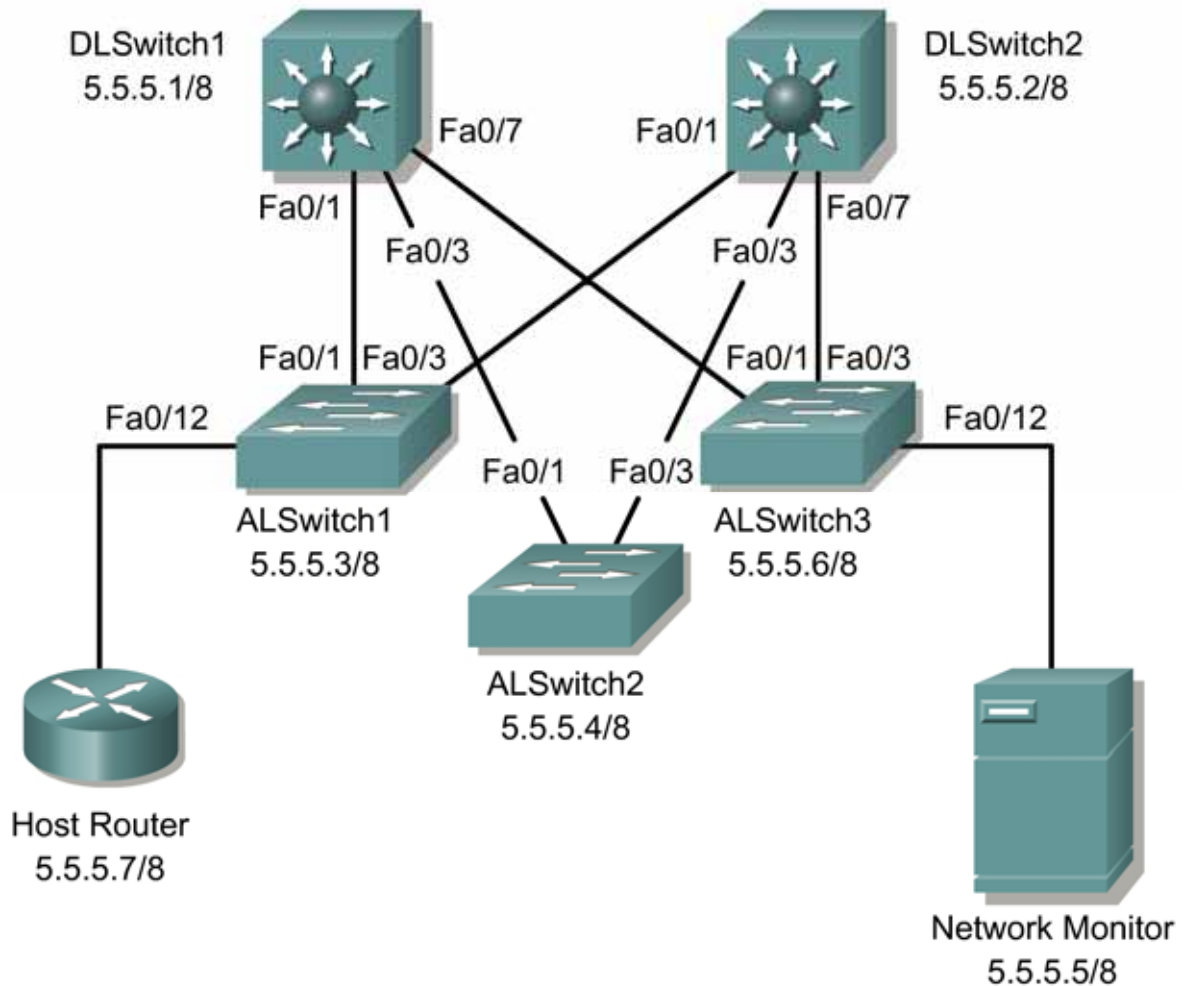


### Lab 3.2.5.2 Use Network Inspector to Observe STP Behavior



#### Objective

The purpose of this lab is to observe STP behavior with the Network Inspector switch trace feature.

#### Scenario

A new switched network has just been installed. The Spanning-Tree Protocol (STP) behavior must be monitored. Fluke Network Inspector has a trace feature. The trace feature can track the path that data will take over the network.

The network design is as follows.

Switch	VTP Domain	VTP Mode
DLSwitch1	CORP	Server
DLSwitch2	CORP	Client
ALSwitch1	CORP	Client
ALSwitch2	CORP	Client
ALSwitch3	CORP	Client

The VLAN configuration information is as follows.

VLAN ID	VLAN Name	VLAN Subnet	DLSwitch	ALSwitch
1	Native	5.0.0.0/8	All Ports	All Ports
Trunk				802.1q

Device	DLSwitch1	DLSwitch2	ALSwitch1	ALSwitch2	ALSwitch3	Network Inspector	Host Router
IP address	5.5.5.1/8	5.5.5.2/8	5.5.5.3/8	5.5.5.4/8	5.5.5.6/8	5.5.5.5/8	5.5.5.7/8

## Step 1

Cable the lab according to the diagram.

