Chapter 3: Using Maintenance & Troubleshooting Tools and Applications

CCNP TSHOOT: Maintaining and Troubleshooting IP Networks

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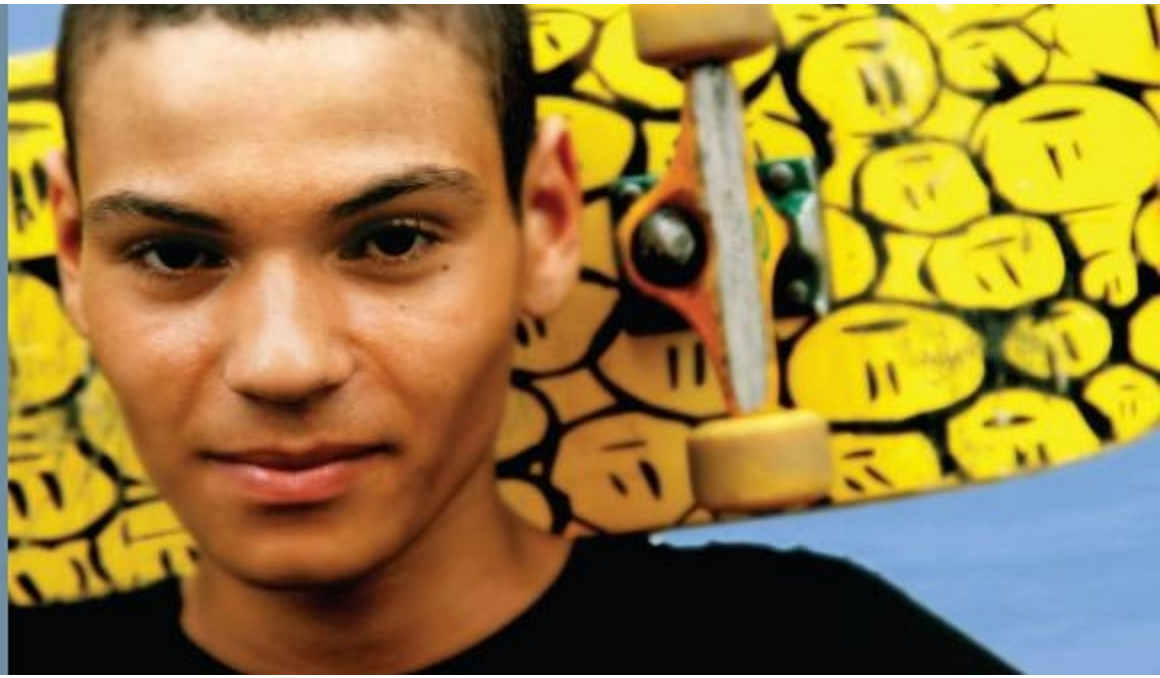
Chapter 3 Objectives

- Use Cisco IOS commands to gather information in support of diagnostic processes.
- Identify tools used for specific maintenance and troubleshooting processes.

Using Cisco IOS Software for Maintenance and Troubleshooting



Collecting and Filtering Information Using IOS show Commands

Filtering **show ip route** command output

```
R1# show ip route 10.1.193.2
Routing entry for 10.1.193.0/30
  Known via "connected", distance 0, metric 0 (connected, via
interface)
  Redistributing via eigrp 1
  Routing Descriptor Blocks:
  * directly connected, via Serial0/0/1
      Route metric is 0, traffic share count is 1

R1# show ip route 10.1.193.10
% subnet not in table
```

Collecting and Filtering Information Using IOS show Commands – Cont.

Using the **longer-prefixes** keyword with **show ip route**

```
R1# show ip route 10.1.193.0 255.255.255.0 longer-prefixes
< output omitted >
Gateway of last resort is not set
     10.0.0.0/8 is variably subnetted, 46 subnets, 6 masks
C       10.1.193.2/32 is directly connected, Serial0/0/1
C       10.1.193.0/30 is directly connected, Serial0/0/1
D       10.1.193.6/32 [90/20517120] via 10.1.192.9, 2d01h, FastEthernet0/1
                      [90/20517120] via 10.1.192.1, 2d01h, FastEthernet0/0
D       10.1.193.4/30 [90/20517120] via 10.1.192.9, 2d01h, FastEthernet0/1
                      [90/20517120] via 10.1.192.1, 2d01h, FastEthernet0/0
D       10.1.193.5/32 [90/41024000] via 10.1.194.6, 2d01h, Serial0/0/0.122
```

Collecting and Filtering Information Using IOS show Commands – Cont.

Using pipes with **include**, **exclude** and **begin**

```
R1# show processes cpu | include IP Input
  71     3149172   7922812         397  0.24%  0.15%  0.05%   0 IP Input

S1# show ip interface brief | exclude unassigned
Interface              IP-Address      OK? Method Status                Protocol
Vlan128                10.1.156.1      YES NVRAM  up                    up

S1# show running-config | begin line vty
line vty 0 4
 transport input telnet ssh
line vty 5 15
 transport input telnet ssh
!
End

R1# show processes cpu| include IP Input
                        ^
% Invalid input detected at '^' marker.
```

Collecting and Filtering Information Using IOS show Commands – Cont.

