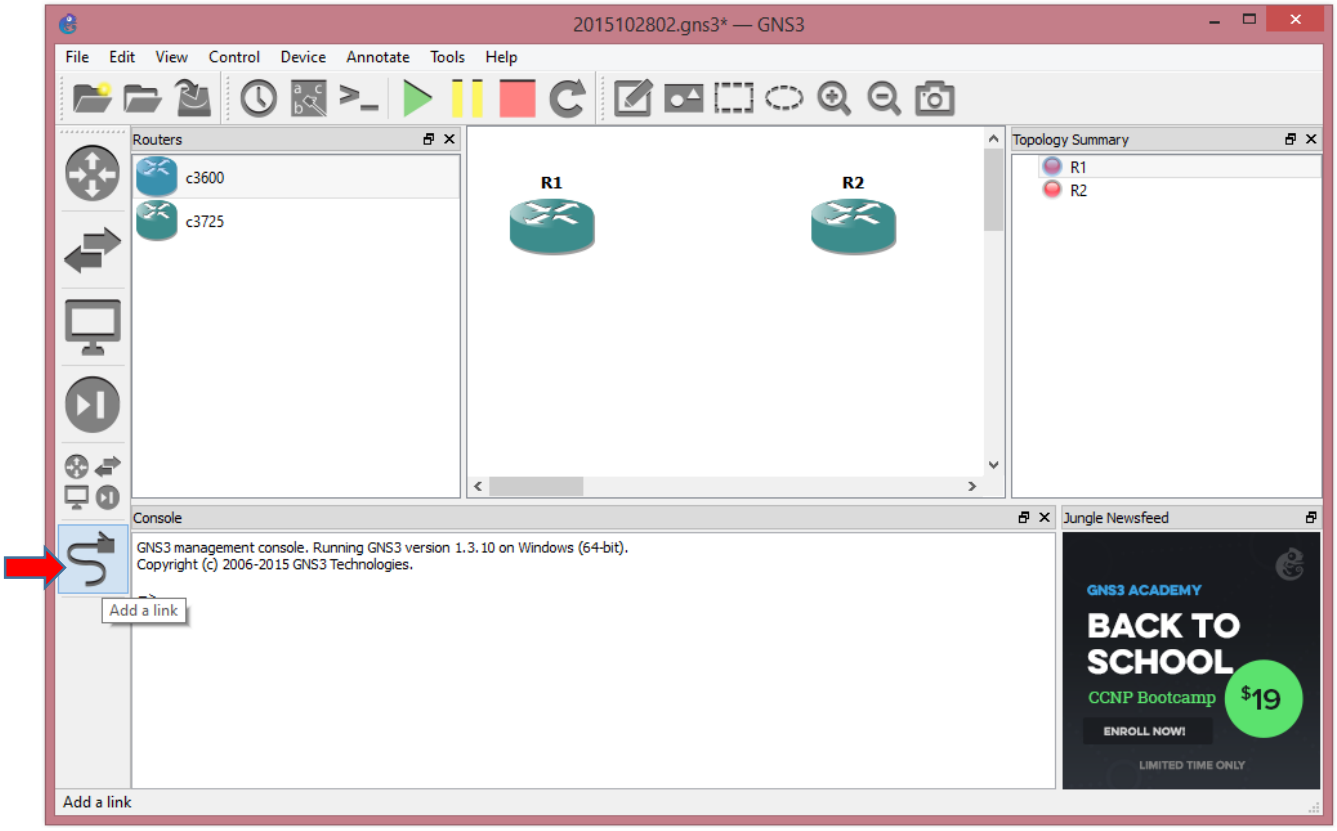
This will add a NM-1FE-TX Fast Ethernet adapter to the router. Click OK.

NM-1FE-TX is One-port Fast Ethernet (10/100BaseTX interface). VLAN support on the NM-1FE-TX module, allows network managers to group users logically rather than by physical location, easing adds, moves, and changes within the network.

