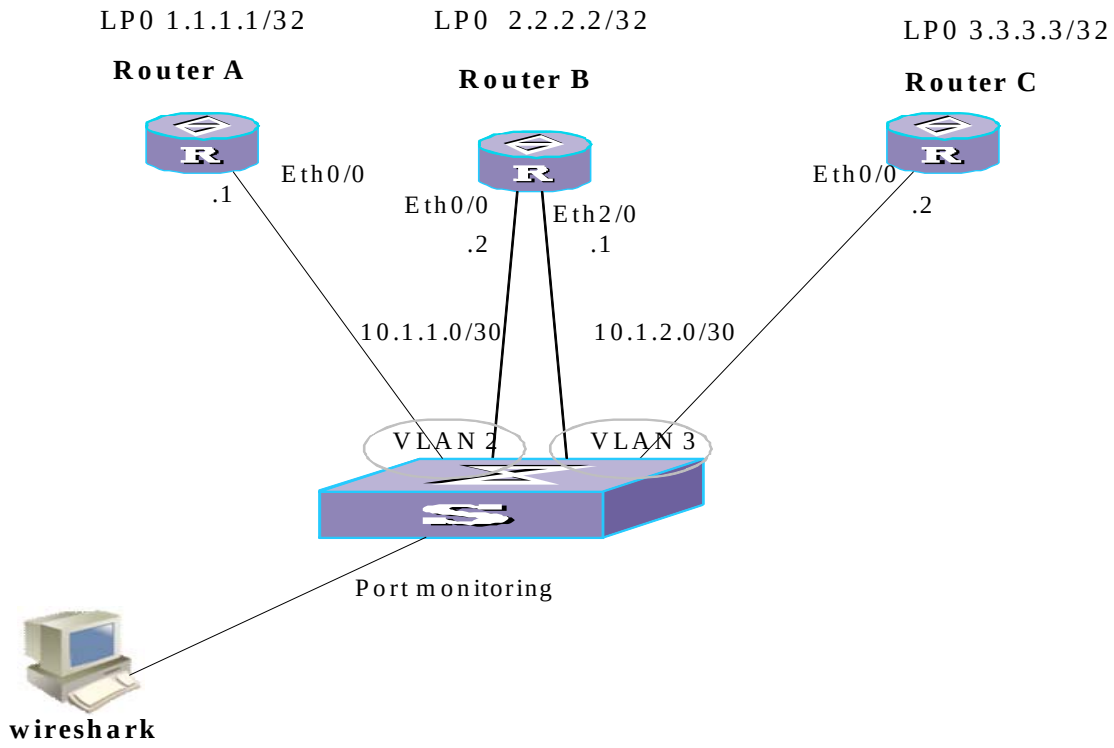
Práctica de MPLS

Objetivo: Por medio de una práctica demostrativa repasar los conceptos básicos de MPLS y su configuración.

PRACTICA I

Diagrama de interconexión:



Configuración Equipamiento

Switch

El puerto 24 conectado a PC de monitoreo en port-monitoring. Los routers conectados a puertos 1,2,3,4 respectivamente configurados en port-mirroring.

<switch>display current-configuration
#
#
vlan 1
#
vlan 2

```
#
vlan 3
#
interface Ethernet1/0/1
 port access vlan 2
 mirroring-port both
#
interface Ethernet1/0/2
 port access vlan 2
 mirroring-port both
#
interface Ethernet1/0/3
 port access vlan 3
 mirroring-port both
#
interface Ethernet1/0/4
 port access vlan 3
 mirroring-port both
#
……..
#
interface Ethernet1/0/24
monitor-port
#
return
```

Configuración MPLS Estático

Router A

```
<RouterA>display current-configuration
#
 sysname RouterA
#
 mpls lsr-id 1.1.1.1
#
mpls
 static-lsp ingress 1 destination 3.3.3.3 32 nexthop 10.1.1.2 out-label 16
#
interface Ethernet0/0
 ip address 10.1.1.1 255.255.255.252
 mpls
#
interface LoopBack0
 ip address 1.1.1.1 255.255.255.255
#
return

<RouterA>display mpls lsp
```

```
------------------------------------------------------------------------------
                LSP Information: Static Lsp
------------------------------------------------------------------------------

TOTAL:  1 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     3.3.3.3/32       10.1.1.2       -----/16     Eth0/0
```