Using pipes with **section** and **^**

```
R1# show running-config | section router eigrp
router eigrp 1
 network 10.1.192.2 0.0.0.0
 network 10.1.192.10 0.0.0.0
 network 10.1.193.1 0.0.0.0
 no auto-summary

R1# show processes cpu | include ^CPU|IP Input
CPU utilization for five seconds: 1%/0%; one minute: 1%; five minutes: 1%
  71   3149424   7923898     397  0.24%  0.04%  0.00%   0 IP Input
```

Collecting and Filtering Information Using IOS show Commands – Cont.

Using the **redirect** and **tee** options

```
R1# show tech-support | redirect tftp://192.168.37.2/show-tech.txt

R1# show ip interface brief | tee flash:show-int-brief.txt
Interface                  IP-Address      OK? Method Status
Protocol
FastEthernet0/0            10.1.192.2      YES manual up                    up

FastEthernet0/1            10.1.192.10     YES manual up                    up

Loopback0                  10.1.220.1      YES manual up                    up

R1# dir flash:
Directory of flash:/
 1 -rw-  23361156  Mar 2 2009 16:25:54 -08:00 c1841-advipservicesk9mz.1243.bin
 2 -rw-       680  Mar 7 2010 02:16:56 -08:00 show-int-brief.txt
```

Collecting and Filtering Information Using IOS show Commands – Cont.

Using the **append** option and the **more** command

```
R1# show version | append flash:show-commands.txt

R1# show ip interface brief | append flash:show-commands.txt

R1# more flash:show-commands.txt
Cisco IOS Software, 1841 Software (C1841-ADVIPSERVICESK9-M), Version 12.4(23),
RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2008 by Cisco Systems, Inc.
Compiled Sat 08-Nov-08 20:07 by prod_rel_team
ROM: System Bootstrap, Version 12.3(8r)T9, RELEASE SOFTWARE (fc1)
R1 uptime is 3 days, 1 hour, 22 minutes
< output omitted >
Interface                  IP-Address      OK? Method Status
Protocol
FastEthernet0/0            10.1.192.2      YES manual up                    up

FastEthernet0/1            10.1.192.10     YES manual up                    up
```

Collecting and Filtering Information Using IOS ping and Telnet Commands

```
Router#
ping ip-address | hostname [repeat repeat-count size
datagram-size source [address | interface] df-bit]
```

Parameter	Description
repeat *repeat-count*	Number of ping packets that are sent to the destination address. The default is 5.
size *datagram-size*	Size of the ping packet (in bytes). Default: 100 bytes.
source [*address* | *interface*]	The interface or IP address of the router to use as a source address for the probes.

Testing Network Connectivity Using Cisco IOS Commands – Cont.

Using the ping extended option: **source**

```
R1# ping 10.1.156.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.156.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

R1# ping 10.1.156.1 source FastEthernet 0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.156.1, timeout is 2 seconds:
Packet sent with a source address of 10.1.192.2
.....
Success rate is 0 percent (0/5)
```

Testing Network Connectivity Using Cisco IOS Commands – Cont.

Explanation of ping results characters

- **!** Each exclamation point indicates receipt of a reply.
- **.** Each period indicates a timeout waiting for a reply.
- **U** A destination unreachable ICMP message was received.
- **Q** Source quench (destination too busy).
- **M** Could not fragment (MTU related).
- **?** Unknown packet type.
- **&** Packet lifetime exceeded

Testing Network Connectivity Using Cisco IOS Commands – Cont.

Using the **ping** extended prompt mode

```
R1# ping
Protocol [ip]:
Target IP address: 10.1.221.1
Repeat count [5]: 1
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface:
Type of service [0]:
Set DF bit in IP header? [no]: yes
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]: y
Sweep min size [36]: 1400
Sweep max size [18024]: 1500
Sweep interval [1]:
Type escape sequence to abort.
Sending 101, [1400..1500]-byte ICMP Echos to 10.1.221.1, timeout is 2 seconds:
<output omitted>
```

Testing Network Connectivity Using Cisco IOS Commands – Cont.

Using Telnet to test the Transport and Application Layer

```
R1# telnet 192.168.37.2 80
Trying 192.168.37.2, 80 ... Open
GET
<html><body><h1>It works!</h1></body></html>
[Connection to 192.168.37.2 closed by foreign host]


R1# telnet 192.168.37.2 25
Trying 192.168.37.2, 25 ...
% Connection refused by remote host
```

Collecting Real-time Information Using Cisco IOS debug Commands

- Remember, because debugging output is assigned high priority in the CPU process, it can render the system unusable.
- Use debug commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco techn support staff.

Collecting Real-time Information Using Cisco IOS debug Commands

The **debug ip packet** command output

```
R1# debug ip packet
IP: s=172.69.13.44 (Fddi0), d=10.125.254.1 (Serial2), g=172.69.16.2,
forward
IP: s=172.69.1.57 (Ethernet4), d=10.36.125.2 (Serial2),
g=172.69.16.2, forward
IP: s=172.69.1.6 (Ethernet4), d=255.255.255.255, rcvd 2
IP: s=172.69.1.55 (Ethernet4), d=172.69.2.42 (Fddi0), g=172.69.13.6,
forward
IP: s=172.69.89.33 (Ethernet2), d=10.130.2.156 (Serial2),
g=172.69.16.2, forward
IP: s=172.69.1.27 (Ethernet4), d=172.69.43.126 (Fddi1),
g=172.69.23.5, forward
IP: s=172.69.1.27 (Ethernet4), d=172.69.43.126 (Fddi0),
g=172.69.13.6, forward
IP: s=172.69.20.32 (Ethernet2), d=255.255.255.255, rcvd 2
IP: s=172.69.1.57 (Ethernet4), d=10.36.125.2 (Serial2),
g=172.69.16.2, access denied
```

Collecting Real-time Information Using Cisco IOS debug Commands – Cont.

