

# République Algérienne Démocratique et Populaire



## École Polytechnique

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### Rapport de TP 2

IP avancé

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# 1 Introduction

The objective of this lab is to familiarize and practice the QoS concepts seen in class using CISCO equipment. At the end of this tutorial, we will be able to create traffic classes, define traffic management policies (classification, marking, policing/shaping, queuing and scheduling), and apply them to interfaces/protocols to differentiate between the flows circulating in an IP network.

## Part I

### 2 Part 1: Getting to know QoS

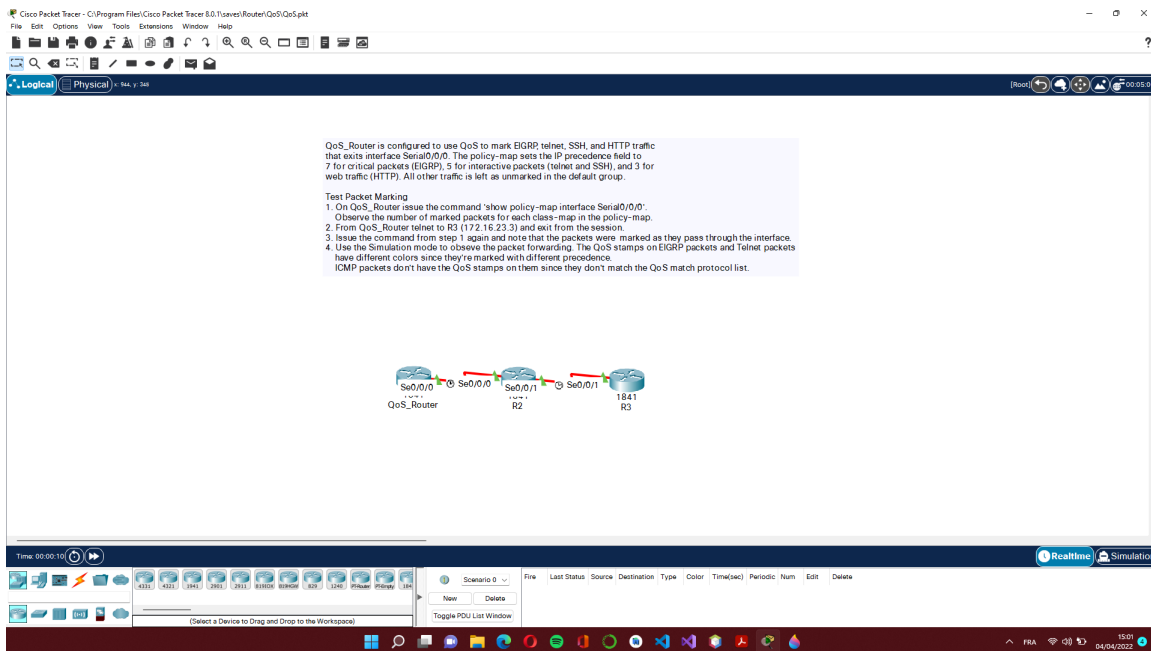


Figure 1: Qos Packet Tracer

When we run the **show policy-map interface Serial0/0/0** command in QoS\_Router, we can observe the number of packets marked for each class map in the policy map. QoS\_Router is configured to use QoS to mark EIGRP, telnet, SSH and HTTP traffic that exits the Serial0/0/0 interface. Serial0/0/0. The policy map sets the IP precedence field to 7 for critical packets (EIGRP), 5 for interactive packets (telnet and SSH), and 3 for web traffic (HTTP). All other traffic is left as unmarked in the default group.

#### 2.1

From QoS\_Router, the telnet command to R3 (172.16.23.3) connects to router R3, as shown in Figure 2.

