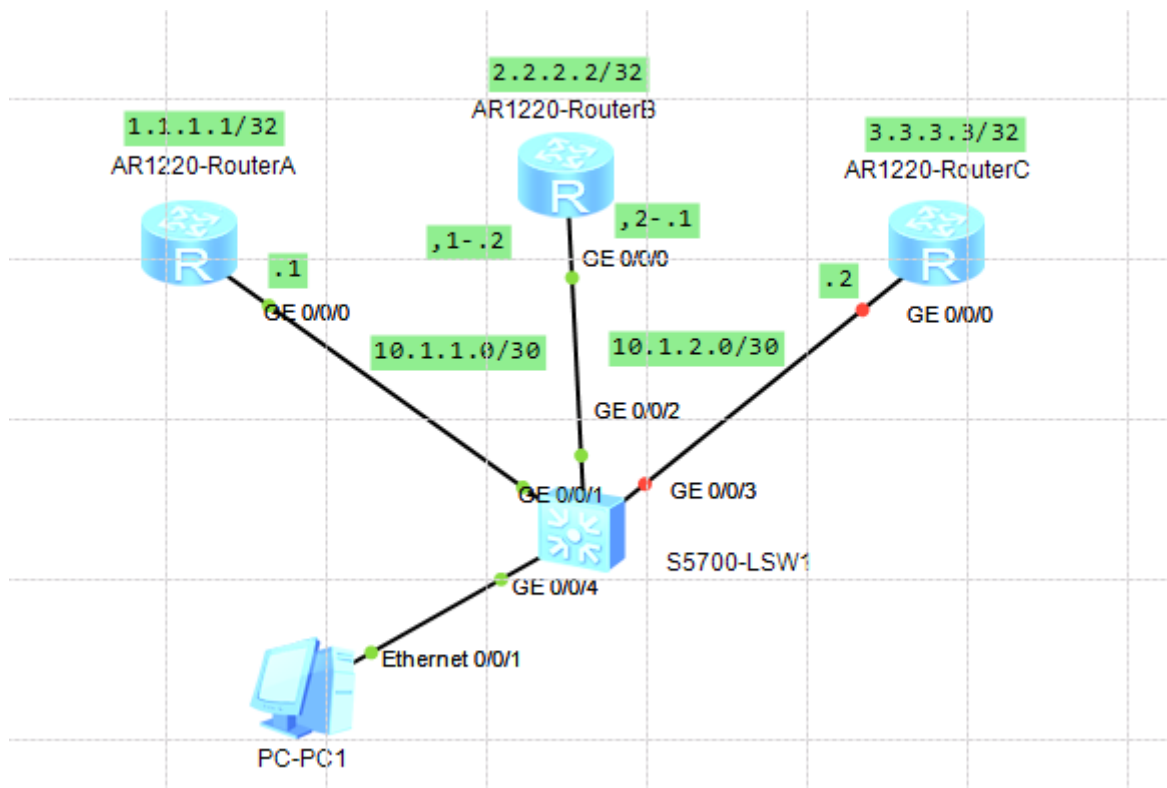


# Ejercicio MPLS - LSPs Estáticos

## Topología



RA y RB tienen una conexión point-to-point

RB y RC tienen una conexión point-to-point

La interfaz GE0/0/0 está particionada en:

- .0 conectado a RA
- .1 conectado a RC

## Preconfiguración y Generación del LSP Left2Right

### Switch

```
// Creo VLANs
<Huawei>system-view
[Huawei]sysname Switch
[Switch]vlan 1
[Switch-vlan1]vlan 2
[Switch-vlan2]vlan 3
[Switch-vlan3]quit

// Configuro interfaz para ser el sumidero de paquetes copiados
[Switch]observe-port 1 interface GigabitEthernet 0/0/4
```



```
2    common  UT:GE0/0/1(U)
```

```
      TG:GE0/0/2(D)
```

```
3    common  UT:GE0/0/3(D)
```

```
      TG:GE0/0/2(D)
```

```
VID   Status   Property      MAC-LRN Statistics Description
```

```
-----  
-----
```

```
1     enable   default      enable  disable  VLAN 0001
```

```
2     enable   default      enable  disable  VLAN 0002
```

```
3     enable   default      enable  disable  VLAN 0003
```

