## Practical 1

Aim: Implement IP SLA (IP Service Level Agreement)

What is IP SLA?

- IP SLA full from is Internet protocol service level agreement.

- IP SLAs are especially useful for wide area networks (WANs) that connect multiple geographies and needs to be monitored from one central location.

- IP SLAs continuously collect data about such things as Response times, latency, jitter and packet loss.

- This not only provides the network administrator with baseline information about network performance, it also helps the administrator to verify Quality of Service levels and quickly identify the root of a problem if performance levels drop.

- By "active," it refers to the fact that IP SLA will generate and actively monitor traffic continuously across the network.

- IP SLA can be configured in two parts. There is the IP SLA router, which generates the traffic, and the IP SLA Responder.

- IP SLA can be configured in such a way that it can report on statistics such as Jitter, Response time, Packet loss, Voice Quality Scoring (MOS), Connectivity and Delay.

Step 1: Create the topology as below.
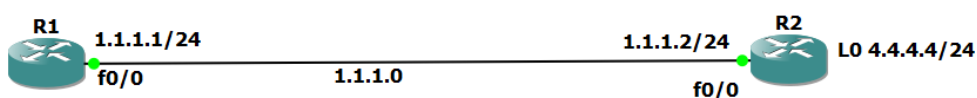
Step 2: Assign IP Address and Loopback to the router

R1: We have assigned 1.1.1.1 to f0/0 of R1

```
*Mar  1 00:00:04.331: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1, changed state to down
R1#
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#int f0/0
R1(config-if)#ip add 1.1.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#ex
R1(config)#do w
*Mar  1 00:00:37.527: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 00:00:38.527: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R1(config)#do wr
Building configuration...
[OK]
```

R2: We have assigned 1.1.1.2 to f0/0 of R2 and 4.4.4.4 to loopback 0

We have change the hostname of R2 to ISP

```
R2#en
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#hostname ISP
ISP(config)#int f0/0
ISP(config-if)#ip add 1.1.1.2 255.255.255.0
ISP(config-if)#no shut
ISP(config-if)#int L
*Mar  1 00:01:25.335: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 00:01:26.335: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
ISP(config-if)#int L0
ISP(config-if)#
*Mar  1 00:01:28.959: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
ISP(config-if)#ip add 4.4.4.4 255.255.255.0
ISP(config-if)#no shut
ISP(config-if)#ex
ISP(config)#do wr
Building configuration...
[OK]
```

Step 3: From R1 ping R2 IP and Loopback:

```
*Mar  1 00:00:41.483: %SYS-5-CONFIG_I: Configured from console by consol
R1#ping 1.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.2, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 16/30/40 ms
R1#ping 4.4.4.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R1#conf t
```

We can successfully ping 1.1.1.2 but we can't ping the loopback of R2.

So, we will give default route to 1.1.1.2.

Once it's done, we can ping the loopback of R2 as below.

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 0.0.0.0 0.0.0.0 1.1.1.2
R1(config)#do wr
Building configuration...
[OK]
R1(config)#end
R1#p1
*Mar  1 00:01:29.859: %SYS-5-CONFIG_I: Configured from console by console
R1#ping 4.4.4.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/33/44 ms
R1#conf t
```

Step 4: Then we configure the IP SLA.

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/33/44 ms
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip sla monitor 1
R1(config-sla-monitor)#type echo protocol ipIcmpEcho ?
  Hostname or A.B.C.D  IP address or hostname, broadcast disallowed

R1(config-sla-monitor)#type echo protocol ipIcmpEcho 4.4.4.4 ?
  source-interface  Source Interface (ingress icmp packet interface)
  source-ipaddr     Source Address
  <cr>

R1(config-sla-monitor)#$rotocol ipIcmpEcho 4.4.4.4 source-ipaddr 1.1.1.1
R1(config-sla-monitor-echo)#freq
R1(config-sla-monitor-echo)#frequency 10
R1(config-sla-monitor-echo)#thre
R1(config-sla-monitor-echo)#threshold 300
R1(config-sla-monitor-echo)#end
```

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip sla monitor schedule 1 life forever start-time now
```

Step 5: Now we have configured IP SLA successfully.

We will use ip sla monitor command for monitoring the IP SLA.

Step 6: ip sla monitor collection-statistics:

Here it provides a collection of all the statistics of ip sla.