Before configuring the switches, delete the **vlan.dat** database file and power cycle each switch. Then erase the startup configuration on each switch and issue the **reload** command.

```
DLSwitch1#delete flash
Delete filename [flash]? vlan.dat
DLSwitch1#erase start
DLSwitch1#reload
```

**Note:** Do not save the configuration changes when prompted.

Configure the hostname, passwords, and Telnet access to all the switches. Use interface vlan 1 to configure the IP address of all the switches.

```
Switch(config)#hostname DLSwitch1
DLSwitch1(config)#enable secret cisco
DLSwitch1(config)#line console 0
DLSwitch1(config-line)#password cisco
DLSwitch1(config-line)#login
DLSwitch1(config-line)#line vty 0 15
DLSwitch1(config-line)#password cisco
DLSwitch1(config-line)#login
DLSwitch1(config-line)#interface vlan 1
DLSwitch1(config-if)#ip address 5.5.5.1 255.0.0.0
DLSwitch1(config-if)#no shutdown
```

```
DLSwitch1(config-if)#^Z
Switch(config)#hostname DLSwitch2
DLSwitch2(config)#enable secret cisco
DLSwitch2(config)#line console 0
DLSwitch2(config-line)#password cisco
DLSwitch2(config-line)#login
DLSwitch2(config-line)#line vty 0 15
DLSwitch2(config-line)#password cisco
DLSwitch2(config-line)#login
DLSwitch2(config-line)#interface vlan 1
DLSwitch2(config-if)#ip address 5.5.5.2 255.0.0.0
DLSwitch2(config-if)#no shutdown
DLSwitch2(config-if)#^Z
```

```
Switch(config)#hostname ALSwitch1
ALSwitch1(config)#enable secret cisco
ALSwitch1(config)#line console 0
ALSwitch1(config-line)#password cisco
ALSwitch1(config-line)#login
ALSwitch1(config-line)#line vty 0 15
ALSwitch1(config-line)#password cisco
ALSwitch1(config-line)#login
ALSwitch1(config-line)#interface vlan 1
ALSwitch1(config-if)#ip address 5.5.5.3 255.0.0.0
ALSwitch1(config-if)#no shutdown
ALSwitch1(config-if)#^Z
```

```
Switch(config)#hostname ALSwitch2
ALSwitch2(config)#enable secret cisco
ALSwitch2(config)#line console 0
ALSwitch2(config-line)#password cisco
ALSwitch2(config-line)#login
ALSwitch2(config-line)#line vty 0 15
ALSwitch2(config-line)#password cisco
ALSwitch2(config-line)#login
ALSwitch2(config-line)#interface vlan 1
ALSwitch2(config-if)#ip address 5.5.5.4 255.0.0.0
ALSwitch2(config-if)#no shutdown
ALSwitch2(config-if)#^Z
```

```
Switch(config)#hostname ALSwitch3
ALSwitch3(config)#enable secret cisco
ALSwitch3(config)#line console 0
ALSwitch3(config-line)#password cisco
ALSwitch3(config-line)#login
ALSwitch3(config-line)#line vty 0 15
ALSwitch3(config-line)#password cisco
ALSwitch3(config-line)#login
ALSwitch3(config)#interface vlan 1
ALSwitch3(config-if)#ip address 5.5.5.6 255.0.0.0
ALSwitch3(config-if)#no shutdown
ALSwitch3(config-if)#^Z
```

## Step 2

Configure the trunking interfaces.

Create a trunk link between the switches. On the DLSwitch1 and DLSwitch2 set the port to trunking with the 802.1q encapsulation.

---

<b>Note</b>	If an error is received, it is because the port is set to auto encapsulation. Fix the error by entering the <b>switchport mode trunk</b> command after the <b>switchport trunk encapsulation dot1q</b> command.
-------------	---

---

```
DLSwitch1(config)#interface FastEthernet 0/1
DLSwitch1(config-if)#switchport mode trunk
DLSwitch1(config-if)#switchport trunk encapsulation dot1q
DLSwitch1(config-if)#interface FastEthernet 0/3
DLSwitch1(config-if)#switchport mode trunk
DLSwitch1(config-if)#switchport trunk encapsulation dot1q
DLSwitch1(config-if)#interface FastEthernet 0/7
DLSwitch1(config-if)#switchport mode trunk
DLSwitch1(config-if)#switchport trunk encapsulation dot1q
DLSwitch1(config-if)^Z

DLSwitch2(config)#interface FastEthernet 0/1
DLSwitch2(config-if)#switchport mode trunk
DLSwitch2(config-if)#switchport trunk encapsulation dot1q
DLSwitch2(config-if)#interface FastEthernet 0/3
DLSwitch2(config-if)#switchport mode trunk
DLSwitch2(config-if)#switchport trunk encapsulation dot1q
DLSwitch2(config-if)#interface FastEthernet 0/7
DLSwitch2(config-if)#switchport mode trunk
DLSwitch2(config-if)#switchport trunk encapsulation dot1q
DLSwitch2(config-if)^Z
```

The access layer switches do not need the encapsulation configured. It defaults to 802.1q. In some IOS versions there are no other options.

```
ALSwitch1(config)#interface FastEthernet0/1
ALSwitch1(config-if)#switchport mode trunk
ALSwitch1(config-if)#interface FastEthernet 0/3
ALSwitch1(config-if)#switchport mode trunk
ALSwitch1(config-if)^Z

ALSwitch2(config)#interface fastethernet 0/1
ALSwitch2(config-if)#switchport mode trunk
ALSwitch2(config-if)#interface fastethernet 0/3
ALSwitch2(config-if)#switchport mode trunk
ALSwitch2(config-if)^Z

ALSwitch3(config)#interface fastethernet 0/1
ALSwitch3(config-if)#switchport mode trunk
ALSwitch3(config-if)#interface fastethernet 0/3
ALSwitch3(config-if)#switchport mode trunk
ALSwitch3(config-if)^Z
```

Verify the trunk configuration with the show vtp counters command.

```
DLSwitch1#show vtp counters
VTP statistics:
Summary advertisements received      : 0
Subset advertisements received       : 0
```

```

Request advertisements received      : 0
Summary advertisements transmitted  : 0
Subset advertisements transmitted   : 0
Request advertisements transmitted  : 0
Number of config revision errors    : 0
Number of config digest errors      : 0
Number of V1 summary errors         : 0