Router B

```
<RouterB>display current-configuration
#
 sysname RouterB
#
 mpls lsr-id 2.2.2.2
#
mpls
 static-lsp transit 1 incoming-interface Ethernet0/0 in-label 16 nexthop 10.1.2.
2 out-label 17
#
interface Ethernet0/0
 ip address 10.1.1.2 255.255.255.252
 mpls
#
interface Ethernet2/0
 ip address 10.1.2.1 255.255.255.252
 mpls
#
interface LoopBack0
 ip address 2.2.2.2 255.255.255.255
#
return

<RouterB>display mpls lsp

------------------------------------------------------------------------------
                LSP Information: Static Lsp
------------------------------------------------------------------------------

TOTAL:  1 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     -------/--       10.1.2.2       16/17        Eth2/0
```

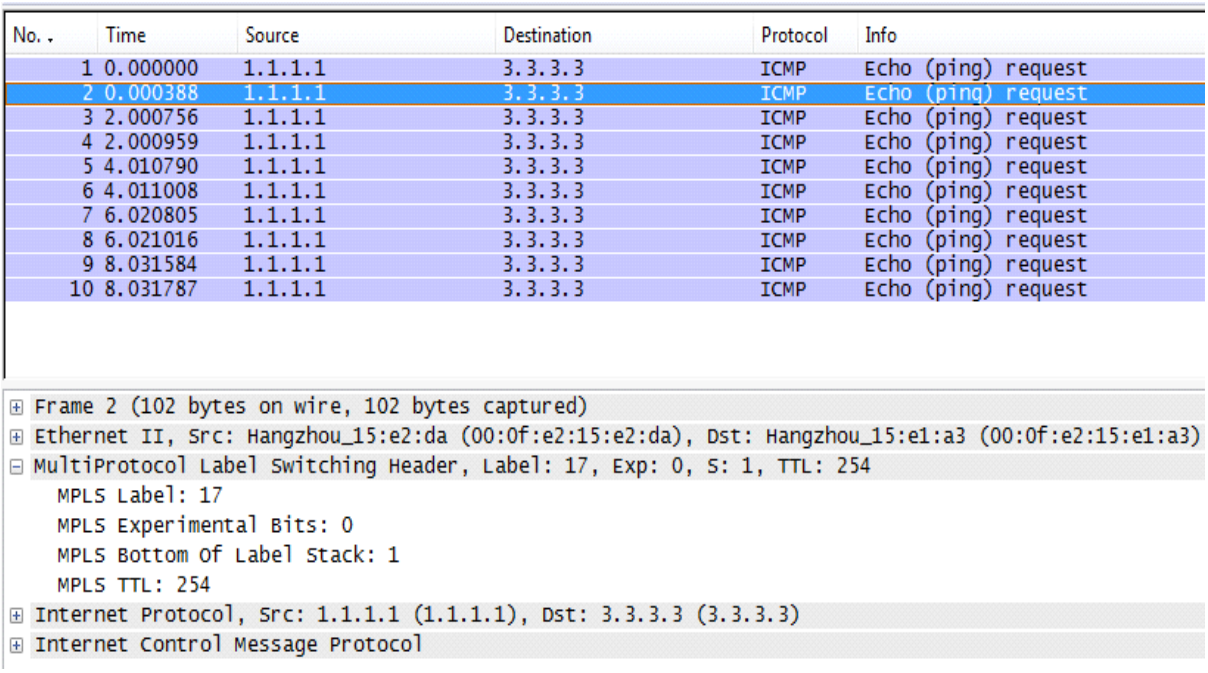
Router C

```
[RouterC]display current-configuration
#
 sysname RouterC
#
 mpls lsr-id 3.3.3.3
#
mpls
```

```
 static-lsp egress 1 incoming-interface Ethernet0/0 in-label 17
#
interface Ethernet0/0
 ip address 10.1.2.2 255.255.255.252
 mpls
#
interface LoopBack0
 ip address 3.3.3.3 255.255.255.255
#
return

[RouterC]display mpls lsp
-------------------------------------------------------------------------------
                LSP Information: Static Lsp
-------------------------------------------------------------------------------
TOTAL:  1 Record(s) Found.
NO    FEC                NEXTHOP         I/O-LABEL    OUT-INTERFACE
1     -------/--         -------         17/-----     -------

<RouterA>ping -a 1.1.1.1 3.3.3.3
  PING 3.3.3.3: 56  data bytes, press CTRL_C to break

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

No.	Time	Source	Destination	Protocol	Info
1	0.000000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
2	0.000388	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
3	2.000756	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
4	2.000959	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5	4.010790	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
6	4.011008	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
7	6.020805	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
8	6.021016	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
9	8.031584	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
10	8.031787	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request

