

Escuela Superior de Cómputo
Instituto Politécnico Nacional
Administración de Servicios en Red
Practica Servicios Diferenciados
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13 de junio de 2021

1. Descripción y Desarrollo

Para desarrollar esta practica, previamente se estudio y se leyo acerca de los siguientes temas:

- Enrutamiento Dinamico OSPF con Interfaz Loopback
- Uso de Interfaces Virtuales de Red para GNS3
- Previo conocimiento acerca de QoS así como los config file de la topología a implementar

2. Topología y más

Para realizar cada tarea y verificación del perfomance de la practica se tiene la siguiente topología con las siguientes configuraciones:

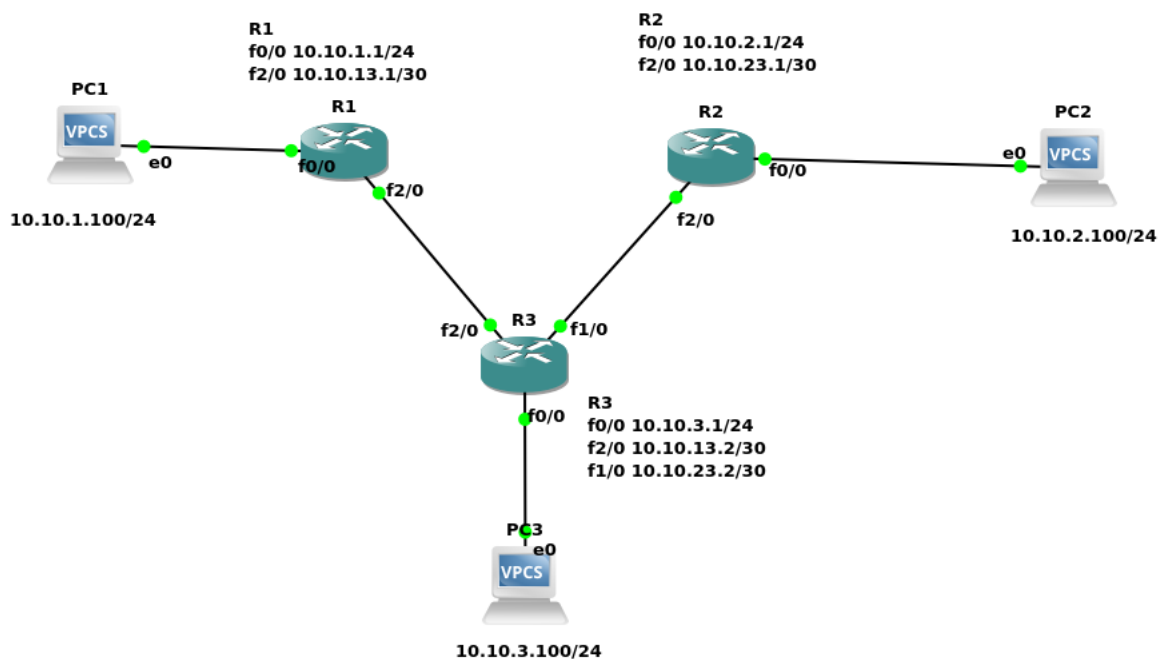


Figura 1: Topología de la red utilizada

2.1. Archivos de configuración VPC

Nota con fines de la imagen es necesario cambiar las VPCs por VMs ya que se hará uso del comando telnet para más adelante, solo se adaptó esta parte por fines de que sea sencilla la configuración rápida de los dispositivos y se conozca al menos como se configuran.