```

VTP pruning statistics:

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Fa0/1	0	0	0
Fa0/3	0	0	0
Fa0/7	0	0	0

Verify the configuration on all the switches.

```

DLSwitch1#show vtp counters
<Output omitted>

```

VTP pruning statistics:

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Fa0/1	0	0	0
Fa0/3	0	0	0
0	0		0

```

DLSwitch2#show vtp counters
<Output omitted>

```

VTP pruning statistics:

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Fa0/1	0	0	0
Fa0/3	0	0	0
Fa0/7	0	0	0

```

ALSwitch1#show vtp counters
<Output omitted>

```

VTP pruning statistics:

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Fa0/1	0	0	0
Fa0/3	0	0	0

```

ALSwitch2#show vtp counters
<Output omitted>

```

VTP pruning statistics:

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Fa0/1	0	0	0
Fa0/3	0	0	0

```
ALSwitch3#show vtp counters
```

```
<Output omitted>
```

```
VTP pruning statistics:
```

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Fa0/1	0	0	0
Fa0/3	0	0	0

### Step 3

Configure the VLAN database on DLSwitch1 and DLSwitch2.

Create the VLAN database on DLSwitch1. Place the switch in **vtp server** mode.

```
DLSwitch1#vlan database
DLSwitch1(vlan)#vtp domain CORP
DLSwitch1(vlan)#vtp server
DLSwitch1(vlan)#exit
```

Use the **show vtp status** command to verify the configuration.

On the DLSwitch2, create the VLAN database. Place the switch in **vtp client** mode.

```
DLSwitch2#vlan database
DLSwitch2(vlan)#vtp client
DLSwitch2(vlan)#exit
```

Use the **show vtp status** command to verify the configuration.

```
DLSwitch1#show vtp status
```

```
VTP Version : 2
Configuration Revision : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs : 5
VTP Operating Mode : Server
VTP Domain Name : CORP
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xB7 0x5D 0xB6 0x6D 0xE0 0xC0 0x3E 0x2E
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
Local updater ID is 5.5.5.1 on interface V11 (lowest numbered VLAN
interface found)
```

```
DLSwitch2#show vtp status
```

```
VTP Version : 2
Configuration Revision : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs : 5
VTP Operating Mode : Client
VTP Domain Name : CORP
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0xB7 0x5D 0xB6 0x6D 0xE0 0xC0 0x3E 0x2E
```

## Step 4

Configure the VLAN database on the access layer switches. Place them in **client** mode.

```
ALSwitch1#vlan database
ALSwitch1(vlan)#vtp client
ALSwitch1(vlan)#exit
```

```
ALSwitch2#vlan database
ALSwitch2(vlan)#vtp client
ALSwitch2(vlan)#exit
```

```
ALSwitch3#vlan database
ALSwitch3(vlan)#vtp client
ALSwitch3(vlan)#exit
```

Verify the vtp configuration with the **show vtp status** command on all the switches.

```
ALSwitch1#show vtp status
VTP Version                : 2
Configuration Revision      : 0
Maximum VLANs supported locally : 250
Number of existing VLANs    : 5
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0xB7 0x5D 0xB6 0x6D 0xE0 0xC0 0x3E 0x2E
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
```

```
ALSwitch2#show vtp status
VTP Version                : 2
Configuration Revision      : 0
Maximum VLANs supported locally : 250
Number of existing VLANs    : 5
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0xB7 0x5D 0xB6 0x6D 0xE0 0xC0 0x3E 0x2E
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
```

```
ALSwitch3#show vtp status
VTP Version                : 2
Configuration Revision      : 0
Maximum VLANs supported locally : 250
Number of existing VLANs    : 5
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0xB7 0x5D 0xB6 0x6D 0xE0 0xC0 0x3E 0x2E
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
```

## Step 5

Configure DLSwitch1 as the root bridge.

Change the root bridge priority to 4096 on DLSwitch1.

```
DLSwitch1(config)#spanning-tree vlan 1 priority 4096
DLSwitch1(config)^Z
```

Verify that DLSwitch1 is the root bridge with the **show spanning-tree** command.

```
DLSwitch1#show spanning-tree

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority      4097
             Address      000b.be4f.bc00
             This bridge is the root
             Hello Time   2 sec    Max Age 20 sec    Forward Delay 15 sec

  Bridge ID  Priority      4097    (priority 4096 sys-id-ext 1)
             Address      000b.be4f.bc00
             Hello Time   2 sec    Max Age 20 sec    Forward Delay 15 sec
             Aging Time   300

Interface    Port ID      Cost Sts      Designated                                Port ID
Name          Prio.Nbr          Cost Sts      Cost Bridge ID                                Prio.Nbr
-----
Fa0/1         128.1           19 FWD          0  4097 000b.be4f.bc00 128.1
Fa0/3         128.3           19 FWD          0  4097 000b.be4f.bc00 128.3
Fa0/7         128.7           19 FWD          0  4097 000b.be4f.bc00 128.7
```

## Step 6

Configure the HostRouter. The router is only acting as a host device. It will be used as an end device to which to trace.

