

MPLS TE

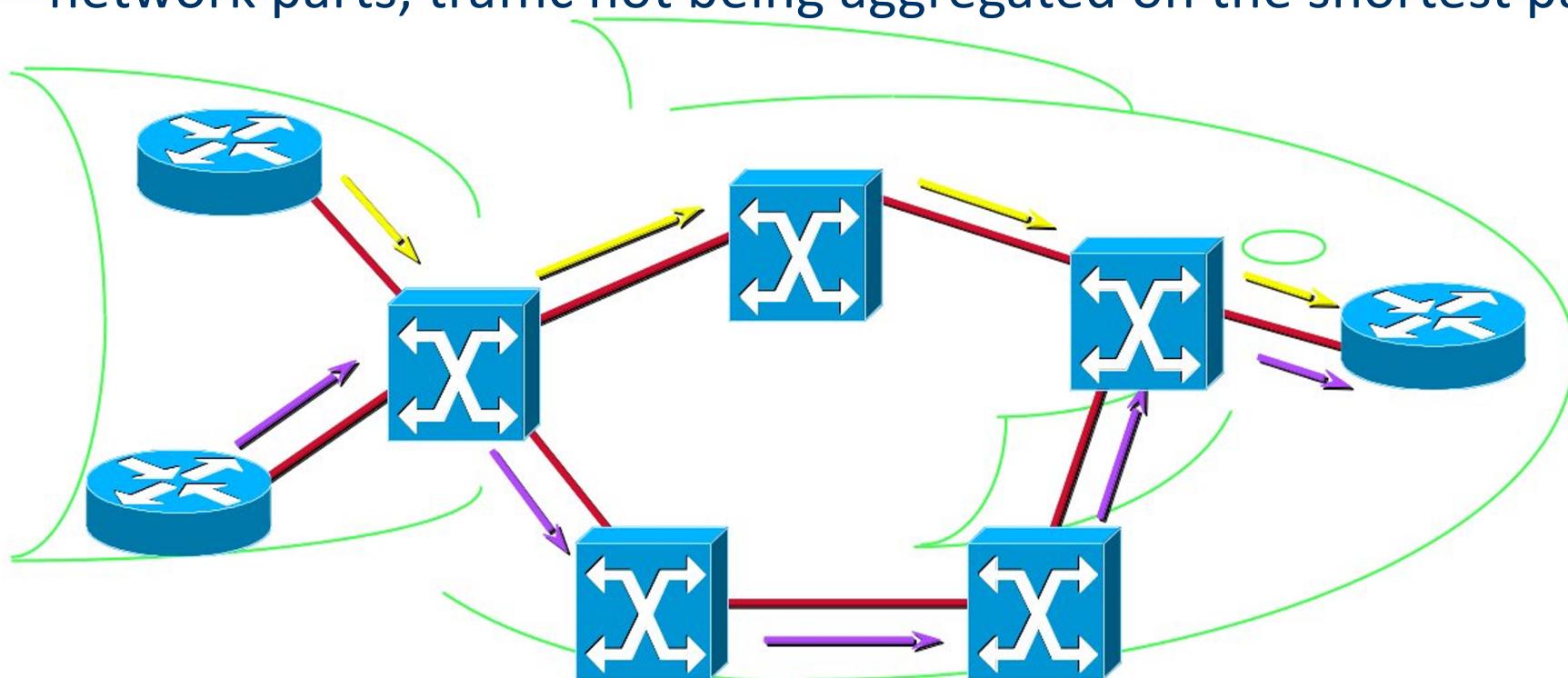
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MPLS TE

- Traditional IP networks uses **destination-based routing**
- **Explicit routing** (e.g., source based routing) is not supported
- MPLS networks can support **destination-based and explicit routing simultaneously**
- TE is a generic name corresponding to the use of different technologies to optimize the utilization of a given backbone capacity and topology.
- **MPLS TE** uses extensions to RSVP and MPLS forwarding to support constrained-based routing (taking into account more information on network constraints and policy requirements)

