MPLS TE

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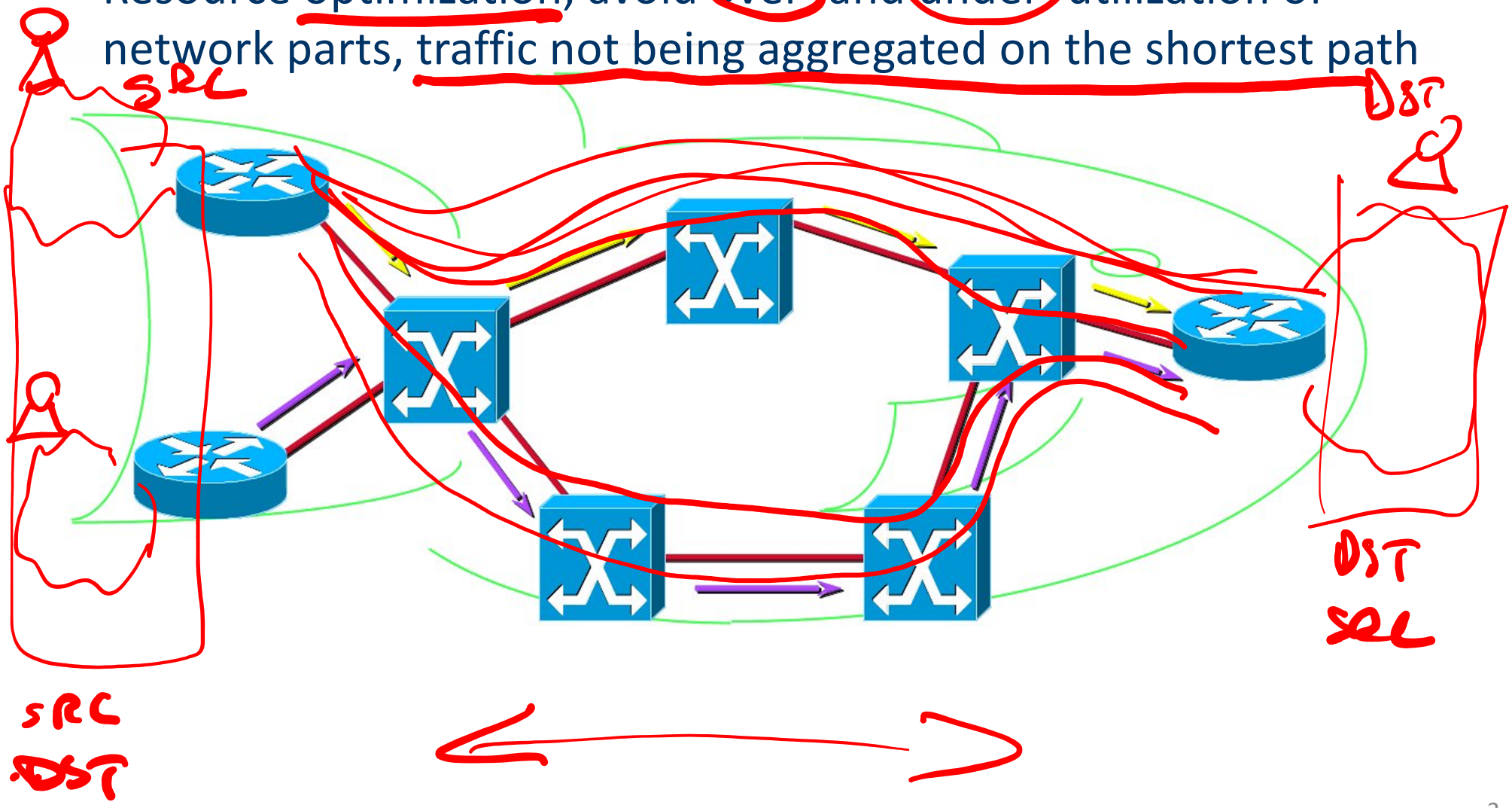
MPLS TE