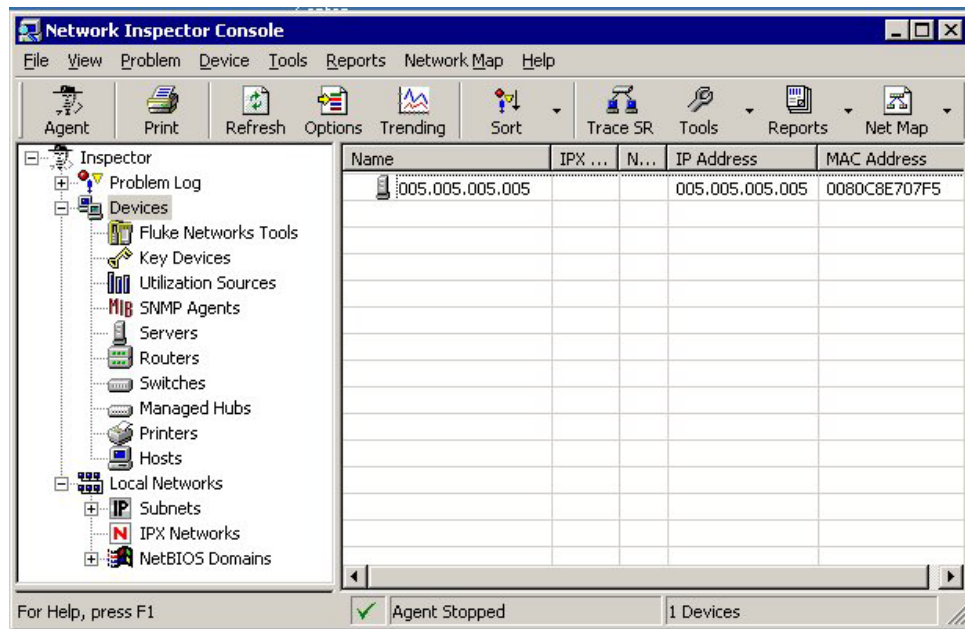
```
Router(config)#hostname HostRouter
HostRouter(config)#interface fa0/0
HostRouter(config-if)#ip address 5.5.5.7 255.0.0.0
HostRouter(config-if)#no shutdown
HostRouter(config-if)#exit
```

## Step 7

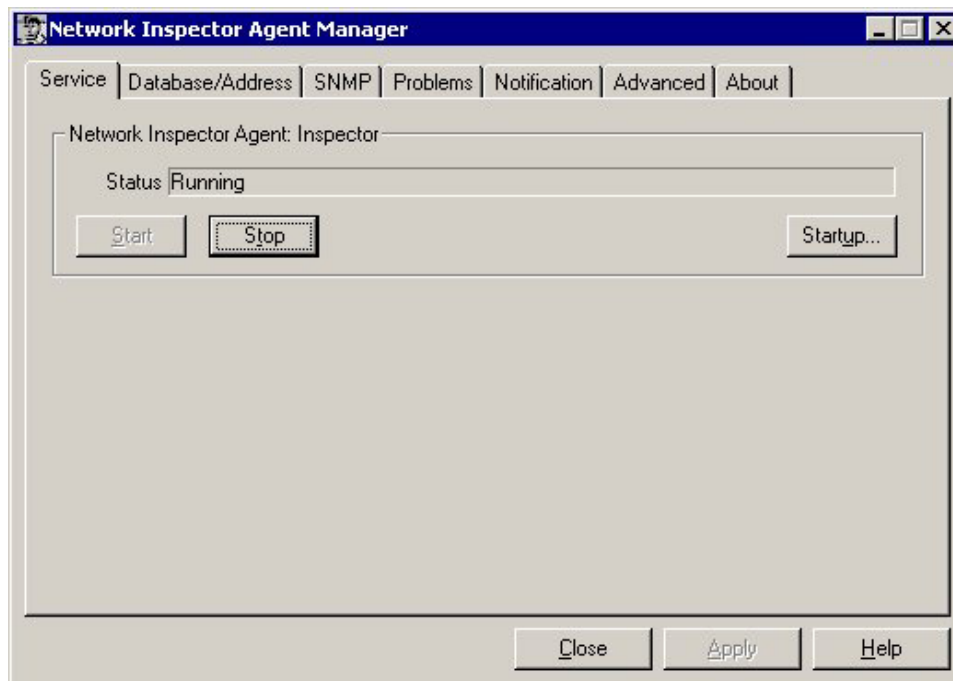
Fluke Network Inspector can be used to monitor the behavior of the switched network. Monitoring is important in successful network management. For this lab, use the **Trace SwitchRoute** feature to monitor STP.

Run Fluke Network Inspector console from the **Start** menu or from a desktop shortcut. The screen should look like the following image.

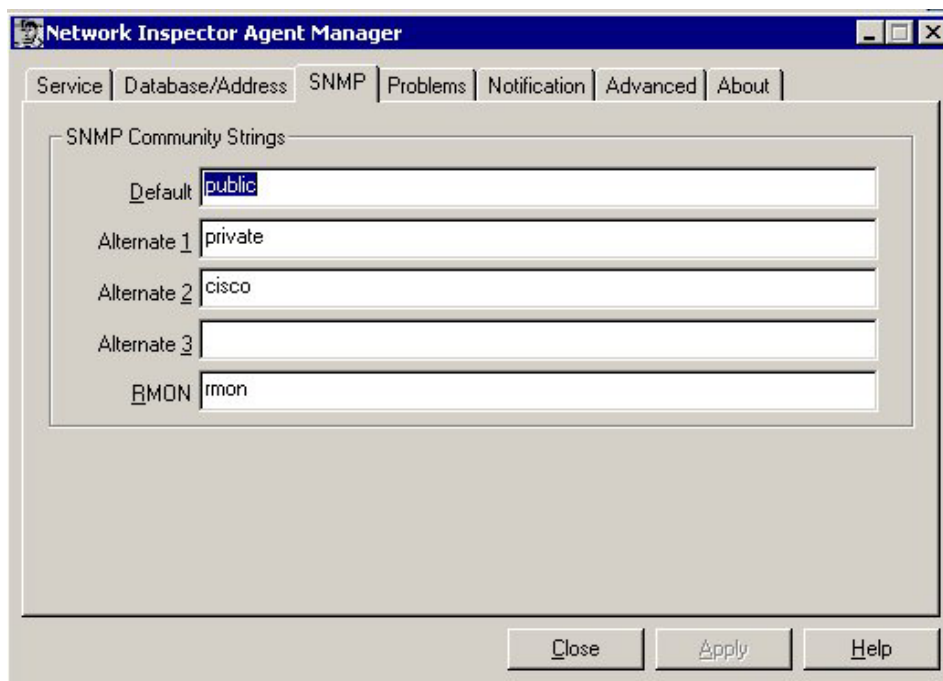




First, a community string must be defined. A public community string may be defined by default. For security purposes, it is highly recommend that a different community string be selected. Click on the **Agent** tab at the top of the console to get the following screen.