2.1.1. VPC1

```
1 # This the configuration for PC1
2 #
3 # Uncomment the following line to enable DHCP
4 # dhcp
5 # or the line below to manually setup an IP address and subnet mask
6 # ip 192.168.1.1 255.0.0.0
7 #
8
9 set pcname PC1
10 ip 10.10.1.100/24 10.10.1.1
```

2.1.2. VPC2

```
1 # This the configuration for PC2
2 #
3 # Uncomment the following line to enable DHCP
4 # dhcp
5 # or the line below to manually setup an IP address and subnet mask
6 # ip 192.168.1.1 255.0.0.0
7 #
8
9 set pcname PC2
10 ip 10.10.2.100/24 10.10.2.1
```

2.1.3. VPC3

```
1 # This the configuration for PC3
2 #
3 # Uncomment the following line to enable DHCP
4 # dhcp
5 # or the line below to manually setup an IP address and subnet mask
6 # ip 192.168.1.1 255.0.0.0
7 #
8
9 set pcname PC3
10 ip 10.10.3.100/24 10.10.3.1
```

2.2. Archivos de configuración Routers

Para esto es posible solo copiar y pegar todo el archivo de configuración de acuerdo con el router y el archivo a utilizar directamente.

2.2.1. Router 1

```
1 # Router 1
2 !
3 !
4 !
5
6 !
7 version 12.4
8 service timestamps debug datetime msec
9 service timestamps log datetime msec
10 no service password-encryption
11 !
12 hostname R1
13 !
14 boot-start-marker
15 boot-end-marker
16 !
```

```

17 !
18 no aaa new-model
19 no ip icmp rate-limit unreachable
20 !
21 !
22 ip cef
23 no ip domain lookup
24 !
25 !
26 !
27 !
28 !
29 !
30 !
31 !
32 !
33 !
34 !
35 !
36 !
37 !
38 !
39 !
40 !
41 !
42 ip tcp synwait-time 5
43 !
44 class-map match-all OSPF
45 match protocol ospf
46 class-map match-all MATCH_HTTP
47 match access-group 105
48 class-map match-all ICMP_TO_CORE
49 match precedence 1
50 class-map match-all HTTP_TO_CORE
51 match precedence 3
52 class-map match-all MATCH_ICMP
53 match access-group 101
54 !
55 !
56 policy-map FROM_HOST
57 class MATCH_ICMP
58 set precedence 1
59 class MATCH_HTTP
60 set precedence 3
61 policy-map TO_CORE
62 class ICMP_TO_CORE
63 bandwidth 8
64 police cir 8000
65 conform-action transmit
66 exceed-action drop
67 class HTTP_TO_CORE
68 bandwidth 10000
69 class OSPF
70 set precedence 7
71 priority 1000
72 !
73 !
74 !
75 !
76 !
77 !
78 interface Loopback0
79 ip address 220.0.0.1 255.255.255.255
80 !
81 interface FastEthernet0/0
82 ip address 10.10.1.1 255.255.255.0
83 duplex half
84 service-policy input FROM_HOST
85 !
86 interface FastEthernet1/0
87 no ip address

```

```

88 shutdown
89 duplex auto
90 speed auto
91 !
92 interface FastEthernet1/1
93 no ip address
94 shutdown
95 duplex auto
96 speed auto
97 !
98 interface FastEthernet2/0
99 ip address 10.10.13.1 255.255.255.252
100 duplex auto
101 speed auto
102 service-policy output TO_CORE
103 !
104 interface FastEthernet2/1
105 no ip address
106 shutdown
107 duplex auto
108 speed auto
109 !
110 !
111 router ospf 1
112 log-adjacency-changes
113 network 10.10.1.0 0.0.0.255 area 0
114 network 10.10.13.0 0.0.0.3 area 0
115 !
116 ip forward-protocol nd
117 !
118 no ip http server
119 no ip http secure-server
120 !
121 !
122 access-list 101 permit icmp any any
123 access-list 101 remark "match icmp"
124 access-list 105 remark "match http"
125 access-list 105 permit tcp any any eq www
126 no cdp log mismatch duplex
127 !
128 !
129 !
130 control-plane
131 !
132 !
133 !
134 !
135 !
136 !
137 gatekeeper
138 shutdown
139 !
140 !
141 line con 0
142 exec-timeout 0 0
143 privilege level 15
144 logging synchronous
145 stopbits 1
146 line aux 0
147 exec-timeout 0 0
148 privilege level 15
149 logging synchronous
150 stopbits 1
151 line vty 0 4
152 login
153 !
154 !
155 end

