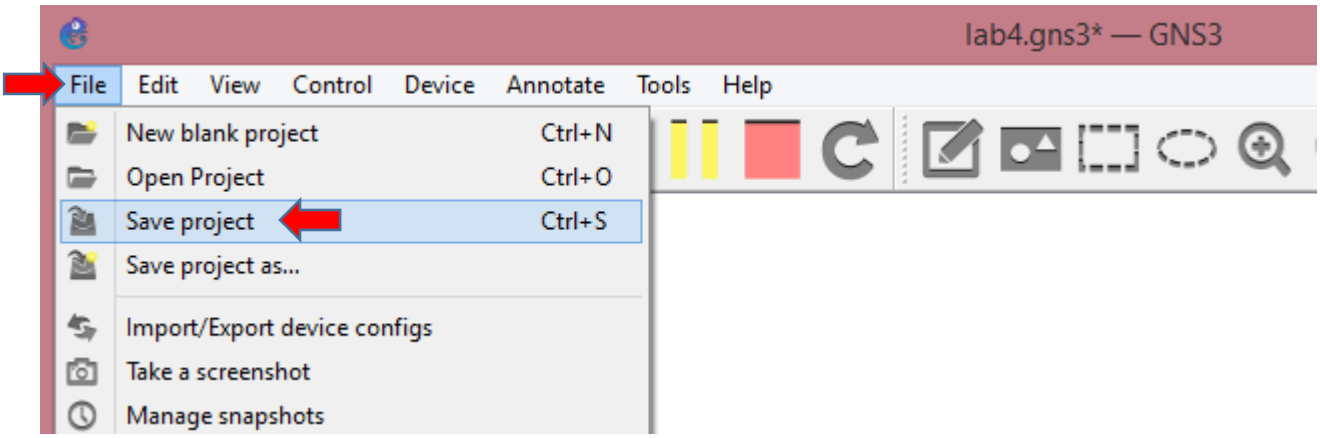
1 Saving Project in GNS3

You may experience problems with saving configurations in GNS3. The command **copy** copies any file from a source to a destination. The **system:running-config** keyword represents the current running configuration file. The **nvram:startup-config** keyword represents the configuration file used during initialization (startup). This file is contained in NVRAM for all platforms except the Cisco 7000 family, which uses the CONFIG_FILE environment variable to specify the startup configuration. The Cisco 4500 series cannot use the copy running-config startup-config command. Please follow the steps below to make sure everything is properly saved.

Step1: Configure the router

Step2: `R1#copy running-config startup-config`

Step3:



TIP: In Cisco IOS software, aliases are used to cut down on the amount of typing you need to perform. For example, it is easier to type **copy run start** (the abbreviated form of the **copy running-config startup-config** command) than it is to type **copy system:r nvram:s** (the abbreviated form of the **copy system:running-config nvram:startup-config** command). These aliases also allow you to continue using some of the common commands used in previous versions of Cisco IOS software.

After you complete the ip configuration for the Los Angeles router (please see the topology below), please stop and re-start the simulation, and run the command **show interface ip brief**. If you could save the configuration successfully, you should see that Method field is not manual but NVRAM.

```
LosAngeles#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.20.2    YES manual up                    up
FastEthernet1/0            192.168.40.1    YES manual up                    up
Loopback0                  2.2.2.2         YES manual up                    up
LosAngeles#
```

Before Saving

```
LosAngeles#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.20.2    YES NVRAM  up                    up
FastEthernet1/0            192.168.40.1    YES NVRAM  up                    up
Loopback0                  2.2.2.2         YES NVRAM  up                    up
LosAngeles#
```

After Saving

2 Overview: RIP – Dynamic Routing

As you experience in the previous lab study, the time required for entering and maintaining the static routes is a problem. This lab introduces an improvement over static routing through the use of dynamic routing protocols. Dynamic routing protocols enable the router's routing tables to be dynamically updated to account for a loss or a change in routes or changes in data traffic.

Routing Information Protocol (RIP) is a dynamic routing protocol, meaning the routers periodically exchange routes. RIP is a standard protocol, not a proprietary protocol, meaning that the use of the protocol is not limited to certain equipment manufacturers. RIP is classified as a distance vector protocol using router hop count as the metric. The limitation of this approach is that RIP does not take into consideration whether the higher hop count route might have higher bandwidth. A distance vector protocol is a routing algorithm that periodically sends the entire routing table to its neighboring or adjacent router. When the neighboring router receives the table, it assigns a distance vector number to each route. The distance vector number is typically specified by some metric, such as hop count.