The **debug ip rip** command output

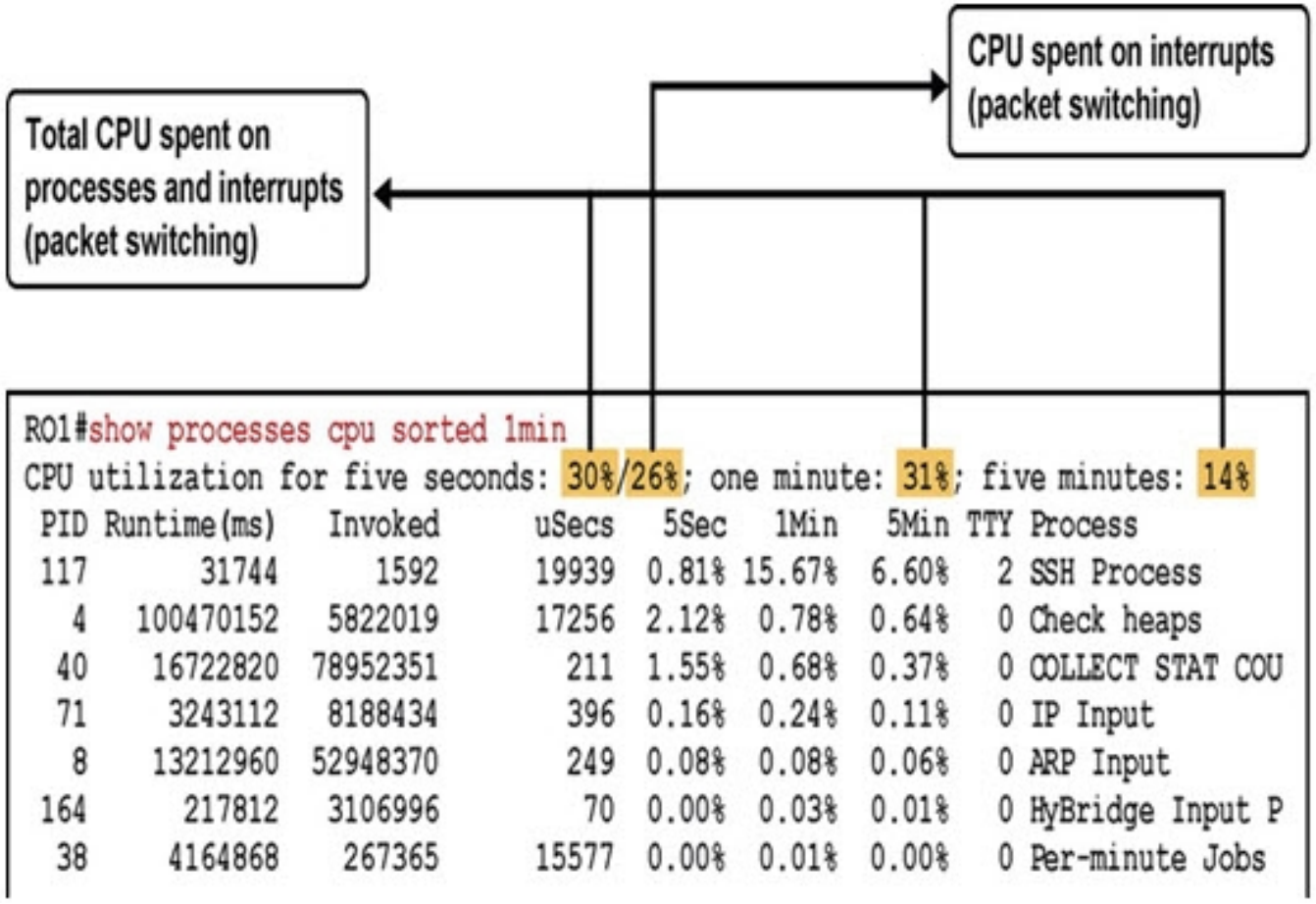
```
R1# debug ip rip
RIP: received v2 update from 10.1.1.2 on Serial0/0/0
      30.0.0.0/8 via 0.0.0.0 in 1 hops
RIP: sending  v2 update to 224.0.0.9 via FastEthernet0/0 (20.1.1.1)
RIP: build update entries
      10.0.0.0/8 via 0.0.0.0, metric 1, tag 0
      30.0.0.0/8 via 0.0.0.0, metric 2, tag 0
RIP: sending  v2 update to 224.0.0.9 via Serial0/0/0 (10.1.1.1)
RIP: build update entries
      20.0.0.0/8 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 10.1.1.2 on Serial0/0/0
      30.0.0.0/8 via 0.0.0.0 in 1 hops
RIP: sending  v2 update to 224.0.0.9 via FastEthernet0/0 (20.1.1.1)
```

Diagnosing Hardware Issues Using Cisco IOS Commands

- The three main categories of failure causes in a network are as follows: hardware failures, software failures (bugs), and configuration errors.
- Performance problems could be a fourth category, but performance problems are symptoms rather than failure causes.