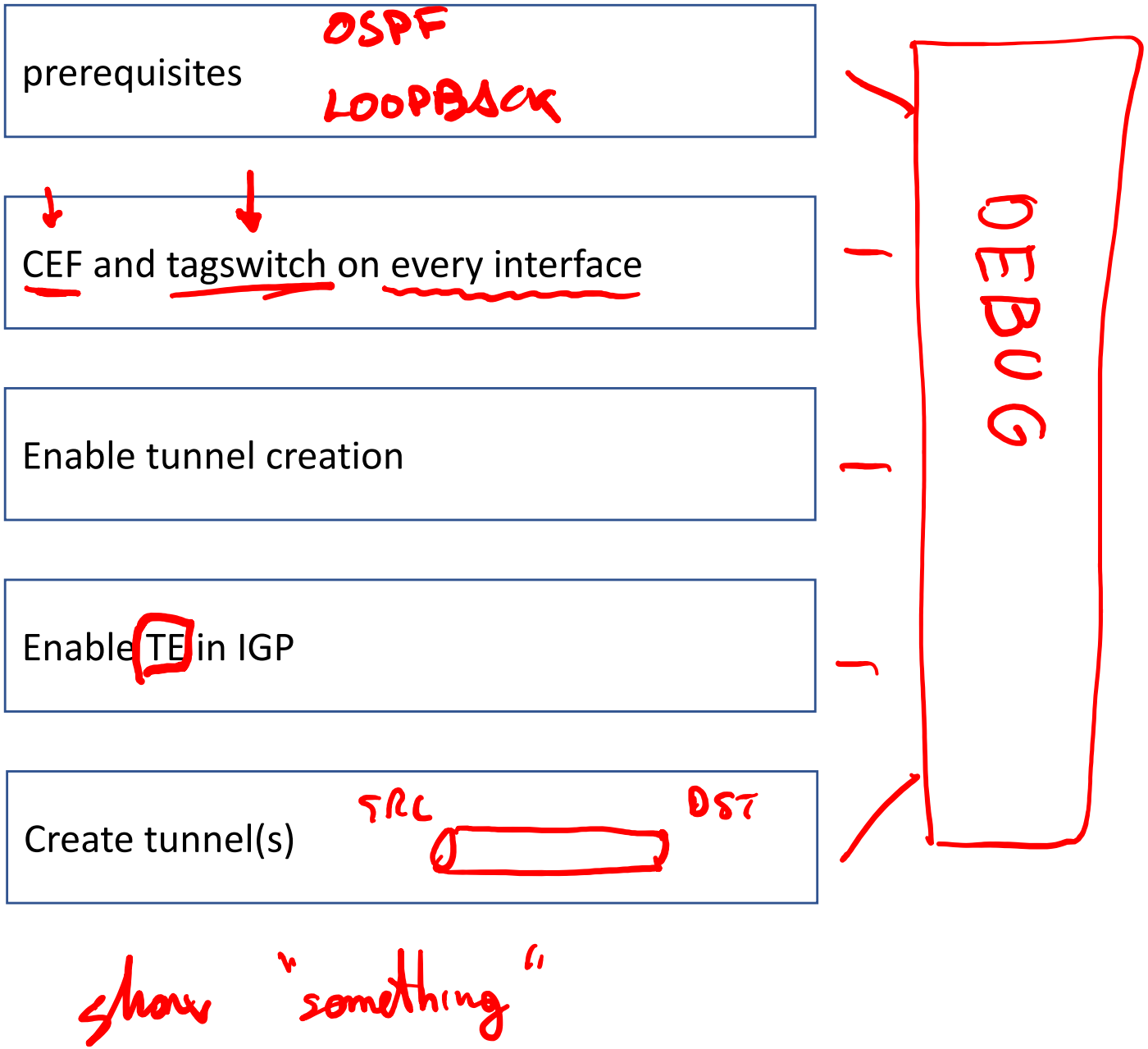
- Traditional IP networks uses ***destination-based routing***
- ***Explicit routing*** (e.g., source based routing) is not supported
- MPLS networks can support ***destination-based and explicit routing simultaneously***
- **TE** is a generic name corresponding to the use of different technologies to 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