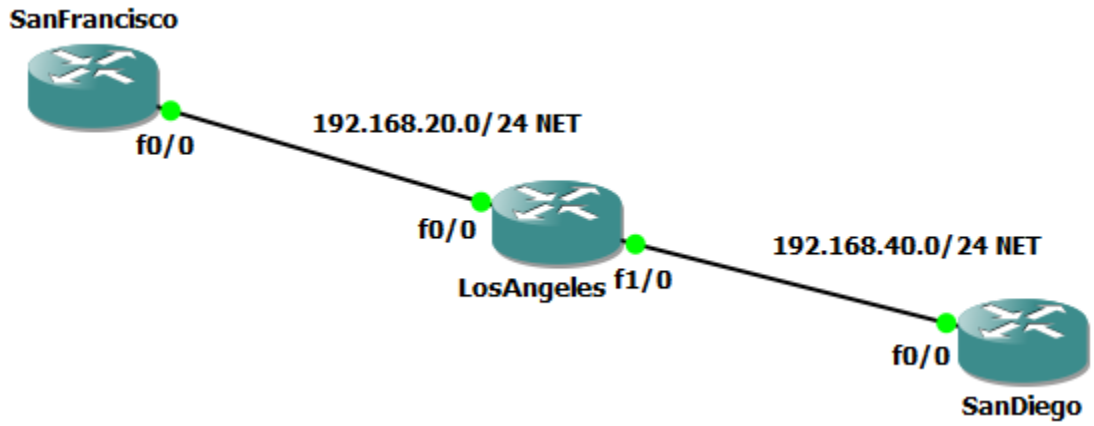
RIP permits a maximum of 15 hops to prevent routing loops. RIP and other distance vector routing protocols send the entire routing table to neighbor routers at regular time intervals. The default time interval for RIP for exchanging routing tables is 30 seconds. This results in slow route convergence, and if there are multiple routers sharing RIP routes, there will be even longer convergence time. Convergence refers to the case where a router obtains a clear view of the routes in a network. The time it takes for the router to obtain a clear view is called the convergence time.

The original specification of RIP (RIPv1), defined in RFC 1058, was published in 1988 and uses classful routing. Due to the deficiencies of the original RIP specification that makes it inefficient in handling a lot of newer IP features, RIP version 2 (RIPv2) was developed in 1993 and last standardized in 1998. It introduced new features, such as support for Variable Length Subnet Mask (VLSM) and Classless Inter-Domain Routing (CIDR), router authentication, next hop specification, route tag, and the use of multicasting.

RIP is a relatively simple routing protocol to configure. However, RIP is good only for very small networks that have a limited staff size for managing the network and is not suited for networks that need fast convergence.

3 Network Topology

You will use the image file c3640-jk9s-mz.124-16.bin (i.e., c3600 series) for this lab study. Add one NM-1FE-TX module to the router San Francisco, add two NM-1FE-TX modules to the router Los Angeles, and add one NM-1FE-TX module to the router San Diego to the slots as shown below.



The next step in configuring the router for RIP is to set up the interfaces. This includes assigning an IP address and a subnet mask to the interface using the commands described in the previous lab studies. Please do not forget to enable the interfaces using the **no shut** command.

San Francisco

- f0/0: 192.168.20.1/24
- Loopback0: 1.1.1.1/24

Los Angeles

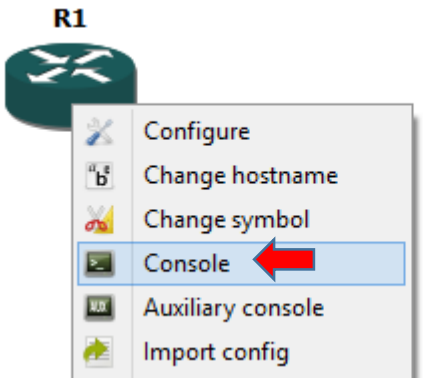
- f0/0: 192.168.20.2
- f1/0: 192.168.40.1
- Loopback0, 2.2.2.2/24

San Diego

- f0/0: 192.168.40.2
- Loopback0: 3.3.3.3/24

TIP: It's a good idea to periodically check that the router interfaces are properly configured. The command **show ip interface brief** (sh ip int brief) is used to check the interfaces.

TIP: Please make sure that you are working on the right console window. Each time you need to configure a router, open the console as shown below (right click).