```
⊞ Frame 1 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:e5 (00:0f:e2:15:e2:e5), Dst: Hangzhou_15:e2:d9 (00:0f:e2:15:e2:d9)
⊟ 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
```



No.	Time	Source	Destination	Protocol	Info
1	0.000000	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
2	0.000388	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
3	2.000756	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
4	2.000959	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5	4.010790	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
6	4.011008	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
7	6.020805	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
8	6.021016	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
9	8.031584	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
10	8.031787	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request

Nota: se puede observar que los paquetes llegan a la 3.3.3.3 y van encapsulados con MPLS según se configuró en cada router. Faltaría configurar la vuelta.

Configuración de 3.3.3.3 a 1.1.1.1

Router A

```
#
mpls
 static-lsp ingress 1 destination 3.3.3.3 32 nexthop 10.1.1.2 out-label 16
 static-lsp egress 2 incoming-interface Ethernet0/0 in-label 16
#

<RouterA>display mpls lsp

-------------------------------------------------------------------------------
              LSP Information: Static Lsp
-------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     3.3.3.3/32       10.1.1.2       -----/16     Eth0/0
2     -------/--       -------        16/-----     -------
```

Router B

```
#
mpls
 static-lsp transit 1 incoming-interface Ethernet0/0 in-label 16 nexthop 10.1.2.
2 out-label 17
```

```
 static-lsp transit 2 incoming-interface Ethernet2/0 in-label 17 nexthop 10.1.1.
1 out-label 16
#

[RouterB-mpls]display mpls lsp

-------------------------------------------------------------------------------
              LSP Information: Static Lsp
-------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     -------/--       10.1.2.2       16/17        Eth2/0
2     -------/--       10.1.1.1       17/16        Eth0/0
```

Router C

```
#
mpls
 static-lsp egress 1 incoming-interface Ethernet0/0 in-label 17
 static-lsp ingress 2 destination 1.1.1.1 32 nexthop 10.1.2.1 out-label 17
#

[RouterC-mpls]display mpls lsp

-------------------------------------------------------------------------------
              LSP Information: Static Lsp
-------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     -------/--       -------        17/-----     -------
2     1.1.1.1/32       10.1.2.1       -----/17     Eth0/0
```

No.	Time	Source	Destination	Protocol	Info
1541	650.328753	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
1542	650.328981	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
1543	650.329571	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
1544	650.329903	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
1545	650.337947	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
1546	650.338974	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
1547	650.339579	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
1548	650.339771	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
1549	650.347118	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
1550	650.347293	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
1551	650.347904	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
1552	650.348880	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
1553	650.357114	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request

```
⊞ Frame 1541 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:e5 (00:0f:e2:15:e2:e5), Dst: Hangzhou_15:e2:d9 (00:0f:e2:15:e2:d9)
⊟ 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
```

```
⊞ Frame 1542 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:da (00:0f:e2:15:e2:da), Dst: Hangzhou_15:e1:a3 (00:0f:e2:15:e1:a3)
⊟ MultiProtocol Label Switching Header, Label: 17, Exp: 0, S: 1, TTL: 254
    MPLS Label: 17
    MPLS Experimental Bits: 0
    MPLS Bottom Of Label Stack: 1
    MPLS TTL: 254
⊞ Internet Protocol, Src: 1.1.1.1 (1.1.1.1), Dst: 3.3.3.3 (3.3.3.3)
⊞ Internet Control Message Protocol
```

```
⊞ Frame 1543 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e1:a3 (00:0f:e2:15:e1:a3), Dst: Hangzhou_15:e2:da (00:0f:e2:15:e2:da)
⊟ MultiProtocol Label Switching Header, Label: 17, Exp: 0, S: 1, TTL: 255
    MPLS Label: 17
    MPLS Experimental Bits: 0
    MPLS Bottom Of Label Stack: 1
    MPLS TTL: 255
⊞ Internet Protocol, Src: 3.3.3.3 (3.3.3.3), Dst: 1.1.1.1 (1.1.1.1)
⊞ Internet Control Message Protocol
```

