

# Exemples de configurations N+1 à haute disponibilité

## Contenu

[Introduction](#)

[Scénario 1](#)

[Scénario 2](#)

[Scénario 3](#)

[Scénario 4](#)

[Scénario 5](#)

[Informations connexes](#)

## [Introduction](#)

Ce document fournit des exemples de configuration et des informations pour plusieurs scénarios N+1.

**Remarque:** Maintenez dans l'esprit qui aiment des cartes doit sauvegarder comme des cartes.

## [Scénario 1](#)

Configurations d'échantillon de la Haute disponibilité (ha) avec deux Commutateurs rf (configuration 3x10) dans 4+1 cinq de VXR, vingt MC28C linecards de mode, et des trois châssis de VCom HD4040, qui contiennent quarante modules.

La configuration physique est affichée sur le [schéma 1](#). se rapportent à [câbler le commutateur de Cisco rf à Cisco uBR7246VXR](#).

### Figure 1 – 4+1 avec des cartes MC28C et 2 Commutateurs rf

Cet empilement d'examen médical est assumé, avec les affectations IP qui commencent par 192.168.1.2 au dessus et continuent vers le bas. Puisqu'il sera en mode 4+1, le commutateur 1 rf est considéré deux Commutateurs : a et b, où a est les emplacements 1 à 4 et à b est les emplacements 5 à 8. que le rf Comm2 est également considéré deux Commutateurs : a et B.

