

# Laboratoires Frame-relay

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# Résumé des commandes

## 1. Sur une interface DTE mutlipoint.

```
(config)#interface name number
(config-if)#encapsulation frame-relay [ietf]
(config-if)#ip address adress netmask
(config-if)#no shutdown
```

### Note :

Le changement de l'encapsulation HDLC en Frame-relay. Elle est de type Cisco par défaut.

## 2. Sur une interface DTE multipoint pour se connecter sur un PVC non contigu.

```
(config)#interface name number
(config-if)#encapsulation frame-relay
(config-if)#ip address adress netmask
(config-if)#frame-relay map ip destination_address local_dlc_i [broadcast]
(config-if)#no shutdown
```

### Note :

La commande « frame-relay map » est utilisée pour définir un mapping entre une adresse IP de destination et le numéro de DLCI utilisé localement pour la joindre. L'option « broadcast » transfère les broadcast à travers cette interface (simplifie la configuration d'OSPF en NBMA).

## 3. Sur une sous-interface point-to-point.

```
(config)#interface name number
(config-if)#encapsulation frame-relay
(config-if)#no shutdown
(config-if)#interface name number.sub-number point-to-point
(config-subif)#ip address adress netmask
(config-subif)#frame-relay interface-dlci local_dlc_i
```

### Note :

La commande « frame-relay interface-dlci » assigne un DLCI à une interface ou une sous-interface. Elle est :

- nécessaire sur les sous-interfaces point-to-point ;
- nécessaire sur les sous-interfaces multipoint sur lesquelles Inverse ARP est activé, autrement dit quand on effectue un mappage dynamique ;
- n'est pas nécessaire sur les sous-interfaces multipoint quand le mappage est statique ;
- peut être appliquée sur toute interface quelle que soient les circonstances.

## 4. Mappage dynamique sur les sous-interfaces multipoints dans un réseau partagé

```
(config)#interface name number
(config-if)#encapsulation frame-relay
(config-if)#no shutdown
(config-if)#interface name number.sub-number multipoint
(config-subif)#ip address adress netmask
(config-subif)#frame-relay interface-dlci local_dlc_i
```

### Note :

Le mapping dynamique utilise Inverse ARP pour demander l'adresse IP à l'autre bout d'une connexion pour un DLCI local donné. Les réponses aux requêtes IARP sont entrées dans une table de mapping « adresse – DLCI » sur le routeur. Cette table est utilisée pour fournir l'adresse IP du correspondant à l'autre bout ou le DLCI pour le trafic sortant.

Quand une sous-interface est créée, on doit spécifier l'information qui distingue une sous-interface de l'interface physique et associer la sous-interface en question au numéro DLCI concerné, d'où la commande « frame-relay interface-dlci ». Le mapping statique élimine cette nécessité d'utiliser Inverse ARP et donc de la commande « frame-relay interface-dlci »

## 5. Mappage statique sur les sous-interfaces multipoints dans un réseau partagé

```
(config)#interface name number
```

```
(config-if)#encapsulation frame-relay
(config-if)#no shutdown
(config-if)#interface name number.sub-number multipoint
(config-subif)#ip address adress netmask
(config-subif)#frame-relay map destination_address local_dlc [broadcast]
```

## 6. Activation d'Inverse ARP

```
(config)#interface name number
(config-if)#frame-relay inverse-arp
```

### Note :

Les PVC sont identifiés par un numéro DLCI équivalent à une adresse matérielle ; en échangeant des messages de signalisation, un réseau annonce un nouveau circuit virtuel et grâce à IARP, l'adresse IP du correspondant est découverte.

```
#clear frame-relay-inarp
```

### Note :

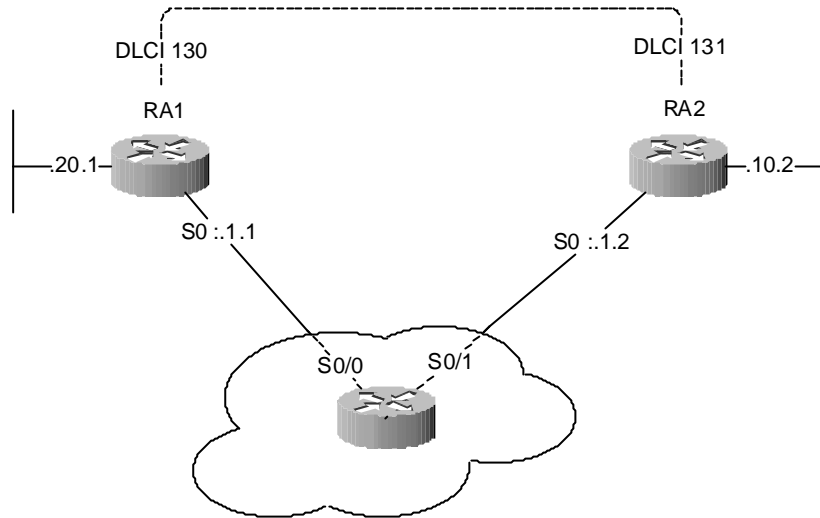
Cette commande efface les entrées dynamiques apprises par IARP

## 7. Commandes de visualisation

Commandes	Descriptions
#show frame-relay lmi	Affiche les statistiques des messages LMI
#show frame-relay pvc	Affiche les statistiques des circuits virtuels sur les interfaces dont le numéro DLCI et le type, les notifications de congestion (FECN, BECN, DE)
#show frame-relay map	Affiche le statut des interfaces frame-relay, l'adresse IP de destination, le DLCI local associé à une destination, le type d'entrée (dynamique ou statique)
#show interface <i>name number</i>	Affiche des informations générales sur une interface Frame-Relay

