1 Overview

In this in lab study, you will work on GNS3 simulator and create 2 static VLANs. You have a couple of servers at your network and your goal is to increase security creating VLANs. A VLAN is a group of devices on one or more LANs that are configured to communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments. Because VLANs are based on logical instead of physical connections, they are extremely flexible. VLANs define broadcast domains in a Layer 2 network. Layer 2 switches create broadcast domains based on the configuration of the switch. Therefore, you need a switch like Cisco Catalyst 3560 to create VLANs.

Cisco Catalyst 3560-24TS Rear View

However, in GNS3 you are unable to add images for Cisco Catalyst Switches. Instead, you will use the following image file c3640-jk9s-mz.124-16.bin, which corresponds to Cisco 3600 Series, Chassis 3640 Router.

2 Switches in GNS3

To emulate a Cisco Catalyst Switch in GNS3, you can configure a router by adding a NM-16ESW EtherSwitch Network Module to its Slot 0.
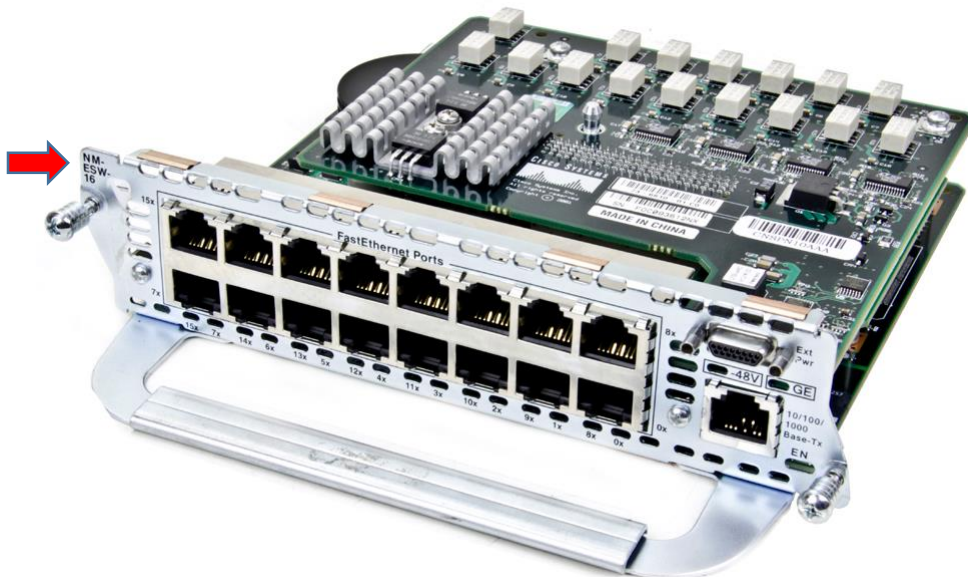
NM-16ESW: One 16-port 10/100 EtherSwitch Network Module Rear View