Diagnosing Hardware Issues Using Cisco IOS Commands – Cont.

Checking CPU utilization with **show processes cpu**



Diagnosing Hardware Issues Using Cisco IOS Commands – Cont.

Checking memory utilization with the **show memory** command

```
R1# show memory
                Head   Total(b)     Used(b)     Free(b)   Lowest(b)  Largest(b)
Processor   820B1DB4   26534476    19686964     6847512     6288260     6712884
      I/O    3A00000    6291456     3702900     2588556     2511168     2577468
```

Diagnosing Hardware Issues Using Cisco IOS Commands – Cont.

Checking interfaces with the **`show interfaces`** command

```
R1# show interfaces FastEthernet 0/0
FastEthernet0/0 is up, line protocol is up
<output omitted>
  Last input 00:00:00, output 00:00:01, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/1120/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 2000 bits/sec, 3 packets/sec
  5 minute output rate 0 bits/sec, 1 packets/sec
     110834589 packets input, 1698341767 bytes
     Received 61734527 broadcasts, 0 runts, 0 giants, 565 throttles
     30 input errors, 5 CRC, 1 frame, 0 overrun, 25 ignored
     0 watchdog
     0 input packets with dribble condition detected
     35616938 packets output, 526385834 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

Diagnosing Hardware Issues Using Cisco IOS Commands – Cont.

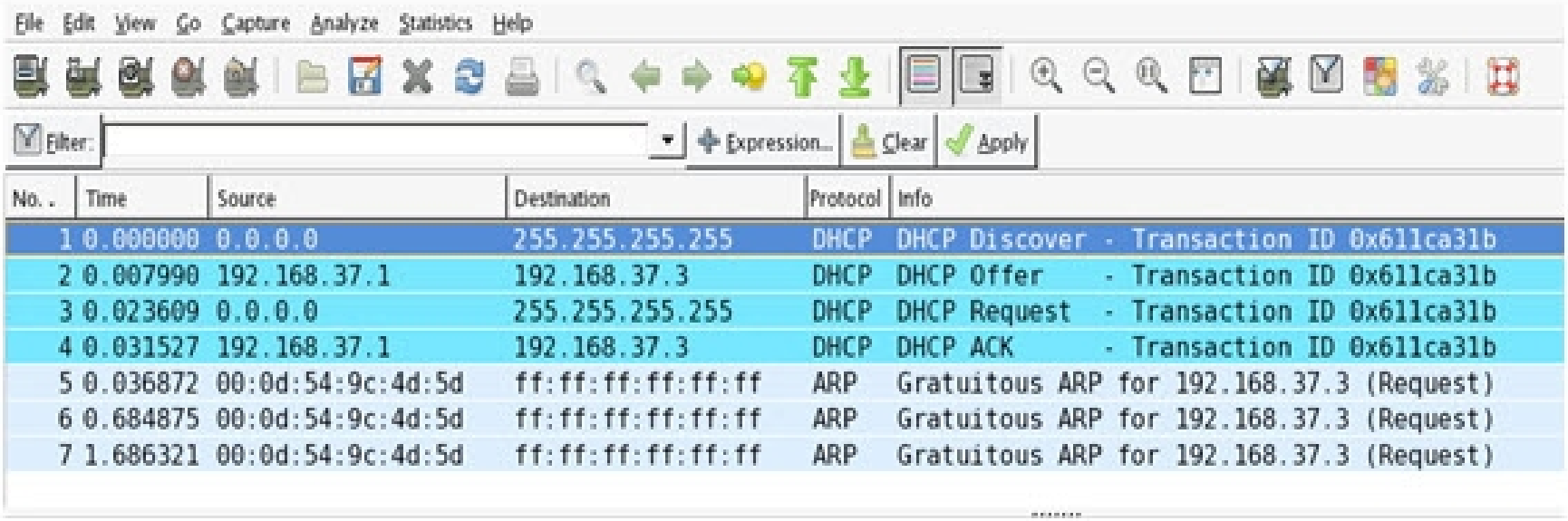
Additional hardware commands and tools:

- **`show controllers`**
- **`show platform`**
- **`show inventory`**
- **`show diag`**
- Generic Online Diagnostics (GOLD)
- Time Domain Reflectometer

Using Specialized Maintenance and Troubleshooting Tools

Using Traffic Capturing Tools

Sample screen shot from a protocol analyzer



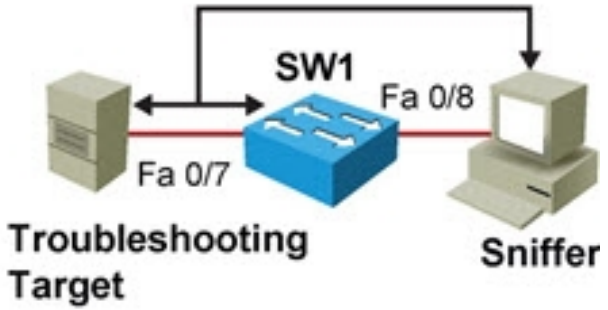
Using Traffic Capturing Tools – Cont.

Switched Port Analyzer (SPAN)