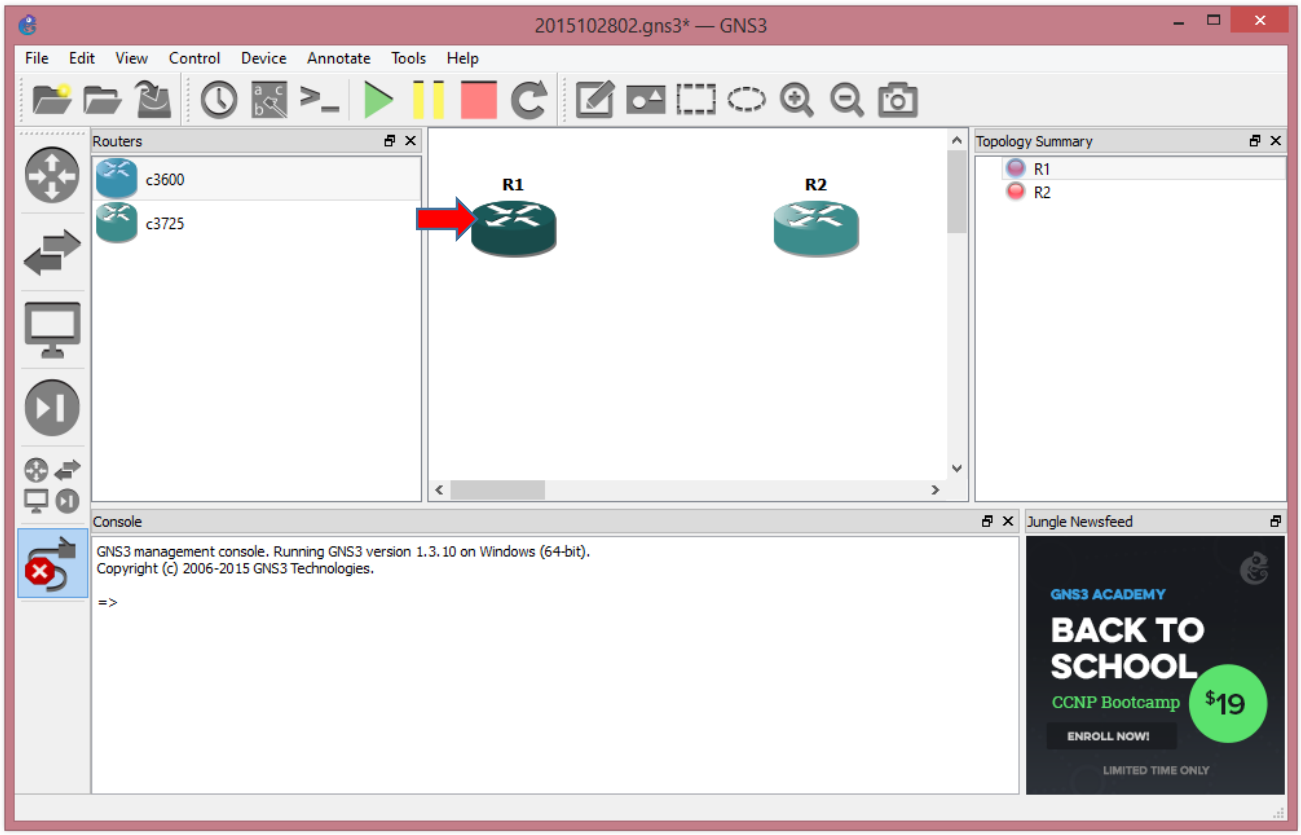


NM-1FE-TX Rear View

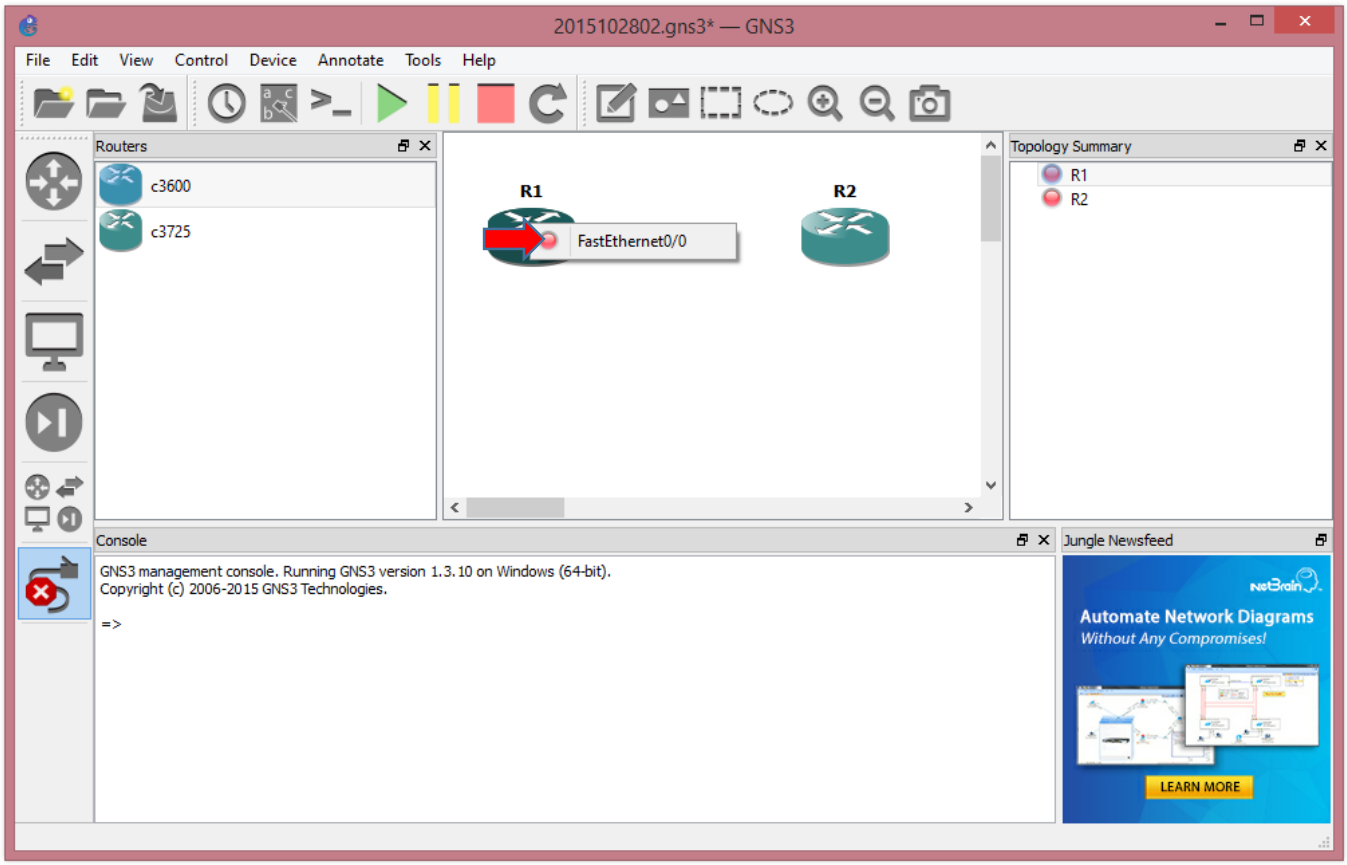
Add the same adapter to the second router. Now you are ready to connect the routers. Click the Add a link button on the toolbar at the top.