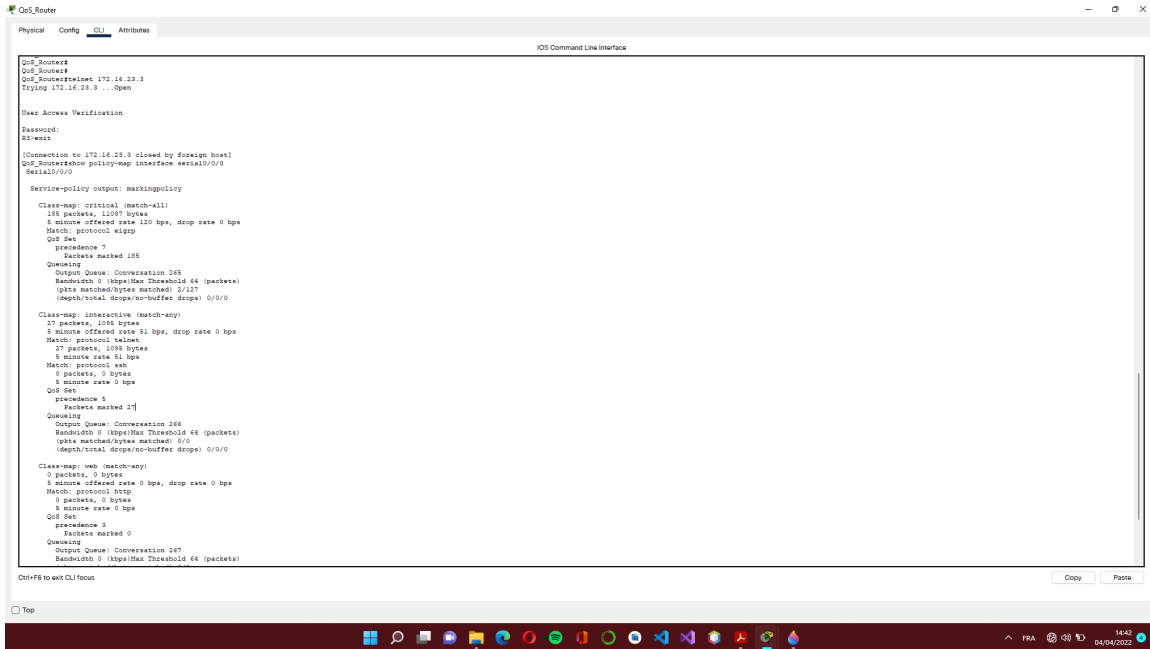


Figure 2: Telnet command

## 2.2

The **show policy-map interface Serial0/0/0** command shows that 27 telnet packets (1095 bytes) have been sent from interface Serial0/0/0 in Qos\_Router (see Figure 3).