```
monitor session 1 source interface Fa0/7
monitor session 1 destination interface Fa0/8
```

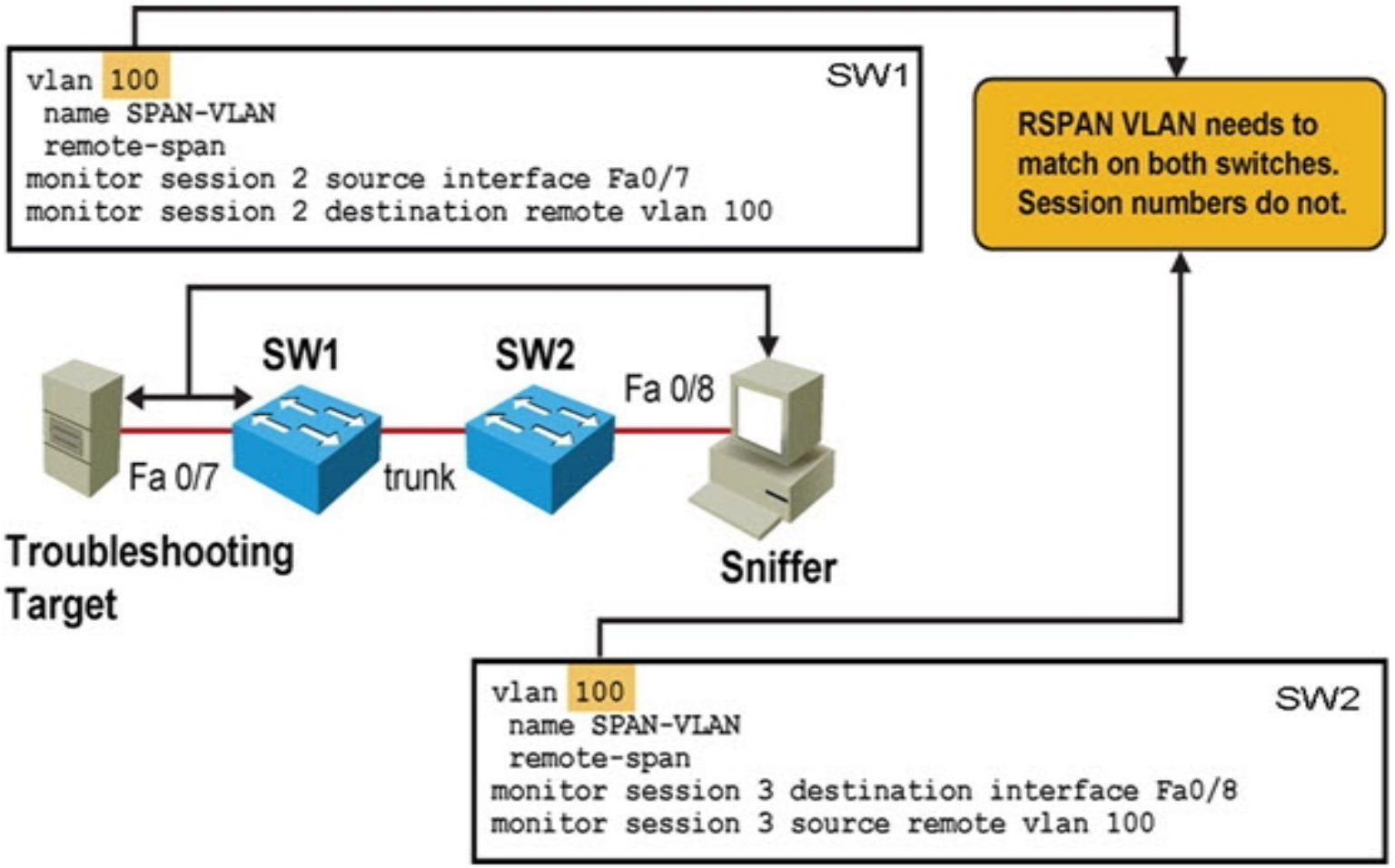
Sources and destinations that form a single SPAN session are identified by a session number

```
SW1#show monitor
Session 1
---------
Type                    : Local Session
Source Ports            :
    Both                : Fa0/7
Destination Ports       : Fa0/8
    Encapsulation       : Native
          Ingress       : Disabled
```



Using Traffic Capturing Tools – Cont.

Remote Switched Port Analyzer (RSPAN)



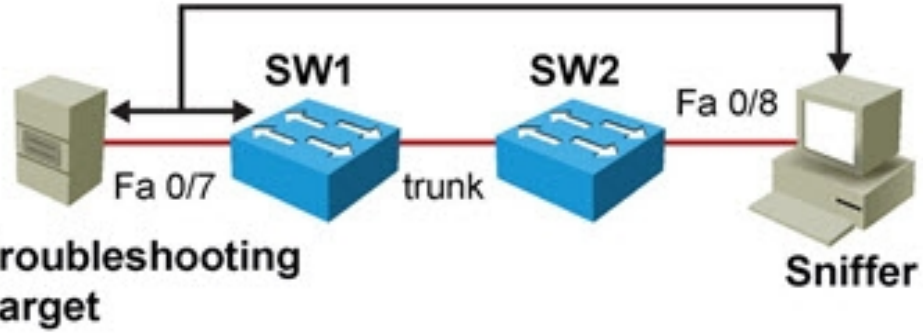
Using Traffic Capturing Tools – Cont.

Remote Switched Port Analyzer (RSPAN) – Cont.