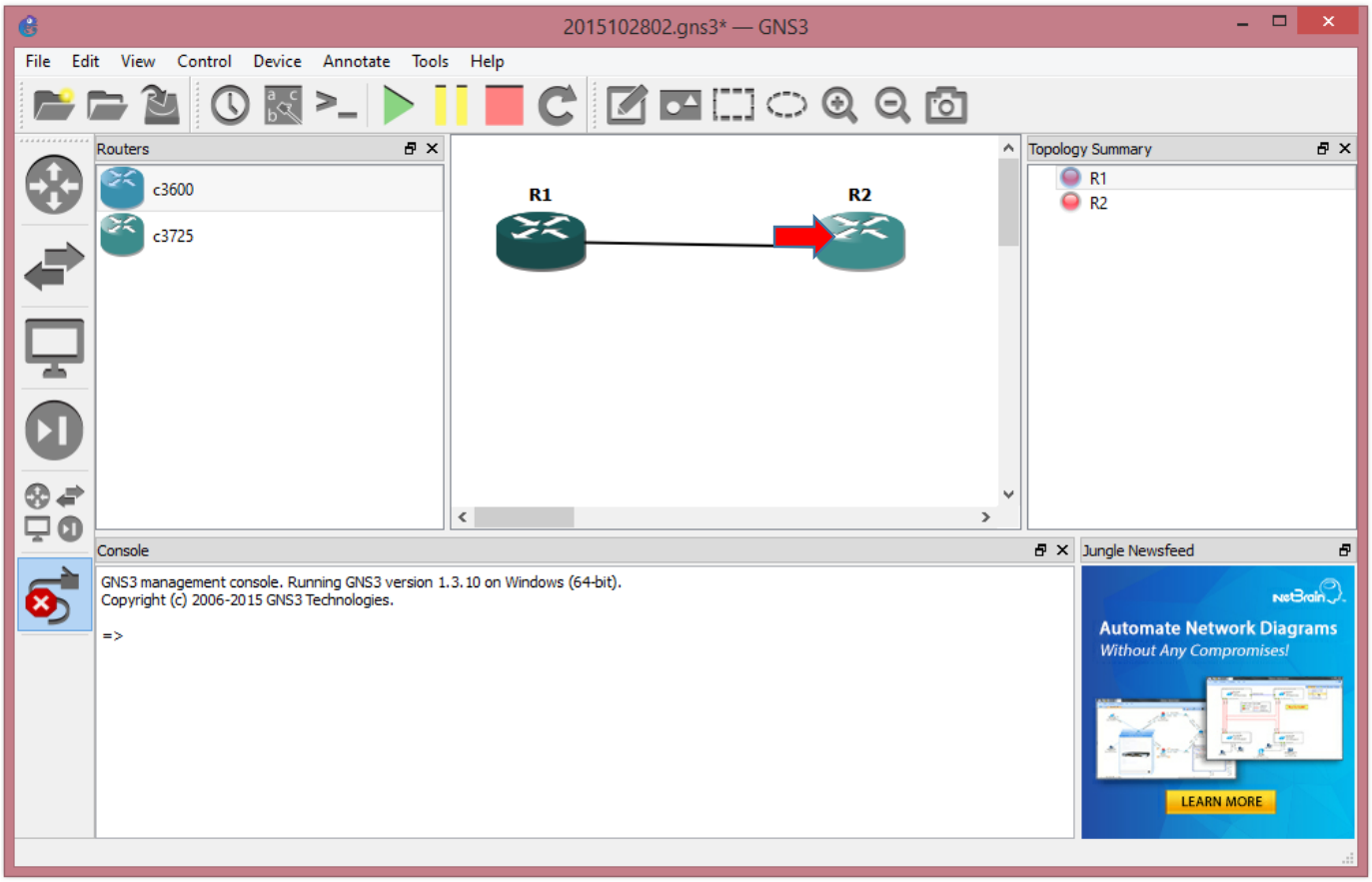


When Add a link functionality is active, there will be a red Stop sign on it.