MPLS TE

- Resource optimization, avoid over- and under- utilization of network parts, traffic not being aggregated on the shortest path



Configuration Steps

prerequisites

CEF and tagswitch on every interface

Enable tunnel creation

Enable TE in IGP

Create tunnel(s)

OSPF configuration

- RIP is a distance vector routing protocol, only link-state routing protocols that provide constant updates on the link state can be used
- For this reason we need to configure OSPF (already done in the MPLS scenario)

```
router ospf 100
    network 10.1.1.0 0.0.0.3 area 1
    network 10.2.2.0 0.0.0.3 area 1
    network 192.168.1.0 0.0.0.255 area 1
    network 192.168.2.0 0.0.0.255 area 1
    network 192.168.3.0 0.0.0.255 area 1
```

as seen from R1

Loopback configuration

- It is mandatory to setup a Loopback interface with IP mask of 32 bits on each router to be used as router-id

```
interface Loopback0  
  ip address 172.16.1.1 255.255.255.255
```

```
router ospf 100  
  network 172.16.1.1 0.0.0.0 area 1
```

MPLS

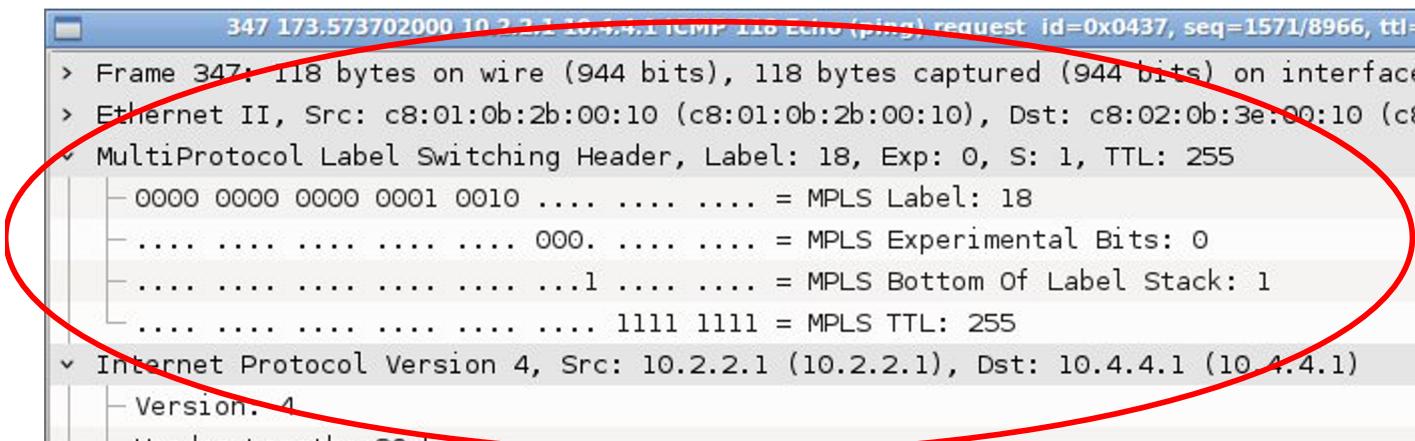
- Cisco MPLS implementation requires CEF – Cisco Express Forwarding
- CEF is an advanced layer 3 switching technology adopted in cisco routers to increase packet switching speed
- CEF keeps track of adjacencies to build the Forwarding Information Base (FIB)

MPLS Configuration

- Configure
 - ip cef
 - Enable CEF
 - interface Serial 2/0
 - mpls ip
 - Enable tag switching on this interface
- Check
 - show mpls interfaces detail