Then click on the SNMP tab. Type **cisco** as an alternative community string. It may be necessary to enter **cisco** as the Default SNMP Community String on older versions of NI.



Click the **Apply** button at the bottom of the screen. A prompt will appear and state that the changes will take effect the next time the service is started.

The next step is to stop and start the service. Click on the **Service** tab at the top of the screen. Click on the **Stop** button. Click **Yes** when prompted to confirm the action. Then click **Start** to start the service. Starting the service might take a few seconds.

Connect the computer running Network Monitor to ALSwitch3 to port FastEthernet 0/12. This will complete the set up of the Network Monitor.

## Step 8

SNMP has to be configured on all the devices so that the Network Monitor can find them. The SNMP community has to be defined with the `snmp-server community` command. The SNMP server host IP address must be defined with the `snmp-server host` command for a device to send SNMP traps to the Network Monitor. Enable SNMP by typing in the following commands on all the devices. These are global configuration commands.

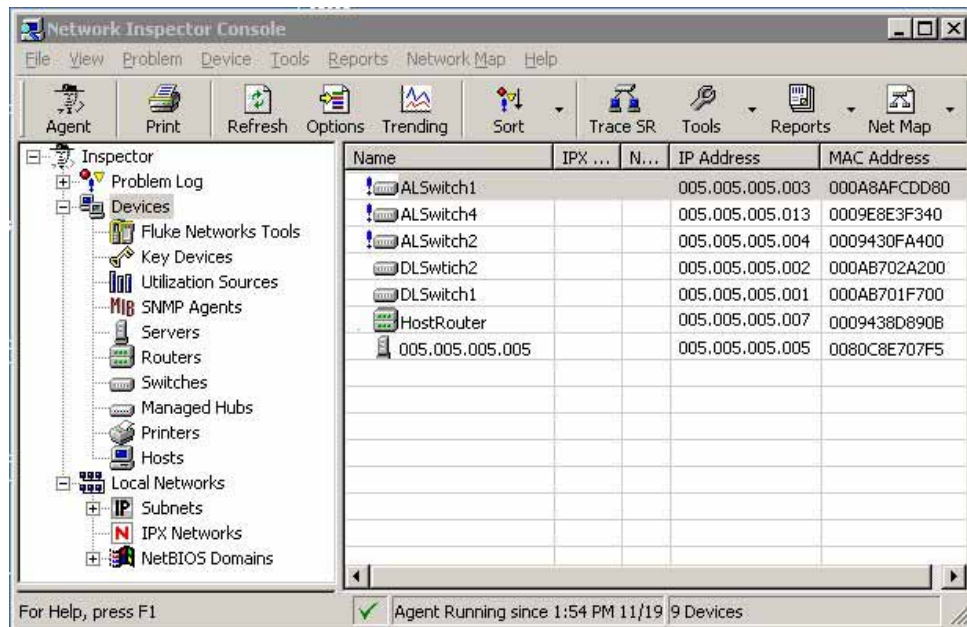
```
snmp-server community cisco ro
snmp-server host 5.5.5.5 cisco
```

The `ro` defines read only for the SNMP server. This prevents the SNMP server from making changes on the device.

This is a good time to take a break. It will take a few minutes for the Fluke Network Inspector to find all the devices.

## Step 9

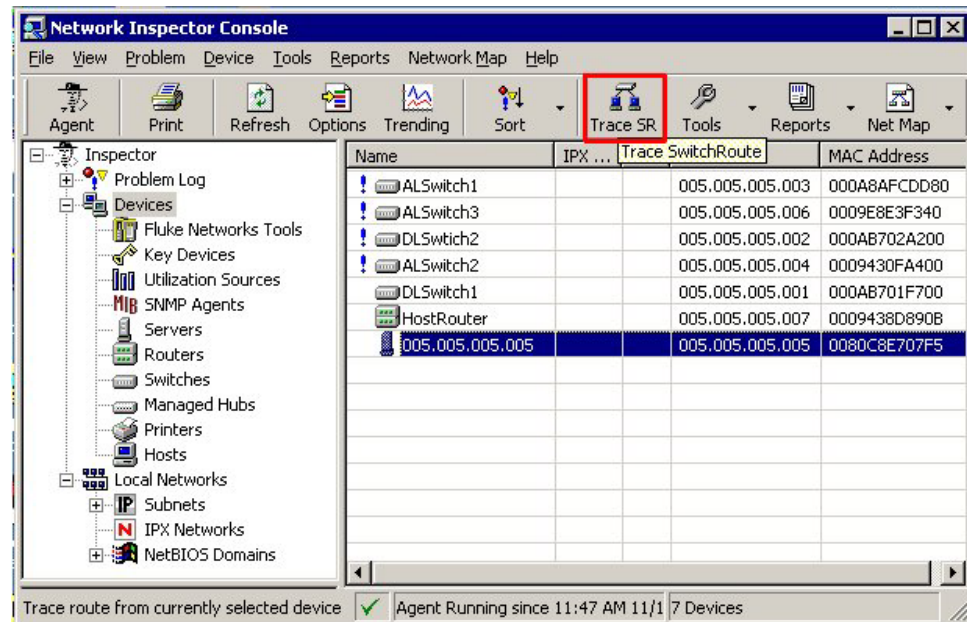
The network monitor will find all the devices and display them in the main window. The screen should look like the following image.



