

Practica 01: Diseño de Segmentos de Direccionamiento IPv4

Carrera: Ingeniería en Sistemas de Información

Materia: Redes de Datos

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a) Implementación de la Topología

Herramienta utilizada: GNS3 con VMs MikroTik RouterOS + VPCS + Switches L2.

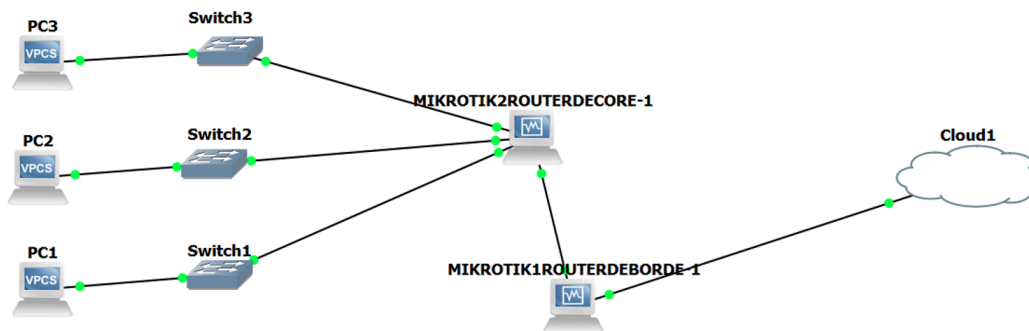
Componentes:

- **RBORDE** (Router de Borde, admin@RBORDE)
- **RCORE** (Router de Core, admin@Mikrotik)
- **PC1, PC2, PC3** (VPCS)
- **Switches L2** (básicos, sin gestión)
- **Internet (NAT VirtualBox)** conectado a RBORDE (ether1).

 **Datos de red (según direccionamiento):**

- **RBORDE:**
 - ether1 → NAT (Internet) vía DHCP (10.0.2.15/24)
 - ether2 → Enlace a RCORE 192.168.100.1/30
- **RCORE:**
 - to-BORDE → 192.168.100.2/30
 - to-LAN1 → 192.168.110.1/25
 - to-LAN2 → 192.168.119.1/26 y 192.168.20.1/24
 - to-LAN3 → 192.168.120.1/27 y 192.168.30.1/24
- **PC1** → 192.168.110.10/25, gateway 192.168.110.1

- **PC2** → 192.168.119.x/26, gateway 192.168.119.1
- **PC3** → 192.168.120.x/27, gateway 192.168.120.1



Topology Summary	
Node	Console
Cloud1	none
MIKROTIK1ROUTERDEBORDE-1	none
MIKROTIK2ROUTERDECORE-1	none
PC1	telnet localhost:5003
PC2	telnet localhost:5005
PC3	telnet localhost:5007
Switch1	none
Switch2	none
Switch3	none

b) Definición de Subredes

1) Segmento 192.168.100.0/30 (Enlace Borde–Core)

- Máscara en decimal: **255.255.255.252**
 - Máscara en binario: **11111111.11111111.11111111.11111100**
 - Primera IP usable: **192.168.100.1**
 - Última IP usable: **192.168.100.2**
 - Cantidad de hosts utilizables: **2**
 - Dirección de broadcast: **192.168.100.3**
-

2) Segmento 192.168.110.0/25 (LAN1 – PC1)

- Máscara en decimal: **255.255.255.128**
 - Máscara en binario: **11111111.11111111.11111111.10000000**
 - Primera IP usable: **192.168.110.1**
 - Última IP usable: **192.168.110.126**
 - Cantidad de hosts utilizables: **126**
 - Dirección de broadcast: **192.168.110.127**
-

3) Segmento 192.168.119.0/26 (LAN2 – PC2)

- Máscara en decimal: **255.255.255.192**
- Máscara en binario: **11111111.11111111.11111111.11000000**
- Primera IP usable: **192.168.119.1**
- Última IP usable: **192.168.119.62**
- Cantidad de hosts utilizables: **62**

- Dirección de broadcast: **192.168.119.63**
-

4) Segmento 192.168.120.0/27 (LAN3 – PC3)