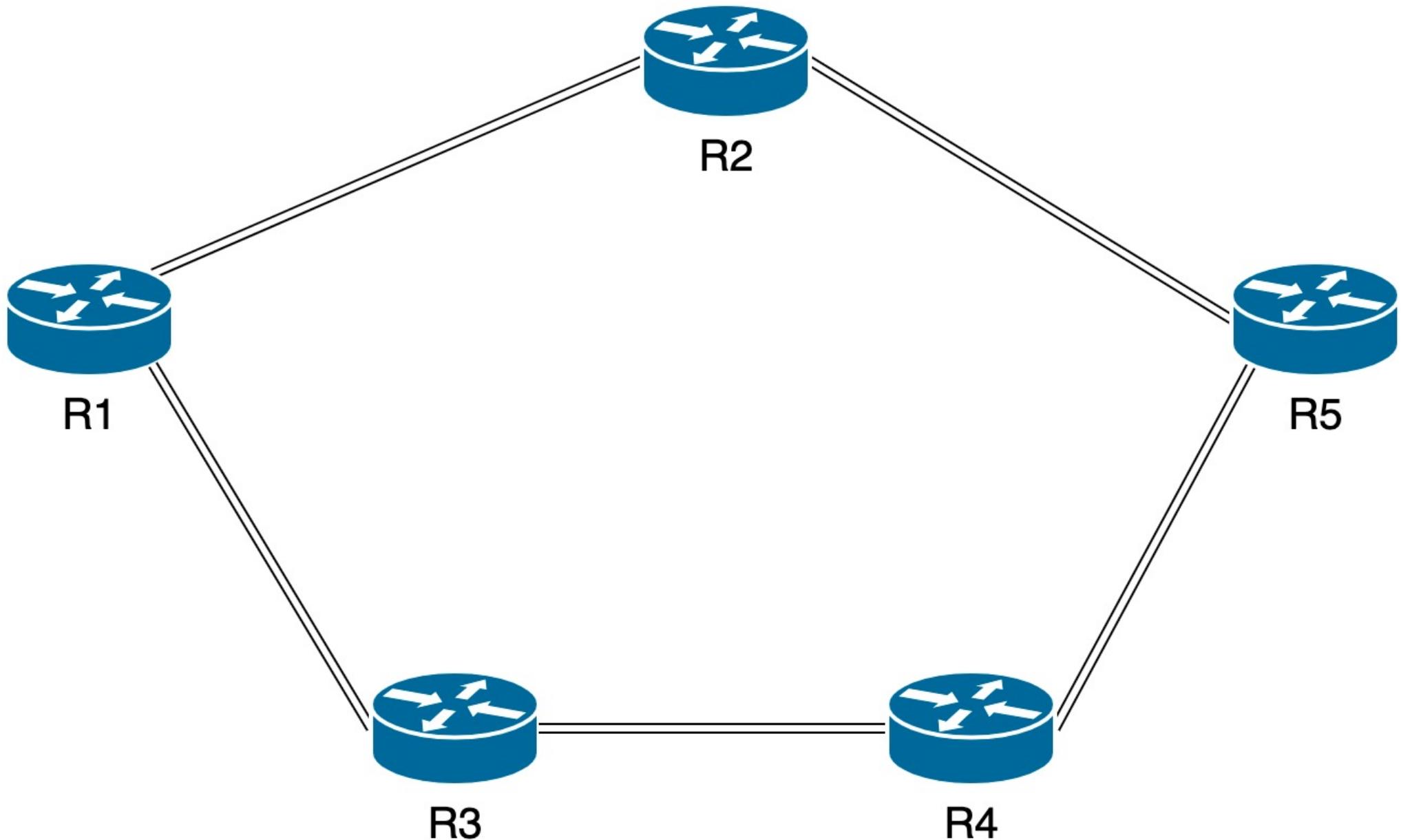
Test

- Open Wireshark and try to ping VoipServer from VoipClient



```
347 173.573702000 10.2.2.1 10.4.4.1 ICMP 116 Echo (ping) request id=0x0437, seq=1571/8966, ttl=255 (no response found!)
> Frame 347: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface 0
> Ethernet II, Src: c8:01:0b:2b:00:10 (c8:01:0b:2b:00:10), Dst: c8:02:0b:3e:00:10 (c8:02:0b:3e:00:10)
  MultiProtocol Label Switching Header, Label: 18, Exp: 0, S: 1, TTL: 255
    0000 0000 0001 0010 .... .... .... = MPLS Label: 18
    .... .... .... 000. .... .... = MPLS Experimental Bits: 0
    .... .... .... ....1 .... .... = MPLS Bottom Of Label Stack: 1
    .... .... .... ....1111 1111 = MPLS TTL: 255
  Internet Protocol Version 4, Src: 10.2.2.1 (10.2.2.1), Dst: 10.4.4.1 (10.4.4.1)
    Version: 4
    Header Length: 20 bytes
    Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
    Total Length: 100
    Identification: 0x000c (12)
    Flags: 0x00
    Fragment offset: 0
    Time to live: 255
  Data (11)
0000  c8 02 0b 3e 00 10 c8 01 0b 2b 00 10 88 47 00 01 ...>.... .+...G..
0010  21 ff 45 00 00 64 00 0c 00 00 ff 01 a1 85 0a 02 !.E..d.. .....
0020  02 01 0a 04 04 01 08 00 9f 6d 04 37 06 23 00 00 ..... .m.7.#..
0030  00 00 00 03 d4 7f ab cd ab cd ab cd ab cd ..... .....

```



Test

show mpls forwarding-table

Local Label	Outgoing Label	Prefix or Tunnel Id	Bytes Switched	Outgoing interface	Next Hop
16	No Label	10.3.3.0/30	0	Se2/1	point2point
17	18	10.4.4.0/30	0	Se2/0	point2point
	No Label	10.4.4.0/30	0	Se2/1	point2point
18	Pop Label	10.5.5.0/30	0	Se2/0	point2point
19	Pop Label	172.16.1.2/32	0	Se2/0	point2point
20	No Label	172.16.1.3/32	0	Se2/1	point2point
21	No Label	172.16.1.4/32	0	Se2/1	point2point
22	22	172.16.1.5/32	0	Se2/0	point2point
23	26	192.168.101.0/24	0	Se2/0	point2point
24	27	192.168.102.0/24	0	Se2/0	point2point
25	28	192.168.103.0/24	0	Se2/0	point2point