# Labo 1 : Configuration basique

Dans cette configuration de base, un PVC est créé entre RA1 et RA2, le type de message LMI est Cisco par défaut. Puisqu'une interface physique est par défaut une interface multipoint, Inverse ARP est activé (ce ne sera pas le cas pour les interfaces point à point). IP Split Horizon est désactivé sur les interfaces configurées en encapsulation Frame-Relay, ainsi les mises à jour de routage peuvent entrer et sortir de la même interface. Les routeurs apprennent les DLCI dont ils ont besoin à partir du Switch Frame-Relay via des mises à jour LMI. Inverse ARP est appliqué sur l'adresse IP distante et un mapping des DLCI locaux est créé avec la correspondance des adresses IP à joindre.



RA1
<pre>interface Serial0 ip address 192.168.1.1 255.255.255.0 encapsulation frame-relay</pre>
RA2
<pre>interface Serial0 ip address 192.168.1.2 255.255.255.0 encapsulation frame-relay</pre>
SWITCH
<pre>frame-relay switching ! interface Serial0/0 no ip address encapsulation frame-relay clockrate 64000 frame-relay intf-type dce frame-relay route 130 interface Serial0/1 131 ! interface Serial0/1 no ip address encapsulation frame-relay clockrate 64000 frame-relay intf-type dce frame-relay route 131 interface Serial0/0 130</pre>

## Diagnostic sur RA1

```
RA1#show frame-relay map
Serial0 (up): ip 192.168.1.2 dlci 130(0x82,0x2020), dynamic,
              broadcast,, status defined, active
RA1#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0

```
Switched      0          0          0          0
Unused        0          0          0          0
```

DLCI = 130, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

```
input pkts 99          output pkts 95          in bytes 9580
out bytes 9316         dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 35     out bcast bytes 3076
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:19:59, last time pvc status changed 00:05:19
```

RA1#show frame-relay lmi

LMI Statistics for interface Serial0 (Frame Relay DTE) LMI TYPE = CISCO

```
Invalid Unnumbered info 0          Invalid Prot Disc 0
Invalid dummy Call Ref 0          Invalid Msg Type 0
Invalid Status Message 0          Invalid Lock Shift 0
Invalid Information ID 0          Invalid Report IE Len 0
Invalid Report Request 0          Invalid Keep IE Len 0
Num Status Enq. Sent 127          Num Status msgs Rcvd 128
Num Update Status Rcvd 0          Num Status Timeouts 0
```

RA1#ping 192.168.20.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.20.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

RA1#show ip route

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route
```

Gateway of last resort is not set

R 192.168.10.0/24 [120/1] via 192.168.1.2, 00:00:06, Serial0

C 192.168.20.0/24 is directly connected, FastEthernet0

C 192.168.1.0/24 is directly connected, Serial0

## Diagnostic sur RA2

RA2#show frame-relay map

```
Serial0 (up): ip 192.168.1.1 dlci 131(0x83,0x2030), dynamic,
                broadcast,, status defined, active
```

RA2#show frame-relay pvc

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

```
input pkts 37          output pkts 36          in bytes 3670
out bytes 3656         dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 6      out bcast bytes 536
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:02:43, last time pvc status changed 00:02:33
```

RA2#show frame-relay lmi

LMI Statistics for interface Serial0 (Frame Relay DTE) LMI TYPE = CISCO

```
Invalid Unnumbered info 0          Invalid Prot Disc 0
```

```
Invalid dummy Call Ref 0          Invalid Msg Type 0
Invalid Status Message 0          Invalid Lock Shift 0
Invalid Information ID 0          Invalid Report IE Len 0
Invalid Report Request 0          Invalid Keep IE Len 0
Num Status Enq. Sent 108          Num Status msgs Rcvd 110
Num Update Status Rcvd 0          Num Status Timeouts 0
RA2#ping 192.168.10.2
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms

RA2#show ip route

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route
```

Gateway of last resort is not set

```
C    192.168.10.0/24 is directly connected, FastEthernet0
R    192.168.20.0/24 [120/1] via 192.168.1.1, 00:00:17, Serial0
C    192.168.1.0/24 is directly connected, Serial0
```



RA1#show frame-relay pvc

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	2	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 130, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

input pkts 245                    output pkts 240                    in bytes 23552  
out bytes 23234                  dropped pkts 0                    in FECN pkts 0  
in BECN pkts 0                  out FECN pkts 0                  out BECN pkts 0  
in DE pkts 0                    out DE pkts 0  
out bcast pkts 165              out bcast bytes 15434  
5 minute input rate 0 bits/sec, 0 packets/sec  
5 minute output rate 0 bits/sec, 0 packets/sec  
pvc create time 01:20:58, last time pvc status changed 00:16:27

DLCI = 134, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

input pkts 149                    output pkts 115                    in bytes 14228  
out bytes 11056                  dropped pkts 0                    in FECN pkts 0  
in BECN pkts 0                  out FECN pkts 0                  out BECN pkts 0  
in DE pkts 0                    out DE pkts 0  
out bcast pkts 90                out bcast bytes 8456  
5 minute input rate 0 bits/sec, 0 packets/sec  
5 minute output rate 0 bits/sec, 0 packets/sec  
pvc create time 00:43:19, last time pvc status changed 00:16:28