```
SW1#show monitor
Session 2
---------
Type                    : Remote Source Session
Source Ports            :
     Both               : Fa0/7
Dest RSPAN VLAN         : 100
```

```
SW1#show vlan remote-span

Remote SPAN VLANs
------------------------
100
```



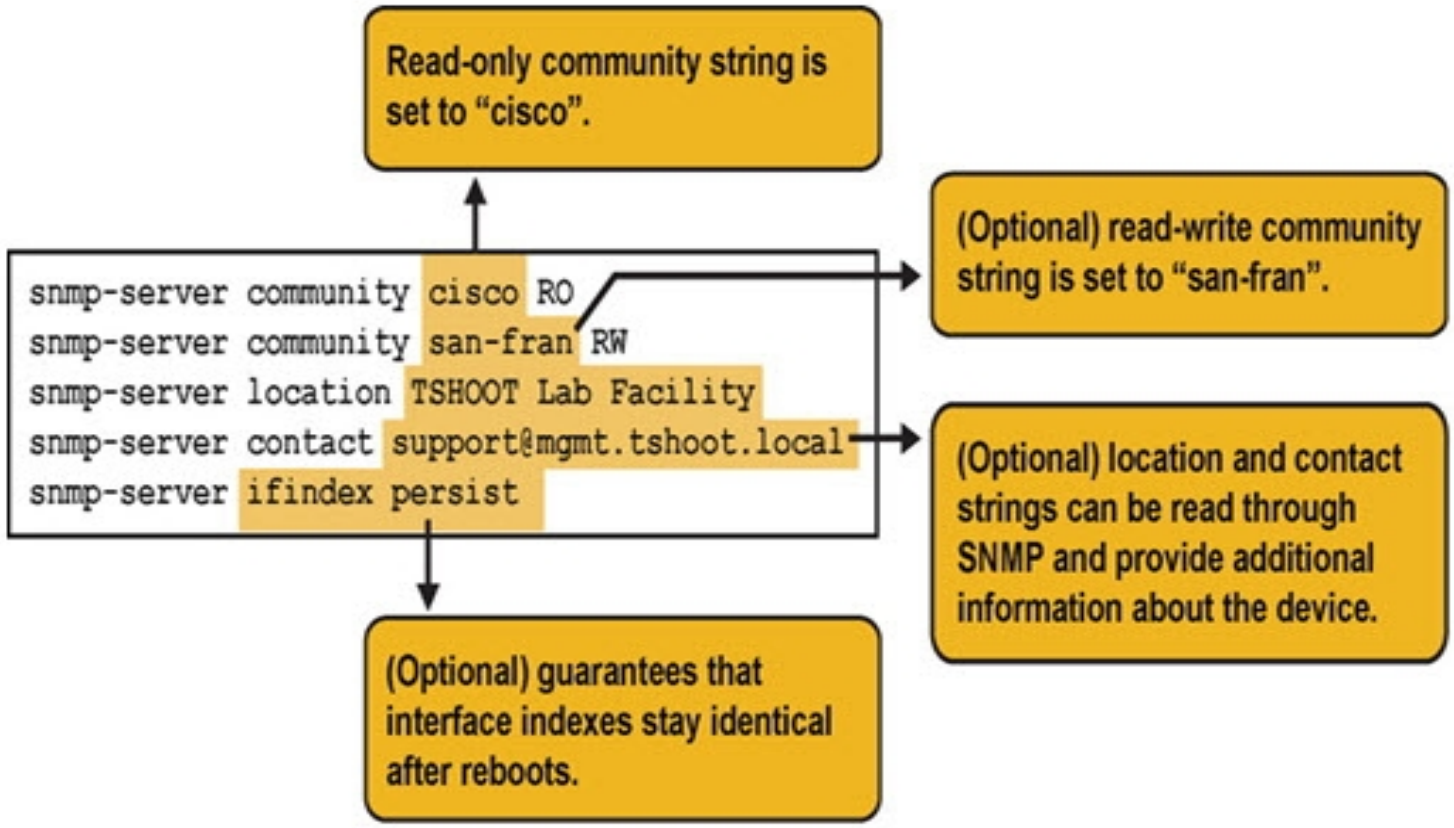