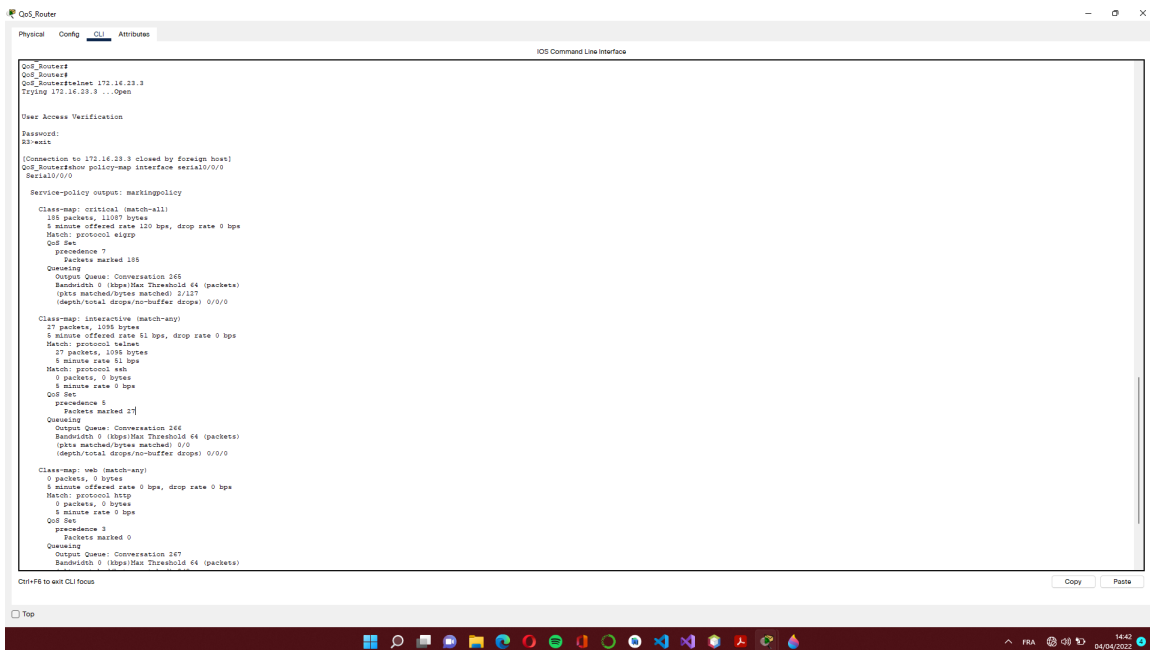


Figure 3: Telnets packets in the network



# Topology

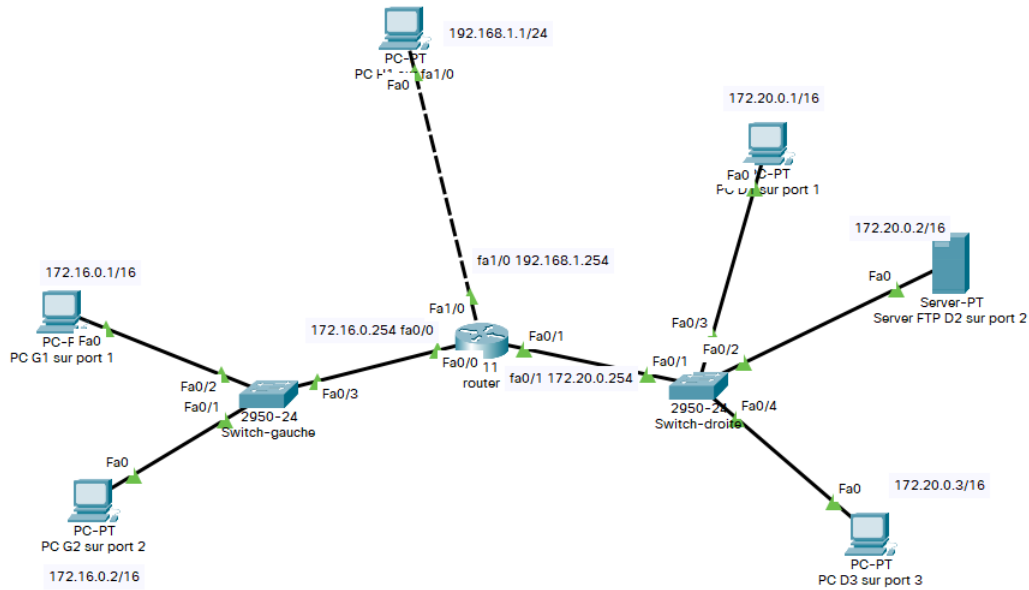


Figure 5: Topology

## 3.1 QoS based on a source interface

### 3.1.1 Phase 1 - Declaration of flow classes

The declaration of a priority class named 'prio-sur-interface' is done by the command **class-map match-all prio-sur-interface** match all flows coming from the interface fa1/0, as it is shown in Figure 6.

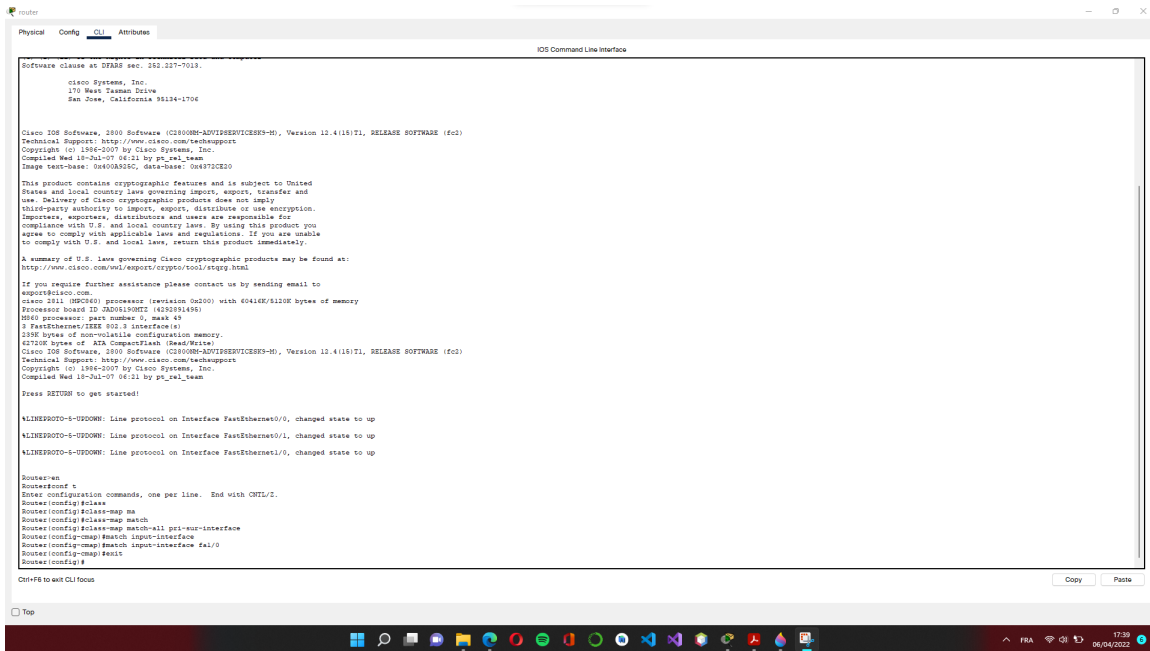


Figure 6: Declaration of flow classes

The 'match-all' clause indicates that, in order to belong to the class, a package must verify all the declared criteria. The 'match-any' clause means that at least one of them must be checked. If we only declare only one membership criterion. We can check the declaration of the class with the **show class-map** command, as shown in Figure 7.