Fonctionner la configuration VXR1
<pre>version 12.2 service timestamps debug uptime service timestamps log uptime no service password-encryption ! hostname "WorkingVXR1" ! boot system disk0:ubr7200-ik8s-mz.BC.28July03 no logging console</pre>

```
enable secret 5 $1$5YHG$mquxabcqzFoUUKhp/c9WT4/
!
cab modem remote-query 10 public
cab modulation-prof 2 request 0 16 0 8 qpsk scrambler
152 no-diff 64 fixed uw8
cab modulation-prof 2 initial 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 2 station 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 2 short 4 76 6 8 qpsk scrambler
152 no-diff 72 short uw8
cab modulation-prof 2 long 8 220 0 8 qpsk scrambler
152 no-diff 80 short uw8
cab modulation-prof 3 request 0 16 0 8 qpsk scrambler
152 no-diff 64 fixed uw16
cab modulation-prof 3 initial 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 3 station 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 3 short 7 76 7 8 16qam scrambler
152 no-diff 144 short uw16
cab modulation-prof 3 long 9 220 0 8 16qam scrambler
152 no-diff 160 short uw16
no cable qos permission create
no cable qos permission update
cable qos permission modems
no cable clock source-midplane
no cable clock force primary
no cable clock force secondary
!
cable config-file docsis.cm
frequency 453000000
service-class 1 max-upstream 10000
service-class 1 max-downstream 10000
service-class 1 max-burst 1522
!
ip subnet-zero
ip cef
!
ip host protect 192.168.1.7
ip host work2 192.168.1.6
ip name-server 171.68.226.120
!
ip dhcp pool MODEMS1
network 192.168.3.0 255.255.255.0
bootfile docsis.cm
next-server 192.168.3.5
default-router 192.168.3.5
option 7 ip 192.168.3.5
option 4 ip 192.168.3.5
option 2 hex 0000.0000
lease 2 3 4
!
ip dhcp pool PC
network 10.11.12.0 255.255.255.0
default-router 10.11.12.1
dns-server 171.68.226.120
lease 10 1 11
!
packetcable element_id 35417
!
interface FastEthernet0/0
ip address 192.168.1.7 255.255.255.0
no keepalive
```

```
speed auto
full-duplex
!--- This interface is used for Hot Standby Connection-
to-Connection Protocol (HCCP) !--- traffic. ! interface
FastEthernet0/1 ip address 192.168.2.7 255.255.255.0
keepalive 1 !--- This is set to 1 second so that, if the
cable is disconnected, then this !--- interface will
failover within 3 seconds. speed auto full-duplex !
interface Cable3/0 ip address 10.11.12.1 255.255.255.0
secondary ip address 192.168.3.5 255.255.255.0 load-
interval 30 keepalive 1 !--- The keepalive time is in
seconds, and the default is 10 seconds for HCCP code.
load-interval 30 cable downstream channel-id 0 cable
bundle 1 master !--- Interface bundling is supported, as
are subinterfaces. !--- Note: Bundles failover together.
cable downstream annex B cable downstream modulation
64qam cable downstream interleave-depth 32 cable
downstream frequency 453000000 !--- This is the
downstream (DS) frequency, which used to be
informational only when !--- you are using an external
UPx. This must be set when you are using the MC28U cards
!--- with internal UPxs or when you are doing N+1 with
MC28C cards, so that the Protect !--- UPx knows what
frequency to use. cable upstream 0 frequency 24000000 !-
-- If you are doing dense mode combining, the upstream
(US) frequencies must be !--- different. If no two US
ports are shared, then the same frequency can be used.
cable upstream 0 power-level 0 cable upstream 0 channel-
width 3200000 cable upstream 0 minislot-size 2 cable
upstream 0 data-backoff automatic cable upstream 0
modulation-profile 3 no cable upstream 0 shutdown cable
dhcp-giaddr policy !--- This tells the cable modems
(CMs) to get an IP address from the primary scope, and
!--- it tells the customer premises equipment (CPE) to
use the secondary scope. hccp 1 working 1 !--- This is
the Working first group, member 1. hccp 1 channel-switch
1 rfswwa rfswwa-group 192.168.1.5 44440400 1 !--- This
is the IP address of the Switch, and it is protecting
member 1 in the !--- left side of Switch slot 1. hccp 1
channel-switch 1 uc31 wavecom-hd 192.168.1.2 1
192.168.1.4 1 !--- This is the IP address of the
upconverter, and it is module 1 (A) that is backing !---
module 1 (A) of another upconverter. This shows that one
upconverter could have !--- a module that backs up a
module in a different chassis with a different IP
address, !--- if need be. If this statement is not
present when you are using Cisco IOS® Software !---
Release 15(BC2) or later, then IF-Muting is assumed, and
an external upconverter !--- with Simple Network
Management Protocol (SNMP) capability is not needed.
hccp 1 track FastEthernet0/1 !--- Tracking is enabled
for the egress port, in the event that the WAN-backhaul
is !--- disrupted. This cable interface will failover to
the Protect. hccp 1 reverttime 120 !--- This is the time
in minutes (plus a 2 minute suspend) for the card to
switch back !--- to normal mode, if the fault has
cleared. If there is a fault on the Protect card, !---
then it will revert back after the suspend time, and it
will not wait for the full !--- revert time. The default
setting is 30 minutes. ! interface Cable3/1 hccp 2
working 1 hccp 2 channel-switch 1 rfswwa rfswwa-group
192.168.1.5 11110100 1 !--- This is the IP address of
the Switch, and it is protecting member 1 in the !---
right side of Switch slot 1. hccp 2 channel-switch 1
```

```

uc31 wavecom-hd 192.168.1.2 2 192.168.1.4 2 hccp 2
reverttime 120 ! interface Cable4/0 hccp 3 working 1
hccp 3 channel-switch 1 rfswlb rfs-switch-group
192.168.1.5 88880800 1 !--- This is the IP address of
the Switch, and it is protecting member 1 in the !---
left side of Switch slot 5. Because the RF Switch is in
4+1 mode, slot 5 is !--- considered to be slot 1 again.
hccp 3 channel-switch 1 uc31 wavecom-hd 192.168.1.2 3
192.168.1.4 3 hccp 3 reverttime 120 ! interface Cable
4/1 hccp 4 working 1 hccp 4 channel-switch 1 rfswlb
rfs-switch-group 192.168.1.5 22220200 1 !--- This is the
IP address of the Switch, and it is protecting member 1
in the !--- right side of Switch slot 5. Because the RF
Switch is in 4+1 mode, slot 5 is !--- considered to be
slot 1 again. hccp 4 channel-switch 1 uc31 wavecom-hd
192.168.1.2 4 192.168.1.4 4 hccp 4 reverttime 120 !
interface Cable5/0 hccp 5 working 1 hccp 5 channel-
switch 1 rfs2a rfs-switch-group 192.168.1.6 44440400 1
hccp 5 channel-switch 1 uc31 wavecom-hd 192.168.1.2 5
192.168.1.4 5 hccp 5 reverttime 120 ! interface Cable
5/1 hccp 6 working 1 hccp 6 channel-switch 1 rfs2a
rfs-switch-group 192.168.1.6 11110100 1 hccp 6 channel-
switch 1 uc31 wavecom-hd 192.168.1.2 6 192.168.1.4 6
hccp 6 reverttime 120 ! interface Cable 6/0 hccp 7
working 1 hccp 7 channel-switch 1 rfs2b rfs-switch-group
192.168.1.6 88880800 1 hccp 7 channel-switch 1 uc31
wavecom-hd 192.168.1.2 7 192.168.1.4 7 hccp 7 reverttime
120 ! interface Cable 6/1 hccp 8 working 1 hccp 8
channel-switch 1 rfs2b rfs-switch-group 192.168.1.6
22220200 1 hccp 8 channel-switch 1 uc31 wavecom-hd
192.168.1.2 8 192.168.1.4 8 hccp 8 reverttime 120 !
router eigrp 2500 network 10.11.12.0 0.0.0.255 network
192.168.1.0 network 192.168.3.0 no auto-summary no eigrp
log-neighbor-changes ! ip classless ip route 0.0.0.0
0.0.0.0 192.168.1.254 ip route 192.168.1.0 255.255.255.0
FastEthernet0/0 ip route 192.168.2.0 255.255.255.0
FastEthernet0/1 no ip http server ! cdp run ! snmp-
server community private RW !--- Unless it is deleted,
this does not affect the HCCP communications between !--
- the upconverter, the Switch, and the 7200. snmp-server
community public RO snmp-server enable traps tty snmp-
server manager tftp-server disk0: tftp-server disk1:
alias exec shb show hccp brief alias exec shd show hccp
detail alias exec scm show cable modem alias exec scr
show cable modem remote alias exec sm show cab modu
alias exec sch show cab hop alias exec sc300 show cont
c3/0 u0 alias exec sint300 show int c3/0 u0 alias exec
scs show cable spec