- Máscara en decimal: **255.255.255.224**
 - Máscara en binario: **11111111.11111111.11111111.11100000**
 - Primera IP usable: **192.168.120.1**
 - Última IP usable: **192.168.120.30**
 - Cantidad de hosts utilizables: **30**
 - Dirección de broadcast: **192.168.120.31**
-

c) Scripts de Configuración

c.1 RBORDE

```
/system identity set name=RBORDE
/ip dhcp-client add interface=ether1 disabled=no
/ip address add address=192.168.100.1/30 interface=ether2 comment="to-RCORE"
/ip firewall nat add chain=srcnat out-interface=ether1 action=masquerade
/ip route add dst-address=192.168.110.0/25 gateway=192.168.100.2
/ip route add dst-address=192.168.119.0/26 gateway=192.168.100.2
/ip route add dst-address=192.168.120.0/27 gateway=192.168.100.2
```

```
[admin@RBORDE] > /ip dhcp-client print
Columns: INTERFACE, USE-PEER-DNS, ADD-DEFAULT-ROUTE, STATUS, ADDRESS
# INTERFACE USE-PEER-DNS ADD-DEFAULT-ROUTE STATUS ADDRESS
0 ether1 yes yes bound 10.0.2.15/24
line 2 of 2>

[admin@RBORDE] > /ip route add dst-address=192.168.110.0/25 gateway=192.168.100.2
2
[admin@RBORDE] > /ip route add dst-address=192.168.119.0/26 gateway=192.168.100.2
2
[admin@RBORDE] > /ip route add dst-address=192.168.120.0/27 gateway=192.168.100.2
2
[admin@RBORDE] > /ip address print
Flags: D - DYNAMIC
Columns: ADDRESS, NETWORK, INTERFACE
# ADDRESS NETWORK INTERFACE
0 192.168.100.1/30 192.168.100.0 ether2
1 D 10.0.2.15/24 10.0.2.0 ether1
```

```

[admin@RBORDE] > /ip firewall nat print
Flags: X - disabled, I - invalid; D - dynamic
0 chain=srcnat action=masquerade out-interface=ether1
[admin@RBORDE] > /ip route print
Flags: D - DYNAMIC; I - INACTIVE, A - ACTIVE; c - CONNECT, s - STATIC, d - DHC>
Columns: DST-ADDRESS, GATEWAY, ROUTING-TABLE, DISTANCE
# DST-ADDRESS GATEWAY ROUTING-TABLE DISTANCE
0 DAd 0.0.0.0/0 10.0.2.2 main 1
0 DAc 10.0.2.0/24 ether1 main 0
0 As+ 192.168.10.0/24 192.168.100.2 main 1
1 As+ 192.168.10.0/24 192.168.100.2 main 1
2 Is 192.168.10.0/24 192.168.100.1 main 1
3 As+ 192.168.20.0/24 192.168.100.2 main 1
4 As+ 192.168.20.0/24 192.168.100.2 main 1
5 Is 192.168.20.0/24 192.168.100.1 main 1
6 As+ 192.168.30.0/24 192.168.100.2 main 1
7 As+ 192.168.30.0/24 192.168.100.2 main 1
8 Is 192.168.30.0/24 192.168.100.1 main 1
9 As 192.168.100.0/24 192.168.100.2 main 1
10 Is 192.168.100.0/24 192.168.100.1 main 1
DAd 192.168.100.0/30 ether2 main 0
11 As 192.168.110.0/25 192.168.100.2 main 1
12 As 192.168.119.0/26 192.168.100.2 main 1
13 As 192.168.120.0/27 192.168.100.2 main 1
-- [Q quit|D dump|right]

```

c.2 RCORE

```

/system identity set name=RCORE
/ip address add address=192.168.100.2/30 interface=to-BORDE
/ip address add address=192.168.110.1/25 interface=to-LAN1
/ip address add address=192.168.119.1/26 interface=to-LAN2
/ip address add address=192.168.120.1/27 interface=to-LAN3
/ip route add dst-address=0.0.0.0/0 gateway=192.168.100.1
/ip dns set servers=8.8.8.8,1.1.1.1 allow-remote-requests=yes