```
SW2#show vlan remote-span

Remote SPAN VLANs
------------------------
100
```

```
SW2#show monitor
Session 3
---------
Type                    : Remote Destination Session
Source RSPAN VLAN       : 100
Destination Ports       : Fa0/8
    Encapsulation       : Native
          Ingress       : Disabled
```

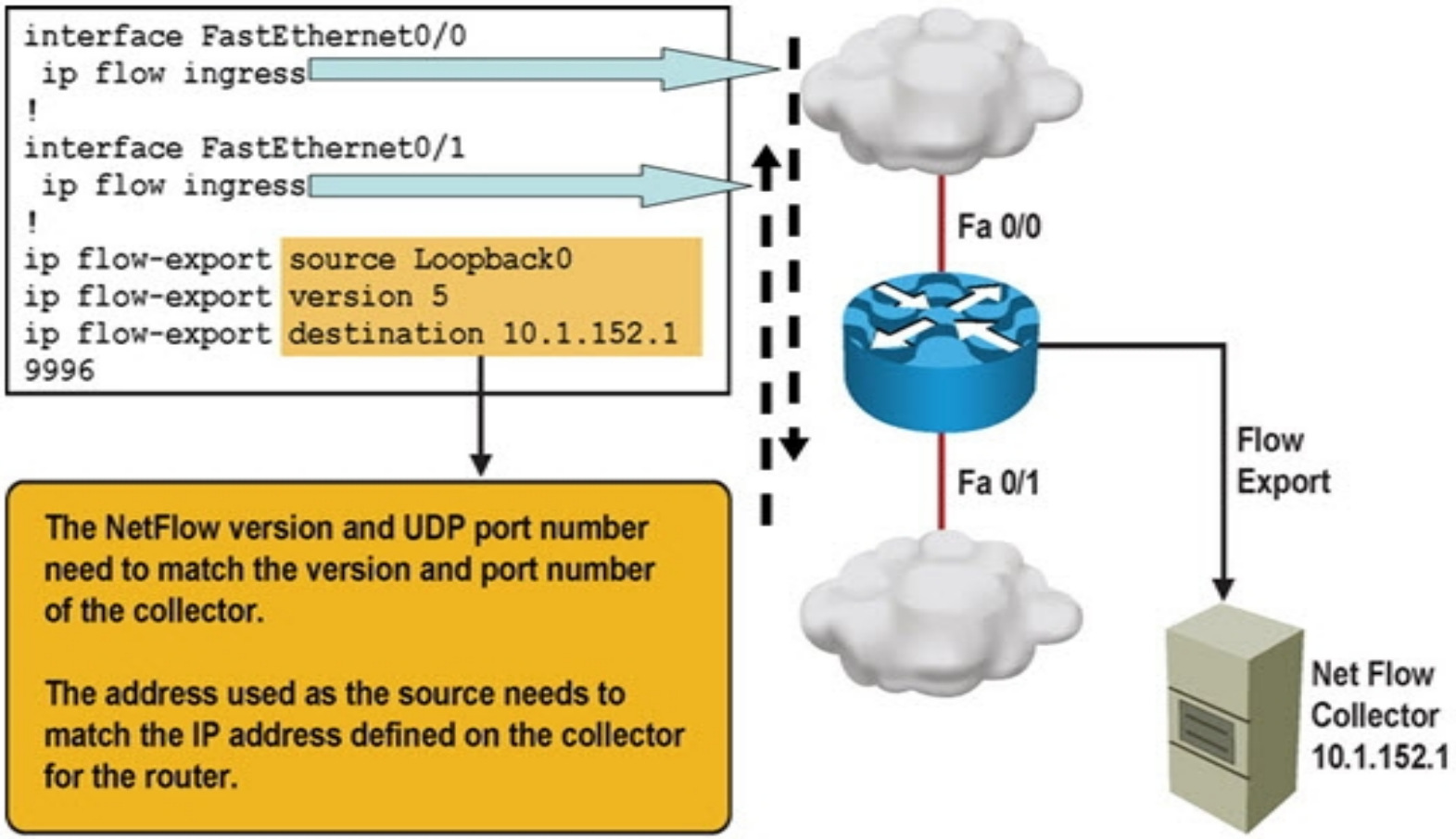
Gathering Information with SNMP

A Simple SNMP Configuration Example



Gathering Information with NetFlow

A Simple NetFlow Configuration Example



Gathering Information with NetFlow

show ip cache flow command output