MPLS - TE

- Unlike conventional IP routing MPLS traffic engineering (TE) uses the implicit MPLS characteristic of separation between the forwarding plane and the control plane to allow routing decisions to be made on criteria other than the destination address
- Label switched paths (LSPs), referred as “traffic engineering tunnels” are setup to steer traffic through the network allowing links ***not included in the shortest path*** to be used

MPLS TE - enable Tunnels

- Enable the creation of mpls tunnels for TE:

```
mpls traffic-eng tunnels
    • Enable tunnels creation on the router
```

```
Interface serial 2/0
```

```
mpls traffic-eng tunnels
    ip rsvp bandwidth 512 512
```

- *Enable MPLS tunnel creation on the interface specifying the reservable bandwidth and the largest reservable flow on the interface*

RSVP adopted
also as
admission
control

- Enable TE extension on OSPF

```
router ospf 100
```

```
    mpls traffic-eng area 1
```

```
    mpls traffic-eng router-id Loopback0
```

MPLS TE - Tunnels

- Define a new (headend) tunnel:

```
interface Tunnel0
    ip unnumbered Loopback0
    tunnel destination 172.16.1.5
    tunnel mode mpls traffic-eng
    tunnel mpls traffic-eng autoroute announce
    tunnel mpls traffic-eng priority 2 2
    tunnel mpls traffic-eng bandwidth 400
    tunnel mpls traffic-eng path-option 1 dynamic
        • The path of the tunnel will be dynamically selected
```

- Check the status:

- show mpls traffic-eng tunnels

Reservation priority for the tunnel

Having “fun” with show commands

show mpls interfaces detail

show mpls traffic-eng tunnels

show mpls traffic-eng topology

show mpls traffic-eng topology path destination xxx.xxx.x.x

show mpls traffic-eng link-management igp-neighbors

show mpls traffic-eng link-management interfaces

show mpls traffic-eng link-management statistics

show ip route