Please follow the steps described in Lab Study 1 and add this module to your router that will be used as a switch. Please note that you need to turn off the router before adding a module or port. You can disable routing by using no ip routing command in global configuration mode. Then, you can use this router as a Layer 2 Switch.
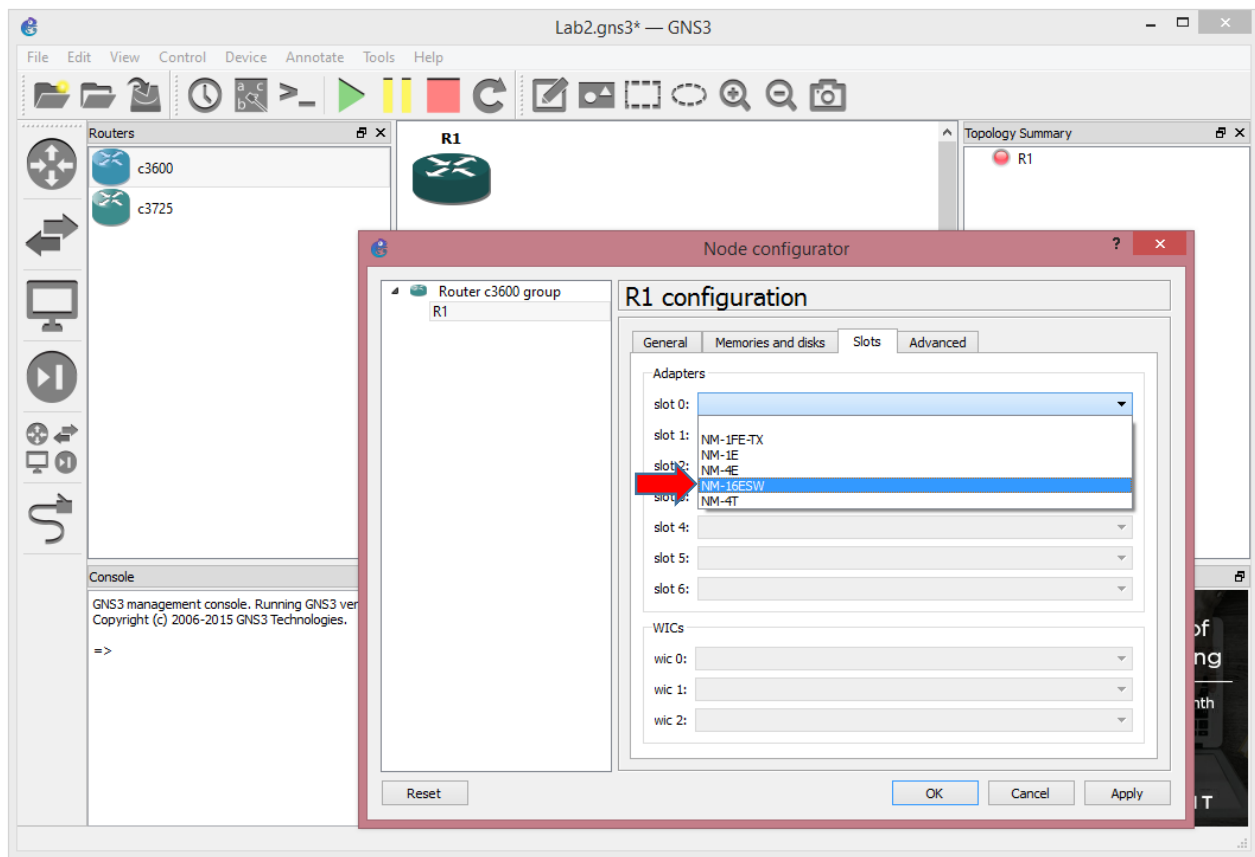
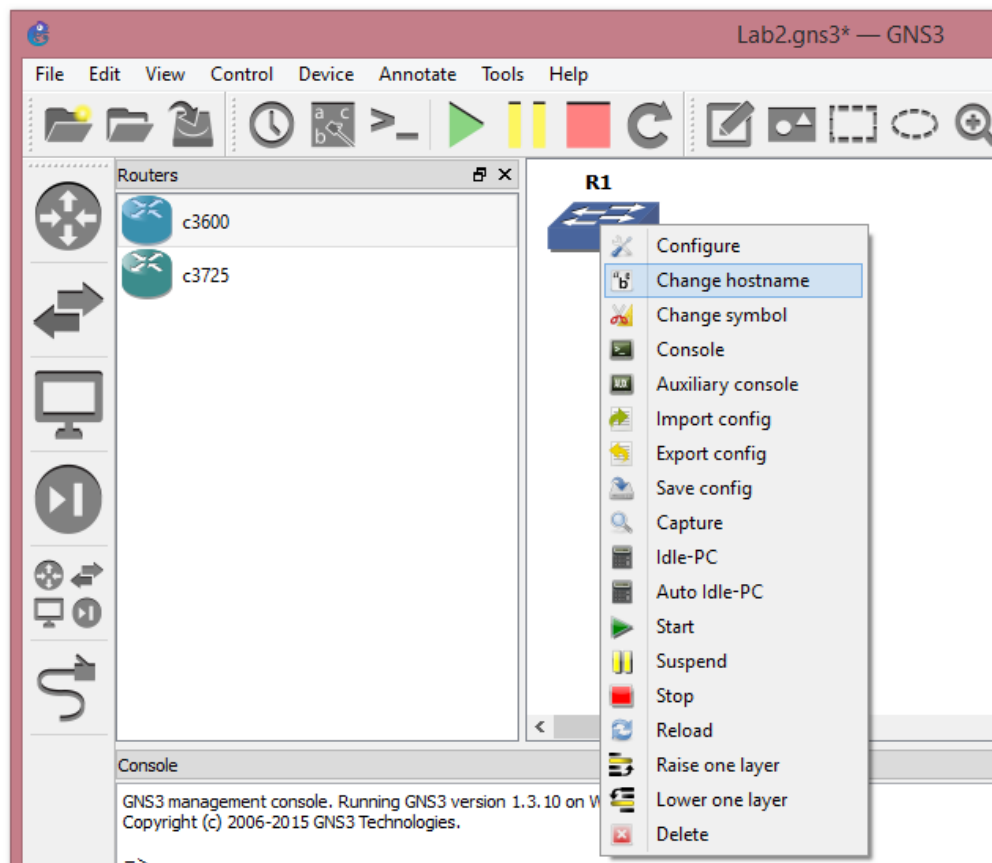You now have a router that can operate as Layer 2 Switch. Please change symbol Router to Catalyst Switch.
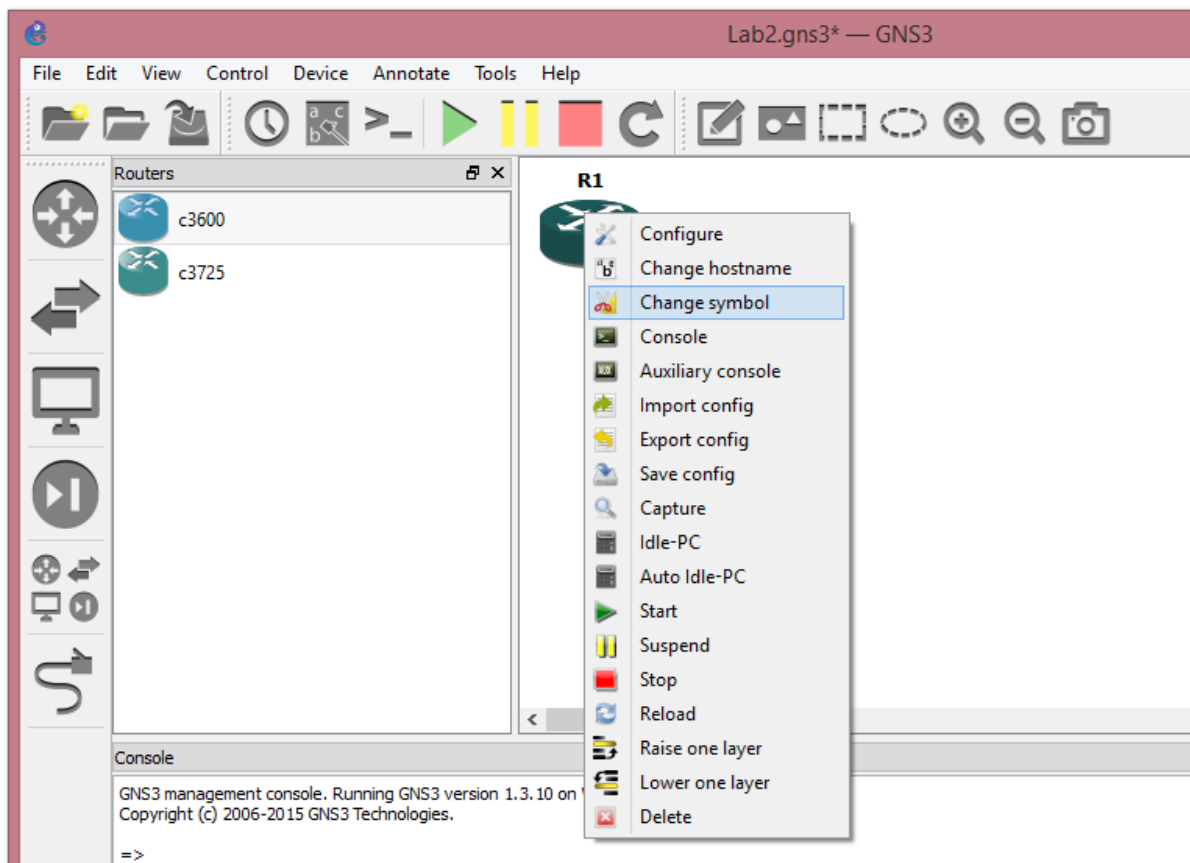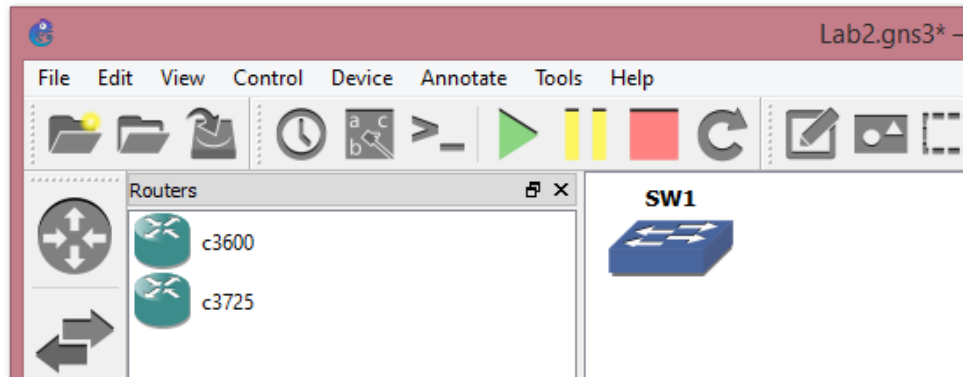
In list of icons, please select ethernet_switch and click apply.
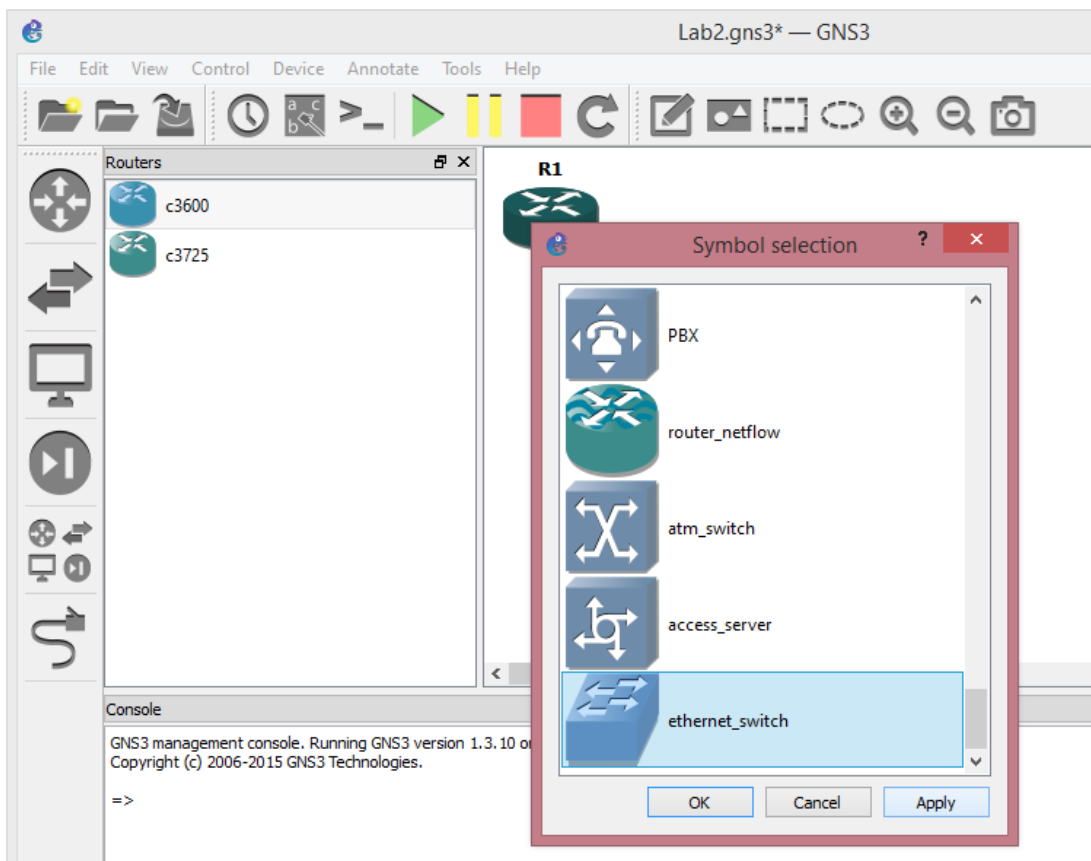
Please change the router name to Switch name.