```

```

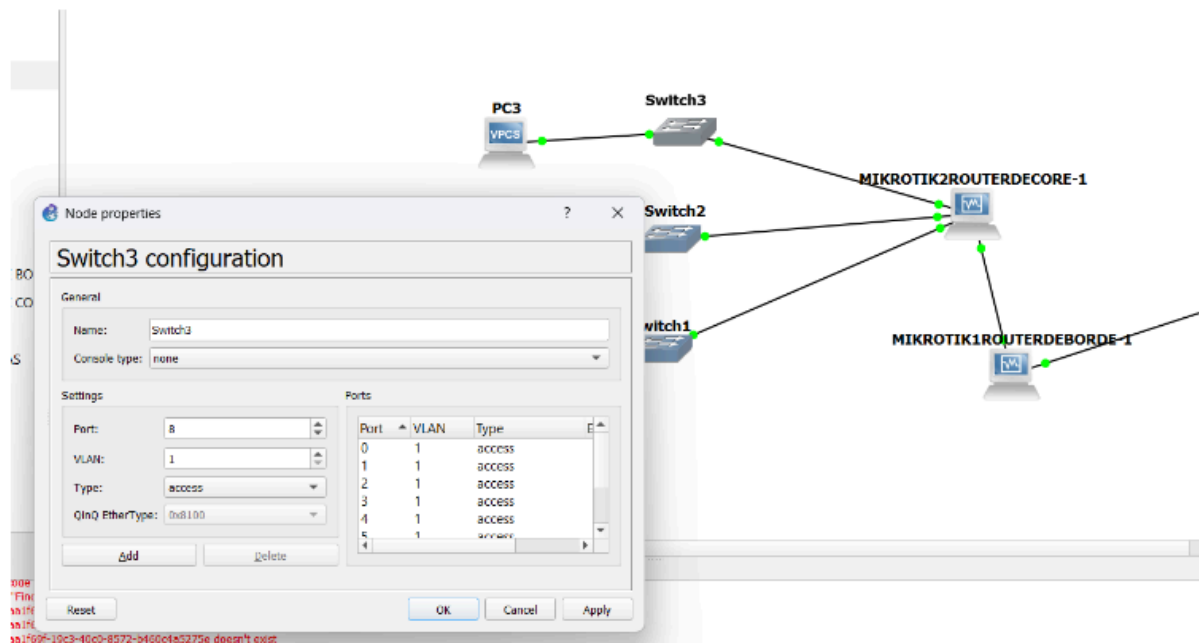
[admin@MikroTik] > /ip route add dst-address=192.168.110.0/25 gateway=192.168.100.2
[admin@MikroTik] > /ip route add dst-address=192.168.119.0/25 gateway=192.168.100.2
[admin@MikroTik] > /ip route add dst-address=192.168.120.0/25 gateway=192.168.100.2
[admin@MikroTik] > /ip address printn
bad command name printn (line 1 column 13)
[admin@MikroTik] > /ip address print
Columns: ADDRESS, NETWORK, INTERFACE
# ADDRESS NETWORK INTERFACE
0 192.168.100.2/30 192.168.100.0 to-BORDE
1 192.168.110.1/25 192.168.110.0 to-LAN1
2 192.168.119.1/26 192.168.119.0 to-LAN2
3 192.168.120.1/27 192.168.120.0 to-LAN3
4 192.168.10.1/24 192.168.10.0 to-LAN1
5 192.168.20.1/24 192.168.20.0 to-LAN2
6 192.168.30.1/24 192.168.30.0 to-LAN3