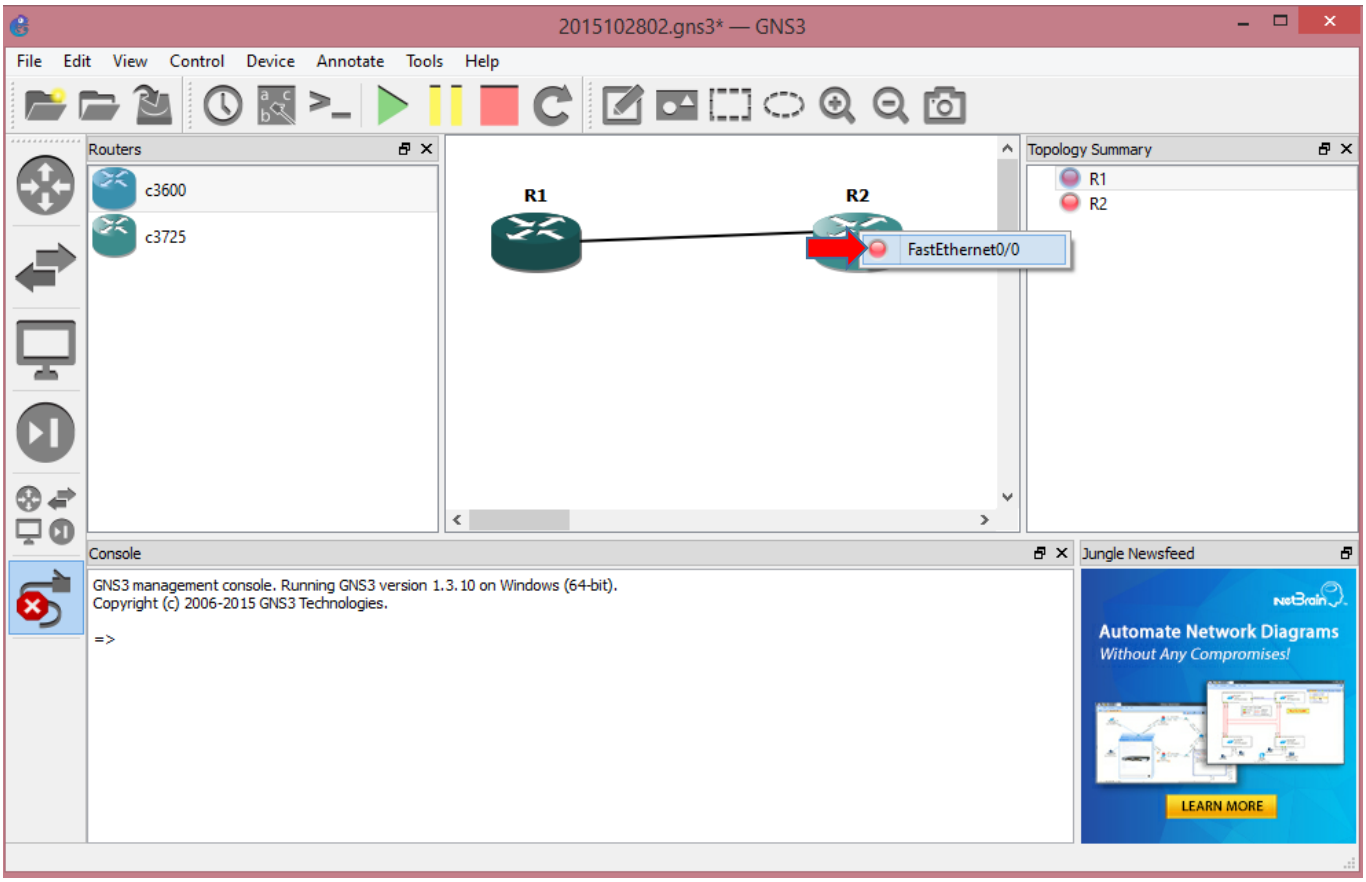


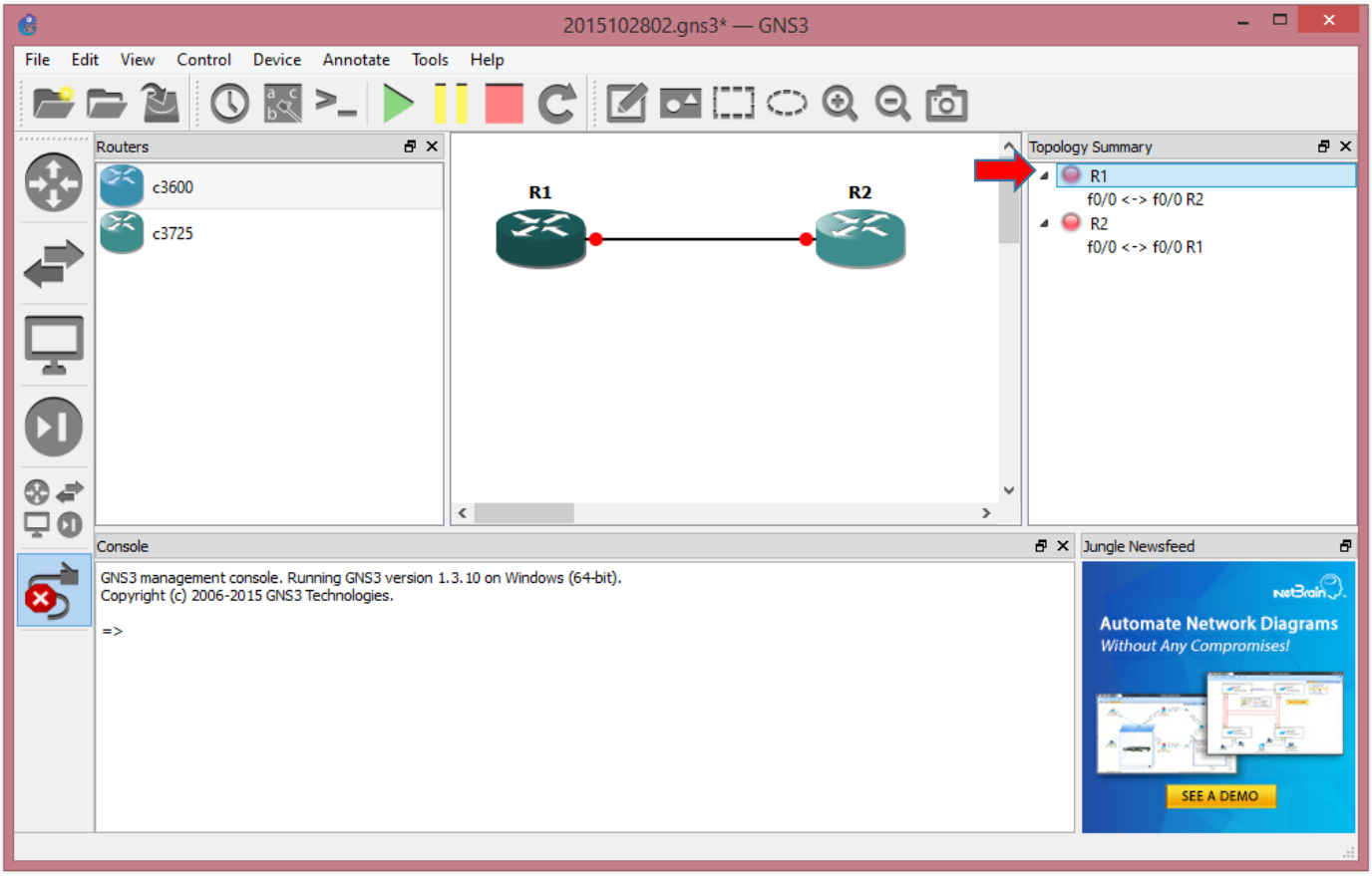
Click on R1 and select FastEthernet0/0



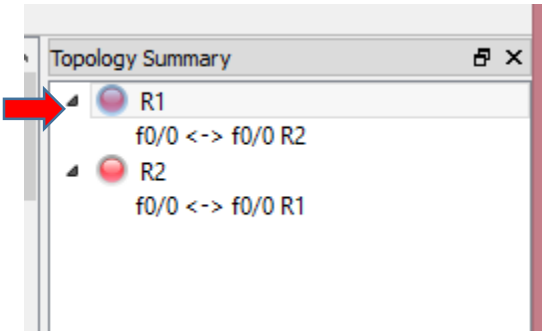


then click on R2 and select FastEthernet0/0.

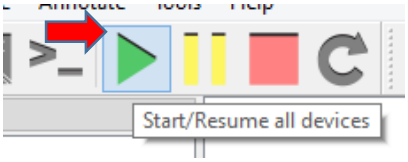


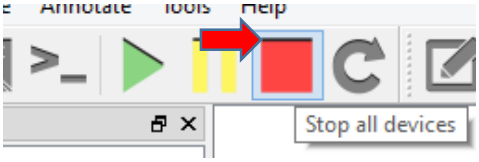


Notice the right-pane call Topology Summary. Your connections are now available for viewing by clicking the arrow next to each router.