## Router A

```
<Huawei>system-view
```

```
[Huawei]sysname RouterA
```

```
[RouterA]mpls lsr-id 1.1.1.1
```

```
[RouterA]mpls
```

```
[RouterA]static-lsp ingress left2right destination 3.3.3.3 32 nexthop  
10.1.1.2 out-label 16
```

```
[RouterA]ip route-static 3.3.3.3 32 10.1.1.2
```

```
[RouterA]interface LoopBack 0
```

```
[RouterA-LoopBack0]ip address 1.1.1.1 255.255.255.255
```

```
[RouterA-LoopBack0]quit
```

```
[RouterA]interface GigabitEthernet 0/0/0
```

```
[RouterA-GigabitEthernet0/0/0]ip address 10.1.1.1 30
```

```
[RouterA-GigabitEthernet0/0/0]mpls
```

```
[RouterA-GigabitEthernet0/0/0]quit
```

```
<RouterA>display ip routing-table
```

```
Route Flags: R - relay, D - download to fib
```

```
-----  
---
```

```
Routing Tables: Public
```

```
Destinations : 8
```

```
Routes : 8
```

```
Destination/Mask    Proto    Pre  Cost           Flags NextHop           Interface
```

```
      1.1.1.1/32    Direct   0     0                D    127.0.0.1          LoopBack0
```

```
     10.1.1.0/30    Direct   0     0                D    10.1.1.1
```

```
GigabitEthernet 0/0/0
```

```
      10.1.1.1/32    Direct   0     0                D    127.0.0.1
```

```
GigabitEthernet 0/0/0
```

```

10.1.1.3/32 Direct 0 0 D 127.0.0.1
GigabitEthernet 0/0/0
127.0.0.0/8 Direct 0 0 D 127.0.0.1
InLoopBack0
127.0.0.1/32 Direct 0 0 D 127.0.0.1
InLoopBack0
127.255.255.255/32 Direct 0 0 D 127.0.0.1
InLoopBack0
255.255.255.255/32 Direct 0 0 D 127.0.0.1
InLoopBack0

[RouterA]display mpls static-lsp
TOTAL          :      1          STATIC LSP(S)
UP              :      1          STATIC LSP(S)
DOWN           :      0          STATIC LSP(S)
Name            FEC              I/O Label      I/O If
Status
left2right      3.3.3.3/32        NULL/16      -/GE0/0/0
Up

```

## Router B

Como se trabaja primero con subinterfaces, es necesario crearlas antes de utilizarlas en MPLS

```

<Huawei>system-view
[Huawei]sysname RouterB

[RouterB]mpls lsr-id 2.2.2.2
[RouterB]mpls

[RouterB]interface GigabitEthernet 0/0/0.1
[RouterB-GigabitEthernet0/0/0.1]ip address 10.1.1.2 30
[RouterB-GigabitEthernet0/0/0.1]dot1q termination vid 2
[RouterB-GigabitEthernet0/0/0.1]mpls
[RouterB-GigabitEthernet0/0/0.1]quit
[RouterB]static-lsp transit left2right incoming-interface GigabitEthernet
0/0/0.1 in-label 16 nexthop 10.1.2.2 out-label 17

[RouterB]interface GigabitEthernet 0/0/0.2
[RouterB-GigabitEthernet0/0/0.2]ip address 10.1.2.1 30
[RouterB-GigabitEthernet0/0/0.2]dot1q termination vid 3
[RouterB-GigabitEthernet0/0/0.2]mpls
[RouterB-GigabitEthernet0/0/0.2]quit

[RouterB]interface LoopBack 0
[RouterB-LoopBack0]ip address 2.2.2.2 32
[RouterB-LoopBack0]quit

<RouterB>display ip routing-table
Route Flags: R - relay, D - download to fib