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. The notation 0/0 indicates the [interface-card-slot/port]. You can see the available ports for the slot 0.
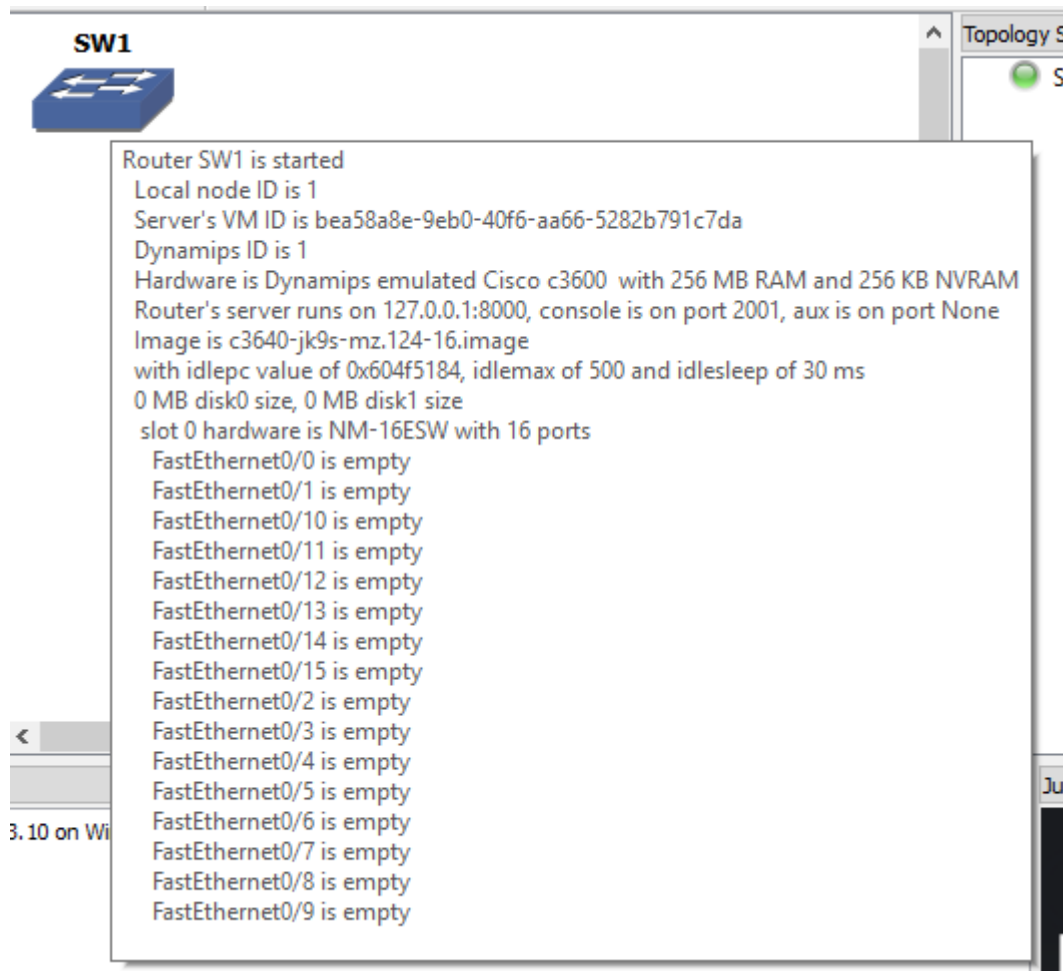
If we click the Console connect to all devices button, a console window will open for the device.