RA1#ping 192.168.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms

RA1#ping 192.168.1.3

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms

## Diagnostic sur RA2

RA2#show frame-relay map

Serial0 (up): ip 192.168.1.1 dlci 131(0x83,0x2030), dynamic,  
                  broadcast,, status defined, active

RA2#show frame-relay pvc

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

input pkts 198                    output pkts 196                    in bytes 19102  
out bytes 19074                  dropped pkts 0                    in FECN pkts 0  
in BECN pkts 0                  out FECN pkts 0                  out BECN pkts 0  
in DE pkts 0                    out DE pkts 0  
out bcast pkts 146              out bcast bytes 13874  
5 minute input rate 0 bits/sec, 0 packets/sec  
5 minute output rate 0 bits/sec, 0 packets/sec  
pvc create time 01:08:17, last time pvc status changed 00:18:16

RA2#ping 192.168.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms

```
RA2#ping 192.168.1.3
```

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:  
.....  
Success rate is 0 percent (0/5)
```

## Diagnostic sur RA3

```
RA3#show frame-relay map  
Serial0 (up): ip 192.168.1.1 dlci 133(0x85,0x2050), dynamic,  
                  broadcast,, status defined, active  
RA3#show frame-relay pvc
```

```
PVC Statistics for interface Serial0 (Frame Relay DTE)
```

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

```
DLCI = 133, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0
```

```
input pkts 92                  output pkts 93                  in bytes 9028  
out bytes 9086                 dropped pkts 0                 in FECN pkts 0  
in BECN pkts 0                 out FECN pkts 0                 out BECN pkts 0  
in DE pkts 0                  out DE pkts 0  
out bcast pkts 58              out bcast bytes 5446  
5 minute input rate 0 bits/sec, 0 packets/sec  
5 minute output rate 0 bits/sec, 0 packets/sec  
pvc create time 00:24:03, last time pvc status changed 00:23:53  
RA3#ping 192.168.1.1
```

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms  
RA3#ping 192.168.1.3
```

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:  
.....  
Success rate is 0 percent (0/5)
```

## Diagnostic sur Switch

```
Switch#sh frame-relay route
```

Input Intf	Input Dlci	Output Intf	Output Dlci	Status
Serial0/0	130	Serial0/1	131	active
Serial0/0	134	Serial0/2	133	active
Serial0/1	131	Serial0/0	130	active
Serial0/2	133	Serial0/0	134	active

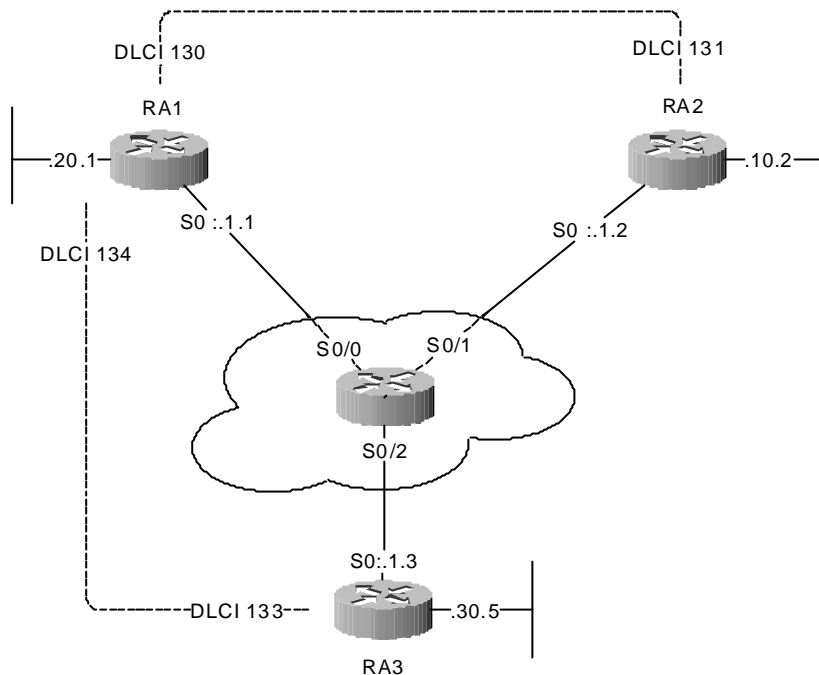
## Ping d'un LAN vers un LAN

```
RA3#ping  
Protocol [ip]:  
Target IP address: 192.168.10.2  
Repeat count [5]:  
Datagram size [100]:  
Timeout in seconds [2]:  
Extended commands [n]: y  
Source address or interface: 192.168.30.5  
Type of service [0]:  
Set DF bit in IP header? [no]:  
Validate reply data? [no]:  
Data pattern [0xABCD]:  
Loose, Strict, Record, Timestamp, Verbose[none]:  
Sweep range of sizes [n]:  
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 108/111/112 ms
```

```
RA2#ping
Protocol [ip]:
Target IP address: 192.168.30.5
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface: 192.168.10.2
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.30.5, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 108/111/112 ms
```

# Labo 3 : connection Spoke to Spoke

Dans le Labo 2 précédent, on a vu que RA2 et RA3 ne pouvaient se joindre car IARP ne pouvait connaître uniquement que l'adresse du Hub RA1. En établissant un mapping manuel de l'un à l'autre, ils pourront se joindre. La commande `frame-relay map` dans le mode de configuration des interfaces réalise cette fonction.



RA2
<pre>interface Serial0 ip address 192.168.1.2 255.255.255.0 encapsulation frame-relay frame-relay map ip 192.168.1.3 131</pre>
RA3
<pre>interface Serial0 ip address 192.168.1.3 255.255.255.0 encapsulation frame-relay frame-relay map ip 192.168.1.2 133</pre>

## Diagnostic sur RA2