```
⊞ Frame 1544 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:d9 (00:0f:e2:15:e2:d9), Dst: Hangzhou_15:e2:e5 (00:0f:e2:15:e2:e5)
⊟ MultiProtocol Label Switching Header, Label: 16, Exp: 0, S: 1, TTL: 254
    MPLS Label: 16
    MPLS Experimental Bits: 0
    MPLS Bottom Of Label Stack: 1
    MPLS TTL: 254
⊞ Internet Protocol, Src: 3.3.3.3 (3.3.3.3), Dst: 1.1.1.1 (1.1.1.1)
⊞ Internet Control Message Protocol
```

Configuración MPLS con LDP

Deshabilitar mpls en todos los routers:

[RouterX]undo mpls

Luego habilitarlo y configurar que envíe la etiqueta desde el penúltimo router.

[RouterX]mpls
[RouterX-mpls]mpls label advertise non-null
[RouterX-mpls]quit

Habilitar OSPF en todos los routers

Router A
#
ospf 1
 area 0.0.0.0
  network 1.1.1.1 0.0.0.0
  network 10.1.1.0 0.0.0.3
#
Router B
#
ospf 1
 area 0.0.0.0
  network 2.2.2.2 0.0.0.0
  network 10.1.1.0 0.0.0.3
  network 10.1.2.0 0.0.0.3
#
Router C
#
ospf 1
 area 0.0.0.0
  network 3.3.3.3 0.0.0.0
  network 10.1.2.0 0.0.0.3
#

<RouterA>display ip routing-table
 Routing Table: public net
Destination/Mask Protocol Pre Cost   Nexthop   Interface
1.1.1.1/32   DIRECT   0   0   127.0.0.1   InLoopBack0
2.2.2.2/32   OSPF   10   2   10.1.1.2   Ethernet0/0
3.3.3.3/32   OSPF   10   3   10.1.1.2   Ethernet0/0
10.1.1.0/30   DIRECT   0   0   10.1.1.1   Ethernet0/0
10.1.1.1/32   DIRECT   0   0   127.0.0.1   InLoopBack0
10.1.2.0/30   OSPF   10   2   10.1.1.2   Ethernet0/0
127.0.0.0/8   DIRECT   0   0   127.0.0.1   InLoopBack0
127.0.0.1/32   DIRECT   0   0   127.0.0.1   InLoopBack0

<RouterC>display ip routing-table
 Routing Table: public net
Destination/Mask Protocol Pre Cost   Nexthop   Interface
1.1.1.1/32   OSPF   10   3   10.1.2.1   Ethernet0/0
2.2.2.2/32   OSPF   10   2   10.1.2.1   Ethernet0/0