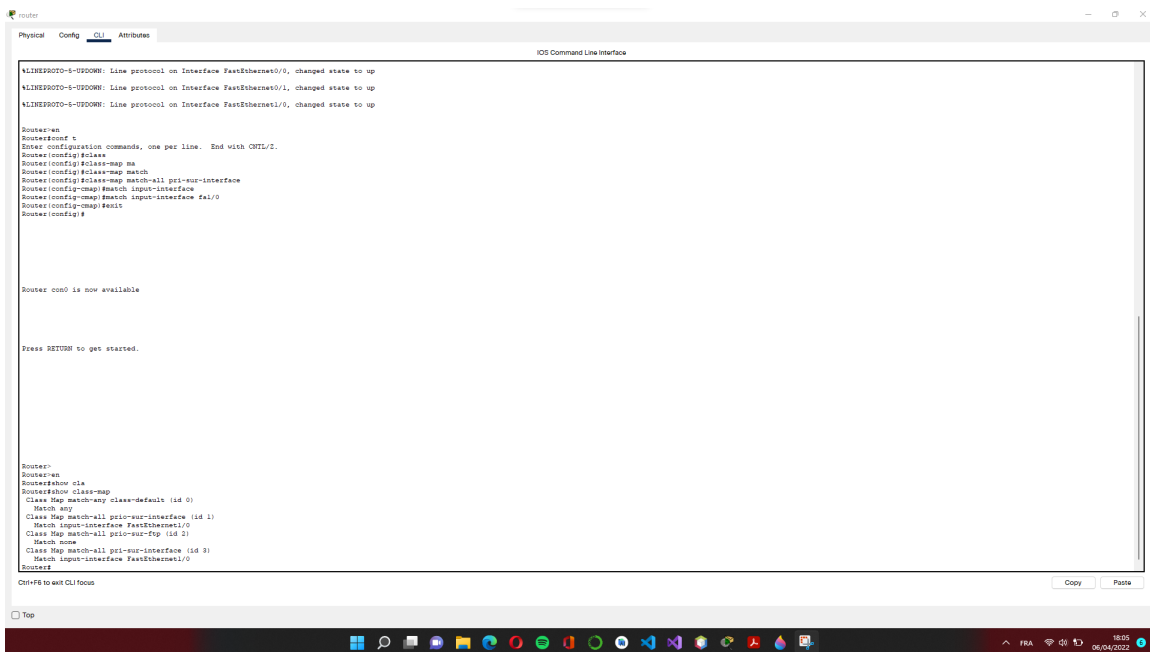
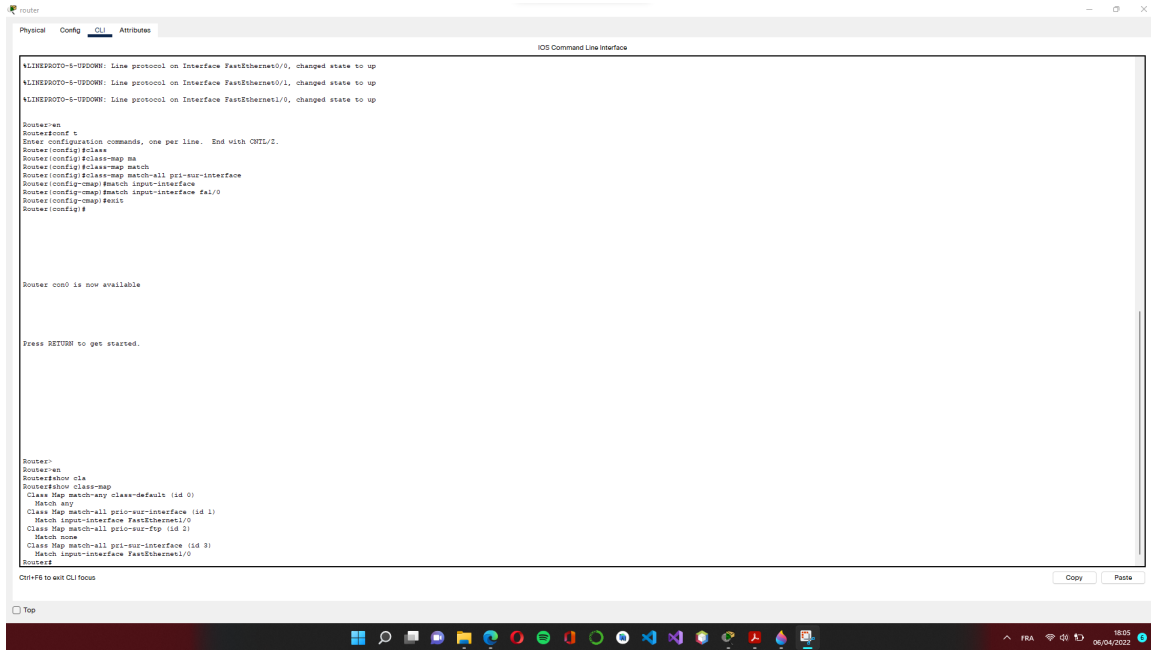


Figure 7: Check Classes

We see that there is a default class, **class-default**, of which all packages are part.

### 3.1.2 Phase 2 - Declaration of a QoS policy

On the traffic class created above, we to apply a simple management policy called 'mon-politique-qos' which is used to assign the precedence 7 DSCP code 'cs7' to all packets of the 'prio-sur-interface' class (Figure 9).



```
Router>
Router>conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#class
Router(config)#class-map m1
Router(config)#class-map match-all prio-sur-interface
Router(config)#match input-interface
Router(config)#match input-interface fa1/0
Router(config)#exit
Router(config)#

Router con0 is now available.

Press RETURN to get started.

Router>
Router>
Router>show class-map
Class Map match-any class-default (id 0)
  Match any
  Class Map match-all prio-sur-interface (id 1)
    Match input-interface FastEthernet1/0
  Class Map match-all prio-sur-fip (id 2)
    Match none
  Class Map match-all prio-sur-interface (id 3)
    Match input-interface FastEthernet1/0
Router#
```

Figure 8: Declaration of a QoS policy

A DSCP field priority is defined for packets of the 'prio-sur-interface' class with the code 'cs7', equivalent to a DSCP of '111000' and thus a high priority of 7, which is shown in the table below:

**Table 6-1** Commonly Used DSCP Values (continued)

DSCP Value	Decimal Value	Meaning	Drop Probability	Equivalent IP Precedence Value
<b>011 000</b>	24	CS3		3
<b>100 000</b>	32	CS4		4
<b>101 000</b>	40	CS5		5
<b>110 000</b>	48	CS6		6
<b>111 000</b>	56	CS7		7
<b>000 000</b>	0	Default		
<b>101 110</b>	46	EF		