```
RA2#show frame-relay map
Serial0 (up): ip 192.168.1.1 dlci 131(0x83,0x2030), dynamic,
              broadcast,, status defined, active
Serial0 (up): ip 192.168.1.3 dlci 131(0x83,0x2030), static,
              CISCO, status defined, active
```

```
RA2#show frame-relay pvc
```

```
PVC Statistics for interface Serial0 (Frame Relay DTE)
```

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

```
DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0
```

```
input pkts 261          output pkts 265          in bytes 25914
out bytes 26542        dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 187    out bcast bytes 18430
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 01:26:53, last time pvc status changed 00:36:52
```

```
RA2#ping 192.168.1.3
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 192.168.1.3, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 108/111/112 ms
```

## Diagnostic sur RA3

```
RA3#show frame-relay map
Serial0 (up): ip 192.168.1.1 dlci 133(0x85,0x2050), dynamic,
              broadcast,, status defined, active
Serial0 (up): ip 192.168.1.2 dlci 133(0x85,0x2050), static,
              CISCO, status defined, active
RA3#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 133, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

```
input pkts 153          output pkts 146          in bytes 15712
out bytes 14994         dropped pkts 0          in FECN pkts 0
in BECN pkts 0         out FECN pkts 0        out BECN pkts 0
in DE pkts 0           out DE pkts 0
out bcast pkts 91      out bcast bytes 9274
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:39:02, last time pvc status changed 00:38:52
RA3#ping 192.168.1.2
```

Type escape sequence to abort.

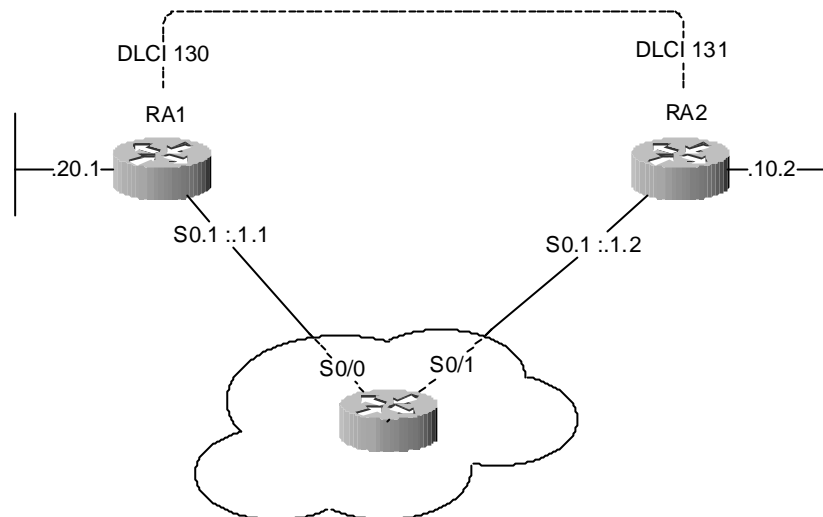
```
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 108/110/112 ms
```

## Labo 4 : Sous-interfaces Point-to-Point

Les sous-interfaces Frame-Relay fournissent un mécanisme pour supporter des réseaux entièrement ou partiellement maillés. En Frame-Relay, la transitivité n'est pas assurée, même si des nœuds B et C sont connectés à un nœud A, ces points ne se verront qu'à condition qu'il existe une connexion directe entre eux.

Le maillage avec des sous-interfaces point-to-point suppose une interconnexion de réseaux différents (domaines de broadcast différents) tandis qu'un maillage multipoint suppose une interconnexion dans un même réseau.

Aussi, les sous-interfaces représentent une économie d'interfaces physiques puisqu'une seule interface physique peut représenter de multiples interfaces virtuelles.



### RA1

```
hostname RA1
!  
interface FastEthernet0  
 ip address 192.168.20.1 255.255.255.0  
 no keepalive  
 speed auto  
!  
interface Serial0  
 no ip address  
 encapsulation frame-relay  
!  
interface Serial0.1 point-to-point  
 ip address 192.168.1.1 255.255.255.0  
 frame-relay interface-dlci 130  
!  
router rip  
 network 192.168.1.0  
 network 192.168.20.0
```

### RA2

```
hostname RA2  
!  
interface FastEthernet0  
 ip address 192.168.10.2 255.255.255.0  
 no keepalive  
 speed auto  
!  
interface Serial0  
 no ip address  
 encapsulation frame-relay  
!  
interface Serial0.1 point-to-point  
 ip address 192.168.1.2 255.255.255.0  
 frame-relay interface-dlci 131  
!  
router rip  
 network 192.168.1.0  
 network 192.168.10.0
```

## Diagnostic sur RA1

```
RA1#show frame-relay map
Serial0.1 (up): point-to-point dlci, dlci 130(0x82,0x2020), broadcast
                status defined, active
RA1#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 130, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```
input pkts 529          output pkts 517          in bytes 57382
out bytes 56150         dropped pkts 0           in FECN pkts 0
in BECN pkts 0         out FECN pkts 0         out BECN pkts 0
in DE pkts 0           out DE pkts 0
out bcast pkts 401     out bcast bytes 44130
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 03:09:20, last time pvc status changed 02:04:49
```

