Informe

Práctica 6:
Border Gateway Protocol (BGP) y redundancia del primer salto

Laboratorio de Redes

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Parte 1. Border GateWay Protocol (BGP):

Objetivos

- Entender el funcionamiento de BGP
- Conocer las diferencia de eBGP e iBGP
- Conocer los tipos de sistemas autónomos
- Ser capaz de configurar BGP en un sistema multihomed
- Conocer el manejo básico de mapas de rutas.

Sistemas autónomos

Según el [RFC 1930], un sistema autónomo se define como Un grupo conectado de uno o más prefijos IP promovidos por uno o más operadores de red con una poli´tica de enrutamiento única y claramente definida.

Tipos de sistemas autónomos
Multihomed: Son los que tiene conexión con más de un sistema autónomo y no permiten el tránsito del tráfico a través del sistema autónomo.
Stub: Es un sistema autónomo que está únicamente conectado con un sistema autónomo.
Tránsito: Permite la interconexión de otros sistemas autónomos pasando por dentro del propio sistema autónomo.
Internet Exchange Point (IXP): Es una infraestructura física a través de la cual los proveedores de servicio o de contenido intercambian tráfico entre sus sistemas autónomos.

Enrutamiento entre sistemas autónomos: BGP(Border Gateway Protocol)

El protocolo de puerta de enlace de frontera o BGP es un protocolo mediante el cual se intercambia información de encaminamiento entre sistemas autónomos. Emplea el protocolo TCP junto con el puerto 179. La conexión entre dos routers BGP se denomina peers. Existen varios mensajes que puede ser intercambiado entre 2 routers peers:

OPEN: Se emplea en la negociación de los términos de la comunicación después de abrir la comunicación tcp. Ejemplo Versión de BGP.
UPDATE: Es un mensaje de actualización con los nuevos prefijos, se generan cada vez que se determine una nueva ruta óptima o una modificación de una existente.
KEEPALIVE: Se emplea para comunicar al resto de equipos q el nodo está funcionando correctamente y se emplea. Se envía periódicamente.
NOTIFICATION: Se envía cuando cierra una sesión de BGP por un error.

Atributos de paquete BGP

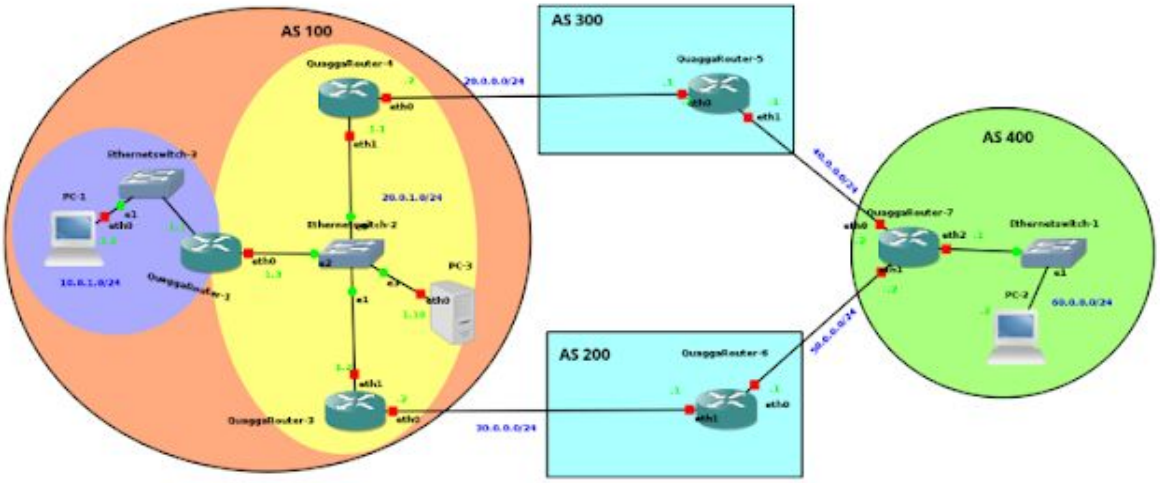
ORIGIN: Identifica el mecanismo por el cual se anunció el prefijo IP por primera vez. Se puede especificar como IGP (0), EGP (1) o INCOMPLETE (2).
AS-PATH: Secuencia de números AS que permiten identificar el camino recorrido por un paquete. cada vez que entra en un sistema autónomo diferente el router bgp de entrada, modifica el atributo para identificar que ha atravesado el sistema autónomo, de esta forma se puede determinar la ruta más corta.
NEXT-HOP: dirección IP del router correspondiente al siguiente salto hacia el destino. Se modifica cuando se anuncia una ruta fuera del sistema autónomo o cuando se desea redirigir tráfico a otro interlocutor. La información contenida en este campo sirve para incluir los prefijos IP contenidos en el anuncio en la tabla de enrutamiento.

