



Tcl Scripting for Cisco IOS

A guide to building and modifying Tcl scripts to
automate network administration tasks

Tcl Scripting for Cisco IOS

Ray Blair, CCIE No. 7050
Arvind Durai, CCIE No. 7016
John Lautmann

Cisco Press

800 East 96th Street

Indianapolis, IN 46240

R1

```

R1#show ip route
Codes: C - connected, S - static, R -
RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external,
O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1,
N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 -
OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 -
IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candi-
date default, U - per-user static
route
        o - ODR, P - periodic downloaded
static route

Gateway of last resort is not set

    172.16.0.0/24 is subnetted,
    1 subnets
C    172.16.1.0 is directly connected,
Ethernet1/0
    10.0.0.0/24 is subnetted,
    1 subnets
C    10.1.1.0 is directly connected,
Ethernet0/0
S    192.168.1.0/24 [1/0] via 10.1.1.2
    192.169.2.0/32 is subnetted,
    1 subnets
C    192.169.2.2 is directly connected,
Loopback1
R1#

```

R2

```

r2#show ip route
Codes: C - connected, S - static, R -
RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external,
O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1,
N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 -
OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 -
IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candi-
date default, U - per-user static
route
        o - ODR, P - periodic downloaded
static route

Gateway of last resort is 10.1.1.1 to
network 0.0.0.0

    172.16.0.0/24 is subnetted,
    1 subnets
C    172.16.1.0 is directly connected,
Ethernet1/0
    10.0.0.0/24 is subnetted,
    1 subnets
C    10.1.1.0 is directly connected,
Ethernet0/0
C    192.168.1.0/24 is directly
connected, Loopback0
S*   0.0.0.0/0 [1/0] via 10.1.1.1
R2#

```

Table 4-11 shows the results during the failure of the primary link between R1 and R2.

Table 4-11 *EEM/IP SLA for Static Routing Failure Scenario*

R1	R2
To simulate a failure, the Ethernet interface 0/0 on R1 will be shutdown. We can then observe the results of the simulated failure. <pre> R1(config)#int e0/0 R1(config-if)#shut R1(config-if)#end R1# R1# *Oct 11 09:00:22.023: %SYS-5-CON- FIG_I: Configured from console by console *Oct 11 09:00:22.975: %LINK-5- CHANGED: Interface Ethernet0/0, changed state to administratively down *Oct 11 09:00:23.983: %LINEPROTO-5- UPDOWN: Line protocol on Interface Ethernet0/0, changed state to down R1# </pre>	When the e0/0 interface is shut down on R1 router, the <i>EEM script is triggered and traffic will change to the backup path.</i> <pre> t R2# *Oct 11 09:00:25.343: %TRACKING-5- STATE: 100 ip sla 100 reachability Up->Down R2# *Oct 11 09:00:26.607: %HA_EM-6-LOG: #100: back up route R2# *Oct 11 09:00:26.611: %SYS-5-CON- FIG_I: Configured from console by vty0 </pre>
Object tracking detects the IP SLA probe “down” state. <pre> *Oct 11 09:00:24.503: %TRACKING-5- STATE: 10 ip sla 10 reachability Up->Down *Oct 11 09:00:26.503: %TRACKING-5- STATE: 100 ip sla 100 reachability Up->Down </pre> <i>EEM scripts gets triggered and changes the path to back up. A new syslog message is added by the script to let the admin know the traffic path is passing through back up.</i> <pre> *Oct 11 09:00:28.015: %HA_EM-6-LOG: #100: back up route </pre>	

R1

The show ip route displays the new route that is installed in the table and the original route that points to the primary link is removed.

```
R1#show ip route
*Oct 11 09:00:28.015: %SYS-5-CON-
FIG_I: Configured from console by
vty0
R1#show ip route
Codes: C - connected, S - static,
R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external,
O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1,
N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 -
OSPF external type 2
i - IS-IS, su - IS-IS summary,
L1 - IS-IS level-1, L2 - IS-IS
level-2
ia - IS-IS inter area, * - can-
didate default, U - per-user static
route
o - ODR, P - periodic downloaded
static route

Gateway of last resort is not set

172.16.0.0/24 is subnetted,
1 subnets
C 172.16.1.0 is directly connect-
ed, Ethernet1/0
S 192.168.1.0/24 [1/0] via
172.16.1.2
192.169.2.0/32 is subnetted,
1 subnets
C 192.169.2.2 is directly
connected, Loopback1
R1#
```

R2

The show ip route command shows the new default route has been installed in the table and the original default route that points to the primary link has been removed.

```
R2#show ip route
Codes: C - connected, S - static,
R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external,
O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1,
N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 -
OSPF external type 2
i - IS-IS, su - IS-IS summary,
L1 - IS-IS level-1, L2 - IS-IS
level-2
ia - IS-IS inter area, * - can-
didate default, U - per-user static
route
o - ODR, P - periodic downloaded
static route

Gateway of last resort is 172.16.1.1
to network 0.0.0.0

172.16.0.0/24 is subnetted,
1 subnets
C 172.16.1.0 is directly connect-
ed, Ethernet1/0
10.0.0.0/24 is subnetted,
1 subnets
C 10.1.1.0 is directly connected,
Ethernet0/0
C 192.168.1.0/24 is directly
connected, Loopback0
S* 0.0.0.0/0 [1/0] via 172.16.1.1
R2#
```

Table 4-12 shows the results when the primary link is restored.