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 To access global configuration mode, use the configure terminal command in privileged EXEC mode. Then, Use the no ip routing command to disable routing in global configuration mode.
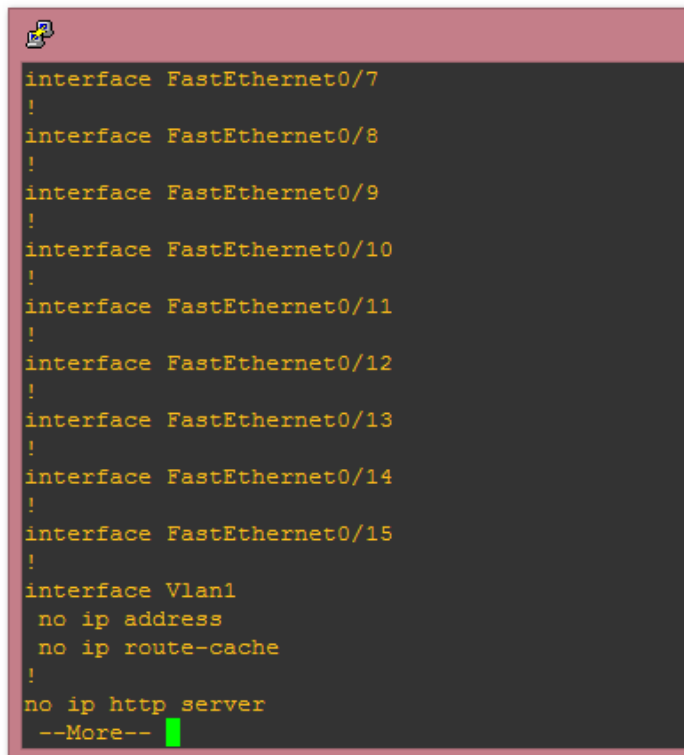
```
SW1#enable
SW1#configure terminal
SW1(config)#no ip routing
```