El proceso de enrutamiento: iBGP y eBGP

Existen dos casos de BGP:
eBGP: Se produce cuando se comunican routers fronterizos de sistemas autónomos diferentes.

iBGP: Se produce cuando se comunican routers del mismo sistema autónomo intercambiando información BGP

Topología



Esquema de la topología de red.

1º Activar las sesiones BGP entre los peers

Configurar eBGP

QuaggaRouter-3

```
Debian# configure terminal
Debian(config)# hostname QuaggaRouter-3
QuaggaRouter-3(config)# router bgp 100
QuaggaRouter-3(config-router)# neighbor 30.0.0.1 remote-as 200
QuaggaRouter-3(config-router)#
```

QuaggaRouter-4

```
Debian# configure  terminal
Debian(config)# hostname
% Command incomplete.
Debian(config)# hostname QuaggaRouter-4
QuaggaRouter-4(config)# router bgp 100
QuaggaRouter-4(config-router)# neighbor 20.0.0.1 remote-as 300
QuaggaRouter-4(config-router)#
```

QuaggaRouter-5

```
Debian# configure terminal
Debian(config)# hostname QuaggaRouter-5
QuaggaRouter-5(config)# router bgp 300
QuaggaRouter-5(config-router)# neighbor 20.0.0.2 remo
remote-as          remove-private-AS
QuaggaRouter-5(config-router)# neighbor 20.0.0.2 remo
remote-as          remove-private-AS
QuaggaRouter-5(config-router)# neighbor 20.0.0.2 remote-as 100
QuaggaRouter-5(config-router)# neighbor 40.0.0.2 remote-as 400
QuaggaRouter-5(config-router)#
```

QuaggaRouter-6

```
Debian# configure terminal
Debian(config)# hostname QuaggaRouter-6
QuaggaRouter-6(config)# remote bgp 200
% Unknown command.
QuaggaRouter-6(config)# route
route-map  router     router-id
QuaggaRouter-6(config)# route
route-map  router     router-id
QuaggaRouter-6(config)# router bgp 200
QuaggaRouter-6(config-router)# neighbor 50.0.0.2 remote-as 400
QuaggaRouter-6(config-router)# neighbor 30.0.0.2 remote-as 100
QuaggaRouter-6(config-router)#
```

QuaggaRouter-7

```
Debian(config)# hostname QuaggaRouter-7
QuaggaRouter-7(config)# router
router     router-id
QuaggaRouter-7(config)# router
router     router-id
QuaggaRouter-7(config)# router b
babel  bgp
QuaggaRouter-7(config)# router bgp 400
QuaggaRouter-7(config-router)# neighbor 40.0.0.1 remo
remote-as          remove-private-AS
QuaggaRouter-7(config-router)# neighbor 40.0.0.1 remote-as 300
QuaggaRouter-7(config-router)# neighbor 50.0.0.1 remote-as 200
QuaggaRouter-7(config-router)#
```

Configurar iBGP

QuaggaRouter-3

```
QuaggaRouter-3(config-router)# neighbor 20.0.1.1 remote-as 100
QuaggaRouter-3(config-router)# neighbor 20.0.1.1 next-hop-self
QuaggaRouter-3(config-router)#
```

QuaggaRouter-4

```
QuaggaRouter-4(config-router)# neighbor 20.0.1.2 remote-as 100
QuaggaRouter-4(config-router)# neighbor 20.0.1.2 next-hop-self
QuaggaRouter-4(config-router)#
```