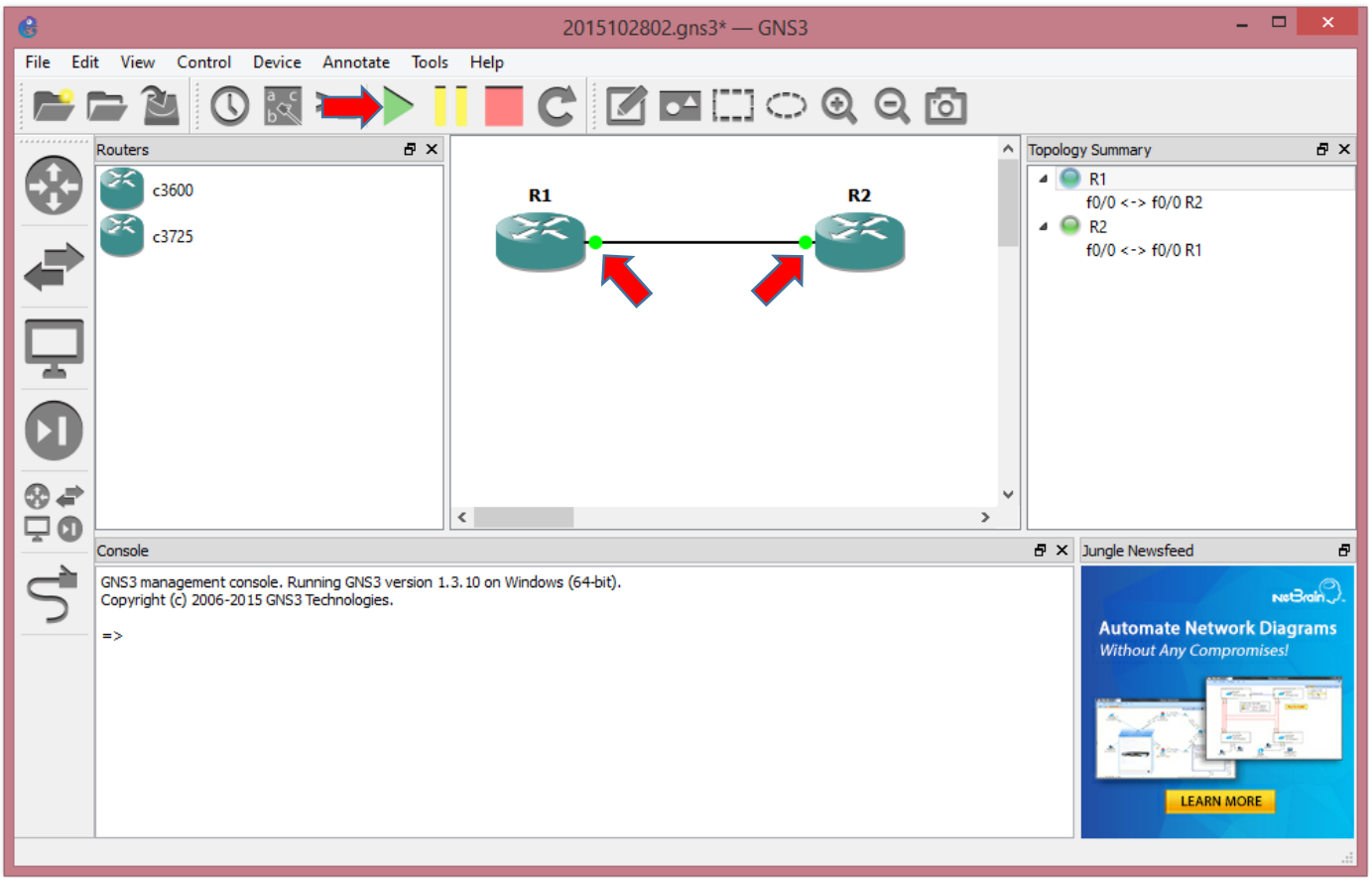


In addition, please have a look at the buttons on the toolbar.

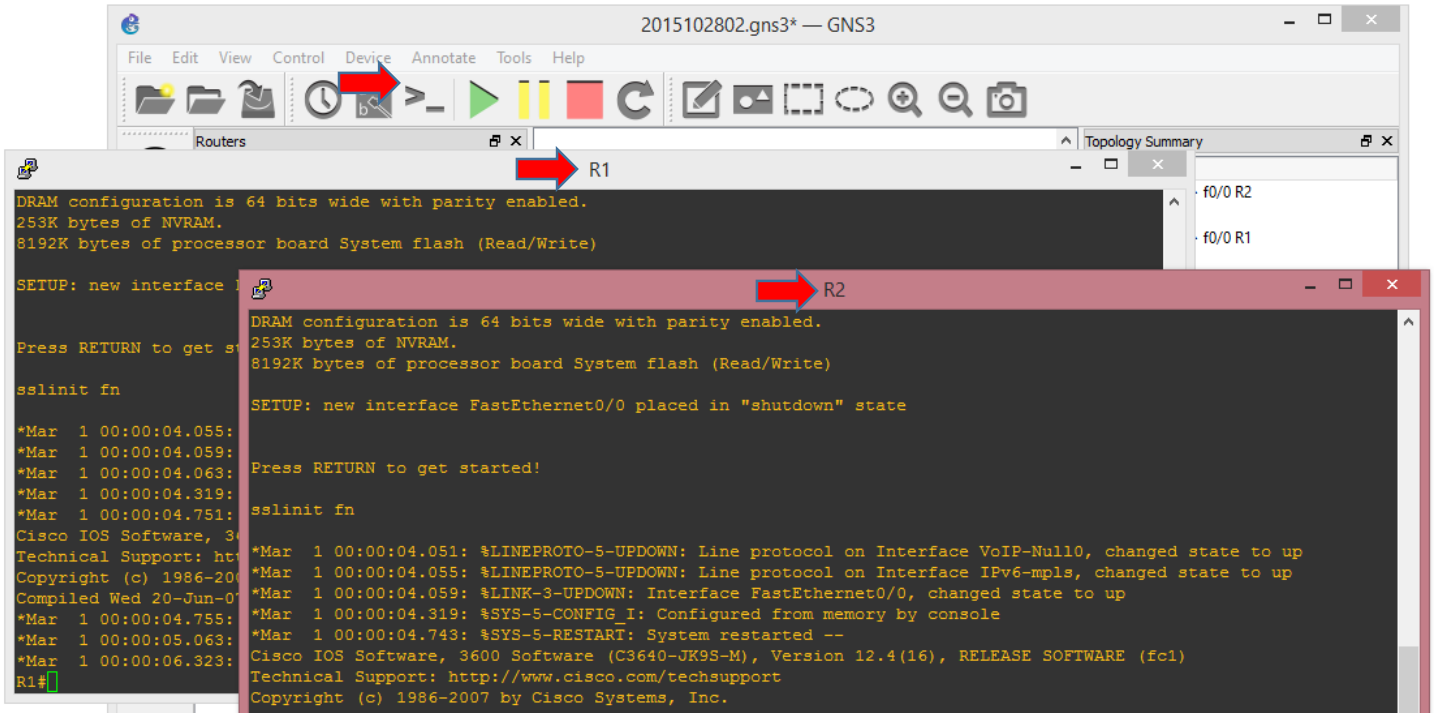




Let's start the routers by clicking the Start/Resume all devices button on the toolbar, and the links will turn green.