```
R1# show ip cache flow
<output omitted>
SrcIf         SrcIPaddress    DstIF    DstIPaddress     Pr  SrcP  DstP  Pkts
Se0/0/0.121   10.1.194.10     Null     224.0.0.10       58  0000  0000  27
Se0/0/0.121   10.1.194.14     Null     224.0.0.10       58  0000  0000  28
Fa0/0         10.1.192.5      Null     224.0.0.10       58  0000  0000  28
Fa0/1         10.1.192.13     Null     224.0.0.10       58  0000  0000  27
Fa0/1         10.1.152.1      Local    10.1.220.2       01  0000  0303   1
Se0/0/1       10.1.193.6      Null     224.0.0.10       58  0000  0000   28
Fa0/1         10.1.152.1      Se0/0/1  10.1.163.193     11  0666  E75E   1906
Se0/0/1       10.1.163.193    Fa0/0    10.1.152.1       11  E75E  0666   1905
```

SNMP and NetFlow Comparison

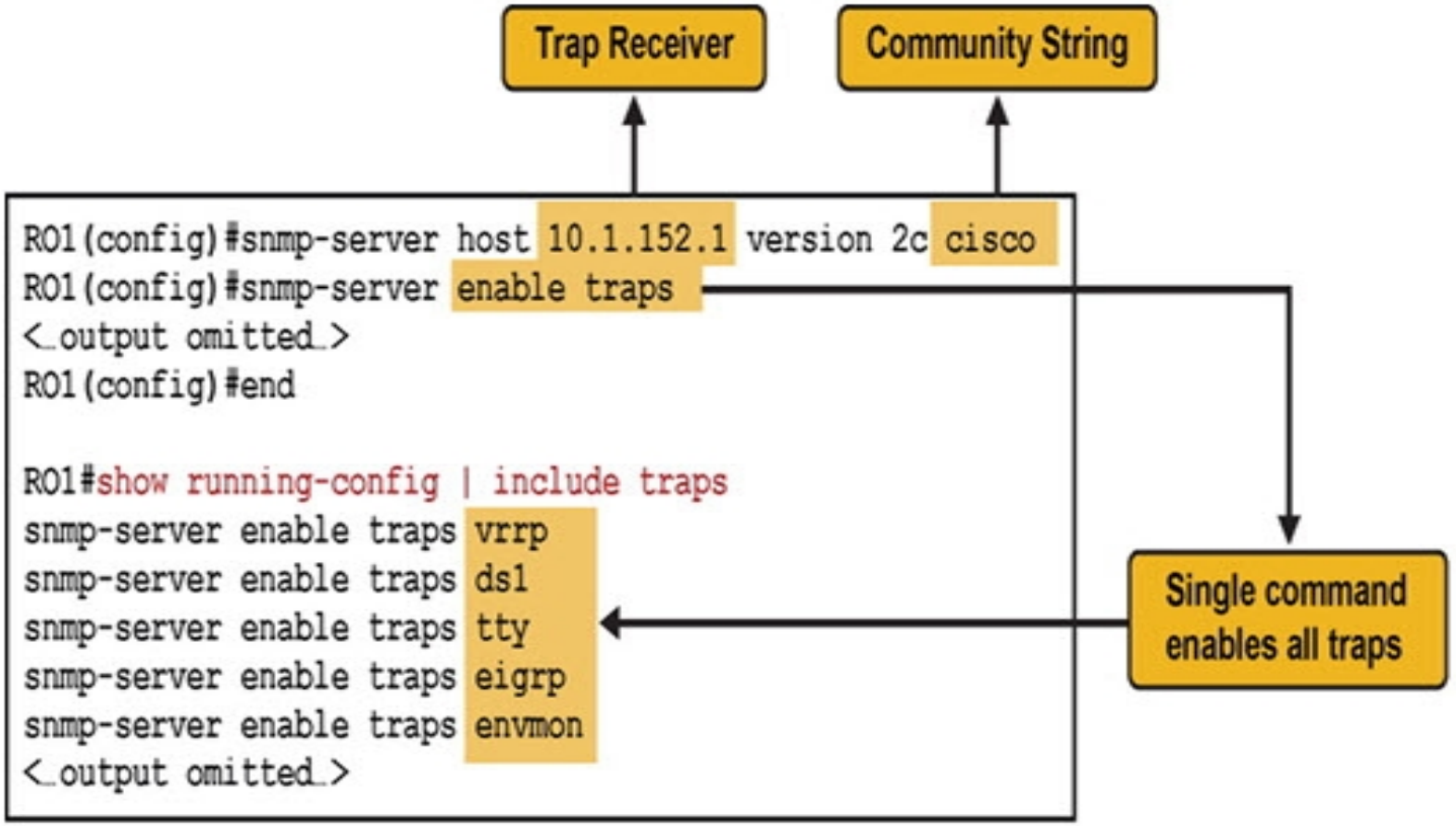
- Both are used to gather statistics from Cisco switches and routers.
- SNMP's focus is primarily on the collection of various statistics from components within network devices.
- A NetFlow enabled device collects information about the IP traffic flowing through the device.
- NetFlow uses a "push" based model – devices send data to a collector.
- SNMP is considered pull-based – the NMS queries SNMP Agents.
- NetFlow only gathers traffic statistics.
- SNMP can also collect many other performance indicators such as interface errors, CPU usage, and memory usage.
- Statistics collected using NetFlow have more granularity.
- NetFlow is currently supported on most Cisco IOS routers but only the 4500 and 6500 series switches

Enabling Network Event Notification

- A key element of a proactive network management strategy is fault notification.
- SNMP and syslog
- Embedded Event Manager (EEM)

Enabling Network Event Notification – SNMP

Enabling SNMP trap notification



Enabling Network Event Notification – Embedded Event Manager (EEM)

- **Enables custom policies that trigger actions based on events:**
  - syslog messages
  - Cisco IOS counter changes
  - SNMP MIB object changes
  - SNMP traps
  - CLI command execution
  - Timers and many other options
- **Actions can consist of:**
  - Sending SNMP traps or syslog messages
  - Executing CLI commands
  - Sending email
  - Running tool command language (TCL) scripts

Enabling Network Event Notification – EEM

A sample EEM Configuration

```
R1(config)# event manager applet CONFIG-STARTED

R1(config-applet)# event cli pattern "configure terminal" sync no skip no
occurs 1

R1(config-applet)# action 1.0 syslog priority critical msg "Configuration mode
was entered"

R1(config-applet)# action 2.0 syslog priority informational msg "Change
control policies apply. Authorized access only."
```

Enabling Network Event Notification – EEM

A sample EEM policy result

```
R1# conf t
Enter configuration commands, one per line.  End with CNTL/Z.

R1(config)#
Jul 13 03:24:41.473 PDT: %HA_EM-2-LOG: CONFIG-STARTED: Configuration mode was
entered
Jul 13 03:24:41.473 PDT: %HA_EM-6-LOG: CONFIG-STARTED: Change control policies
apply. Authorized access only
```

For more information, visit http://cisco.com/go/instrumentation