



universidade de aveiro
theoria poesis praxis

ARQUITETURA E GESTÃO DE REDES

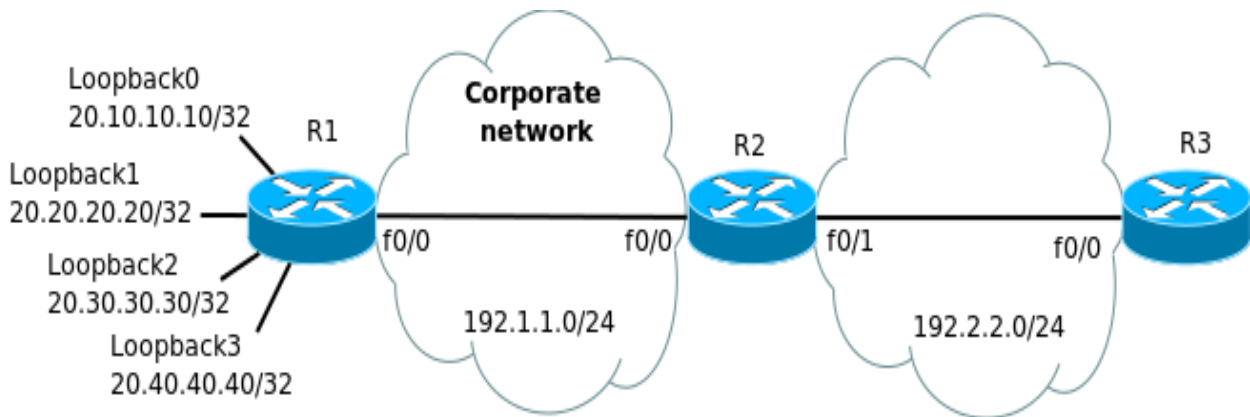
LABORATORY GUIDE

Objectives

- Implementing DiffServ

Implementing DiffServ for end-to-end QoS

Set up the following network. Configure the IP addresses at the routers' interfaces and configure the OSPF protocol in order to have full connectivity.
Enable the Cisco Express Forwarding capability by issuing at all routers the `ip cef` command in global configuration mode.
For simplicity reasons, traffic will be unidirectional, from Router 2 to Router 1.



Consider 4 traffic classes with the following characteristics and requirements:

- **Premium class** will be marked with a **DSCP value of 46 (EF)**.
- **Gold class** will be marked with a **DSCP value of 10 (AF11, low drop probability)**.
- **Silver class** will be marked with a **DSCP value of 22 (AF23, high drop probability)**.
- Everything else is considered as belonging to the “**best-effort**” traffic class.
- The premium class should be forwarded with the lowest delay possible up to a maximum of 40% of the link bandwidth during periods of congestion.
- The gold class should be treated preferentially over the silver class.
- The gold and silver classes should have 20 percent and 15 percent, respectively, of the interface bandwidth as the minimum bandwidth guarantees.
- Best-effort class should be policed to 16 kbps.

1. Defining Classes and classifying packets

The different services will be emulated by generating ICMP traffic from Router 3 to the different *Loopback* interfaces at Router 2. In order to classify traffic in the different classes, three extended access lists must be defined at Router 2:

```
Router2(config)#access-list 101 permit icmp 192.2.2.0 0.0.0.255 20.10.10.0 0.0.0.255
Router2(config)#access-list 102 permit icmp 192.2.2.0 0.0.0.255 20.20.20.0 0.0.0.255
Router2(config)#access-list 103 permit icmp 192.2.2.0 0.0.0.255 20.30.30.0 0.0.0.255
```

```
Router2(config)#class-map match-all EF
Router2(config-cmap)#match access-group 101
Router2(config)#class-map match-all AF11
Router2(config-cmap)#match access-group 102
Router2(config)#class-map match-all AF23
Router2(config-cmap)#match access-group 103
```

2. Configure the SETDSCP policy map in order to **mark packets** according to the previously described scheme:

```
Router2(config)#policy-map SETDSCP
Router2(config-pmap)#class EF
Router2(config-pmap-c)#set ip dscp 46
Router2(config-pmap)#class AF11
Router2(config-pmap-c)#set ip dscp 10
Router2(config-pmap)#class AF23
Router2(config-pmap-c)#set ip dscp 22
```

Apply this policy map in the **input** direction of interface F0/1 of Router 2 by using the following command:

```
service-policy input SETDSCP
```

3. In order to configure the different **per hop behavior (PHB)** match the different DSP values to the traffic classes and create the EDGE policy map:

```
Router2(config)#class-map match-all PREMIUM
Router2(config-cmap)#match ip dscp 46
Router2(config)#class-map match-all GOLD
Router2(config-cmap)#match ip dscp 10
Router2(config)#class-map match-all SILVER
Router2(config-cmap)#match ip dscp 22
Router2(config)#class-map match-all BEST-EFFORT
Router2(config-cmap)#match ip dscp 0
```

```
-----
Router2(config)#policy-map EDGE
Router2(config-pmap)#class PREMIUM
Router2(config-pmap)#priority percent 40
Router2(config-pmap)#class GOLD
Router2(config-pmap)#bandwidth percent 20
Router2(config-pmap)#class SILVER
Router2(config-pmap)#bandwidth percent 15
Router2(config-pmap)#class BEST-EFFORT
Router2(config-pmap)#police 16000 2000 2000 conform-action set-dscp-transmit 0
(rate limit of 16Kbps; normal burst of 2000 bytes and maximum burst of 2000 bytes)
```

Apply this policy map in the **output** direction of interface f0/0 of Router 2 (corporate network) by using the following command:

```
service-policy output EDGE
```

4. Start a Wireshark capture. Using the *ping* command, generate traffic corresponding to the different services. By looking at the captured packets, confirm the DSCP values that were set at the edge of the DiffServ network.

5. Using the

```
show policy-map <map_name>
show policy-map interface <interface>
show queue <interface>
show interface <interface>
```

commands, monitor and troubleshoot the operation of the DiffServ network.