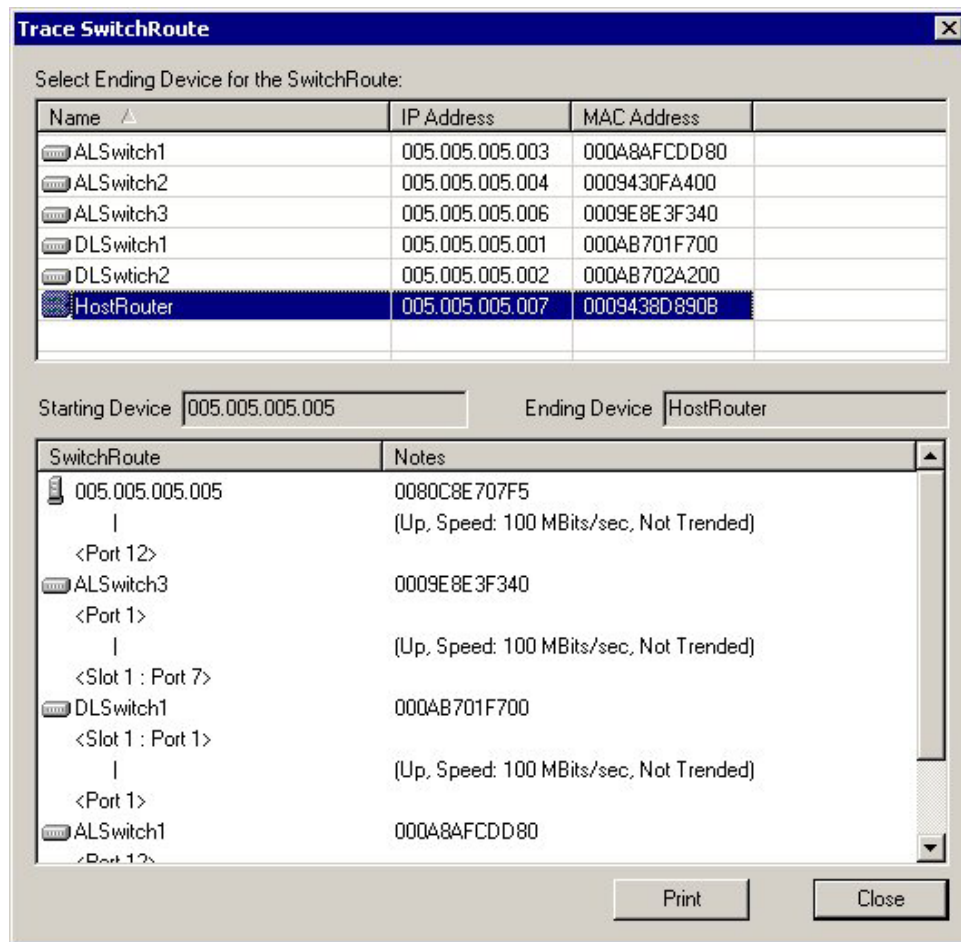
Network Monitor will display the hostname, IP address, MAC address, and the type of device on the right side of the screen. If the device type does not appear, change it by right clicking the device and selecting **Modify Type**. If the device IP address is displayed instead of the hostname, then enter the following command on the device. It will send the hostname to the Network Monitor.

```
snmp-server chassis-id [device hostname]
```

Next, start the switch trace. Select host 5.5.5 by clicking on it and highlighting it. This will be the starting device for the trace. Then, click on the **Trace SR** button on top of the screen as shown in the following image or right click, then left click on the **Trace SwitchRoute** option.



On the next screen choose the HostRouter as the ending device for the trace.



Notice all the devices in the trace display and the entrance and exit ports of the trace through all the devices. This a great tool to observe STP behavior.

1. Why did the trace go through DLSwitch1 instead of DLSwitch2?

Now try a trace from ALSwitch2 to DLSwitch2.

2. Did the trace go through DLSwitch1?

## Step 10

Change the root bridge to DLSwitch2 and observe STP behavior.

On DLSwitch1 enter the following command to change the spanning tree priority.

```
DLSwitch1(config)#no spanning-tree vlan 1 priority 4096
```

On DLSwitch2 enter the following command to change the spanning tree priority.

```
DLSwitch2(config)#spanning-tree vlan 1 priority 4096
```

Verify that DLSwitch2 became the root bridge with the **show spanning-tree** command.

```
DLSwitch2#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    4097  
Address    000a.b702.a200
```

```
This bridge is the root
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID  Priority    4097 (priority 4096 sys-id-ext 1)
```

```
Address    000a.b702.a200
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Aging Time 15
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	0 4097 000a.b702.a200	128.1
Fa0/3	128.3	19	FWD	0 4097 000a.b702.a200	128.3
Fa0/7	128.7	19	FWD	0 4097 000a.b702.a200	128.7

Wait a few minutes while Network Monitor is updated with the new spanning-tree topology.

Now try a trace from host 5.5.5.5 to the HostRouter.