## Diagnostic sur RA2

```
RA2#show frame-relay map
Serial0 (up): ip 192.168.1.1 dlci 131(0x83,0x2030), dynamic,
                broadcast,, status defined, active
Serial0.1 (up): point-to-point dlci, dlci 131(0x83,0x2030), broadcast
                status defined, active
RA2#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

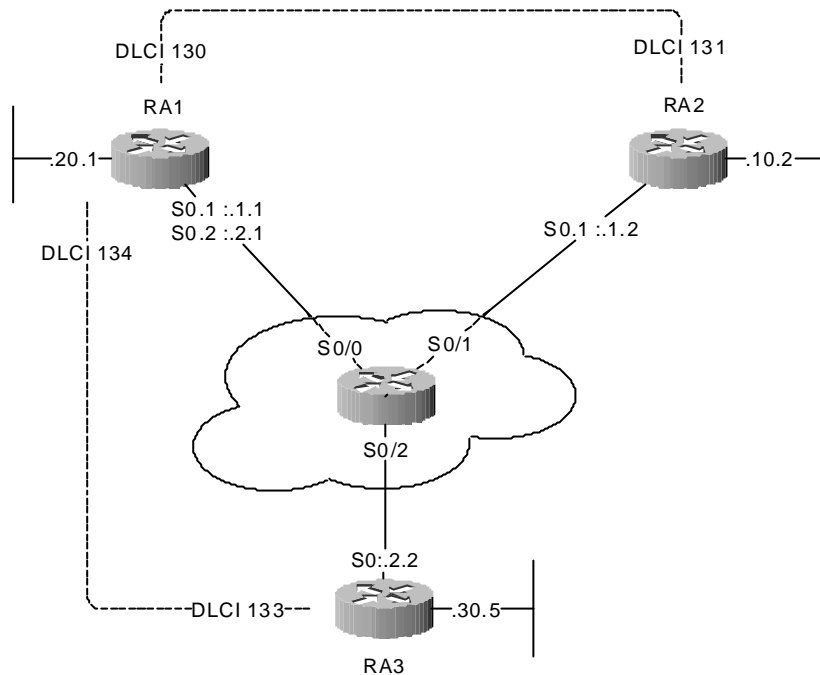
	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```
input pkts 450          output pkts 455          in bytes 48608
out bytes 49494         dropped pkts 0           in FECN pkts 0
in BECN pkts 0         out FECN pkts 0         out BECN pkts 0
in DE pkts 0           out DE pkts 0
out bcast pkts 361     out bcast bytes 39766
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 02:49:52, last time pvc status changed 01:59:51
```

# Labo 5 : Sous-interfaces Hub and Spoke

Cette configuration montre un exemple de configuration Hub and Spoke utilisant deux sous-interfaces pour joindre le nœud distant RA1. Chaque sous-interfaces disposent d'un réseau différent (.2.0 et .1.0) et la commande **frame-relay interface-dlci** assure qu'elles sont associées à un numéro DLCI spécifique.



## RA1

```
hostname RA1
!
interface FastEthernet0
 ip address 192.168.20.1 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
!
interface Serial0.1 point-to-point
 ip address 192.168.1.1 255.255.255.0
 frame-relay interface-dlci 130
!
interface Serial0.2 point-to-point
 ip address 192.168.2.1 255.255.255.0
 frame-relay interface-dlci 134
!
router rip
 network 192.168.1.0
 network 192.168.2.0
 network 192.168.20.0
```

## RA2

```
hostname RA2
!
interface FastEthernet0
 ip address 192.168.10.2 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
!
interface Serial0.1 point-to-point
 ip address 192.168.1.2 255.255.255.0
 frame-relay interface-dlci 131
!
```

```

router rip
network 192.168.1.0
network 192.168.10.0

```

---

**RA3**

```

hostname RA3
!
interface FastEthernet0
ip address 192.168.30.5 255.255.255.0
no keepalive
speed auto
!
interface Serial0
ip address 192.168.2.2 255.255.255.0
encapsulation frame-relay
!frame-relay interface-dlci 133
!
router rip
network 192.168.2.0
network 192.168.30.0

```

## Diagnostic sur RA1

```

RA1#show frame-relay map
Serial0.2 (up): point-to-point dlci, dlci 134(0x86,0x2060), broadcast
status defined, active
Serial0.1 (up): point-to-point dlci, dlci 130(0x82,0x2020), broadcast
status defined, active
RA1#show frame-relay pvc

```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	2	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 130, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```

input pkts 702          output pkts 691          in bytes 83240
out bytes 84970        dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 544    out bcast bytes 69754
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 03:52:27, last time pvc status changed 00:28:41

```

DLCI = 134, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.2

```

input pkts 471          output pkts 528          in bytes 51052
out bytes 66106        dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 406    out bcast bytes 53450
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 03:14:48, last time pvc status changed 00:28:42

```

RA1#ping 192.168.10.2

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
RA1#ping 192.168.30.5

```

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.30.5, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/64/96 ms

```

## Diagnostic sur RA2

```
RA2#show frame-relay map
Serial0.1 (up): point-to-point dlci, dlci 131(0x83,0x2030), broadcast
                status defined, active
RA2#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```
input pkts 621          output pkts 636          in bytes 76458
out bytes 77170        dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 511    out bcast bytes 64266
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 03:35:12, last time pvc status changed 00:25:56
RA2#ping 192.168.30.5
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.30.5, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 108/111/112 ms

## Diagnostic sur RA3

```
RA3#show frame-relay map
Serial0 (up): ip 192.168.2.1 dlci 133(0x85,0x2050), dynamic,
                broadcast,, status defined, active
RA3#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 133, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