```

2.2.2. Router 2

```
1 # Router 2
2 !
3 !
4 !
5 !
6 version 12.4
7 service timestamps debug datetime msec
8 service timestamps log datetime msec
9 no service password-encryption
10 !
11 hostname R2
12 !
13 boot-start-marker
14 boot-end-marker
15 !
16 !
17 no aaa new-model
18 no ip icmp rate-limit unreachable
19 !
20 !
21 ip cef
22 no ip domain lookup
23 !
24 !
25 !
26 !
27 !
28 !
29 !
30 !
31 !
32 !
33 !
34 !
35 !
36 !
37 !
38 !
39 !
40 !
41 ip tcp synwait-time 5
42 !
43 class-map match-all OSPF
44 match protocol ospf
45 class-map match-all MATCH_HTTP
46 match access-group 105
47 class-map match-all ICMP_TO_CORE
48 match precedence 1
49 class-map match-all HTTP_TO_CORE
50 match precedence 3
51 class-map match-all MATCH_ICMP
52 match access-group 101
53 !
54 !
55 policy-map FROM_HOST
56 class MATCH_ICMP
57 set precedence 1
58 class MATCH_HTTP
59 set precedence 3
60 policy-map TO_CORE
61 class ICMP_TO_CORE
62 bandwidth 8
63 police cir 8000
64 conform-action transmit
65 exceed-action drop
66 class HTTP_TO_CORE
67 bandwidth 10000
68 class OSPF
69 set precedence 7
```

```

70  priority 1000
71  !
72  !
73  interface Loopback0
74  ip address 220.0.0.3 255.255.255.255
75  !
76  interface FastEthernet0/0
77  ip address 10.10.2.1 255.255.255.0
78  duplex half
79  service-policy output TO_CORE
80  !
81  interface FastEthernet1/0
82  no ip address
83  shutdown
84  duplex auto
85  speed auto
86  !
87  interface FastEthernet1/1
88  no ip address
89  shutdown
90  duplex auto
91  speed auto
92  !
93  interface FastEthernet2/0
94  ip address 10.10.23.1 255.255.255.252
95  duplex auto
96  speed auto
97  service-policy output TO_CORE
98  !
99  interface FastEthernet2/1
100 no ip address
101 shutdown
102 duplex auto
103 speed auto
104 !
105 !
106 router ospf 3
107 log-adjacency-changes
108 network 10.10.2.0 0.0.0.255 area 0
109 network 10.10.23.0 0.0.0.3 area 0
110 !
111 ip forward-protocol nd
112 !
113 no ip http server
114 no ip http secure-server
115 !
116 !
117 access-list 101 permit icmp any any
118 access-list 101 remark "match icmp"
119 access-list 105 remark "match http"
120 access-list 105 permit tcp any any eq www
121 no cdp log mismatch duplex
122 !
123 !
124 !
125 control-plane
126 !
127 !
128 !
129 !
130 !
131 !
132 gatekeeper
133 shutdown
134 !
135 !
136 line con 0
137 exec-timeout 0 0
138 privilege level 15
139 logging synchronous
140 stopbits 1

```

```

141 line aux 0
142 exec-timeout 0 0
143 privilege level 15
144 logging synchronous
145 stopbits 1
146 line vty 0 4
147 login
148 !
149 !
150 end