2º Comprobar que se han establecido las relaciones de peering entre los routers

```
QuaggaRouter-3# show bgp neighbors
BGP neighbor is 20.0.1.1, remote AS 100, local AS 100, internal link
  BGP version 4, remote router ID 20.0.1.1
  BGP state = Established, up for 00:05:34
  Last read 00:00:34, hold time is 180, keepalive interval is 60 seconds
  Neighbor capabilities:
    4 Byte AS: advertised and received
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    Inq depth is 0
    Outq depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                0          0
    Keepalives:             7          6
    Route Refresh:          0          0
    Capability:             0          0
    Total:                  8          7
  Minimum time between advertisement runs is 5 seconds

 For address family: IPv4 Unicast
  NEXT_HOP is always this router
  Community attribute sent to this neighbor(both)
  0 accepted prefixes

  Connections established 1; dropped 0
  Last reset never
Local host: 20.0.1.2, Local port: 41207
Foreign host: 20.0.1.1, Foreign port: 179
Nexthop: 20.0.1.2
Nexthop global: fe80::296:cbff:feab:be01
Nexthop local: ::
BGP connection: non shared network
Read thread: on  Write thread: off

BGP neighbor is 30.0.0.1, remote AS 200, local AS 100, external link
  BGP version 4, remote router ID 50.0.0.1
  BGP state = Established, up for 00:27:27
  Last read 00:00:26, hold time is 180, keepalive interval is 60 seconds
  Neighbor capabilities:
    4 Byte AS: advertised and received
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    Inq depth is 0
    Outq depth is 0
                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                0          0
    Keepalives:            29         28
    Route Refresh:          0          0
    Capability:             0          0
    Total:                 30         29
  Minimum time between advertisement runs is 30 seconds

 For address family: IPv4 Unicast
  Community attribute sent to this neighbor(both)
  0 accepted prefixes

  Connections established 1; dropped 0
  Last reset never
Local host: 30.0.0.2, Local port: 54064
Foreign host: 30.0.0.1, Foreign port: 179
Nexthop: 30.0.0.2
Nexthop global: fe80::296:cbff:feab:be00
Nexthop local: ::
BGP connection: non shared network
Read thread: on  Write thread: off

QuaggaRouter-3#
```

3º Añadir anuncios de prefijo a los routers

Propagación BGP

QuaggaRouter-7

```
QuaggaRouter-7# show bgp ipv4 unicast
BGP table version is 0, local router ID is 60.0.0.1
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
              i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 60.0.0.0/24      0.0.0.0                  0         32768 i

Total number of prefixes 1
QuaggaRouter-7#
```

QuaggaRouter-3

```
QuaggaRouter-3# show bgp ipv4 unicast
BGP table version is 0, local router ID is 30.0.0.2
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
              i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
* i60.0.0.0/24      20.0.1.1                 100      0 300 400 i
*>                  30.0.0.1                          0 200 400 i

Total number of prefixes 1
QuaggaRouter-3#
```

QuaggaRouter-4

```
QuaggaRouter-4# show bgp ipv4 unicast
BGP table version is 0, local router ID is 20.0.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
              i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 60.0.0.0/24      20.0.0.1                               0 300 400 i
* i                 20.0.1.2                 100           0 200 400 i

Total number of prefixes 1
QuaggaRouter-4#
```

Tablas de enrutamiento

QuaggaRouter-3

```
QuaggaRouter-3# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, A - Babel,
       > - selected route, * - FIB route

R>* 10.0.1.0/24 [120/2] via 20.0.1.3, eth1, 08:59:26
R>* 20.0.0.0/24 [120/2] via 20.0.1.1, eth1, 08:59:25
C>* 20.0.1.0/24 is directly connected, eth1
C>* 30.0.0.0/24 is directly connected, eth0
B>* 60.0.0.0/24 [20/0] via 30.0.0.1, eth0, 00:08:50
C>* 127.0.0.0/8 is directly connected, lo
QuaggaRouter-3#
```

QuaggaRouter-4

```
QuaggaRouter-4# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, A - Babel,
       > - selected route, * - FIB route

R>* 10.0.1.0/24 [120/2] via 20.0.1.3, eth1, 08:59:21
C>* 20.0.0.0/24 is directly connected, eth0
C>* 20.0.1.0/24 is directly connected, eth1
B>* 60.0.0.0/24 [20/0] via 20.0.0.1, eth0, 00:08:42
C>* 127.0.0.0/8 is directly connected, lo
QuaggaRouter-4#
```

4º Propagar los prefijos internos del AS 100

Comprobación en QuaggaRouter-5

```
QuaggaRouter-5# show bgp ipv4 unicast
BGP table version is 0, local router ID is 40.0.0.1
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
              i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  20.0.0.0/16      40.0.0.2                             0 400 200 100 i
*>                  20.0.0.2                 0           0 100 i
*> 60.0.0.0/24      40.0.0.2                 0           0 400 i

Total number of prefixes 2
QuaggaRouter-5#
```