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

```
SW1#enable
SW1#configure terminal
SW1(config)#no ip routing
SW1(config)#end
```

The show running-config command displays the active configuration in memory (including saved configuration changes) on the adaptive security appliance.

```
SW1#enable
SW1#configure terminal
SW1(config)#no ip routing
SW1(config)#end
SW1# show running-config
```
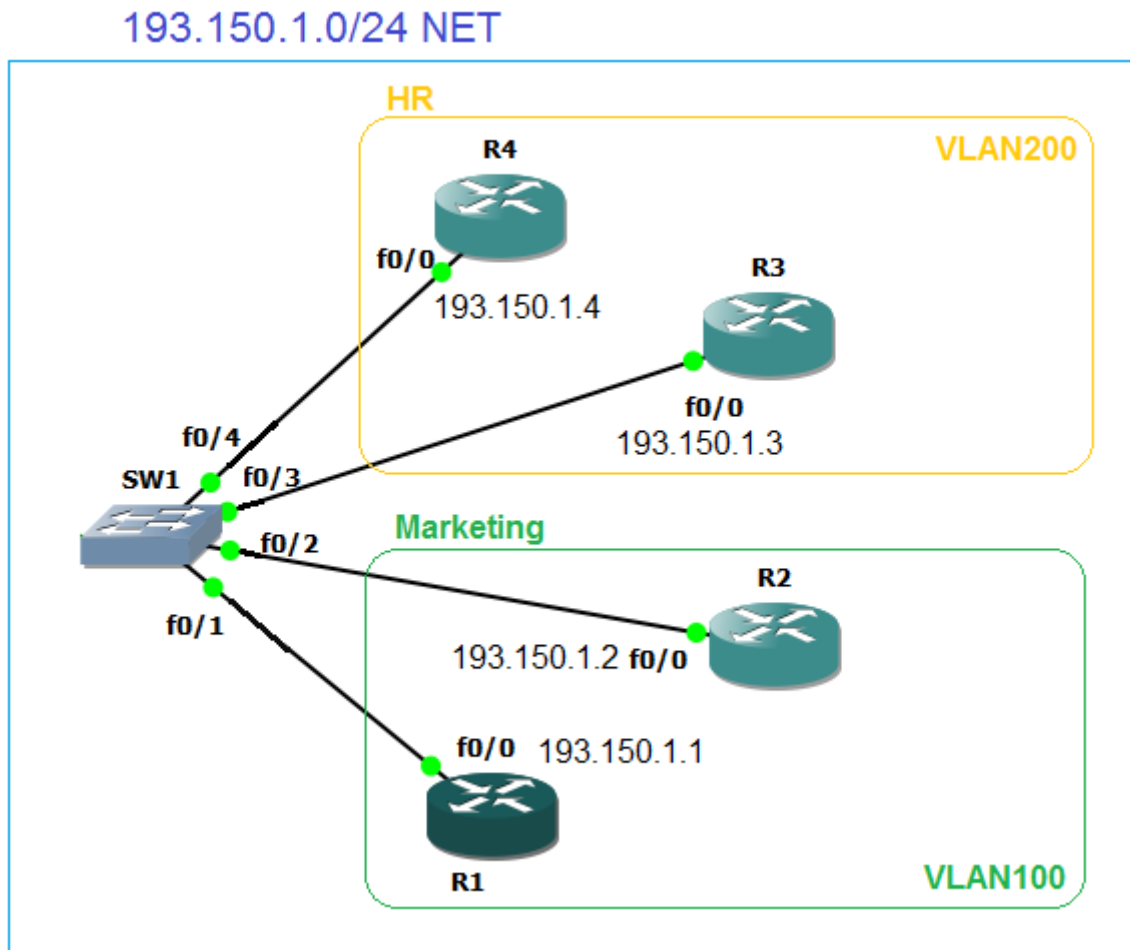
```
interface FastEthernet0/7
!
interface FastEthernet0/8
!
interface FastEthernet0/9
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface Vlan1
 no ip address
 no ip route-cache
!
no ip http server
 --More--
```

(Type enter as many times as you need)

3 GNS3 Simulation Structure

3.1 Topology

Please build the topology shown in the figure below. Drag 5 routers running an IOS you have configured into the workspace. Please note that you will modify one of the 5 routers and it will emulate a switch.