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

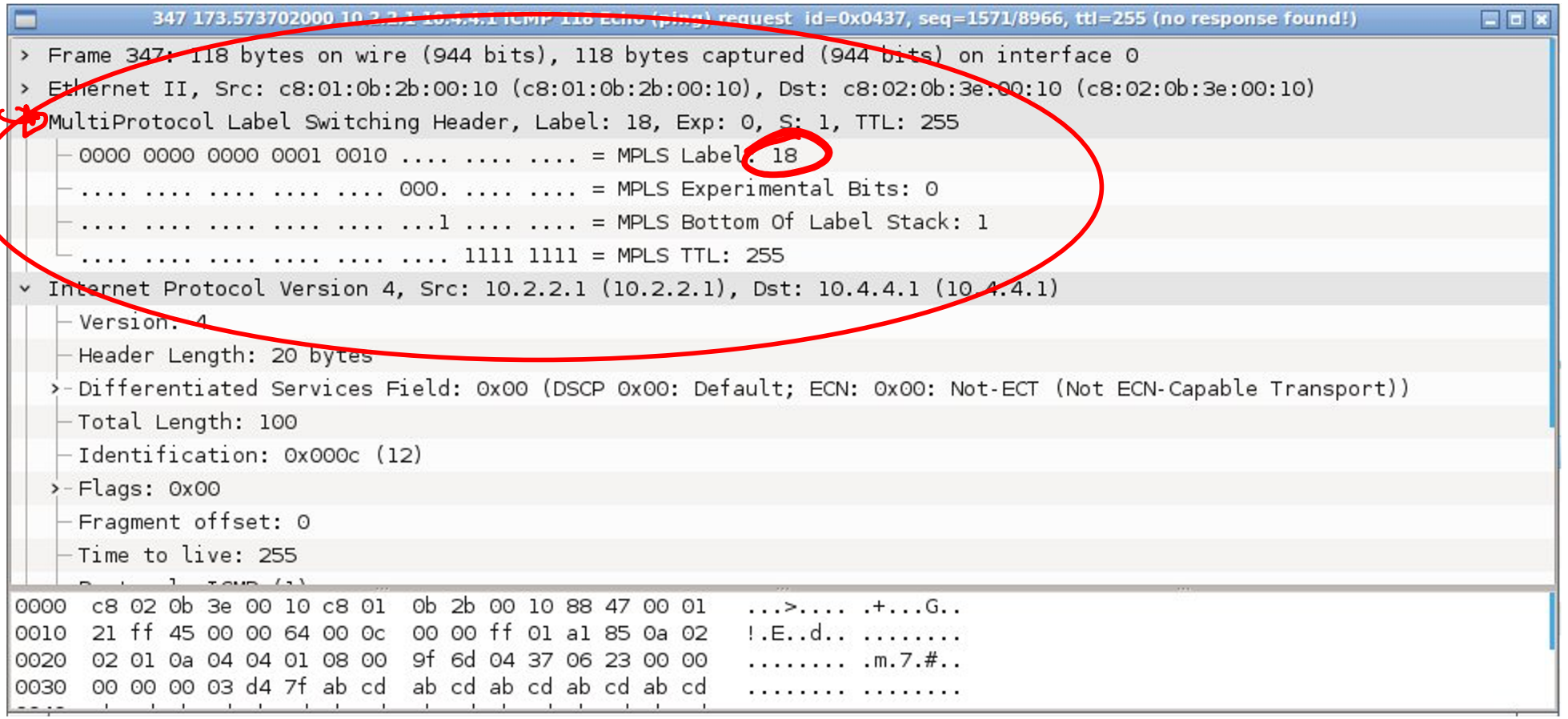
- Cisco MPLS implementation requires CEF – Cisco Express Forwarding
- CEF is an advanced layer 3 switching technology adopted in cisco routers to increase packet switching speed
- CEF keeps track of adjacencies to build the Forwarding Information Base (FIB)