Traceroute de PC-2 a PC-3

```
root@Debian:~# traceroute 20.0.1.10
traceroute to 20.0.1.10 (20.0.1.10), 30 hops max, 60 byte packets
 1  60.0.0.1 (60.0.0.1)  1.216 ms  1.106 ms  1.154 ms
 2  50.0.0.1 (50.0.0.1)  1.623 ms  1.758 ms  1.757 ms
 3  30.0.0.2 (30.0.0.2)  2.479 ms  3.260 ms  3.263 ms
 4  20.0.1.10 (20.0.1.10)  4.329 ms  4.459 ms  4.449 ms
root@Debian:~#
```

6º Propagar una ruta por defecto hacia los routers frontera

Comprobación ruta por defecto desde QuaggaRouter-1

```
QuaggaRouter-1# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, A - Babel,
       > - selected route, * - FIB route

R>* 0.0.0.0/0 [120/2] via 20.0.1.1, eth0, 00:02:27
C>* 10.0.1.0/24 is directly connected, eth1
R>* 20.0.0.0/24 [120/2] via 20.0.1.1, eth0, 09:23:17
C>* 20.0.1.0/24 is directly connected, eth0
C>* 127.0.0.0/8 is directly connected, lo
QuaggaRouter-1#
```

Ping PC-2

```
QuaggaRouter-1# ping 60.0.0.2
PING 60.0.0.2 (60.0.0.2) 56(84) bytes of data.
64 bytes from 60.0.0.2: icmp_seq=2 ttl=61 time=7.75 ms
64 bytes from 60.0.0.2: icmp_seq=3 ttl=61 time=6.31 ms
64 bytes from 60.0.0.2: icmp_seq=4 ttl=61 time=6.46 ms
64 bytes from 60.0.0.2: icmp_seq=5 ttl=61 time=5.92 ms
64 bytes from 60.0.0.2: icmp_seq=6 ttl=61 time=6.20 ms
64 bytes from 60.0.0.2: icmp_seq=7 ttl=61 time=2.95 ms
64 bytes from 60.0.0.2: icmp_seq=8 ttl=61 time=5.87 ms
64 bytes from 60.0.0.2: icmp_seq=9 ttl=61 time=6.24 ms
64 bytes from 60.0.0.2: icmp_seq=10 ttl=61 time=6.26 ms
```

7º Comprobar el funcionamiento de la salida redundante a Internet

Traceroute de QuaggaRouter-1 a PC-2

```
QuaggaRouter-1# traceroute 60.0.0.2
traceroute to 60.0.0.2 (60.0.0.2), 30 hops max, 60 byte packets
 1  20.0.1.1 (20.0.1.1)  1.806 ms  1.573 ms  1.789 ms
 2  20.0.0.1 (20.0.0.1)  3.687 ms  4.123 ms  3.569 ms
 3  50.0.0.2 (50.0.0.2)  5.678 ms  7.485 ms  7.124 ms
 4  60.0.0.2 (60.0.0.2)  7.988 ms  10.049 ms  15.310 ms
QuaggaRouter-1#
```

Traceroute de QuaggaRouter-1 a PC-2 desactivando eth1 de QuaggaRouter-5

```
QuaggaRouter-1# traceroute 60.0.0.2
traceroute to 60.0.0.2 (60.0.0.2), 30 hops max, 60 byte packets
 1  20.0.1.1 (20.0.1.1)  1.741 ms  1.613 ms  1.180 ms
 2  20.0.1.2 (20.0.1.2)  2.599 ms  2.076 ms  1.687 ms
 3  30.0.0.1 (30.0.0.1)  6.657 ms  10.387 ms  9.063 ms
 4  50.0.0.2 (50.0.0.2)  9.070 ms  9.500 ms  8.912 ms
 5  60.0.0.2 (60.0.0.2)  12.797 ms  15.758 ms  15.648 ms
QuaggaRouter-1#
```

Tiene un salto más ya que tenemos que saltar entre los routers Quaggarouter-4 al Quaggarouter-3 ya que hemos establecido por defecto la salida por Quaggarouter-4 por lo tanto Quaggarrouter-1 no sabe qué puede salir por Quaggarouter-3 y tiene que realizar un salto desde Quaggarouter-4

8º Ingeniería de tráfico: Evitar que el AS100 se convierta en un AS de tránsito (políticas de enrutamiento)