```
input pkts 82          output pkts 60          in bytes 13852
out bytes 7578        dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 45    out bcast bytes 6018
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:20:50, last time pvc status changed 00:20:50
RA3#ping 192.168.10.2
```

Type escape sequence to abort.

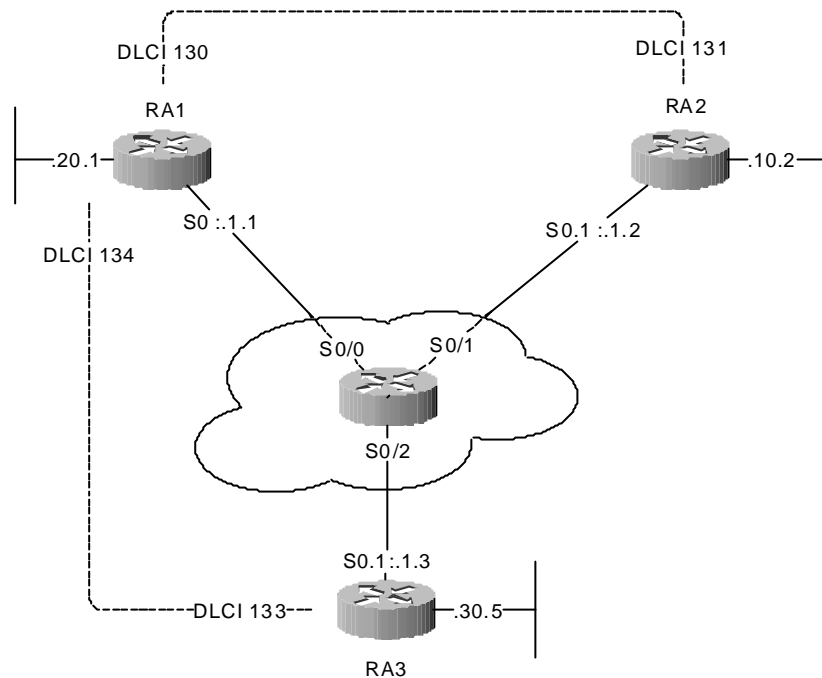
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 108/110/112 ms

# Labo 6 : Sous-interfaces Multipoint avec mappage statique

Au cas où Inverse ARP n'est pas applicable, on utilisera un mappage statique grâce à la commande **frame-relay map**.



## RA1

```
hostname RA1
!
interface FastEthernet0
 ip address 192.168.20.1 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 ip address 192.168.1.1 255.255.255.0
 encapsulation frame-relay
 frame-relay map ip 192.168.1.2 130 broadcast
 frame-relay map ip 192.168.1.3 134 broadcast
!
router rip
 network 192.168.1.0
 network 192.168.20.0
```

## RA2

```
hostname RA2
!
interface FastEthernet0
 ip address 192.168.10.2 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
!
interface Serial0.1 multipoint
 ip address 192.168.1.2 255.255.255.0
 frame-relay map ip 192.168.1.1 131 broadcast
 frame-relay map ip 192.168.1.3 131 broadcast
!
router rip
 network 192.168.1.0
 network 192.168.10.0
```

## RA3

```
hostname RA3
!
interface FastEthernet0
 ip address 192.168.30.5 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type cisco
!
interface Serial0.1 multipoint
 ip address 192.168.1.3 255.255.255.0
 frame-relay map ip 192.168.1.1 133 broadcast
 frame-relay map ip 192.168.1.2 133 broadcast
!
router rip
 network 192.168.1.0
 network 192.168.30.0
```

## Diagnostic sur RA2

```
RA2#show frame-relay map
Serial0.1 (up): ip 192.168.1.1 dlci 131(0x83,0x2030), static,
                broadcast,
                CISCO, status defined, active
Serial0.1 (up): ip 192.168.1.3 dlci 131(0x83,0x2030), static,
                broadcast,
                CISCO, status defined, active
RA2#show frame-relay pvc
```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	1	0	0	0

DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```
input pkts 17          output pkts 28          in bytes 1852
out bytes 1568         dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 28     out bcast bytes 1568
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:06:38, last time pvc status changed 00:06:25
```

DLCI = 136, DLCI USAGE = UNUSED, PVC STATUS = ACTIVE, INTERFACE = Serial0

```
input pkts 0          output pkts 0          in bytes 0
out bytes 0           dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 0      out bcast bytes 0
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
switched pkts 0
Detailed packet drop counters:
no out intf 0         out intf down 0        no out PVC 0
in PVC down 0         out PVC down 0         pkt too big 0
shaping Q full 0     pkt above DE 0         policing drop 0
pvc create time 00:06:38, last time pvc status changed 00:06:18
```

```
RA2#ping 192.168.20.1
```

Type escape sequence to abort.

```
Sending 5, 100-byte ICMP Echos to 192.168.20.1, timeout is 2 seconds:
```

```
!!!!!
```