Table 4-12 *EEM/IP SLA for Static Routing Restoration Scenario*

R1	R2
In this example, the primary interface is restored and we can observe the behavior. <pre> R1(config)#interface e0/0 R1(config-if)#no shut R1(config-if)# *Oct 11 09:21:25.515: %LINK-3- UPDOWN: Interface Ethernet0/0, changed state to up *Oct 11 09:21:26.515: %LINEPROTO-5- UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up R1(config-if)#end R1# </pre>	When the e0/0 interface has been restored on R1.
The track object detects the SLA probe and changes from down to an up state. <pre> *Oct 11 09:21:27.887: %TRACKING-5- STATE: 100 ip sla 100 reachability Down->Up *Oct 11 09:21:28.387: %SYS-5-CON- FIG_I: Configured from console by console </pre>	<pre> R2# *Oct 11 09:21:26.987: %TRACKING-5- STATE: 100 ip sla 100 reachability Down->Up The EEM applet generates the syslog message "back to primary route." *Oct 11 09:21:28.239: %HA_EM-6-LOG: #101: back to primary routeR2# *Oct 11 09:21:28.255: %SYS-5-CON- FIG_I: Configured from console by vty0 </pre>
The EEM applet generates a syslog message, "back to primary route."	The primary route is restored and the back-up route is removed.

R1

```

*Oct 11 09:21:29.287: %HA_EM-6-LOG:
#101: back to primary route
R1#
*Oct 11 09:21:29.287: %SYS-5-CON-
FIG_I: Configured from console by
vty0
R1#
*Oct 11 09:21:32.899: %TRACKING-5-
STATE: 10 ip sla 10 reachability
Down->Up

! The primary route is restored and
the
! back up route is removed.

R1#
R1#show ip route
Codes: C - connected, S - static,
R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external,
O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1,
N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 -
OSPF external type 2
        i - IS-IS, su - IS-IS summary,
L1 - IS-IS level-1, L2 - IS-IS
level-2
        ia - IS-IS inter area, * - can-
didate default, U - per-user static
route
        o - ODR, P - periodic downloaded
static route

Gateway of last resort is not set.

        172.16.0.0/24 is subnetted,
1 subnets
C    172.16.1.0 is directly connect-
ed, Ethernet1/0
        10.0.0.0/24 is subnetted, 1 sub-
nets
C    10.1.1.0 is directly connected,
Ethernet0/0
S    192.168.1.0/24 [1/0] via 10.1.1.2
        192.169.2.0/32 is subnetted, 1
subnets
C    192.169.2.2 is directly con-
nected, Loopback1

```

R2

```

R2#show ip route
Codes: C - connected, S - static, R
- RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external,
O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1,
N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 -
OSPF external type 2
        i - IS-IS, su - IS-IS summary,
L1 - IS-IS level-1, L2 - IS-IS
level-2
        ia - IS-IS inter area, * - can-
didate default, U - per-user static
route
        o - ODR, P - periodic downloaded
static route

Gateway of last resort is 10.1.1.1
to network 0.0.0.0

        172.16.0.0/24 is subnetted,
1 subnets
C    172.16.1.0 is directly connect-
ed, Ethernet1/0
        10.0.0.0/24 is subnetted,
1 subnets
C    10.1.1.0 is directly connected,
Ethernet0/0
C    192.168.1.0/24 is directly
connected, Loopback0
S* 0.0.0.0/0 [1/0] via 10.1.1.1

```

Table 4-13 shows the final configuration of R1 and R2.

Table 4-13 *EEM/IP SLA for Static Routing Configuration*

R1	R2
<pre> R1#show run Building configuration... Current configuration : 2831 bytes ! version 12.4 ! hostname R1 ! ip cef ! To track IP SLA 100 track 100 ip sla 100 reachability ! ! interface Ethernet0/0 ip address 10.1.1.1 255.255.255.0 ! interface Ethernet1/0 ip address 172.16.1.1 255.255.255.0 ! ! ip forward-protocol nd ip route 192.168.1.0 255.255.255.0 10.1.1.2 ! </pre>	<pre> r2#show run Building configuration... Current configuration : 2667 bytes ! version 12.4 ! hostname r2 ! ! ip cef ! track 100 ip sla 100 reachability ! interface Loopback0 ip address 192.168.1.1 255.255.255.0 ! interface Ethernet0/0 ip address 10.1.1.2 255.255.255.0 ! ! interface Ethernet1/0 ip address 172.16.1.2 255.255.255.0 ! ! ip route 0.0.0.0 0.0.0.0 10.1.1.1 ! </pre>
! IP SLA 100 is configured using an ICMP-ECHO probe, the timeout and frequency is adjusted for quicker convergence. <pre> ip sla 100 icmp-echo 10.1.1.2 source-ip 10.1.1.1 timeout 5 frequency 2 ip sla schedule 100 start-time now recurring ! </pre>	! IP SLA 100 is configured using an ICMP-ECHO probe, the timeout and frequency is adjusted for quicker convergence. <pre> ! ip sla 100 icmp-echo 10.1.1.1 source-ip 10.1.1.2 timeout 5 frequency 2 ip sla schedule 100 start-time now recurring ! </pre>