```

```
-----
---
Routing Tables: Public
      Destinations : 11          Routes : 11

Destination/Mask    Proto    Pre  Cost           Flags NextHop         Interface

      2.2.2.2/32    Direct  0     0                D   127.0.0.1       LoopBack0
      10.1.1.0/30    Direct  0     0                D   10.1.1.2
GigabitEthernet 0/0/0.1
      10.1.1.2/32    Direct  0     0                D   127.0.0.1
GigabitEthernet 0/0/0.1
      10.1.1.3/32    Direct  0     0                D   127.0.0.1
GigabitEthernet 0/0/0.1
      10.1.2.0/30    Direct  0     0                D   10.1.2.1
GigabitEthernet 0/0/0.2
      10.1.2.1/32    Direct  0     0                D   127.0.0.1
GigabitEthernet 0/0/0.2
      10.1.2.3/32    Direct  0     0                D   127.0.0.1
GigabitEthernet 0/0/0.2
      127.0.0.0/8     Direct  0     0                D   127.0.0.1
InLoopBack0
      127.0.0.1/32    Direct  0     0                D   127.0.0.1
InLoopBack0
      127.255.255.255/32  Direct  0     0                D   127.0.0.1
InLoopBack0
      255.255.255.255/32  Direct  0     0                D   127.0.0.1
InLoopBack0

<RouterB>display mpls static-lsp
TOTAL          :      1          STATIC LSP(S)
UP              :      1          STATIC LSP(S)
DOWN           :      0          STATIC LSP(S)
Name           FEC              I/O Label      I/O If
Status

left2right     -/-              16/17          GE0/0/0.1/GE0/0/0.2
Up
```

Router C

```
<Huawei>system-view
[Huawei]sysname RouterC

[RouterC]mpls lsr-id 3.3.3.3
[RouterC]mpls
[RouterC]static-lsp egress left2right incoming-interface GigabitEthernet
0/0/0 in-label 17

[RouterC]interface LoopBack 0
```

```
[RouterC-LoopBack0]ip address 3.3.3.3 32
[RouterC-LoopBack0]quit

[RouterC]interface GigabitEthernet 0/0/0
[RouterC-GigabitEthernet0/0/0]ip address 10.1.2.2 30
[RouterC-GigabitEthernet0/0/0]mpls
[RouterC-GigabitEthernet0/0/0]quit

<RouterC>display ip routing-table
Route Flags: R - relay, D - download to fib
-----
---
Routing Tables: Public
      Destinations : 8          Routes : 8

Destination/Mask    Proto   Pre  Cost      Flags NextHop          Interface
-----
      3.3.3.3/32    Direct   0    0          D   127.0.0.1        LoopBack0
      10.1.2.0/30    Direct   0    0          D   10.1.2.2
GigabitEthernet 0/0/0
      10.1.2.2/32    Direct   0    0          D   127.0.0.1
GigabitEthernet 0/0/0
      10.1.2.3/32    Direct   0    0          D   127.0.0.1
GigabitEthernet 0/0/0
      127.0.0.0/8     Direct   0    0          D   127.0.0.1
InLoopBack0
      127.0.0.1/32    Direct   0    0          D   127.0.0.1
InLoopBack0
      127.255.255.255/32 Direct   0    0          D   127.0.0.1
InLoopBack0
      255.255.255.255/32 Direct   0    0          D   127.0.0.1
InLoopBack0

<RouterC>display mpls lsp
-----
----
                        LSP Information: STATIC LSP
-----
----
FEC                  In/Out Label  In/Out IF          Vrf Name
-/-                  17/NULL        GE0/0/0/-
```

## Ping Router A a Router C

No tendría que funcionar porque el LSP es unidireccional, falta el camino de vuelta.