If we click the Console connect to all devices button, we may observe the boot-up process of each router. A separate console window will open for each router.



You may now configure each router. In our lab study, you will change the hostnames, assign IP addresses to the interfaces and turn them on, and finally test connectivity by using pings.

3.2 Routed Port Configuration

Routers can have Ethernet (10 Mbps), Fast Ethernet (100 Mbps), Gigabit Ethernet (1,000 Mbps), and 10 gigabit (10 GB), Serial, and ATM interfaces. A router can have multiple interfaces, and the steps for configuring each interface are basically the same. Each interface is assigned a number. In our case, Cisco 3640 Router has 4 interfaces: Slot 0, Slot 1, Slot 2, and Slot 4. The notation 0/0 indicates the [interface-card-slot/port]. Our routers have 1-port interfaces, so each has one FastEthernet 0/0 interface. On Cisco's routers, a routed port can be configured simply by assigning an IP address to the interface. Once an IP address and its subnet mask are assigned to the interface and the interface is enabled, a Layer 3 network is created. The interface IP address becomes the gateway for that network. To program the interface, the router must be in the configuration mode. In the terminals, to enter privileged EXEC mode, or any other security level set by a system administrator, use the enable command. Entering privileged EXEC mode enables the use of privileged commands.

```
R1# enable
```

To access global configuration mode, use the configure terminal command in privileged EXEC mode:

```
R1# enable
R1# configure terminal
```

As shown below, note that the system prompt changes to indicate that you are now in global configuration mode.

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

To set the hostname, enter the command hostname name.

```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
```

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

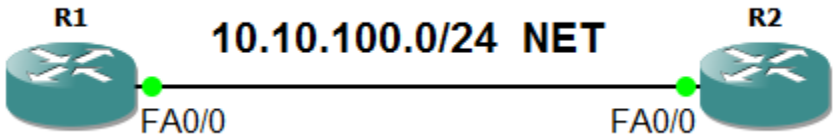
To select a particular Fast Ethernet interface for configuration, use the interface fastethernet slot/port command in global configuration mode.

```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
Willowbrook(config)# interface fastethernet 0/0
```

Note that the system prompt changes to indicate the interface mode.

```
R1#enable
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname Willowbrook
Willowbrook(config)#interface fastethernet 0/0
Willowbrook(config-if)#
```

The next step is to assigning IP addresses to the network interface. An IP address identifies a location to which IP datagrams can be sent. To set a primary IP address for an interface, we use the command ip address ip-address mask.




```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
Willowbrook(config)# interface fastethernet 0/0
Willowbrook(config-if)# ip address 10.10.100.1 255.255.255.0
```

```
R1#enable
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname Willowbrook
Willowbrook(config)#interface fastethernet 0/0
Willowbrook(config-if)#ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)#
```

Use the shutdown interface configuration command to disable an interface. Use the no form of this command to restart a disabled interface.

```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
Willowbrook(config)# interface fastethernet 0/0
Willowbrook(config-if)# ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)# no shutdown
```

Notice that the router prompts you that the line protocol on interface FastEthernet 0/0 changed state to up.

```
R1#enable
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname Willowbrook
Willowbrook(config)#interface fastethernet 0/0
Willowbrook(config-if)#ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)#no shutdown
Willowbrook(config-if)#
*Mar  1 01:14:53.255: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 01:14:54.255: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Willowbrook(config-if)#
```

To exit any configuration mode to the next highest mode in the Command-Line Interface (CLI) mode hierarchy, use the exit command in any configuration mode.

```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
Willowbrook(config)# interface fastethernet 0/0
Willowbrook(config-if)# ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)# no shutdown
Willowbrook(config-if)# exit
```

```
R1#enable
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname Willowbrook
Willowbrook(config)#interface fastethernet 0/0
Willowbrook(config-if)#ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)#no shutdown
Willowbrook(config-if)#
*Mar  1 01:14:53.255: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 01:14:54.255: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Willowbrook(config-if)#exit
Willowbrook(config)#
```

To end the current configuration session and return to privileged EXEC mode, use the end global configuration command.

```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
Willowbrook(config)# interface fastethernet 0/0
Willowbrook(config-if)# ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)# no shutdown
Willowbrook(config-if)# exit
Willowbrook(config)# end
```

Note that the system prompt changes to indicate that you exit from the global configuration mode.

```
R1#enable
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname Willowbrook
Willowbrook(config)#interface fastethernet 0/0
Willowbrook(config-if)#ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)#no shutdown
Willowbrook(config-if)#
*Mar  1 01:14:53.255: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 01:14:54.255: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Willowbrook(config-if)#exit
Willowbrook(config)#end
Willowbrook#
*Mar  1 01:33:41.911: %SYS-5-CONFIG_I: Configured from console by console
Willowbrook#
```