When you are done, close the console window.

4 Configuring Routes with RIP Version 1

Please note that all routers need to have RIP enabled. The RIP routing protocol is enabled on the router by entering the command **router rip** at the Router(config)# prompt.

```
SanFrancisco#enable
SanFrancisco#configure terminal
SanFrancisco(config)#router rip
SanFrancisco(config-router)#
```

Notice that the **router rip** command places the router in the (config-router) mode, as shown in the prompt. This indicates that the router is in the state for specifying the networks using RIP. Without specifying the version, RIPv1 will be used by default.

The command **show ip protocol** (sh ip protocol) is used to display the routing protocols running on the router. The command **show ip protocol** also shows that router updates are being sent every 30 seconds and indicates in how many seconds the next update will be sent. This command will display protocol information only after the routing protocol has been enabled and the network addresses are specified. Otherwise, it will display nothing.

```
SanFrancisco#show ip protocol

SanFrancisco#
```

In RIPv1, network statements are required to declare what networks will be advertised by the RIP routing protocol. To advertise the network means the routing table containing the network is shared with its neighbors. RIPv1can be used only in contiguous networks, meaning the networks and routes must have the same class network address. This means the router addresses for the network connecting the routers must be the same class as the LAN connected to the router. The **network** command requires the use of a class network address (Class A, Class B, Class C) after the network command. This is called classful addressing. A class network address or classful address is the network portion of the address for the particular class of the network.

Class	**Address Range**			**Network Bits/CDIR (Default)**
Class A	0.0.0.0	to	127.255.255.255`	8
Class B	128.0.0.0	to	191.255.255.255	16
Class C	192.0.0.0	to	223.255.255.255	24

Address Range for Each Class of Network

For example, in our network topology we have 192.168.20.0 NET, this is a class C network, and the network portion of the address is 192.168.20.0. To use RIPv1 on the "192.168.20.0" network, we need to use the command **network 192.168.20.0**. Let's think about the Loopback 0 interface that we have: 1.1.1.1 NET. This is a class A network, and the network portion of the address is 1.0.0.0. To use RIPv1 on the "1.0.0.0" network, we should use the command **network 1.0. 0.0**.

```
SanFrancisco#enable
SanFrancisco#configure terminal
SanFrancisco(config)#router rip
SanFrancisco(config-router)#network 192.168.20.0
SanFrancisco(config-router)#network 1.0.0.0
SanFrancisco(config-router)#exit
SanFrancisco(config)#end
SanFrancisco#
```

Please repeat the steps for the 2 other routers.

```
LosAngeles#enable
LosAngeles#configure terminal
LosAngeles(config)#router rip
LosAngeles(config-router)#network 192.168.20.0
LosAngeles(config-router)#network 192.168.40.0
LosAngeles(config-router)#network 2.0.0.0
LosAngeles(config-router)#exit
LosAngeles(config)#end
LosAngeles#
```

```
SanDiego#enable
SanDiego#configure terminal
SanDiego(config)#router rip
SanDiego(config-router)#network 192.168.40.0
SanDiego(config-router)#network 3.0.0.0
SanDiego(config-router)#exit
SanDiego(config)#end
SanDiego#
```

Please wait a minute, and then use the **show ip route** (sh ip route) command to display the routes configured on the Router SanFrancisco.

```
Gateway of last resort is not set

     1.0.0.0/24 is subnetted, 1 subnets
C       1.1.1.0 is directly connected, Loopback0
R    2.0.0.0/8 [120/1] via 192.168.20.2, 00:00:09, FastEthernet0/0
R    3.0.0.0/8 [120/1] via 192.168.20.2, 00:00:09, FastEthernet0/0
R    192.168.40.0/24 [120/1] via 192.168.20.2, 00:00:09, FastEthernet0/0
C    192.168.20.0/24 is directly connected, FastEthernet0/0
SanFrancisco#
```

This console screenshot above shows the connected (C) networks and RIP routes (R).

- Router SanFrancisco learns the 2.0.0.0/8 network route via its FastEthernet0/0 interface from the IP address 192.168.2.2, which is the FastEthernet0/0 interface of Router LosAngeles.
- Router SanFrancisco learns the 3.0.0.0/8 network route via its FastEthernet0/0 interface from the IP address 192.168.2.2, which is the FastEthernet0/0 interface of Router LosAngeles.
- Router SanFrancisco learns the 192.168.40.0/24 network route via its FastEthernet0/0 interface from the IP address 192.168.2.2, which is the FastEthernet0/0 interface of Router LosAngeles.