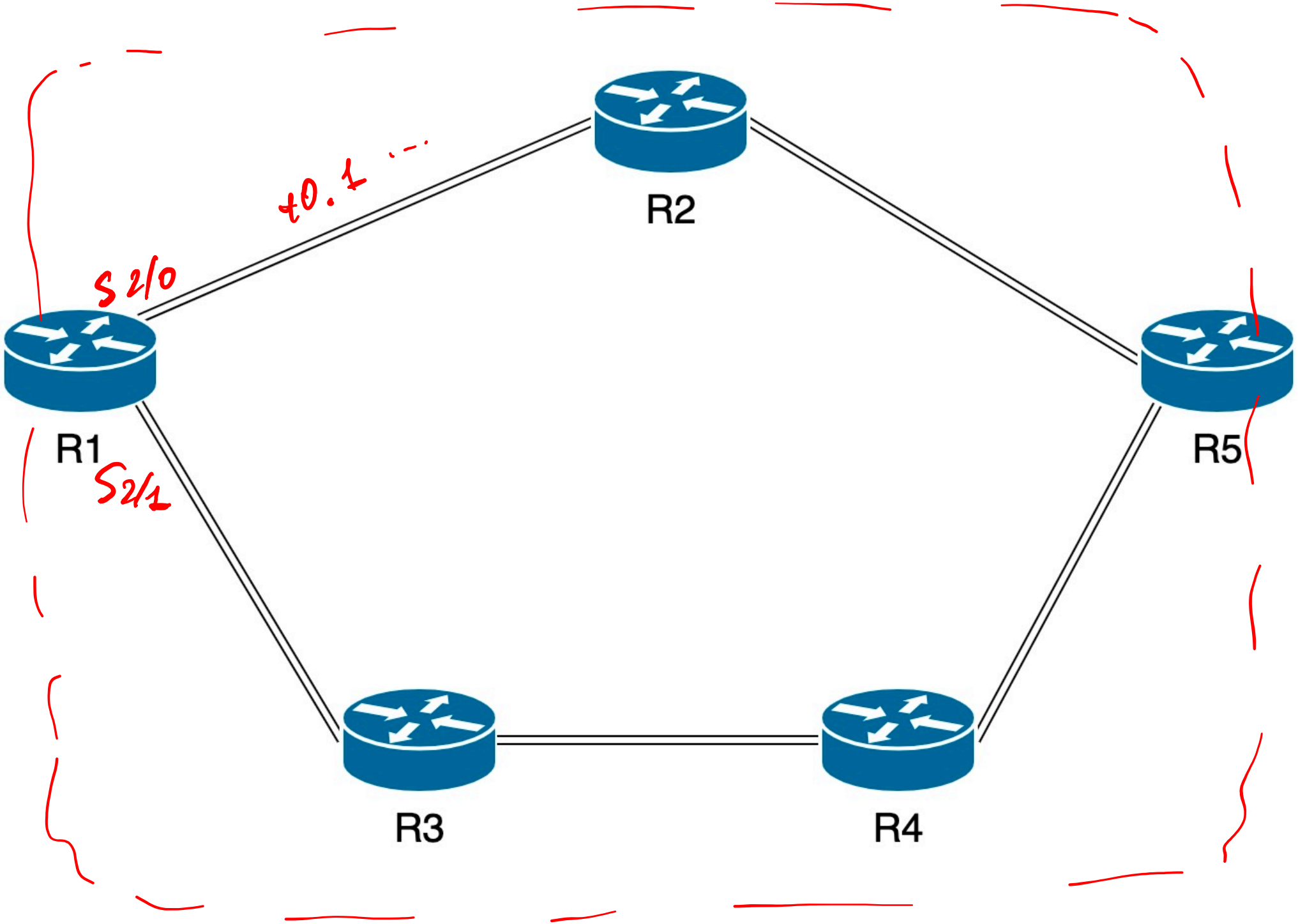
MPLS Configuration

- Configugre
  - `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




R2
R1
R5
R3
R4

Test

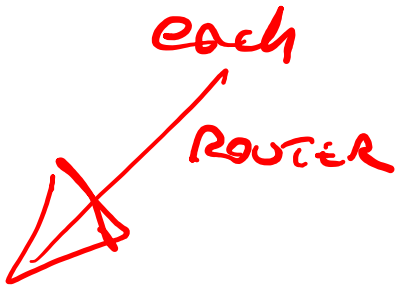
`show mpls forwarding-table`

```
R1#show mpls forwarding-table
Local      Outgoing   Prefix           Bytes Label   Outgoing   Next Hop
Label      Label      or Tunnel Id     Switched      interface
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

Reservation priority for the tunnel

- Check the status:
  - `show mpls traffic-eng tunnels`

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
```