```

2.2.3. Router 3

```

1 # Router 3
2 !
3 !
4 !
5 !
6 version 12.4
7 service timestamps debug datetime msec
8 service timestamps log datetime msec
9 no service password-encryption
10 !
11 hostname R3
12 !
13 boot-start-marker
14 boot-end-marker
15 !
16 !
17 no aaa new-model
18 no ip icmp rate-limit unreachable
19 !
20 !
21 ip cef
22 no ip domain lookup
23 !
24 !
25 !
26 !
27 !
28 !
29 !
30 !
31 !
32 !
33 !
34 !
35 !
36 !
37 !
38 !
39 !
40 !
41 ip tcp synwait-time 5
42 !
43 class-map match-all OSPF
44 match protocol ospf
45 class-map match-all MATCH_HTTP
46 match access-group 105
47 class-map match-all ICMP_TO_CORE
48 match precedence 1
49 class-map match-all HTTP_TO_CORE
50 match precedence 3
51 class-map match-all MATCH_ICMP
52 match access-group 101
53 !
54 !
55 policy-map FROM_HOST
56 class MATCH_ICMP
57 set precedence 1
58 class MATCH_HTTP

```

```

59  set precedence 3
60  policy-map TO_CORE
61  class ICMP_TO_CORE
62    bandwidth 8
63    police cir 8000
64      conform-action transmit
65      exceed-action drop
66  class HTTP_TO_CORE
67    bandwidth 10000
68  class OSPF
69    set precedence 7
70    priority 1000
71  !
72  !
73  !
74  !
75  interface Loopback0
76  ip address 220.0.0.2 255.255.255.255
77  !
78  interface FastEthernet0/0
79  ip address 10.10.3.1 255.255.255.0
80  duplex half
81  !
82  interface FastEthernet1/0
83  ip address 10.10.23.2 255.255.255.252
84  duplex auto
85  speed auto
86  service-policy output TO_CORE
87  !
88  interface FastEthernet1/1
89  no ip address
90  shutdown
91  duplex auto
92  speed auto
93  !
94  interface FastEthernet2/0
95  ip address 10.10.13.2 255.255.255.252
96  duplex auto
97  speed auto
98  service-policy output TO_CORE
99  !
100 interface FastEthernet2/1
101 no ip address
102 shutdown
103 duplex auto
104 speed auto
105 !
106 !
107 router ospf 2
108 log-adjacency-changes
109 network 10.10.3.0 0.0.0.255 area 0
110 network 10.10.13.0 0.0.0.3 area 0
111 network 10.10.23.0 0.0.0.3 area 0
112 !
113 ip forward-protocol nd
114 !
115 no ip http server
116 no ip http secure-server
117 !
118 !
119 access-list 101 permit icmp any any
120 access-list 101 remark "match icmp"
121 access-list 105 remark "match http"
122 access-list 105 permit tcp any any eq www
123 no cdp log mismatch duplex
124 !
125 !
126 !
127 control-plane
128 !
129 !

```



```

130 !
131 !
132 !
133 !
134 gatekeeper
135 shutdown
136 !
137 !
138 line con 0
139 exec-timeout 0 0
140 privilege level 15
141 logging synchronous
142 stopbits 1
143 line aux 0
144 exec-timeout 0 0
145 privilege level 15
146 logging synchronous
147 stopbits 1
148 line vty 0 4
149 login
150 !
151 !
152 end

```

2.3. Comandos

Con estos archivos de configuración no solamente tendremos las interfaces de red ya configuradas, sino que ya tendremos el enrutamiento OSPF activado con su respectiva interfaz de loopback, de igual forma tendremos configuradas las políticas de QoS:

- Asignación de tráfico ICMP con la precedencia de IP 1
- Asignación de tráfico HTTP con la precedencia de IP 3
- Asignación de tráfico OSPF con la precedencia de IP 7
- Control de tráfico ICMP a máximo 8Kbps
- Asignación de ancho de banda de 10Mbps para el tráfico HTTP
- Configuración de prioridad estricta para el tráfico de OSPF y asignación de 1Mbps de ancho de banda