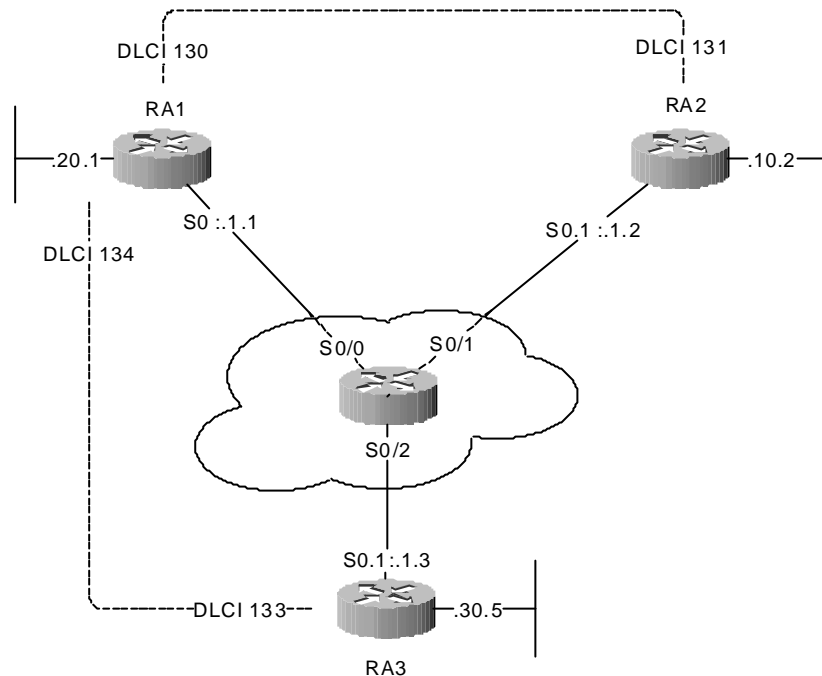
```
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/60 ms
```

```
RA2#ping 192.168.10.2
```

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:  
!!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

# Labo 7 : Sous-interfaces multipoint avec mappage dynamique et maillage partiel

Dans ce labo 7, les adresses des nœuds sont censées être apprises dynamiquement. Il semble bien qu'une activation d'IARP soit nécessaire avec la commande **frame-relay inverse-arp**. En conséquence il faut donc associer l'adresse IP à joindre avec le numéro DLCI local. On notera que le maillage est partiel.



## RA1

```
hostname RA1
!
interface FastEthernet0
 ip address 192.168.20.1 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 ip address 192.168.1.1 255.255.255.0
 encapsulation frame-relay
!
router rip
 network 192.168.1.0
 network 192.168.20.0
```

## RA2

```
hostname RA2
!
interface FastEthernet0
 ip address 192.168.10.2 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
!
interface Serial0.1 multipoint
 ip address 192.168.1.2 255.255.255.0
 frame-relay interface-dlci 131
!
router rip
 network 192.168.1.0
 network 192.168.10.0
```

## RA3

```
hostname RA3
```

```

!
interface FastEthernet0
 ip address 192.168.30.5 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type cisco
!
interface Serial0.1 multipoint
 ip address 192.168.1.3 255.255.255.0
 frame-relay interface-dlci 133
!
router rip
 network 192.168.1.0
 network 192.168.30.0

```

## Diagnostic de RA1

```

RA1#show frame-relay map
Serial0 (up): ip 192.168.1.2 dlci 130(0x82,0x2020), dynamic,
              broadcast,, status defined, active
Serial0 (up): ip 192.168.1.3 dlci 134(0x86,0x2060), dynamic,
              broadcast,, status defined, active
RA1#show frame-relay pvc

```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	2	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 130, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

```

input pkts 13          output pkts 16          in bytes 706
out bytes 1550        dropped pkts 0          in FECN pkts 0
in BECN pkts 0       out FECN pkts 0        out BECN pkts 0
in DE pkts 0         out DE pkts 0
out bcast pkts 16    out bcast bytes 1550
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:08:05, last time pvc status changed 00:07:55

```

DLCI = 134, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

```

input pkts 29          output pkts 31          in bytes 2082
out bytes 3154        dropped pkts 0          in FECN pkts 0
in BECN pkts 0       out FECN pkts 0        out BECN pkts 0
in DE pkts 0         out DE pkts 0
out bcast pkts 21    out bcast bytes 2114
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:08:07, last time pvc status changed 00:07:57

```

RA1#ping 192.168.10.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms

RA1#ping 192.168.30.5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.30.5, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms

## Diagnostic de RA2

```

RA2#show frame-relay map
Serial0.1 (up): ip 192.168.1.1 dlci 131(0x83,0x2030), dynamic,

```

```
        broadcast,, status defined, active
RA2#show frame-relay pvc
```

```
PVC Statistics for interface Serial0 (Frame Relay DTE)
```

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

```
DLCI = 131, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1
```

```
input pkts 25          output pkts 23          in bytes 2698
out bytes 1528         dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 18     out bcast bytes 1008
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:08:47, last time pvc status changed 00:08:47
```

```
RA2#ping 192.168.20.1
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 192.168.20.1, timeout is 2 seconds:
```

```
!!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
```

```
RA2#ping 192.168.1.3
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 192.168.30.5, timeout is 2 seconds:
```

```
.....
```

```
Success rate is 0 percent (0/5)
```

## Diagnostic de RA3

```
RA3#show frame-relay map
```

```
Serial0.1 (up): ip 192.168.1.1 dlci 133(0x85,0x2050), dynamic,
        broadcast,, status defined, active
```

```
RA3#show frame-relay pvc
```

```
PVC Statistics for interface Serial0 (Frame Relay DTE)
```

	Active	Inactive	Deleted	Static
Local	1	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

```
DLCI = 133, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1
```

```
input pkts 20          output pkts 17          in bytes 1938
out bytes 1192         dropped pkts 0          in FECN pkts 0
in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
in DE pkts 0          out DE pkts 0
out bcast pkts 12     out bcast bytes 672
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:05:55, last time pvc status changed 00:05:27
```

```
RA3#ping 192.168.20.1
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 192.168.20.1, timeout is 2 seconds:
```

```
!!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms
```

```
RA3#ping 192.168.1.2
```

```
Type escape sequence to abort.
```