## Ping enviado por Router A

```
<RouterA>ping 3.3.3.3
  PING 3.3.3.3: 56 data bytes, press CTRL_C to break
    Request time out
```

```
Request time out
Request time out
Request time out
Request time out
```

```
--- 3.3.3.3 ping statistics ---
5 packet(s) transmitted
0 packet(s) received
100.00% packet loss
```

## Paquetes capturados con Wireshark en Router B

No.	Time	Source	Destination	Protocol	Info
7	13.931000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=256/1, ttl=255)
8	13.946000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=256/1, ttl=255)
9	16.006000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=512/2, ttl=255)
10	16.006000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=512/2, ttl=255)
12	17.987000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=768/3, ttl=255)
13	18.002000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=768/3, ttl=255)
15	19.999000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=1024/4, ttl=255)
16	20.015000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=1024/4, ttl=255)
18	22.027000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=1280/5, ttl=255)
19	22.043000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe6ab, seq(be/le)=1280/5, ttl=255)

<p>7 13.931000 1.1.1.1 3.3.3.3 ICMP Echo (ping) request (id=0xe6ab, seq(be/le)=256/1, ttl=255)</p> <ul style="list-style-type: none"> <li>Frame 7: 106 bytes on wire (848 bits), 106 bytes captured (848 bits)</li> <li>Ethernet II, Src: HuaweiTe_c9:4b:7b (00:e0:fc:c9:4b:7b), Dst: HuaweiTe_37:4d:de (00:e0:fc:37:4d:de)</li> <li>802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 2</li> <li>MultiProtocol Label Switching Header, Label: 16, Exp: 0, S: 1, TTL: 255 <ul style="list-style-type: none"> <li>MPLS Label: 16</li> <li>MPLS Experimental Bits: 0</li> <li>MPLS Bottom of Label Stack: 1</li> <li>MPLS TTL: 255</li> </ul> </li> <li>Internet Protocol, Src: 1.1.1.1 (1.1.1.1), Dst: 3.3.3.3 (3.3.3.3)</li> <li>Internet Control Message Protocol</li> </ul>	<p>8 13.946000 1.1.1.1 3.3.3.3 ICMP Echo (ping) request (id=0xe6ab, seq(be/le)=256/1, ttl=255)</p> <ul style="list-style-type: none"> <li>Frame 8: 106 bytes on wire (848 bits), 106 bytes captured (848 bits)</li> <li>Ethernet II, Src: HuaweiTe_37:4d:de (00:e0:fc:37:4d:de), Dst: HuaweiTe_c5:2a:2a (00:e0:fc:c5:2a:2a)</li> <li>802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 3</li> <li>MultiProtocol Label Switching Header, Label: 17, Exp: 0, S: 1, TTL: 254 <ul style="list-style-type: none"> <li>MPLS Label: 17</li> <li>MPLS Experimental Bits: 0</li> <li>MPLS Bottom of Label Stack: 1</li> <li>MPLS TTL: 254</li> </ul> </li> <li>Internet Protocol, Src: 1.1.1.1 (1.1.1.1), Dst: 3.3.3.3 (3.3.3.3)</li> <li>Internet Control Message Protocol</li> </ul>
---	---

## Generación LSP Right2Left

### Router A

```
<RouterA>system-view
[RouterA]static-lsp egress right2left incoming-interface GigabitEthernet
0/0/0 in-label 16

[RouterA]display mpls static-lsp
TOTAL          :      2          STATIC LSP(S)
UP              :      2          STATIC LSP(S)
DOWN           :      0          STATIC LSP(S)
Name           FEC              I/O Label    I/O If
Status

left2right     3.3.3.3/32        NULL/16     -/GE0/0/0
Up

right2left     -/-              16/NULL     GE0/0/0/-
Up

[RouterA]quit
<RouterA>save
```