Con esto ejecutara lo siguiente, de acuerdo al orden presentado y a los dispositivos previamente descritos.

```

1 # En R2
2 show ip route | begin Gateway
3
4 # En R1
5 show running-config | section class-map
6 show running-config | section policy-map
7 show running-config | section access-list
8 show running-config interface f0/0
9 show running-config interface f2/0
10 show policy-map interface f0/0
11 show policy-map interface f2/0
12
13 # En la VM1 conocida como VPC1 de acuerdo a la topologia
14 telnet 10.10.2.100 80
15
16 # En R1
17 show policy-map interface f0/0 input class MATCH_HTTP
18
19 # En R3
20 show policy-map interface f1/0 output class HTTP_TO_CORE
21
22 # En R1
23 ping
24 # Con los siguientes datos que se despliegan cuando se da ping:
25 # Protocol [ip]:
26 # Target IP address: 10.10.23.2
27 # Repeat count [5]: 100

```

```

28 # Datagram size [100]: 1400
29 # Timeout in seconds [2]:
30 # Extended commands [n]: y
31 # Source address or interface: 10.10.13.1
32 # Type of service [0]: 32
33 # Set DF bit in IP header? [no]: yes
34 # Validate reply data? [no]:
35 # Data pattern [0xABCD]:
36 # Loose, Strict, Record, Timestamp, Verbose[none]:
37 # Sweep range of sizes [n]:
38
39 show policy-map interface f2/0 output class ICMP_TO_CORE
40
41 # En R3
42 show policy-map interface f2/0 output class ICMP_TO_CORE

```

De acuerdo con lo anteriormente realizado se obtendra las siguientes capturas para el caso de policy-map de las interfaces de red de los router puede cambiar si es un caso automatico del duplex y otros parametros.

Entonces si se ejecutan correctamente se obtendran los siguientes datos que se muestran en las caputras.

```

R2#show ip route | begin Gateway
Gateway of last resort is not set

    220.0.0.0/32 is subnetted, 1 subnets
C       220.0.0.3 is directly connected, Loopback0
    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
O       10.10.1.0/24 [110/3] via 10.10.23.2, 00:16:25, FastEthernet2/0
C       10.10.2.0/24 is directly connected, FastEthernet0/0
O       10.10.3.0/24 [110/2] via 10.10.23.2, 00:16:25, FastEthernet2/0
O       10.10.13.0/30 [110/2] via 10.10.23.2, 00:16:25, FastEthernet2/0
C       10.10.23.0/30 is directly connected, FastEthernet2/0

```

```

R1#show running-config | section class-map
class-map match-all OSPF
 match protocol ospf
class-map match-all MATCH_HTTP
 match access-group 105
class-map match-all ICMP_TO_CORE
 match precedence 1
class-map match-all HTTP_TO_CORE
 match precedence 3
class-map match-all MATCH_ICMP
 match access-group 101

```

```

R1#show running-config | section policy-map
policy-map FROM_HOST
 class MATCH_ICMP
 set precedence 1
 class MATCH_HTTP
 set precedence 3
policy-map TO_CORE
 class ICMP_TO_CORE
 bandwidth 8
 police cir 8000
 conform-action transmit
 exceed-action drop
 class HTTP_TO_CORE
 bandwidth 10000
 class OSPF
 set precedence 7
 priority 1000
R1#

```

```

R1#show running-config | section access-list
access-list 101 permit icmp any any
access-list 101 remark "match icmp"
access-list 105 remark "match http"
access-list 105 permit tcp any any eq www
R1#