Please take screen shot of the ENTIRE SCREEN for all the routers SanFrancisco, LosAngeles, and SanDiego; where we can see the result of the **show ip route** command. Please DO NOT MAXIMIZE the console screen and allow your background to be seen in the image. Otherwise, your grade for this image will be zero. The file name must be as follows; otherwise, your grade for this image will be zero.

ShIR.SF.FirstName.LastName.png
ShIR.LA.FirstName.LastName.png
ShIR.SD.FirstName.LastName.png

Please test if SanFrancisco router is able to ping the Loopback0 interface on the LosAngeles, and SanDiego.

Please test if LosAngeles router is able to ping the Loopback0 interface on the SanFrancisco and SanDiego.

Please test if SanDiego router is able to ping the Loopback0 interface on the SanFrancisco and LosAngeles.

Please take screen shot of the ENTIRE SCREEN for all the routers SanFrancisco, LosAngeles, and SanDiego; where we can see the result of the **2 ping** commands. Please DO NOT MAXIMIZE the console screen and allow your background to be seen in the image. Otherwise, your grade for this image will be zero. The file name must be as follows; otherwise, your grade for this image will be zero.

Ping.SF.FirstName.LastName.png
Ping.LA.FirstName.LastName.png
Ping.SD.FirstName.LastName.png

To display information on RIP routing transactions, use the **debug ip rip** command in the privileged EXEC mode. The output will show that the router being debugged has received and sent updates from/to other routers. Please take screen shot of the ENTIRE SCREEN for all the routers SanFrancisco, LosAngeles, and SanDiego; where we can see the result of the **debug ip rip** command. Please DO NOT MAXIMIZE the console screen and allow your background to be seen in the image. Otherwise, your grade for this image will be zero. The file name must be as follows; otherwise, your grade for this image will be zero.

Dbug.SF.FirstName.LastName.png
Dbug.LA.FirstName.LastName.png
Dbug.SD.FirstName.LastName.png

5 Configuring Routes with RIP Version 2

The steps needed to configure RIPv2 are almost exactly the same as configuring RIPv1. The only difference is the version must be specified in the router rip configuration. Let's take the RIP configuration that was done earlier in this section, then enter the router's configuration mode [Router(config)#], and input the command **router rip** to use the RIP routing protocol. The next step is to configure RIPv2 to be used with the command **version 2**. Without specifying the version, RIPv1 will be used by default.

On the other hand, RIPv2 is a classless routing protocol. However, it still summarizes routes at the class network boundaries by default. Therefore, it may appear as if RIPv2 only advertises classful networks, like RIPv1.

To disable the auto summarization function, the command **no auto-summary** is used. This command instructs the router not to summarize the network routes. The no auto-summary command alters this behavior by enabling RIP to advertise the actual networks, not the classful summary. The no auto-summary command should be used when a classful network is divided and parts of the same classful network exist in different parts of the network topology.

6 Grading

Please make the console screen large but DO NOT MAXIMIZE it and allow your background to be seen in the screenshot. Otherwise, your grade for the image will be zero.

The file name must be as follows; otherwise, your grade for the image will be zero.

ShIR.SF.FirstName.LastName.png	15 points
ShIR.LA.FirstName.LastName.png	20 points
ShIR.SD.FirstName.LastName.png	20 points
Ping.SF.FirstName.LastName.png	10 points
Ping.LA.FirstName.LastName.png	10 points
Ping.SD.FirstName.LastName.png	10 points
Dbug.SF.FirstName.LastName.png	5 points
Dbug.LA.FirstName.LastName.png	5 points
Dbug.SD.FirstName.LastName.png	5 points

7 References

[1] A Practical Guide to Advanced Networking, 3rd Edition, Jeffrey S. Beasley and Piyasat Nilkaew, Pearson, 2012, CourseSmart
[2] http://www.cisco.com/c/en/us/td/docs/ios/12_2/configfun/command/reference/ffun_r/frf006.html
[3] https://en.wikipedia.org/wiki/Routing_Information_Protocol
[4] http://www.omnisecu.com/cisco-certified-network-associate-ccna/difference-between-ripv1-and-ripv2.php
[5] http://www.cisco.com/c/en/us/td/docs/ios/12_2/debug/command/reference/122debug/dbfippim.html#wp1017294