Traceroute a PC-2 desde QuaggaRoute-5 con su eth1 apagado

```
QuaggaRouter-5# traceroute 60.0.0.2
traceroute to 60.0.0.2 (60.0.0.2), 30 hops max, 60 byte packets
 1  20.0.0.2 (20.0.0.2)  2.311 ms  1.735 ms  1.205 ms
 2  20.0.1.2 (20.0.1.2)  5.068 ms  4.377 ms  4.311 ms
 3  30.0.0.1 (30.0.0.1)  6.110 ms  5.705 ms  6.854 ms
 4  50.0.0.2 (50.0.0.2)  7.644 ms  13.076 ms  12.351 ms
 5  60.0.0.2 (60.0.0.2)  17.196 ms  17.020 ms  16.362 ms
QuaggaRouter-5#
```

Comprovacion de prefijo 60.0.0.0/24 en QuaggaRouter-3 y traceroute a PC-2

```
QuaggaRouter-3# sh ip bgp 60.0.0.0/24
BGP routing table entry for 60.0.0.0/24
Paths: (1 available, best #1, table Default-IP-Routing-Table)
  Advertised to non peer-group peers:
  20.0.1.1
  200 400
    30.0.0.1 from 30.0.0.1 (50.0.0.1)
      Origin IGP, localpref 100, valid, external, best
      Last update: Sat Apr 18 01:39:08 2020

QuaggaRouter-3# traceroute 60.0.0.2
traceroute to 60.0.0.2 (60.0.0.2), 30 hops max, 60 byte packets
 1  20.0.1.1 (20.0.1.1)  2.106 ms  1.597 ms  1.551 ms
 2  20.0.0.1 (20.0.0.1)  4.979 ms  3.738 ms  4.278 ms
 3  50.0.0.2 (50.0.0.2)  4.455 ms  5.280 ms  7.632 ms
 4  60.0.0.2 (60.0.0.2)  7.456 ms  8.902 ms  7.495 ms
QuaggaRouter-3#
```

Configuración de QuaggaRouter-4

```
QuaggaRouter-4(config)# route-map AS300-entrada permit 10
QuaggaRouter-4(config-route-map)# set local-preference 200
QuaggaRouter-4(config-route-map)# exit
QuaggaRouter-4(config)# route-map AS300-entrada permit 10
QuaggaRouter-4(config-route-map)# match
  as-path       Match BGP AS path list
  community     Match BGP community list
  extcommunity  Match BGP/VPN extended community list
  interface     match first hop interface of route
  ip            IP information
  ipv6          IPv6 information
  metric        Match metric of route
  origin        BGP origin code
  peer          Match peer address
  probability   Match portion of routes defined by percentage value
  tag           Match tag of route
QuaggaRouter-4(config-route-map)# exit
QuaggaRouter-4(config)# router bgp 100
QuaggaRouter-4(config-router)# neighbor 20.0.0.1 route-map AS300-entrada in
QuaggaRouter-4(config-router)# exit
QuaggaRouter-4(config)#
QuaggaRouter-4(config)# ip as-path access-list 1 permit 10
QuaggaRouter-4(config)# ip as-path access-list 1 permit ^$
QuaggaRouter-4(config)# route-map AS300-salida permit 10
QuaggaRouter-4(config-route-map)# match as-path 1
QuaggaRouter-4(config-route-map)# exit
QuaggaRouter-4(config)# router bgp 100
QuaggaRouter-4(config-router)# neighbor 20.0.0.1 route-map AS300-salida out
QuaggaRouter-4(config-router)# exit
QuaggaRouter-4(config)# exit
QuaggaRouter-4# clear ip bgp * soft
QuaggaRouter-4# clear ip bgp 100 soft
QuaggaRouter-4# clear ip bgp 200 soft
%BGP: No peer is configured with AS 200
QuaggaRouter-4# clear ip bgp 300 soft
QuaggaRouter-4# clear ip bgp 400 soft
%BGP: No peer is configured with AS 400
QuaggaRouter-4# clear ip bgp 500 soft
%BGP: No peer is configured with AS 500
QuaggaRouter-4# sh
```

Configuración de QuaggaRouter-3

```
QuaggaRouter-3(config)# ip as-path access-list 1 permit ^$
QuaggaRouter-3(config)# route-map AS400-salida permit 10
QuaggaRouter-3(config-route-map)# match as-path 1
QuaggaRouter-3(config-route-map)# exit
QuaggaRouter-3(config)# router bgp 100
QuaggaRouter-3(config-router)# neighbor 30.0.0.1 route-map AS400-salida out
QuaggaRouter-3(config-router)#
```