To display the slot/port numbers, please click the show/hide interface labels button.

- Please add a NM-1FE-TX Fast Ethernet adapter to Slot 0 of each router.
- Please do the cabling properly (slot/port numbers) as shown in the topology image.

3.2 Assign IP Addresses to Interfaces

Please follow the steps described in the Lab Study 1 to assign proper IP addresses given in the topology image to all required devices. Here is the summary for the Router 1.

```
R1#enable
R1#configure terminal
R1(config)#interface fastethernet 0/0
R1(config)#ip address 193.150.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#end
```

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

Before creating the VLANs, please ping all devices (R1, R2, R3, and R4) in order to test the accessibility. Take screen shot of the entire screen (not only the GNS3 interface but the entire screen) for each device where you ping the other routers. Please use the file name format shown below:

FirstNameLastNameR1Ping.png
FirstNameLastNameR2Ping.png
FirstNameLastNameR3Ping.png
FirstNameLastNameR4Ping.png

3.3 VLAN Configuration

This section briefly demonstrates the steps for configuring a static VLAN. We use the show vlan command in privileged EXEC mode to display VLAN information on a switch. However, please remember that we do not have a real switch here and we cannot use this command. We use NM16-SW switch module in the router. This switch module is configured differently from the Cisco Catalyst Series switches. What we can do is that we can define one or many virtual bridges within the switch module. Each virtual bridge defines a new broadcast domain (VLAN). Traffic cannot pass directly to another VLAN (between broadcast domains) within the switch or between two switches.

Because we are using NM16-SW switch module in GNS3, the VLAN commands are a bit different than the ones on real switches. For example, we need to use the relatively old VLAN database method to configure VLANs. Use the command show vlan-switch to see the current VLANs.

SW1#show vlan-switch

```
SW1#show vlan-switch

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/0, Fa0/1, Fa0/2, Fa0/3
                                                Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        1002   1003
1002 fddi  101002     1500  -      -      -        -    -        1      1003
1003 tr    101003     1500  1005   0      -        -    srb      1      1002
1004 fdnet 101004     1500  -      -      1        ibm  -        0      0
1005 trnet 101005     1500  -      -      1        ibm  -        0      0
SW1#
```

In general, user-configurable VLANs have unique IDs from 1 to 4094. All ports are assigned to VLAN 1 by default. VLANS 1002-1005 are Cisco defaults for FDDI and Token Ring. You can configure VLANs in the VLAN database mode. Database mode supports configuration of IDs from 1 to 1001, but not the extended addresses from 1006 to 4094. You cannot delete the default VLANs for the different media types: Ethernet VLAN 1 and FDDI or Token Ring VLANs 1002 to 1005. We use vlan database command to enter VLAN database mode.

```
SW1#vlan database
```

You can configure a supported switch to be in one of the VTP mode. In VTP server mode, you can create, modify, and delete VLANs, and specify other configuration parameters (such as the VTP version) for the entire VTP domain. VTP server is the default mode. To verify the mode, please enter the command vtp server.
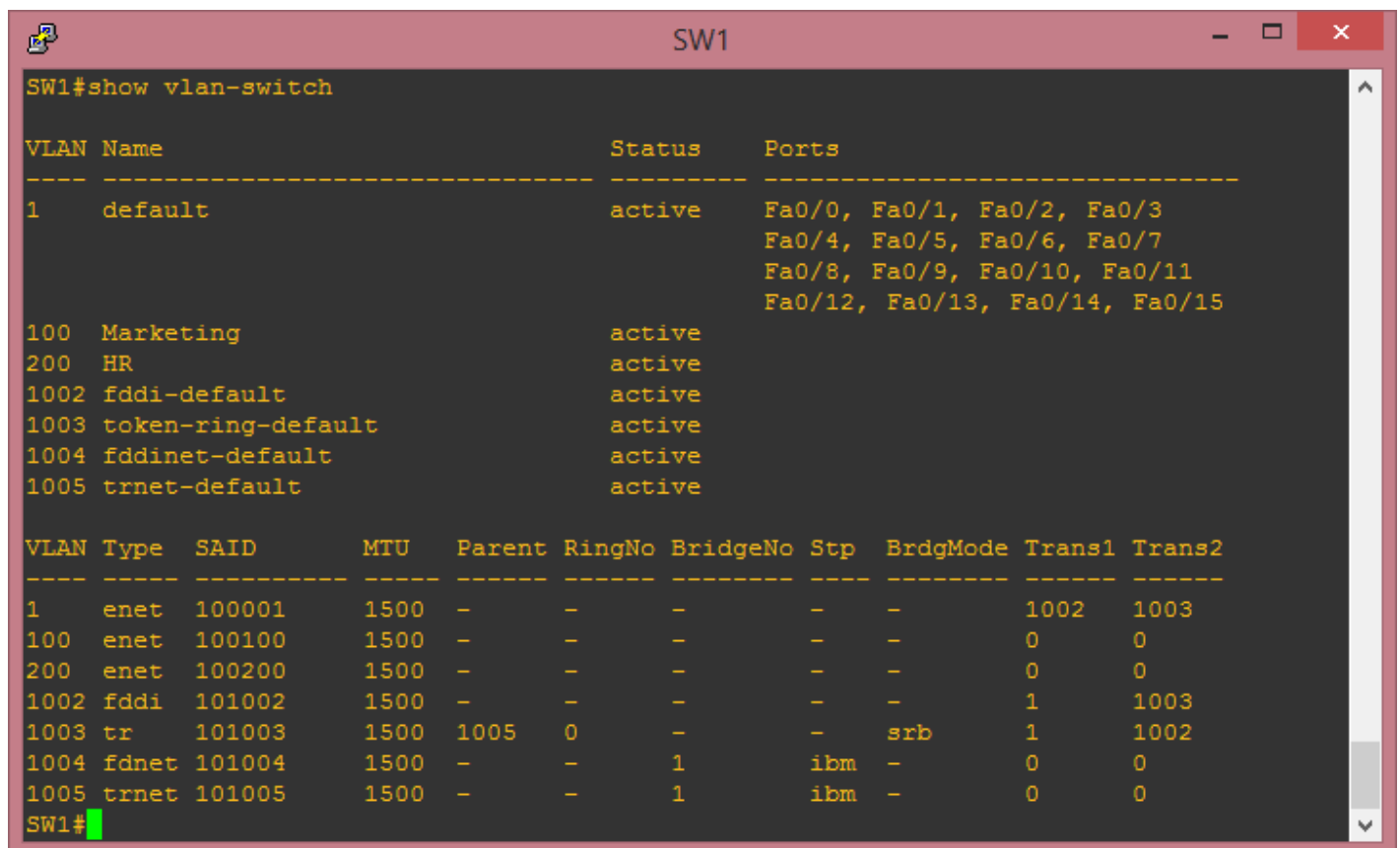
```
SW1#vlan database
SW1(vlan)#vtp server
```