```

```
[admin@MikroTik] > /ip route print
Flags: D - DYNAMIC; I - INACTIVE, A - ACTIVE; c - CONNECT, s - STATIC; + - ECMP
Columns: DST-ADDRESS, GATEWAY, ROUTING-TABLE, DISTANCE
#   DST-ADDRESS      GATEWAY      ROUTING-TABLE  DISTANCE
0   As+ 0.0.0.0/0     192.168.100.1  main           1
1   As+ 0.0.0.0/0     192.168.100.1  main           1
2   As+ 0.0.0.0/0     192.168.100.1  main           1
   DAc 192.168.10.0/24  to-LAN1       main           0
3   s 192.168.10.0/24  192.168.100.1  main           1
4   Is 192.168.10.0/24  192.168.100.2  main           1
   DAc 192.168.20.0/24  to-LAN2       main           0
5   s 192.168.20.0/24  192.168.100.1  main           1
6   Is 192.168.20.0/24  192.168.100.2  main           1
   DAc 192.168.30.0/24  to-LAN3       main           0
7   s 192.168.30.0/24  192.168.100.1  main           1
8   Is 192.168.30.0/24  192.168.100.2  main           1
   DAc 192.168.100.0/30  to-BORDE      main           0
   DAc 192.168.110.0/25  to-LAN1       main           0
9   Is 192.168.110.0/25  192.168.100.2  main           1
10  Is 192.168.119.0/25  192.168.100.2  main           1
   DAc 192.168.119.0/26  to-LAN2       main           0
11  Is 192.168.120.0/25  192.168.100.2  main           1
   DAc 192.168.120.0/27  to-LAN3       main           0
```

```
[admin@MikroTik] > /ip dns print
servers: 8.8.8.8
        1.1.1.1
dynamic-servers:
use-doh-server:
verify-doh-cert: no
doh-max-server-connections: 5
doh-max-concurrent-queries: 50
doh-timeout: 5s
allow-remote-requests: yes
max-udp-packet-size: 4096
query-server-timeout: 2s
query-total-timeout: 10s
max-concurrent-queries: 100
max-concurrent-tcp-sessions: 20
cache-size: 2048KiB
cache-max-ttl: 1w
address-list-extra-time: 0s
vrf: main
mdns-repeat-ifaces:
cache-used: 42KiB
```

c.3 Switches




c.4 PCs

```
PC1> show ip
NAME       : PC1[1]
IP/MASK    : 192.168.110.10/25
GATEWAY    : 192.168.110.1
DNS        :
MAC        : 00:50:79:66:68:00
LPORT     : 10037
RHOST:PORT : 127.0.0.1:10038
MTU       : 1500
```


- **PC1** → 192.168.110.10/25, gateway 192.168.110.1
- **PC2** → 192.168.119.x/26, gateway 192.168.119.1
- **PC3** → 192.168.120.x/27, gateway 192.168.120.1

d) Informe de Pruebas de Conectividad

 **PC1**

1. ping 192.168.110.1 →  Gateway responde.

```
PC1> ping 192.168.110.1
84 bytes from 192.168.110.1 icmp_seq=1 ttl=64 time=4.057 ms
84 bytes from 192.168.110.1 icmp_seq=2 ttl=64 time=3.573 ms
84 bytes from 192.168.110.1 icmp_seq=3 ttl=64 time=4.138 ms
84 bytes from 192.168.110.1 icmp_seq=4 ttl=64 time=4.502 ms
```

2. ping 192.168.100.1 →  Acceso a RBORDE.


```
PC1> ping 192.168.100.1
84 bytes from 192.168.100.1 icmp_seq=1 ttl=63 time=8.491 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=63 time=10.051 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=63 time=9.109 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=63 time=8.746 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=63 time=9.526 ms
```

3. ping 8.8.8.8 →  Internet vía NAT.

```
PC1> ping 8.8.8.8
84 bytes from 8.8.8.8 icmp_seq=1 ttl=253 time=37.198 ms
84 bytes from 8.8.8.8 icmp_seq=2 ttl=253 time=37.525 ms
84 bytes from 8.8.8.8 icmp_seq=3 ttl=253 time=37.636 ms
84 bytes from 8.8.8.8 icmp_seq=4 ttl=253 time=39.145 ms
```

LO MISMO PASA EN PC2 Y PC3...