### Router B

```

<RouterB>system-view
[RouterB]static-lsp transit right2left incoming-interface GigabitEthernet
0/0/0.2 in-label 17 nexthop 10.1.1.1 out-label 16

[RouterB]display mpls static-lsp
TOTAL          :      2          STATIC LSP(S)
UP             :      2          STATIC LSP(S)
DOWN          :      0          STATIC LSP(S)
Name           FEC              I/O Label    I/O If
Status
left2right     -/-              16/17     GE0/0/0.1/GE0/0/0.2
Up
right2left     -/-              17/16     GE0/0/0.2/GE0/0/0.1
Up

[RouterB]quit
<RouterB>save

```

## Router C

```

<RouterC>system-view
[RouterC]static-lsp ingress right2left destination 1.1.1.1 32 nexthop
10.1.2.1 out-label 17
[RouterC]ip route-static 1.1.1.1 32 10.1.2.1

[RouterC]display mpls static-lsp
TOTAL          :      2          STATIC LSP(S)
UP             :      2          STATIC LSP(S)
DOWN          :      0          STATIC LSP(S)
Name           FEC              I/O Label    I/O If
Status
left2right     -/-              17/NULL    GE0/0/0/-
Up
right2left     1.1.1.1/32        NULL/17     -/GE0/0/0
Up
[RouterC]quit
<RouterC>save

```

## Ping Router A a Router C con 2 LSPs

Es necesario que el Router A mande el paquete con la dirección de fuente 1.1.1.1 ya que el Router C solo lo conoce con esa dirección

## Ping enviado por Router A



```

<RouterA>ping -a 1.1.1.1 3.3.3.3
PING 3.3.3.3: 56 data bytes, press CTRL_C to break
  Reply from 3.3.3.3: bytes=56 Sequence=1 ttl=254 time=280 ms
  Reply from 3.3.3.3: bytes=56 Sequence=2 ttl=254 time=210 ms
  Reply from 3.3.3.3: bytes=56 Sequence=3 ttl=254 time=110 ms
  Reply from 3.3.3.3: bytes=56 Sequence=4 ttl=254 time=360 ms
  Reply from 3.3.3.3: bytes=56 Sequence=5 ttl=254 time=140 ms

--- 3.3.3.3 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 110/220/360 ms

```

## Paquetes capturados con Wireshark en Router B

No.	Time	Source	Destination	Protocol	Info
7	14.149000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=256/1, ttl=255)
8	14.165000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=256/1, ttl=255)
9	14.212000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=256/1, ttl=255)
10	14.212000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=256/1, ttl=255)
11	14.649000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=512/2, ttl=255)
12	14.664000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=512/2, ttl=255)
13	14.992000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=512/2, ttl=255)
14	15.007000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=512/2, ttl=255)
15	15.132000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=768/3, ttl=255)
16	15.148000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=768/3, ttl=255)
17	15.195000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=768/3, ttl=255)
18	15.210000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=768/3, ttl=255)
19	15.647000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=1024/4, ttl=255)
20	15.647000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=1024/4, ttl=255)
21	15.678000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=1024/4, ttl=255)
22	15.694000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=1024/4, ttl=255)
24	16.131000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=1280/5, ttl=255)
25	16.131000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request (id=0xe2ab, seq(be/le)=1280/5, ttl=255)
26	16.240000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=1280/5, ttl=255)
27	16.240000	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply (id=0xe2ab, seq(be/le)=1280/5, ttl=255)

[+] Frame 7: 106 bytes on wire (848 bits), 106 bytes captured (848 bits)  
 [+] Ethernet II, Src: HuaweiTe\_c9:4b:7b (00:e0:fc:c9:4b:7b), Dst: HuaweiTe\_37:4d:de (00:e0:fc:37:4d:de)  
 [+] 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 2  
 [+] MultiProtocol Label Switching Header, Label: 16, Exp: 0, S: 1, TTL: 255  
   MPLS Label: 16  
   MPLS Experimental Bits: 0  
   MPLS Bottom of Label Stack: 1  
   MPLS TTL: 255  
 [+] Internet Protocol, Src: 1.1.1.1 (1.1.1.1), Dst: 3.3.3.3 (3.3.3.3)  
 [+] Internet Control Message Protocol