The vlan *vlan_number* name *vlan_name* command is executed in VLAN Database configuration mode to create and name a VLAN when using the NM-16ESW.

```
SW1#vlan database
SW1(vlan)#vlan 100 name Marketing
SW1(vlan)#vlan 200 name HR
```

The exit command is executed in VLAN Database configuration mode and will apply changes that you've made while in VLAN Configuration mode and exit back to privileged mode.

```
SW1#vlan database
SW1(vlan)#vlan 100 name Marketing
SW1(vlan)#vlan 200 name HR
SW1(vlan)#exit
```

Use the command show vlan-switch to see the current VLANs.

```
SW1#show vlan-switch

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/0, Fa0/1, Fa0/2, Fa0/3
                                                Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15

100  Marketing                        active
200  HR                               active
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        1002   1003
100  enet  100100     1500  -      -      -        -    -        0      0
200  enet  100200     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        1      1003
1003 tr    101003     1500  1005   0      -        -    srb      1      1002
1004 fdnet 101004     1500  -      -      1        ibm  -        0      0
1005 trnet 101005     1500  -      -      1        ibm  -        0      0
SW1#
```

Assign the interfaces f0/1 and f0/2 to VLAN 100, and the interfaces f0/3 and f0/4 to VLAN 200. To program the VLAN, the router must be in the configuration mode. In the terminal, use the enable command to access global configuration mode, and use the configure terminal command in privileged EXEC mode.

```
SW1#enable
SW1#configure terminal
SW1(config)#
```

To select a particular interface (port) for configuration, use the interface Fa *slot*/*port* command in global configuration mode.

```
SW1#enable
SW1#configure terminal
SW1(config)#interface Fa 0/1
```