Ping desde QuaggaRouter-5 a PC-2 con eth1 apagado de QuaggaRouter-5

```
QuaggaRouter-5# ping 60.0.0.2
connect: Network is unreachable
QuaggaRouter-5#
```

Ping desde QuagaRouter-1 a PC-2 con eth1 apagado de QuaggaRouter-5

```
QuaggaRouter-1# ping 60.0.0.2
PING 60.0.0.2 (60.0.0.2) 56(84) bytes of data.
64 bytes from 60.0.0.2: icmp_seq=1 ttl=61 time=8.17 ms
64 bytes from 60.0.0.2: icmp_seq=2 ttl=61 time=8.59 ms
64 bytes from 60.0.0.2: icmp_seq=3 ttl=61 time=7.08 ms
64 bytes from 60.0.0.2: icmp_seq=4 ttl=61 time=7.63 ms
64 bytes from 60.0.0.2: icmp_seq=6 ttl=61 time=8.71 ms
64 bytes from 60.0.0.2: icmp_seq=7 ttl=61 time=7.54 ms
64 bytes from 60.0.0.2: icmp_seq=8 ttl=61 time=8.40 ms
64 bytes from 60.0.0.2: icmp_seq=9 ttl=61 time=8.43 ms
64 bytes from 60.0.0.2: icmp_seq=10 ttl=61 time=8.24 ms
```

Parte 2. VRRP: Redundancia del primer salto

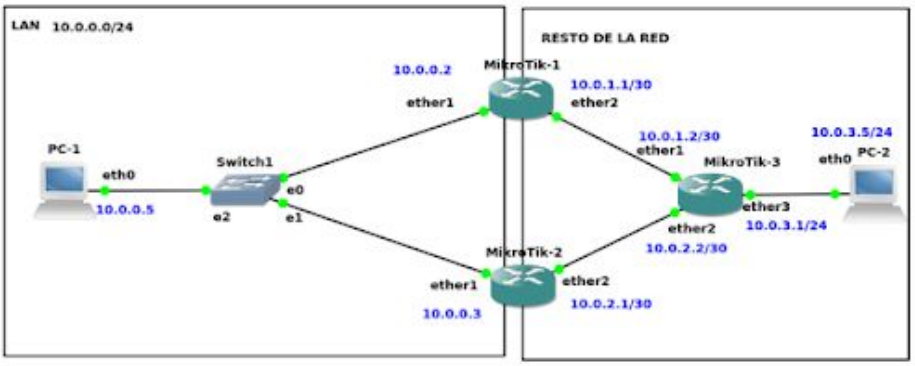
Objetivos

- Ser capaz de establecer una redundancia del primer salto mediante VRRP

VRRP

Si el router de salida por defecto de una red sufre un fallo o no está disponible, esto provoca que ningún nodo de la red se pueda comunicar con el exterior produciendo un fallo que afecta a la red.
La solución a este problema es el uso de VRRP (Virtual Router Redundancy Protocol) permite definir varios routers en nuestra red en modo redundante, uno funcionando (master) y otros de reserva (backup), cuando el master falla, uno de los que estaba en reserva es promocionado a master.

Topología



Esquema de la topología de red.

1º Comprobar la conectividad

Traceroute PC-1 a PC-2

```
root@Debian:~# traceroute 10.0.3.5
traceroute to 10.0.3.5 (10.0.3.5), 30 hops max, 60 byte packets
 1  10.0.0.5 (10.0.0.5)  2999.424 ms !H  2998.795 ms !H  2998.770 ms !H
root@Debian:~#
```

Traceroute PC-2 a PC-1

```
root@Debian:~# traceroute 10.0.0.5
traceroute to 10.0.0.5 (10.0.0.5), 30 hops max, 60 byte packets
 1  10.0.3.1 (10.0.3.1)  2.116 ms  1.754 ms  1.743 ms
 2  10.0.1.1 (10.0.1.1)  3.248 ms  3.247 ms  3.202 ms
 3  * * *
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
root@Debian:~#
```

2º Activa VRRP

MikroTik-1

```
[admin@MikroTik] > interface vrrp add interface=ether1 vrid=51
[admin@MikroTik] >
```