```
3.3.3.3/32        DIRECT   0    0          127.0.0.1       InLoopBack0
10.1.1.0/30       OSPF     10   2          10.1.2.1        Ethernet0/0
10.1.2.0/30       DIRECT   0    0          10.1.2.2        Ethernet0/0
10.1.2.2/32       DIRECT   0    0          127.0.0.1       InLoopBack0
127.0.0.0/8       DIRECT   0    0          127.0.0.1       InLoopBack0
127.0.0.1/32      DIRECT   0    0          127.0.0.1       InLoopBack0
```

Verificar que se llega a todas las redes anunciadas por medio de ping

Si se realiza un ping entre la 1.1.1.1 y la 3.3.3.3 antes de habilitar el ldp en las interfaces se puede ver que no se taguea el paquete.

Habilito mpls en las interfaces y el LDP a nivel global y en todas las interfaces con los siguientes comandos:

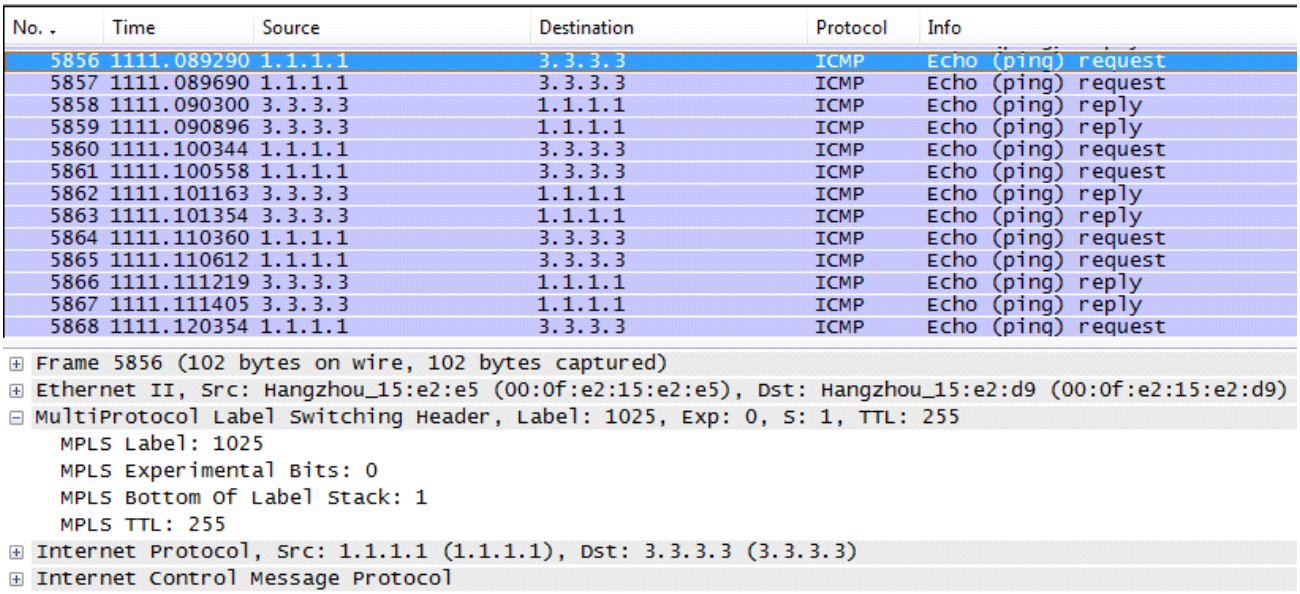
```
#
 mpls ldp
#
#
interface Ethernet0/0
 ip address 10.1.2.2 255.255.255.252
 mpls
 mpls ldp enable
#
```

```
<RouterA>display mpls lsp

------------------------------------------------------------------------------
              LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  3 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     2.2.2.2/32       10.1.1.2       -----/1024   Eth0/0
2     1.1.1.1/32       127.0.0.1       1024/-----   -------
3     3.3.3.3/32       10.1.1.2       -----/1025   Eth0/0
```

```
<RouterB>display mpls lsp

------------------------------------------------------------------------------
              LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  6 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     2.2.2.2/32       127.0.0.1       1024/-----   -------
2     1.1.1.1/32       10.1.1.1       -----/1024   Eth0/0
3     3.3.3.3/32       10.1.2.2       -----/1024   Eth2/0
4     3.3.3.3/32       10.1.2.2       1025/1024    Eth2/0
5     2.2.2.2/32       127.0.0.1       1026/-----   -------
6     1.1.1.1/32       10.1.1.1       1027/1024    Eth0/0
```

```
<RouterC>display mpls lsp

------------------------------------------------------------------------------
              LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  3 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     3.3.3.3/32       127.0.0.1      1024/-----   -------
2     2.2.2.2/32       10.1.2.1       -----/1026   Eth0/0
3     1.1.1.1/32       10.1.2.1       -----/1027   Eth0/0
```

```
<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=3 ms
    Reply from 3.3.3.3: bytes=56 Sequence=2 ttl=254 time=2 ms
    Reply from 3.3.3.3: bytes=56 Sequence=3 ttl=254 time=2 ms
    Reply from 3.3.3.3: bytes=56 Sequence=4 ttl=254 time=2 ms
    Reply from 3.3.3.3: bytes=56 Sequence=5 ttl=254 time=2 ms