RCORE

1. ping 192.168.110.10 →  LAN1 accesible.

```
[admin@MikroTik] > /ping 192.168.110.10
SEQ HOST                SIZE TTL TIME                STATUS
0 192.168.110.10        56  64 2ms771us
1 192.168.110.10        56  64 3ms145us
2 192.168.110.10        56  64 2ms879us
3 192.168.110.10        56  64 2ms157us
4 192.168.110.10        56  64 2ms785us
sent=5 received=5 packet-loss=0% min-rtt=2ms157us avg-rtt=2ms747us
max-rtt=3ms145us
```

2. ping 8.8.8.8 →  Internet via RBORDE.


```
[admin@MikroTik] > ping 8.8.8.8
```

SEQ	HOST	SIZE	TTL	TIME	STATUS
0	8.8.8.8	56	254	44ms777us	
1	8.8.8.8	56	254	32ms737us	
2	8.8.8.8	56	254	29ms931us	
3	8.8.8.8	56	254	32ms948us	
4	8.8.8.8	56	254	108ms38us	

sent=5 received=5 packet-loss=0% min-rtt=29ms931us avg-rtt=49ms686us
max-rtt=108ms38us

3. tool traceroute 8.8.8.8 → Salto 192.168.100.1, luego Internet.

```
[admin@MikroTik] > /tool traceroute 8.8.8.8
```

ADDRESS	LOSS	SENT	LAST	AVG	BEST	WORST
192.168.100.1	0%	3	3.4ms	3.7	3.4	3.9
8.8.8.8	0%	3	36.2ms	37.2	32.1	43.4

4. ip dns print → DNS = 8.8.8.8, 1.1.1.1.


```
[admin@MikroTik] > /ip dns print
```

```

servers: 8.8.8.8
         1.1.1.1
dynamic-servers:
use-doh-server:
verify-doh-cert: no
doh-max-server-connections: 5
doh-max-concurrent-queries: 50
doh-timeout: 5s
allow-remote-requests: yes
max-udp-packet-size: 4096
query-server-timeout: 2s
query-total-timeout: 10s
max-concurrent-queries: 100
max-concurrent-tcp-sessions: 20
cache-size: 2048KiB
cache-max-ttl: 1w
address-list-extra-time: 0s
vrf: main
mdns-repeat-ifaces:
cache-used: 42KiB

```

RBORDE

1. ping 192.168.100.2 →  Enlace con RCORE.

```
[admin@RBORDE] > ping 192.168.100.2
```

SEQ	HOST	SIZE	TTL	TIME	STATUS
0	192.168.100.2	56	64	4ms610us	
1	192.168.100.2	56	64	3ms207us	
2	192.168.100.2	56	64	4ms859us	

2. ping 8.8.8.8 →  Conexión directa a Internet.

```
[admin@RBORDE] > ping 8.8.8.8
```

SEQ	HOST	SIZE	TTL	TIME	STATUS
0	8.8.8.8	56	255	39ms569us	
1	8.8.8.8	56	255	30ms285us	
2	8.8.8.8	56	255	28ms482us	
3	8.8.8.8	56	255	26ms110us	
4	8.8.8.8	56	255	28ms409us	
5	8.8.8.8	56	255	29ms669us	

sent=6 received=6 packet-loss=0% min-rtt=26ms110us avg-rtt=30ms420us
max-rtt=39ms569us

3. tool traceroute 8.8.8.8 → Camino correcto.

```
[admin@RBORDE] > /tool traceroute 8.8.8.8
```

ADDRESS	LOSS	SENT	LAST	AVG	BEST	WORST
8.8.8.8	0%	4	29ms	30.7	27.5	38

-- [Q quit!D dump!C-z pause]

4. ip firewall nat print → Regla masquerade en ether1.

```
[admin@RBORDE] > /ip firewall nat print
```

Flags: X - disabled, I - invalid; D - dynamic

#	chain	srcnat	action	out-interface
0	chain=srcnat	action=masquerade	out-interface=ether1	

5. ip dhcp-client print → ether1 obtiene 10.0.2.15/24.

```
[admin@RBORDE] > /ip dhcp-client print
```

Columns: INTERFACE, USE-PEER-DNS, ADD-DEFAULT-ROUTE, STATUS, ADDRESS

#	INTERFACE	USE-PEER-DNS	ADD-DEFAULT-ROUTE	STATUS	ADDRESS
0	ether1	yes	yes	bound	10.0.2.15/24

Conclusión Final

- ☒ Conectividad LAN ↔ RCORE comprobada.
- ☒ Conectividad RCORE ↔ RBORDE comprobada.
- ☒ Conectividad a Internet desde todos los nodos.
- ☒ NAT y DHCP funcionando en RBORDE.
- ☒ DNS configurado en RCORE.