To verify the status of the router interfaces, we can use the command show ip interface brief at the prompt (RouterName#).

```
R1# enable
R1# configure terminal
R1(config)# hostname Willowbrook
Willowbrook(config)# interface fastethernet 0/0
Willowbrook(config-if)# ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)# no shutdown
Willowbrook(config-if)# exit
Willowbrook(config)# end
Willowbrook# show ip interface brief
```

```
R1#enable
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname Willowbrook
Willowbrook(config)#interface fastethernet 0/0
Willowbrook(config-if)#ip address 10.10.100.1 255.255.255.0
Willowbrook(config-if)#no shutdown
Willowbrook(config-if)#
*Mar  1 01:14:53.255: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 01:14:54.255: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Willowbrook(config-if)#exit
Willowbrook(config)#end
Willowbrook#
*Mar  1 01:33:41.911: %SYS-5-CONFIG_I: Configured from console by console
Willowbrook#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.10.100.1     YES manual up                    up
Willowbrook#
```

Let us highlight the log message:

```
Willowbrook# show ip interface brief
Interface          IP-Address       OK?    Method    Status    Protocol
FastEthernet0/0    10.10.100.1      YES    manual    up        up
```

The output shows that the interface FastEthernet0/0 was configured with the IP address and its status is up.

Please take screen shot of the ENTIRE SCREEN for Willowbrook router!!! You are going to submit the screenshot (**FirstName1LastName1FirstName2LastName2**Image1.png).

Please remember that we have 2 separate console windows for 2 routers. Please repeat all the steps for the **second router in the second console window**.

```
R2# enable
R2# configure terminal
R2(config)# hostname SugarLand
SugarLand(config)# interface fastethernet 0/0
SugarLand(config-if)# ip address 10.10.100.2 255.255.255.0
SugarLand(config-if)# no shutdown
SugarLand(config-if)# exit
SugarLand(config)# end
SugarLand# show ip interface brief
```

```
R2#enable
R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#hostname SugarLand
SugarLand(config)#interface fastethernet 0/0
SugarLand(config-if)#ip address 10.10.100.2 255.255.255.0
SugarLand(config-if)#no shutdown
SugarLand(config-if)#
*Mar  1 01:53:25.671: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 01:53:26.671: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
SugarLand(config-if)#exit
SugarLand(config)#end
SugarLand#s
*Mar  1 01:55:44.247: %SYS-5-CONFIG_I: Configured from console by console
SugarLand#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.10.100.2     YES manual up                    up
SugarLand#
```

Let us highlight the log message:

```
SugarLand# show ip interface brief
Interface          IP-Address      OK?    Method    Status    Protocol
FastEthernet0/0    10.10.100.2     YES    manual    up        up
```

Please take screen shot of the ENTIRE SCREEN for SugarLand router!!! You are going to submit the screenshot (**FirstName1LastName1FirstName2LastName2**Image2.png).

3.3 Test Connectivity

The ping (Packet InterNet Groper) command is a very common method for troubleshooting the accessibility of devices. It uses two Internet Control Message Protocol (ICMP) query messages, ICMP echo requests, and ICMP echo replies to determine whether a remote host is active. The ping command also measures the amount of time it takes to receive the echo reply. The ping command first sends an echo request packet to an address, and then it waits for a reply.

In the console window for `SugarLand` router, please test if `SugarLand` router is able to ping `Willowbrook` router.

```
SugarLand#ping 10.10.100.1
```

```
SugarLand#ping 10.10.100.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.100.1, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 60/64/76 ms
SugarLand#
```

Please take screen shot of the ENTIRE SCREEN for `SugarLand` router!!! You are going to submit the screenshot (**`FirstName1LastName1FirstName2LastName2Image3`**`.png`) .

Repeat the same steps for the `Willowbrook` router. In the console window for `Willowbrook` router, please test if `Willowbrook` router is able to ping `SugarLand` router.

```
Willowbrook#ping 10.10.100.2
```

```
Willowbrook#ping 10.10.100.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.100.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/61/64 ms
Willowbrook#
```

Please take screen shot of the ENTIRE SCREEN for `Willowbrook` router!!! You are going to submit the screenshot (**`FirstName1LastName1FirstName2LastName2Image4`**`.png`) .

4 Grading

Your file names must be as follows:

FirstName1LastName1FirstName2LastName2Image1.png	35 points
FirstName1LastName1FirstName2LastName2Image2.png	35 points
FirstName1LastName1FirstName2LastName2Image3.png	15 points
FirstName1LastName1FirstName2LastName2Image4.png	15 points

5 References

[1] http://www.cisco.com/public/scc/compass/3600/information_files/inf_3600_interface_numbering.htm#fig3
[2] http://www.cisco.com/en/US/products/hw/routers/ps274/products_data_sheet09186a0080091b89.html
[3] http://www.cablesandkits.com/cisco-1port-fast-ethernet-network-module-nm1fetx-p-867.html
[4] A Practical Guide to Advanced Networking, 3rd Edition
[5] http://www.cisco.com/c/en/us/td/docs/ios/12_2/configfun/command/reference/ffun_r/frf001.html#wp1017386
[6] http://www.cisco.com/c/en/us/td/docs/ios/12_2/configfun/configuration/guide/ffun_c/fcf001.html
[7] http://www.cisco.com/c/en/us/td/docs/security/asa/asa90/configuration/guide/asa_90_cli_config/basic_hostname_pw.html
[8] http://www.cisco.com/c/en/us/td/docs/ios/12_2/ip/configuration/guide/fipr_c/1cfipadr.html
[9] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst2960/software/release/12-2_55_se/command/reference/2960_cr/cli3.html
[10] http://www.cisco.com/c/en/us/support/docs/ip/routing-information-protocol-rip/13730-ext-ping-trace.html