Figure 9: Commonly Used DSCP Values



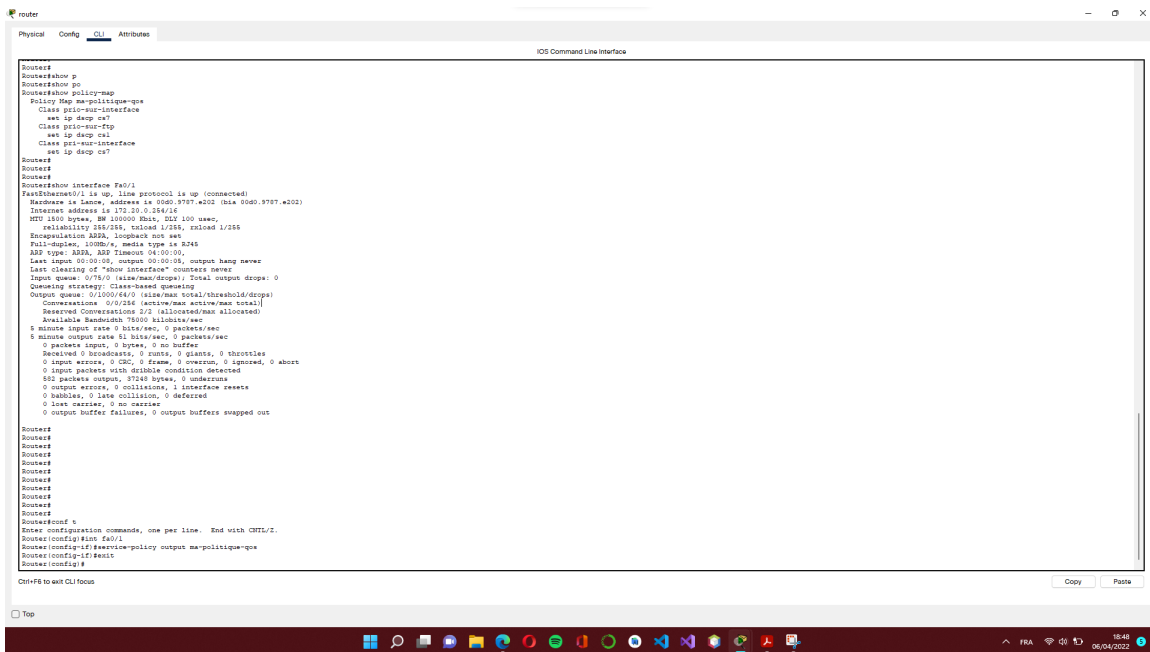
The following policy map class-actions are supported:

- bandwidth — Bandwidth configuration options.
- exit — Exits from the QoS class action configuration mode.
- no — Negates or sets default values for the command.
- police — Policer configuration options.
- priority — Strict scheduling priority configuration options for this class.
- queue - buffers—Queue buffer configuration options.
- service-policy—Configures the QoS service policy.

If the 'ma-politique-qos' policy did not yet exist, it is created. If it did exist, the **class** commands will achieve it.

### 3.1.3 Phase 3 - Application of the QoS policy on an interface

We now want to apply the 'ma-politique-qos' policy on the fa0/1 interface, so we can execute **service-policy output ma-politique-qos** command on the selective interface as shown in Figure 10.





### 3.1.4 Phase 4 - Verification of QoS execution

In 'simulation' mode, if we send any packet (ICMP for example) from the H1, the packet arrives in the router through port Fa1/0 and is therefore part of the 'prio-sur-interface' class. It is assigned the DSCP code '0x38', which means '111 000' DS Field Binary and 'cs7' DSCP Name, The Figure 13 show the result of simulation.