```
R1#show ip sla monitor collection-statistics
Entry number: 1
Start Time Index: *00:08:19.351 UTC Fri Mar 1 2002
Number of successful operations: 14
Number of operations over threshold: 0
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0
RTT Values:
RTTAvg: 30        RTTMin: 20        RTTMax: 40
NumOfRTT: 14      RTTSum: 423       RTTSum2: 13209
```

Step 7: ip sla monitor distribution-statistics:

Here it provides the various distribution statistics of all the operations performed by the ip sla.

```
R1#show ip sla monitor distribution-statistics
        Captured Statistics
Entry    = Entry number
StartT   = Start time of entry (hundredths of seconds)
Pth      = Path index
Hop      = Hop in path index
Dst      = Time distribution index
Comps    = Operations completed
OvrTh    = Operations completed over thresholds
SumCmp   = Sum of RTT (milliseconds)
SumCmp2L = Sum of RTT squared low 32 bits (milliseconds)
SumCmp2H = Sum of RTT squared high 32 bits (milliseconds)
TMax     = RTT maximum (milliseconds)
TMin     = RTT minimum (milliseconds)

Entry StartT     Pth Hop Dst Comps     OvrTh     SumCmp    SumCmp2L  SumCmp2H  TMax      TMin
1     49935      1   1   1   17        0         540       17996     0         51        20
```

Step 8: ip sla monitor operational-state:

Here we are provided with the overall operational state of the ip sla

```
R1#show ip sla monitor operational-state
Entry number: 1
Modification time: *00:08:19.311 UTC Fri Mar 1 2002
Number of Octets Used by this Entry: 2272
Number of operations attempted: 19
Number of operations skipped: 0
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE
Timeout occurred: FALSE
Over thresholds occurred: FALSE
Latest RTT (milliseconds): 47
Latest operation start time: *00:11:19.311 UTC Fri Mar 1 2002
Latest operation return code: OK
RTT Values:
RTTAvg: 47        RTTMin: 47        RTTMax: 47
NumOfRTT: 1       RTTSum: 47        RTTSum2: 2209
```

Step 9: ip sla monitor configuration:

Here we can see the overall configuration of the ip sla

```
R1#show ip sla monitor configuration
SA Agent, Infrastructure Engine-II
Entry number: 1
Owner:
Tag:
Type of operation to perform: echo
Target address: 4.4.4.4
Source address: 1.1.1.1
Request size (ARR data portion): 28
Operation timeout (milliseconds): 5000
Type Of Service parameters: 0x0
Verify data: No
Operation frequency (seconds): 10
Next Scheduled Start Time: Start Time already passed
Group Scheduled : FALSE
Life (seconds): Forever
Entry Ageout (seconds): never
Recurring (Starting Everyday): FALSE
Status of entry (SNMP RowStatus): Active
Threshold (milliseconds): 300
Number of statistic hours kept: 2
Number of statistic distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
History Filter Type: None
Enhanced History:
```

Step 10: ip sla monitor statistics:

Here we can see the basic statistics of the ip sla

```
R1#show ip sla monitor statistics
Round trip time (RTT)    Index 1
        Latest RTT: 39 ms
Latest operation start time: *00:11:59.311 UTC Fri Mar 1 2002
Latest operation return code: OK
Number of successes: 23
Number of failures: 0
Operation time to live: Forever
```

Step 11: Now after monitoring all the commands save the file by using the 2 below commands.

R1:

```
R1(config)#do wr
Building configuration...
[OK]
R1(config)#end
```

```
R1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

R2:

```
ISP(config-if)#ex
ISP(config)#do wr
Building configuration...
[OK]
ISP(config)#copy running-co
```

```
ISP#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
ISP#
```