```
DLSwitch1#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    4097  
Address    000b.be4f.e780
```

```
Cost       38
```

```
Port       7 (FastEthernet0/7)
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
```

```
Address    000b.be4f.bc00
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Aging Time 300
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	BLK	19 32769 000b.bec6.ac00	128.1
Fa0/3	128.3	19	BLK	19 32769 000b.bec6.e080	128.1
Fa0/7	128.7	19	FWD	19 32769 000b.bebd.7a00	128.1

```
DLSwitch2#show spanning-tree
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID    Priority    4097  
Address    000b.be4f.e780
```

```
This bridge is the root
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID  Priority    4097 (priority 4096 sys-id-ext 1)
```

```
Address    000b.be4f.e780
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Aging Time 300
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	0 4097 000b.be4f.e780	128.1
Fa0/3	128.3	19	FWD	0 4097 000b.be4f.e780	128.3
Fa0/7	128.7	19	FWD	0 4097 000b.be4f.e780	128.7

#### ALSwitch1#show spanning-tree

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    4097
             Address    000b.be4f.e780
             Cost        19
             Port        3 (FastEthernet0/3)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
             Address    000b.bec6.ac00
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  300

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	19 32769 000b.bec6.ac00	128.1
Fa0/3	128.3	19	FWD	0 4097 000b.be4f.e780	128.1
Fa0/12	128.12	19	FWD	19 32769 000b.bec6.ac00	128.12

#### ALSwitch2#show spanning-tree

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    4097
             Address    000b.be4f.e780
             Cost        19
             Port        3 (FastEthernet0/3)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
             Address    000b.bec6.e080
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  300

```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	19 32769 000b.bec6.e080	128.1
Fa0/3	128.3	19	FWD	0 4097 000b.be4f.e780	128.3

#### ALSwitch3#show spanning-tree

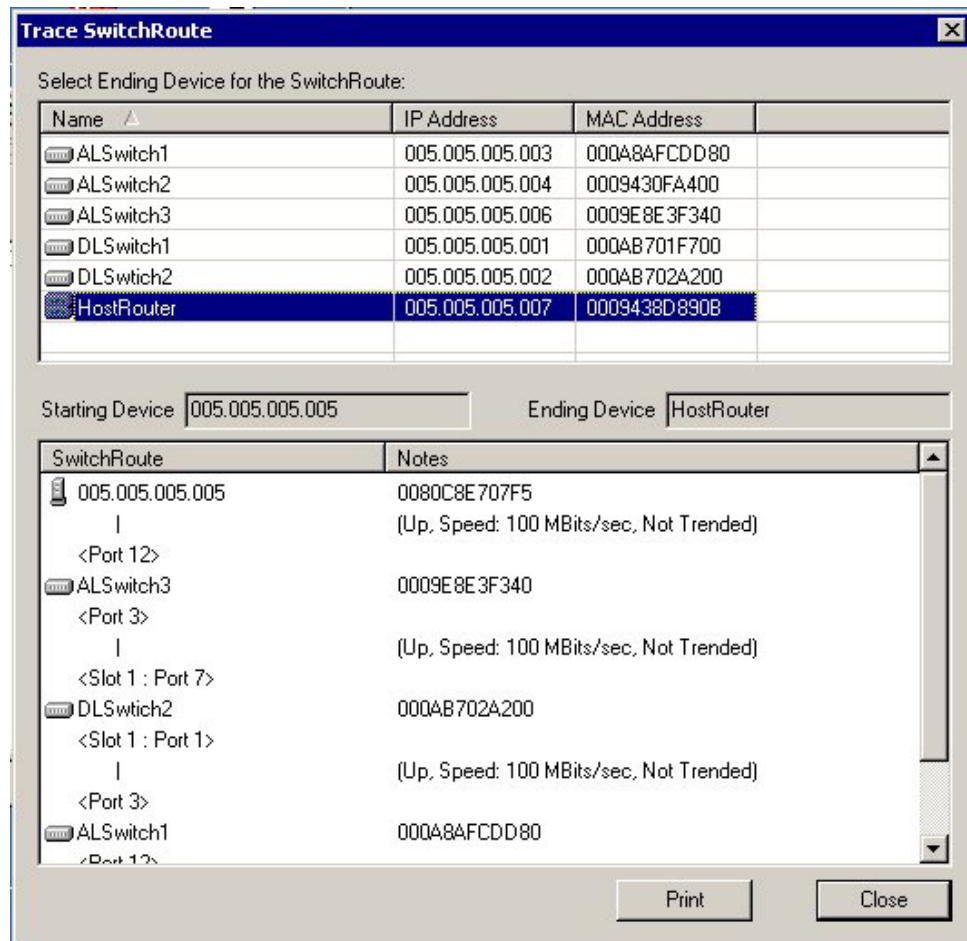
```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    4097
             Address    000b.be4f.e780
             Cost        19
             Port        3 (FastEthernet0/3)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
             Address    000b.bebd.7a00
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  300

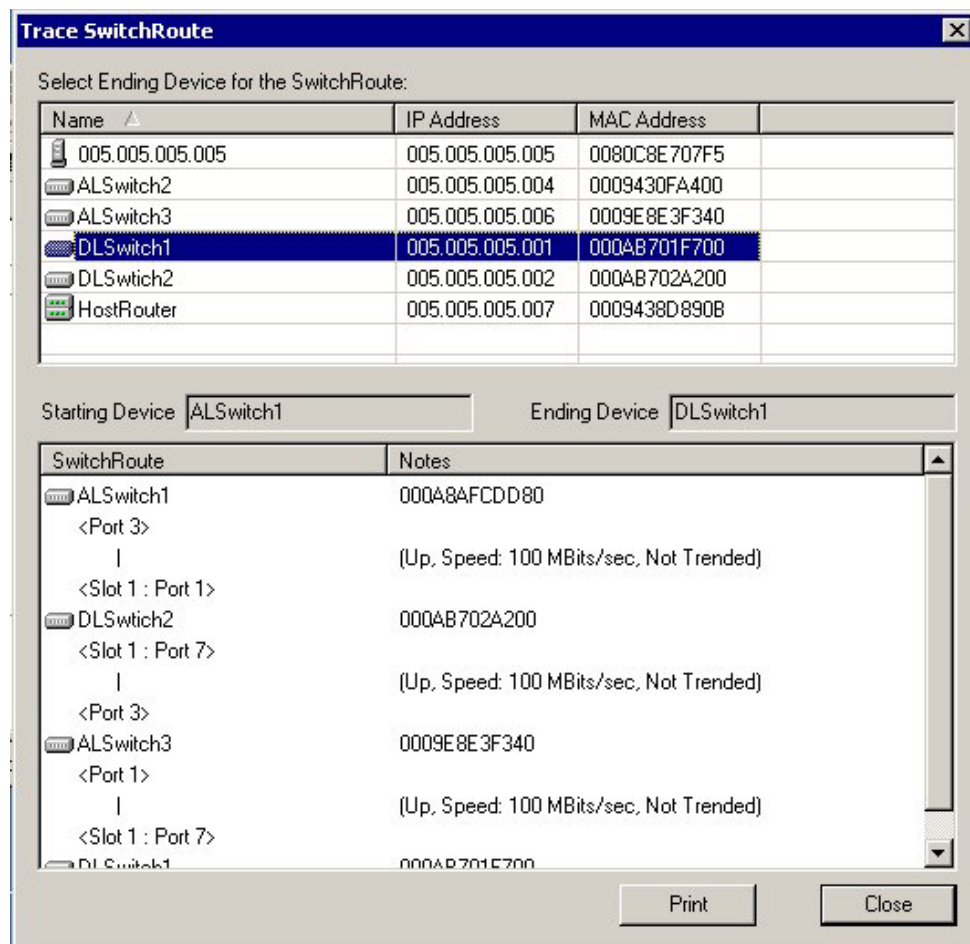
```