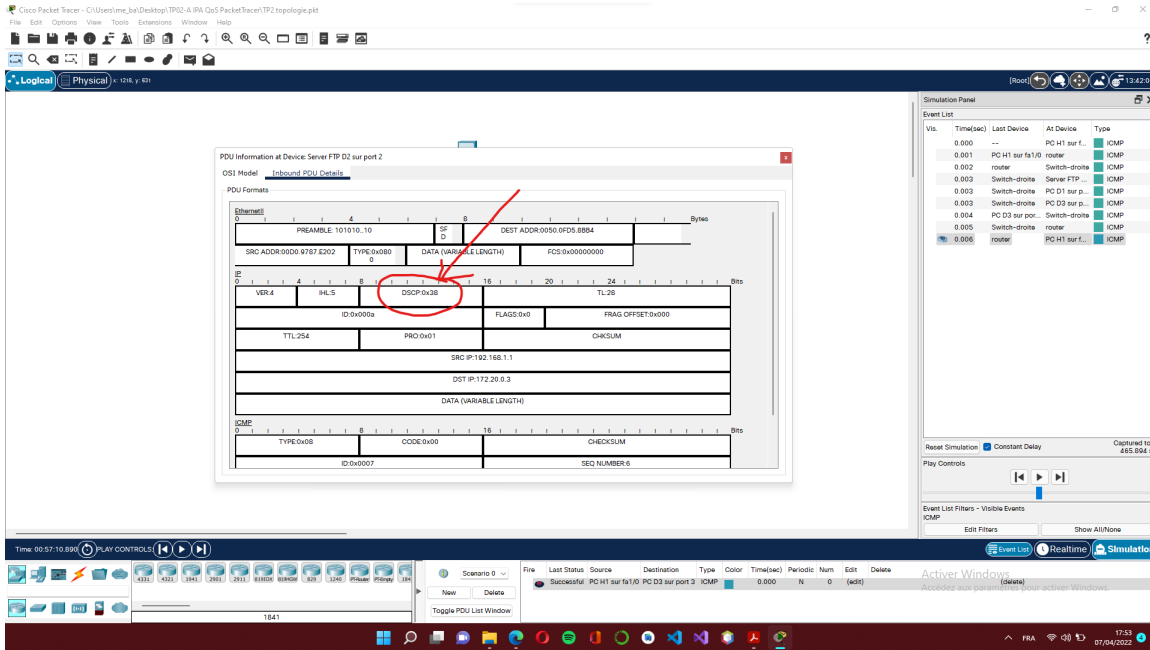


Figure 13: Simulation mode

## 3.2 Protocol-based QoS

### 3.2.1 Phase 1 - declaration of a new flow class

So we declared a class 'prio-sur-ftp'. To belong to this class, the flow must be of FTP protocol, whatever its IP source or its source interface, we can see the result in the Figure 14

### 3.2.2 Phase 2 - QoS policy expansion

In this part, we want to complete the policy 'ma-politique-qos', associated with the interface fa0/1 in output, by adding the class 'prio-basse-ftp' to which we assign a low priority of type 'cs1', that is to say a DSCP '001000' corresponding to a priority '1', the commands shown in Figure 15 can do the objective.