```

```
R1#show running-config interface f0/0
Building configuration...
```

```
Current configuration : 114 bytes
!
interface FastEthernet0/0
 ip address 10.10.1.1 255.255.255.0
 duplex half
 service-policy input FROM_HOST
end
```

```
R1#show running-config interface f2/0
Building configuration...
```

```
Current configuration : 128 bytes
!
interface FastEthernet2/0
 ip address 10.10.13.1 255.255.255.252
 duplex auto
 speed auto
 service-policy output TO_CORE
end
```

```
R1#show policy-map interface f0/0
FastEthernet0/0
```

```
Service-policy input: FROM_HOST
```

```
Class-map: MATCH_ICMP (match-all)
 0 packets, 0 bytes
 5 minute offered rate 0 bps, drop rate 0 bps
 Match: access-group 101
 QoS Set
  precedence 1
  Packets marked 0
```

```
Class-map: MATCH_HTTP (match-all)
 0 packets, 0 bytes
 5 minute offered rate 0 bps, drop rate 0 bps
 Match: access-group 105
 QoS Set
  precedence 3
  Packets marked 0
```

```
Class-map: class-default (match-any)
 0 packets, 0 bytes
 5 minute offered rate 0 bps, drop rate 0 bps
 Match: any
```

```

R1#show policy-map interface f2/0
FastEthernet2/0

Service-policy output: TO_CORE

Class-map: ICMP_TO_CORE (match-all)
  0 packets, 0 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: precedence 1
  Queueing
    Output Queue: Conversation 265
    Bandwidth 8 (kbps)Max Threshold 64 (packets)
    (pkts matched/bytes matched) 0/0
    (depth/total drops/no-buffer drops) 0/0/0
  police:
    cir 8000 bps, bc 1500 bytes
    conformed 0 packets, 0 bytes; actions:
      transmit
    exceeded 0 packets, 0 bytes; actions:
      drop
    conformed 0 bps, exceed 0 bps

Class-map: HTTP_TO_CORE (match-all)
  0 packets, 0 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: precedence 3
  Queueing
    Output Queue: Conversation 266
    Bandwidth 10000 (kbps)Max Threshold 64 (packets)
    (pkts matched/bytes matched) 0/0
    (depth/total drops/no-buffer drops) 0/0/0

Class-map: OSPF (match-all)
  153 packets, 14306 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: protocol ospf
  QoS Set
    precedence 7
    Packets marked 153
  Queueing
    Strict Priority
    Output Queue: Conversation 264
    Bandwidth 1000 (kbps) Burst 25000 (Bytes)
    (pkts matched/bytes matched) 15/1346
    (total drops/bytes drops) 0/0

Class-map: class-default (match-any)
  168 packets, 17131 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: any

```

Figuras 2-9: Ejecución de la primer serie de comandos

```

root@gns:~# telnet 10.10.2.100 80
Trying 10.10.2.100...
telnet: Unable to connect to remote host: Connection refused
root@gns:~#

```

Figuras 10: Ejecución del comando telnet para conexión al sever HTTP de la VPC2

```

R1#show policy-map interface f0/0 input class MATCH_HTTP
FastEthernet0/0

Service-policy input: FROM_HOST

Class-map: MATCH_HTTP (match-all)
  1 packets, 74 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: access-group 105
  QoS Set
    precedence 3
    Packets marked 1
R1#

```

```
R3#show policy map interface f1/0 output class HTTP_TO_CORE
FastEthernet1/0

Service-policy output: TO_CORE

Class-map: HTTP TO CORE (match-all)
  1 packets, 74 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: precedence 3
  Queueing
    Output Queue: Conversation 266
    Bandwidth 10000 (kbps)Max Threshold 64 (packets)
    (pkts matched/bytes matched) 0/0
    (depth/total drops/no-buffer drops) 0/0/0
```

Figuras 11-12: Verificación del trafico realizado a la regla HTTP de nuestra maquina virtual en los routers

[illegible]

```

R3#show policy-map interface f2/0 output class ICMP_TO_CORE
FastEthernet2/0

Service-policy output: TO_CORE

Class-map: ICMP TO CORE (match-all)
  50 packets, 70700 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: precedence 1
  Queueing
    Output Queue: Conversation 265
    Bandwidth 8 (kbps)Max Threshold 64 (packets)
    (pkts matched/bytes matched) 50/70700
    (depth/total drops/no-buffer drops) 0/0/0
  police:
    cir 8000 bps, bc 1500 bytes
    conformed 50 packets, 70700 bytes; actions:
      transmit
    exceeded 0 packets, 0 bytes; actions:
      drop
    conformed 0 bps, exceed 0 bps

```

Figuras 13-15: Verificación del tráfico realizado a la regla ICMP de nuestro R1 hacia otra red exterior y el como esta solo envia el 50 % de los paquetes de acuerdo a nuestra configuración de QoS