Interface Name	Port ID Prio.Nbr	Cost	Sts	Designated Cost Bridge ID	Port ID Prio.Nbr
Fa0/1	128.1	19	FWD	19 32769 000b.bebd.7a00	128.1
Fa0/3	128.3	19	FWD	0 4097 000b.be4f.e780	128.7



1. Did the trace go though DLSwitch1 or DLSwitch2? Why?

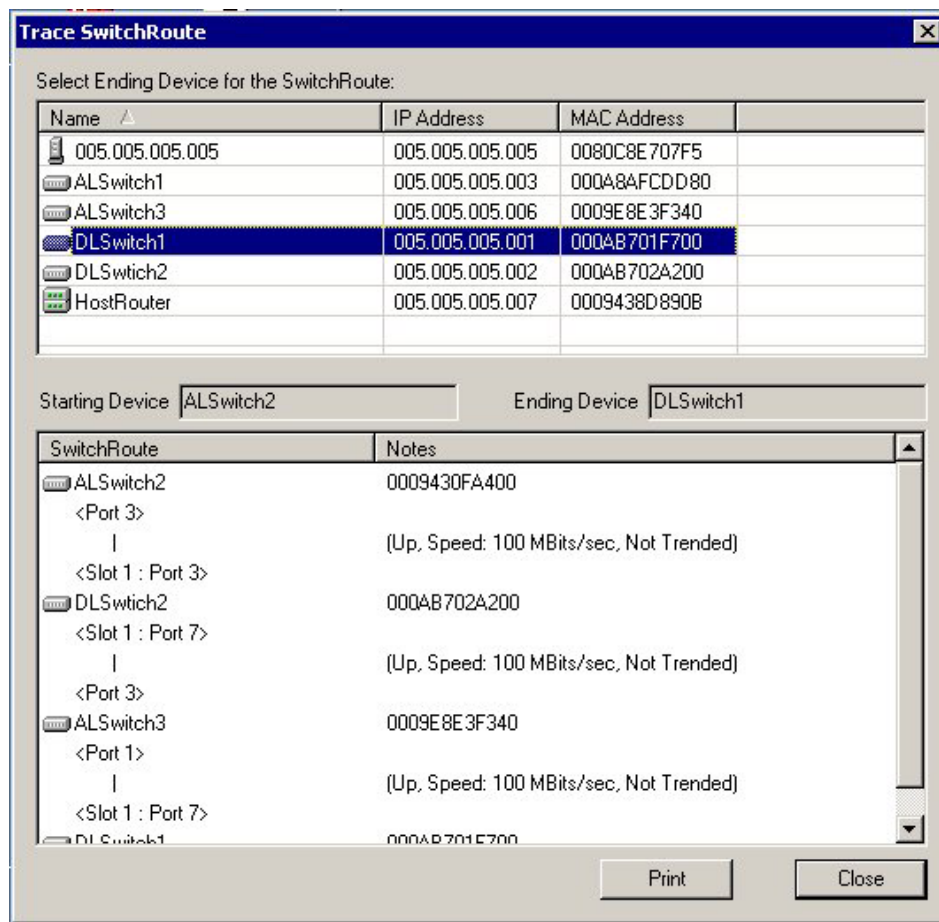
Try a trace from ALSwitch1 to DLSwitch1.



ALSwitch1 and DLSwitch1 are directly connected. However, the trace still goes through DLSwitch2. STP always sends frames to the root bridge before sending them to the destination switch.

Now do a trace from ALSwitch2 to DLSwitch1.





2. Did the trace go through DLSwitch2?

Network Monitor is a great tool that provides an overview of a network. Use it to chart the data flow of the network. Changes can be made to the configuration to get the desired results.

The switch trace feature of Network Monitor can also be used with all the labs. This is another way to verify the network behavior.