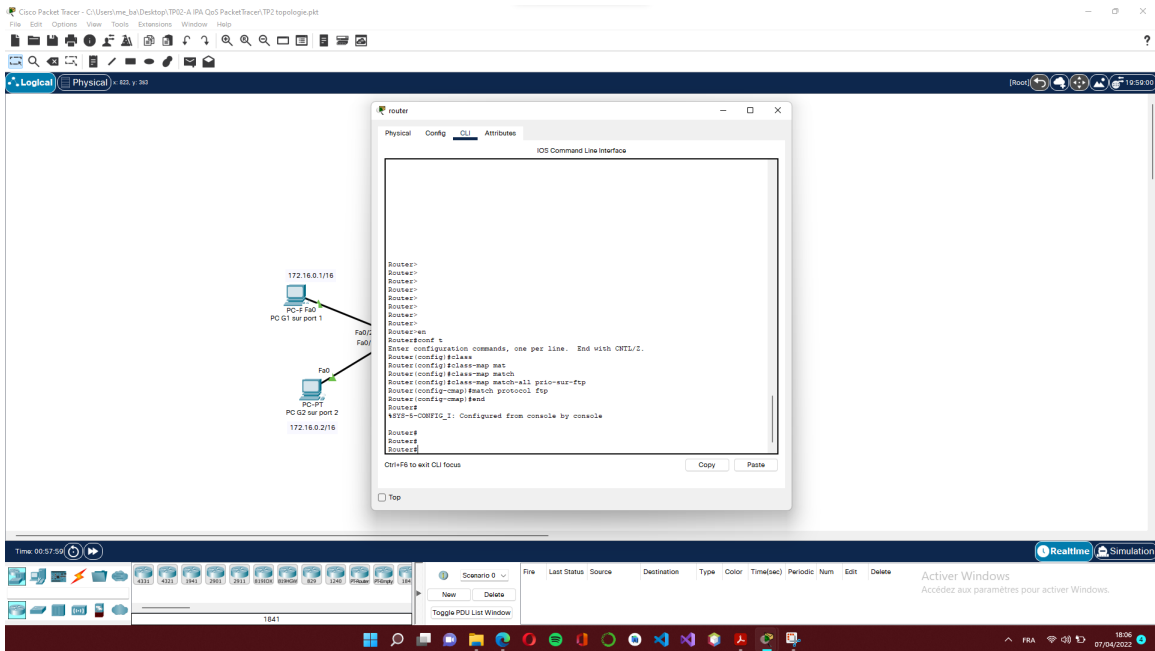


Figure 14: Declaration of a new flow class

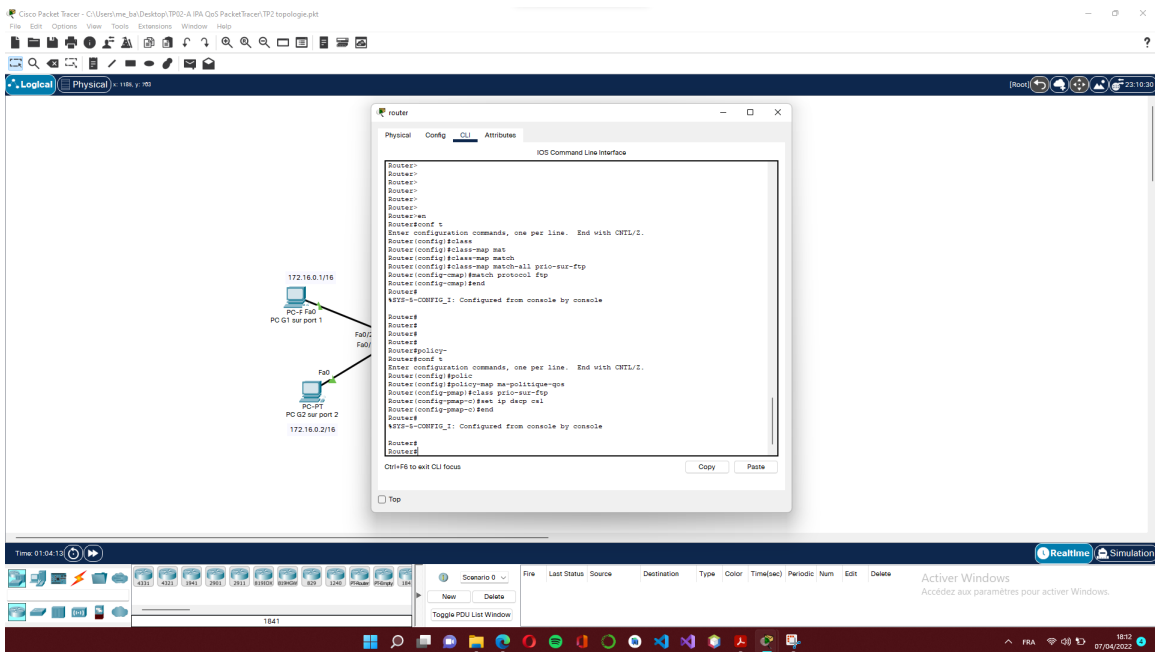


Figure 15: QoS policy expansion

### 3.2.3 Phase 3 - Verification of DSCP marking

In 'simulation' mode, we can generate, by the 'traffic generator' of Packet Tracer FTP flows from station G1 to the FTP server D2. The analysis of the outgoing traffic from the port fa0/1 port or at the input of the right switch gives the result shown in Figure 16.

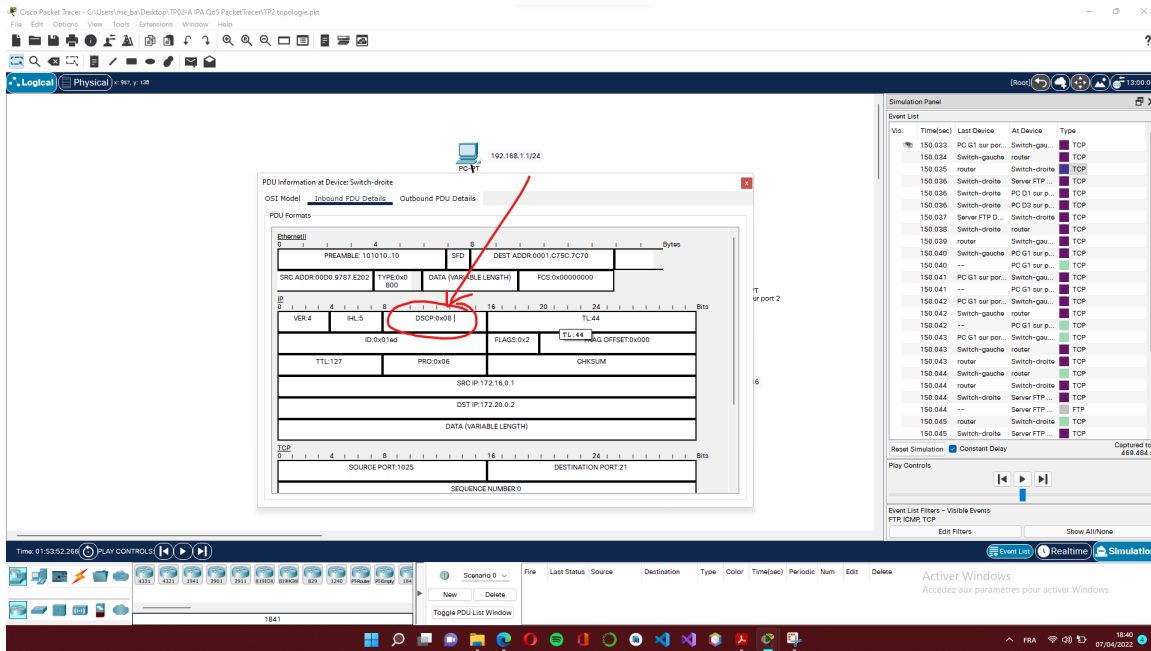


Figure 16: Verification of DSCP marking

The DSCP field is set to '8'. or '001 000' which means 'cs1' DSCP Name.

## Part III

### 4 Part 3: Advanced QoS on a Cisco Router

We could also act on the priority of traffic by the `BANDWIDTH` command, allowing to reserve a share of bandwidth allocated to the traffic class.

#### Example:

```
MonRouteur(config) # policy-map autre-politique
MonRouteur(config) # class prio-sur-ftp
MonRouteur(config) # bandwidth percent 10
```

Here, we complete the 'ma-politique-qos' policy by adding the 'prio-on-ftp' class, to which we specify bandwidth allocation as a percentage of the underlying link rate.

```
Device # configure terminal
Device # class-map prec1
Device # description matching precedence 1 packets
Device # match ip precedence 1
Device # end
```

We Set the precedence value from precedence based on a table map (0 to 7), this example

shows how to classify packets by using precedence values.

The following example shows how to configure average rate shaping, in our case we make an average of 512000:

```
Device # policy-map shaper
```

```
Device # class prec1
```

```
Device # shape average 512000
```

```
Device # exit
```

Before applying the shaper policy we can see that the queueing strategy is in the 'fifo' mode, after we apply the policy on the Fastethernet0/0 we notice that the queueing strategy becomes in 'Class-based queueing' as shown in Figures 17 and 18.