MikroTik-2

```
[admin@MikroTik] > interface vrrp add interface=ether1 vrid=51
[admin@MikroTik] >
```

3º Asignar la dirección al router virtual

MikroTik-1

```
[admin@MikroTik] >  interface print
Flags: D - dynamic, X - disabled, R - running, S - slave
 #     NAME                                TYPE       ACTUAL-MTU L2MTU
 0  R  ether1                              ether            1500
 1  R  ether2                              ether            1500
 2  R  ether3                              ether            1500
 3  R  ether4                              ether            1500
 4  R  ether5                              ether            1500
 5  R  ether6                              ether            1500
 6  R  ether7                              ether            1500
 7  R  ether8                              ether            1500
 8     vrrp1                               vrrp
[admin@MikroTik] > ip address add address=10.0.0.1/24 interface=vrrp1
```

MikroTik-2

```
[admin@MikroTik] > interface print
Flags: D - dynamic, X - disabled, R - running, S - slave
 #     NAME                                TYPE       ACTUAL-MTU L2MTU
 0  R  ether1                              ether            1500
 1  R  ether2                              ether            1500
 2  R  ether3                              ether            1500
 3  R  ether4                              ether            1500
 4  R  ether5                              ether            1500
 5  R  ether6                              ether            1500
 6  R  ether7                              ether            1500
 7  R  ether8                              ether            1500
 8     vrrp1                               vrrp
[admin@MikroTik] > ip address add address=10.0.0.1/24 interface=vrrp1
```

4º Comprobar que el sistema de redundancia funciona correctamente

MikroTik-1

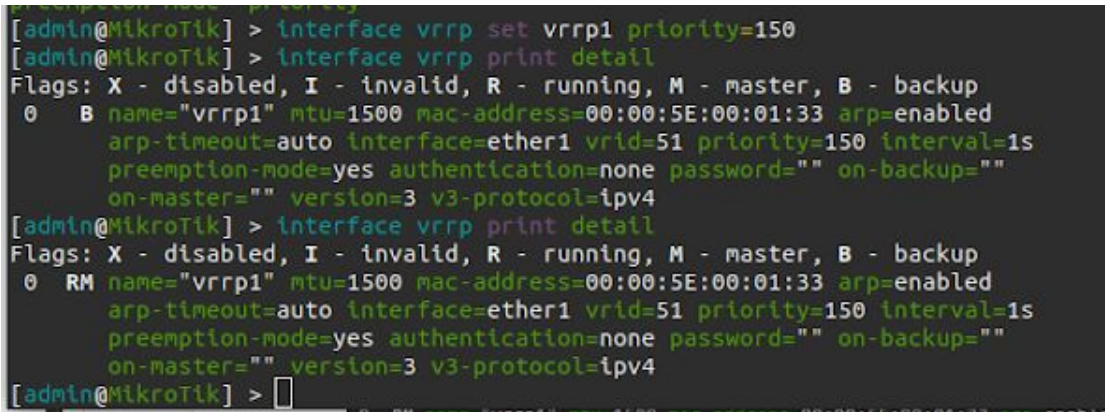
```
[admin@MikroTik] > interface vrrp print detail
Flags: X - disabled, I - invalid, R - running, M - master, B - backup
 0   B name="vrrp1" mtu=1500 mac-address=00:00:5E:00:01:33 arp=enabled
       arp-timeout=auto interface=ether1 vrid=51 priority=100 interval=1s
       preemption-mode=yes authentication=none password="" on-backup=""
       on-master="" version=3 v3-protocol=ipv4
[admin@MikroTik] >
```

MikroTik-2

```
[admin@MikroTik] > interface vrrp print detail
Flags: X - disabled, I - invalid, R - running, M - master, B - backup
 0  RM name="vrrp1" mtu=1500 mac-address=00:00:5E:00:01:33 arp=enabled
       arp-timeout=auto interface=ether1 vrid=51 priority=100 interval=1s
       preemption-mode=yes authentication=none password="" on-backup=""
       on-master="" version=3 v3-protocol=ipv4
[admin@MikroTik] >
```

5º Manejo de la prioridad

MikroTik-1



Referencias

- https://www.cisco.com/c/es_mx/support/docs/security/vpn-3000-series-concentrators/7210-vrrp.pdf
- https://blog.davantel.com/vrrp-virtual-router-redundancy-protocol-los-miercoles-tecnologia
- Enunciado de la práctica