You can configure an Ethernet port as an access port. An access port transmits packets on only one, untagged VLAN. You specify which VLAN traffic that the interface carries. If you do not specify a VLAN for an access port, the interface carries traffic only on the default VLAN. The default VLAN is VLAN1. The VLAN must exist before you can specify that VLAN as an access VLAN. The command switchport access vlan *vlan_number*. specifies the VLAN for which this access port will carry traffic. If you do not enter this command, the access port carries traffic on VLAN1 only; use this command to change the VLAN for which the access port carries traffic.
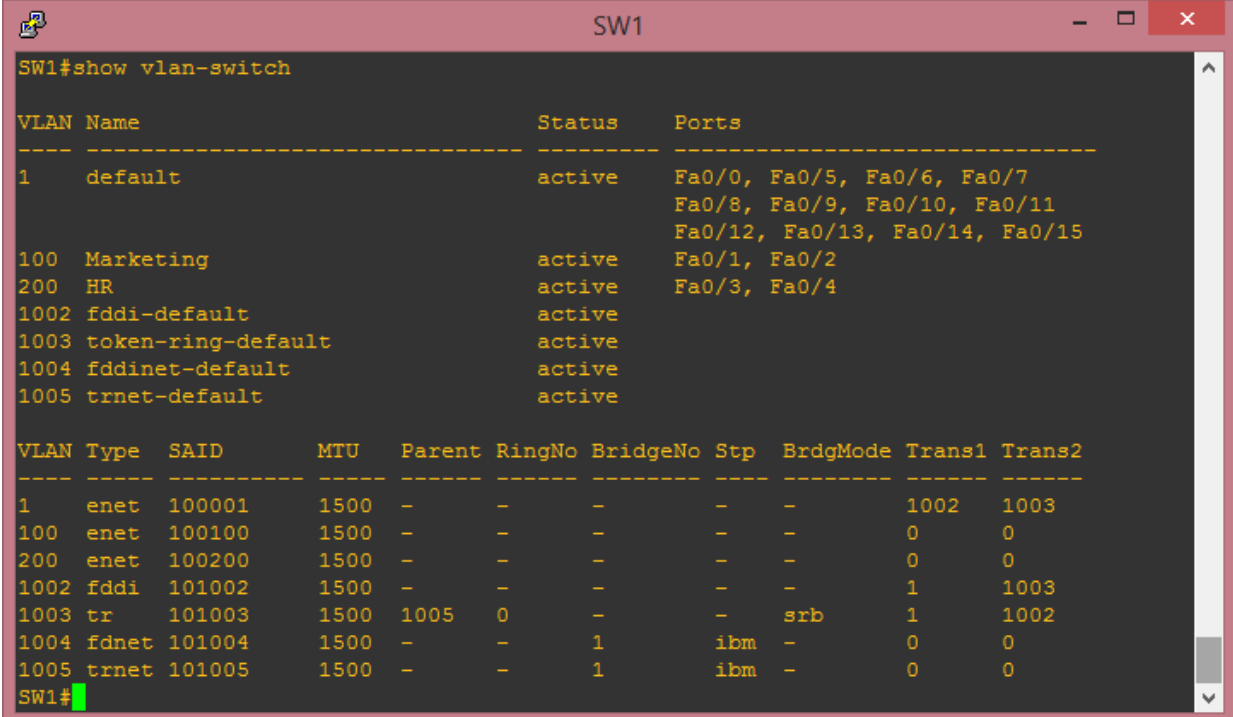
```
SW1#enable
SW1#configure terminal
SW1(config)#interface Fa 0/1
SW1(config-if)#switchport access vlan 100
```

Please assign all ports to the appropriate VLANs. Then, exit from the current mode.

```
SW1(config-if)#exit
SW1(config)#end
SW1#
```

Please verify your configuration by using the show vlan-switch command.

```
SW1#show vlan-switch
```

Please take screen shot of the entire screen (not only the GNS3 interface but the entire screen) for SW#1, where the terminal displays the result of the show vlan-switch command. Please use the file name format shown below:

FirstNameLastNameSW1Show.png

Please ping all devices (R1, R2, R3, and R4) in order to test the VLAN configuration. Take screen shot of the entire screen (not only the GNS3 interface but the entire screen) for each router where you ping the other routers. Please use the file name format shown below:

FirstNameLastNameR1Ping2.png
FirstNameLastNameR2Ping2.png
FirstNameLastNameR3Ping2.png
FirstNameLastNameR4Ping2.png

4 Grading

Your file names must be as follows:

FirstNameLastNameR1Ping1.png	10 points
FirstNameLastNameR2Ping1.png	10 points
FirstNameLastNameR3Ping1.png	10 points
FirstNameLastNameR4Ping1.png	10 points
FirstNameLastNameSW1Show.png	20 points
FirstNameLastNameR1Ping2.png	10 points
FirstNameLastNameR2Ping2.png	10 points
FirstNameLastNameR3Ping2.png	10 points
FirstNameLastNameR4Ping2.png	10 points

5 References

[1] https://community.gns3.com/docs/DOC-2193
[2] http://www.vology.com/img/Cisco/Cisco_NM-16ESW-PWR-1GIG_front1.ebc3100a4746de594f2e3d64bb3089ae.jpg
[3] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst2960/software/release/12-2_58_se/configuration/guide/2960scg/swipstatrout.html
[4] http://www.cisco.com/c/en/us/td/docs/security/asa/asa82/command/reference/cmd_ref/s5.html
[5] http://www.cisco.com/c/en/us/support/docs/interfaces-modules/network-modules/82156-ether-switch-nm-config.html#step1
[6] http://www.cisco.com/c/en/us/products/collateral/switches/catalyst-3560-series-switches/product_data_sheet09186a00801f3d7f.html
[7] http://www.cisco.com/c/dam/en/us/support/docs/SWTG/ProductImages/switches-catalyst-3560g-24TS-switch.jpg
[8] A Practical Guide to Advanced Networking, 3rd Edition, Jeffrey S. Beasley and Piyasat Nilkaew
[9] http://www.cisco.com/c/en/us/td/docs/ios/lanswitch/command/reference/lsw_book/lsw_s2.html
[10] http://www.cisco.com/web/techdoc/dc/reference/cli/nxos/commands/l2/show_spanning-tree.html
[11] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4500/12-2/25ew/configuration/guide/conf/vlans.html
[12] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4500/12-2/25ew/configuration/guide/conf/vlans.html#wp1037080
[13] http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3560/software/release/12-2_52_se/configuration/guide/3560scg/swvtp.html
[14] https://community.gns3.com/docs/DOC-2193
[15] http://www.cisco.com/c/en/us/td/docs/routers/7600/ios/15S/configuration/guide/7600_15_0s_book/vlans.html
[16] http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus5000/sw/configuration/guide/cli/CLIConfigurationGuide/AccessTrunk.html