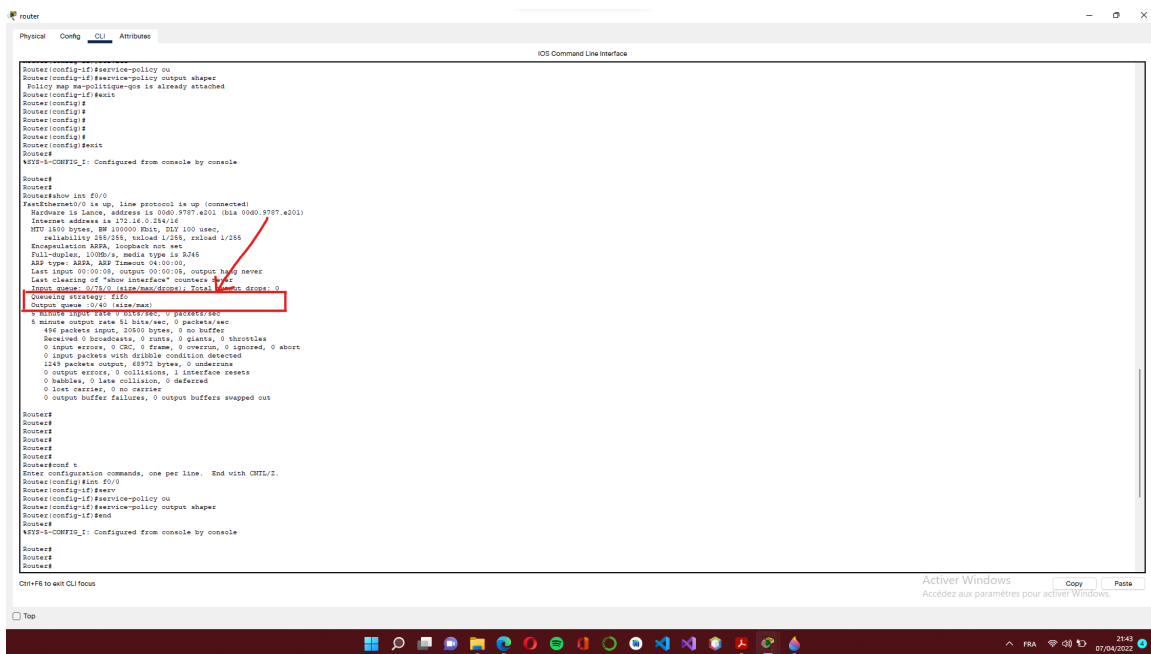


Figure 17: show Interface information

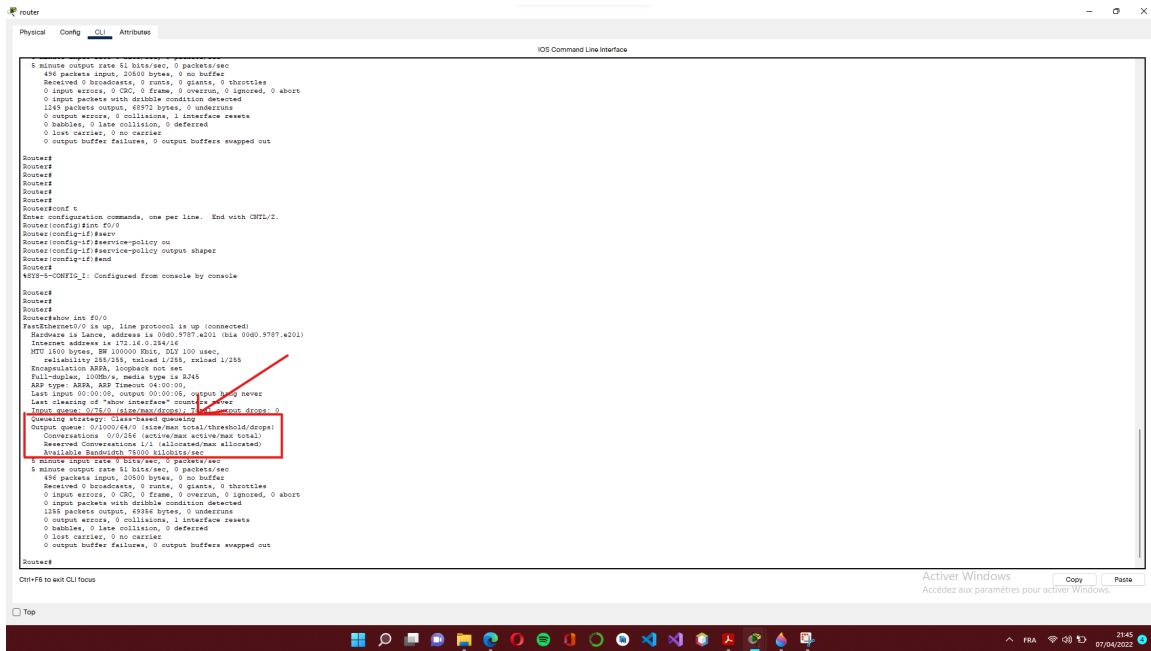


Figure 18: applying shaper policy

The **queue-limit** command allows you to override the default queue size for a class.