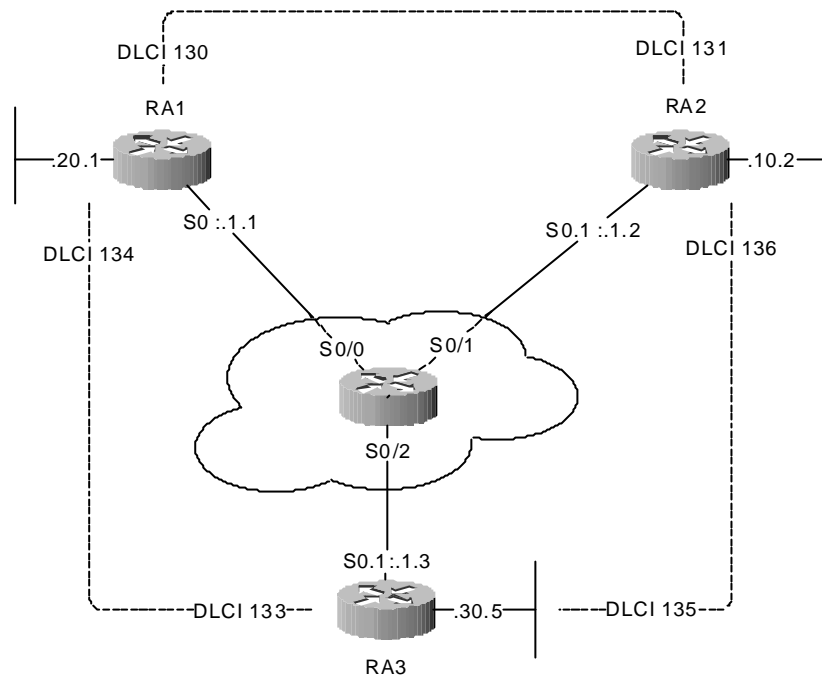
```
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
```

```
.....
```

```
Success rate is 0 percent (0/5)
```

# Labo 8 : Sous-interfaces multipoint avec mappage dynamique et maillage total

Ce labo 8 est identique au précédent sauf que le maillage est total.



## RA2

```
hostname RA2
!
interface FastEthernet0
 ip address 192.168.10.2 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
!
interface Serial0.1 multipoint
 ip address 192.168.1.2 255.255.255.0
 frame-relay interface-dlci 131
 frame-relay interface-dlci 136
!
router rip
 network 192.168.1.0
 network 192.168.10.0
```

## RA3

```
hostname RA3
!
interface FastEthernet0
 ip address 192.168.30.5 255.255.255.0
 no keepalive
 speed auto
!
interface Serial0
 no ip address
 encapsulation frame-relay
!
interface Serial0.1 multipoint
 ip address 192.168.1.3 255.255.255.0
 frame-relay interface-dlci 133
 frame-relay interface-dlci 135
!
router rip
 network 192.168.1.0
```

```

network 192.168.30.0

```

<b>Switch</b>
---------------

```

hostname Switch
!
frame-relay switching
!
interface Serial0/0
no ip address
encapsulation frame-relay
clockrate 64000
frame-relay intf-type dce
frame-relay route 130 interface Serial0/1 131
frame-relay route 134 interface Serial0/2 133
!
interface Serial0/1
no ip address
encapsulation frame-relay
clockrate 64000
frame-relay intf-type dce
frame-relay route 131 interface Serial0/0 130
frame-relay route 136 interface Serial0/2 135
!
interface Serial0/2
no ip address
encapsulation frame-relay
clockrate 64000
frame-relay intf-type dce
frame-relay route 133 interface Serial0/0 134
frame-relay route 135 interface Serial0/1 136

```

## Diagnostic sur RA3

```

RA3#show frame-relay map
Serial0.1 (up): ip 192.168.1.1 dlci 133(0x85,0x2050), dynamic,
                broadcast,, status defined, active
Serial0.1 (up): ip 192.168.1.2 dlci 135(0x87,0x2070), dynamic,
                broadcast,, status defined, active
RA3#show frame-relay pvc

```

PVC Statistics for interface Serial0 (Frame Relay DTE)

	Active	Inactive	Deleted	Static
Local	2	0	0	0
Switched	0	0	0	0
Unused	0	0	0	0

DLCI = 133, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```

input pkts 18          output pkts 9          in bytes 1702
out bytes 504         dropped pkts 0        in FECN pkts 0
in BECN pkts 0       out FECN pkts 0      out BECN pkts 0
in DE pkts 0         out DE pkts 0
out bcast pkts 9     out bcast bytes 504
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:06:51, last time pvc status changed 00:06:41

```

DLCI = 135, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1

```

input pkts 8          output pkts 12         in bytes 426
out bytes 890         dropped pkts 0        in FECN pkts 0
in BECN pkts 0       out FECN pkts 0      out BECN pkts 0
in DE pkts 0         out DE pkts 0
out bcast pkts 7     out bcast bytes 370
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 00:06:52, last time pvc status changed 00:06:42

```

RA3#ping 192.168.10.2

```

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!

```

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/56/56 ms

## Diagnostic sur Switch

Switch#show frame-relay route

Input Intf	Input Dlci	Output Intf	Output Dlci	Status
Serial0/0	130	Serial0/1	131	active
Serial0/0	134	Serial0/2	133	active
Serial0/1	131	Serial0/0	130	active
Serial0/1	136	Serial0/2	135	active
Serial0/2	133	Serial0/0	134	active
Serial0/2	135	Serial0/1	136	active