  --- 3.3.3.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 2/2/3 ms
```



No.	Time	Source	Destination	Protocol	Info
5856	1111.089290	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5857	1111.089690	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5858	1111.090300	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
5859	1111.090896	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
5860	1111.100344	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5861	1111.100558	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5862	1111.101163	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
5863	1111.101354	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
5864	1111.110360	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5865	1111.110612	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request
5866	1111.111219	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
5867	1111.111405	3.3.3.3	1.1.1.1	ICMP	Echo (ping) reply
5868	1111.120354	1.1.1.1	3.3.3.3	ICMP	Echo (ping) request

```
⊞ Frame 5856 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:e5 (00:0f:e2:15:e2:e5), Dst: Hangzhou_15:e2:d9 (00:0f:e2:15:e2:d9)
⊟ MultiProtocol Label Switching Header, Label: 1025, Exp: 0, S: 1, TTL: 255
    MPLS Label: 1025
    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
```

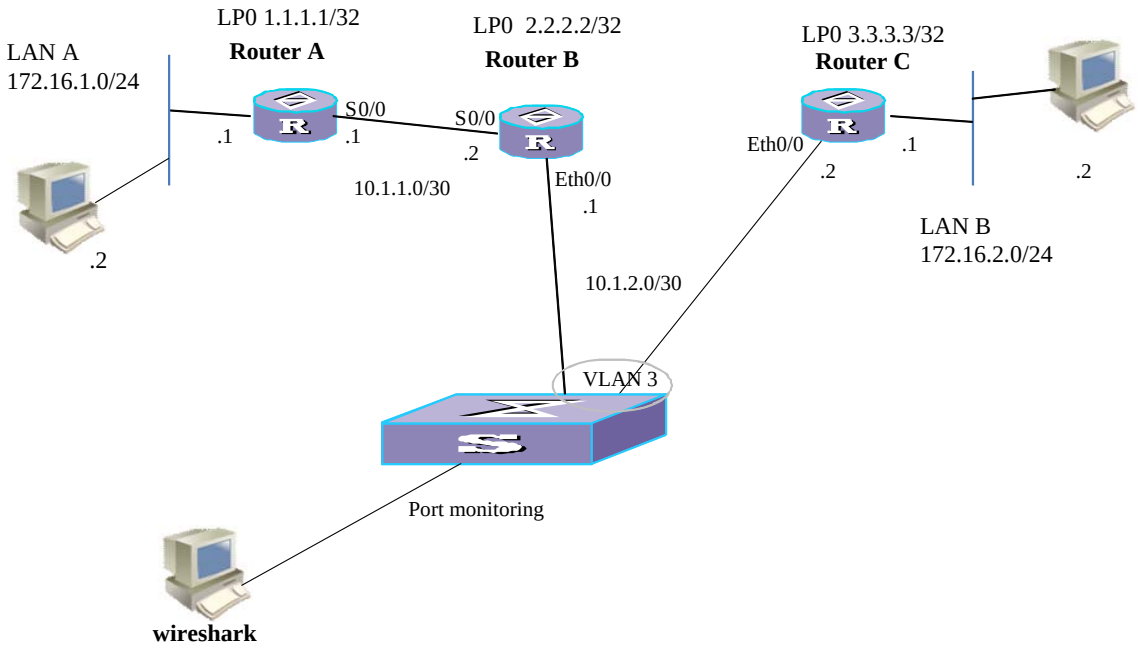
```
⊞ Frame 5857 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:da (00:0f:e2:15:e2:da), Dst: Hangzhou_15:e1:a3 (00:0f:e2:15:e1:a3)
⊟ MultiProtocol Label Switching Header, Label: 1024, Exp: 0, S: 1, TTL: 254
    MPLS Label: 1024
    MPLS Experimental Bits: 0
    MPLS Bottom Of Label Stack: 1
    MPLS TTL: 254
⊞ Internet Protocol, Src: 1.1.1.1 (1.1.1.1), Dst: 3.3.3.3 (3.3.3.3)
⊞ Internet Control Message Protocol
```

```
⊞ Frame 5858 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e1:a3 (00:0f:e2:15:e1:a3), Dst: Hangzhou_15:e2:da (00:0f:e2:15:e2:da)
⊟ MultiProtocol Label Switching Header, Label: 1027, Exp: 0, S: 1, TTL: 255
    MPLS Label: 1027
    MPLS Experimental Bits: 0
    MPLS Bottom Of Label Stack: 1
    MPLS TTL: 255
⊞ Internet Protocol, Src: 3.3.3.3 (3.3.3.3), Dst: 1.1.1.1 (1.1.1.1)
⊞ Internet Control Message Protocol
```

```
⊞ Frame 5859 (102 bytes on wire, 102 bytes captured)
⊞ Ethernet II, Src: Hangzhou_15:e2:d9 (00:0f:e2:15:e2:d9), Dst: Hangzhou_15:e2:e5 (00:0f:e2:15:e2:e5)
⊟ MultiProtocol Label Switching Header, Label: 1024, Exp: 0, S: 1, TTL: 254
    MPLS Label: 1024
    MPLS Experimental Bits: 0
    MPLS Bottom Of Label Stack: 1
    MPLS TTL: 254
⊞ Internet Protocol, Src: 3.3.3.3 (3.3.3.3), Dst: 1.1.1.1 (1.1.1.1)
⊞ Internet Control Message Protocol
```

Conexión mediante interfaz serial y disparo de MPLS por red.

Diagrama de interconexión



En este esquema, sólo quiero que se dispare el MPLS cuando va o viene de LAN A a LAN B.

Configuro en todos los routers:

```
#
mpls
  mpls label advertise non-null
 lsp-trigger ip-prefix LAN
#
#
 ip ip-prefix LAN index 10 permit 172.16.1.0 24
 ip ip-prefix LAN index 20 permit 172.16.2.0 24
#
```

```
<RouterA>display mpls lsp

------------------------------------------------------------------------------
              LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
```

```
1    172.16.1.0/24      172.16.1.1     1025/-----   -------
2    172.16.2.0/24      10.1.1.2       -----/1030   S0/0

<RouterB>display mpls lsp

------------------------------------------------------------------------------
             LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  4 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     172.16.1.0/24      10.1.1.1       1028/1025    S0/0
2     172.16.2.0/24      10.1.2.2       1030/1026    Eth0/0
3     172.16.1.0/24      10.1.1.1       -----/1025   S0/0
4     172.16.2.0/24      10.1.2.2       -----/1026   Eth0/0
<RouterC>display mpls lsp

------------------------------------------------------------------------------
             LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     172.16.2.0/24      172.16.2.1     1026/-----   -------
2     172.16.1.0/24      10.1.2.1       -----/1028   Eth0/0
```

Realizando 4 pings:

1) Entre lans, se ve mpls de ida y vuelta. (172.16.1.1 – 172.16.2.1)
2) Entre las loopbacks, no dispara mpls. (1.1.1.1 – 3.3.3.3)
3) Entre serial router 1 y LAN router 3, mpls solo a la ida (10.1.1.1 – 172.16.2.1)
4) Entre serial router 2 y LAN router 3, mpls solo a la ida (10.1.2.1 – 172.16.2.1)

Pruebas de penúltimo salto

Este parámetro se modifica con el siguiente comando:

```
[RouterC-mpls]mpls label advertise ?
  explicit-null  explicit-null label
  implicit-null  implicit-null label
  non-null       non-null label
```

Pero primero hay que deshabilitar el MPLS con:

```
[RouterC]undo mpls
```

Implicit NULL

El penúltimo salto manda una etiqueta de 3 en la negociación con LDP para indicar que es el ultimo router, y que no se etiqueten los paquetes. La ventaja es que el router de edge tiene menos procesamiento y no tiene que hacer dos búsquedas: una para la etiqueta y otra para rutear luego de sacarle la etiqueta.

```
<RouterC>display mpls lsp

------------------------------------------------------------------------------
              LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     172.16.2.0/24      172.16.2.1     3/-----      -------
2     172.16.1.0/24      10.1.2.1       -----/1025   Eth0/0
```

Explicit NULL

El penúltimo salto manda un 0 de etiqueta en la negociación de LDP y entonces cuando se hace el ping va etiquetado con el 0. La ventaja contra el implícito es que no se pierden los bits de exp.

```
[RouterC]display mpls lsp

------------------------------------------------------------------------------
              LSP Information: Ldp Lsp
------------------------------------------------------------------------------

TOTAL:  2 Record(s) Found.

NO    FEC              NEXTHOP        I/O-LABEL    OUT-INTERFACE
1     172.16.1.0/24      10.1.2.1       -----/1025   Eth0/0
2     172.16.2.0/24      172.16.2.1     0/-----      -------
```