```

## Protégez la configuration VXR

```

version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname "ProtectVXR"
!
boot system disk0:ubr7200-ik8s-mz.BC.28July03
no logging console
enable secret 5 $1$5YHG$mquxabcqzFoUUKhp/c9WT4/
!
cab modem remote-query 10 public
cab modulation-prof 2 request 0 16 0 8 qpsk scrambler
152 no-diff 64 fixed uw8

```

```

cab modulation-prof 2 initial 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 2 station 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 2 short 4 76 6 8 qpsk scrambler
152 no-diff 72 short uw8
cab modulation-prof 2 long 8 220 0 8 qpsk scrambler
152 no-diff 80 short uw8
cab modulation-prof 3 request 0 16 0 8 qpsk scrambler
152 no-diff 64 fixed uw16
cab modulation-prof 3 initial 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 3 station 5 34 0 48 qpsk scrambler
152 no-diff 128 fixed uw16
cab modulation-prof 3 short 7 76 7 8 16qam scrambler
152 no-diff 144 short uw16
cab modulation-prof 3 long 9 220 0 8 16qam scrambler
152 no-diff 160 short uw16
!--- Be sure to pre-configure all global configurations
on the Protect, such as !--- modulation profiles,
spectrum groups, load balancing, and so forth. no cable
qos permission create no cable qos permission update
cable qos permission modems no cable clock source-
midplane no cable clock force primary no cable clock
force secondary ! cable config-file docsis.cm frequency
453000000 service-class 1 max-upstream 10000 service-
class 1 max-downstream 10000 service-class 1 max-burst
1522 ! ip subnet-zero ip cef ! ip host protect
192.168.1.7 ip host work2 192.168.1.6 ip name-server
171.68.226.120 ! ip dhcp pool MODEMS1 network
192.168.3.0 255.255.255.0 bootfile docsis.cm next-server
192.168.3.5 default-router 192.168.3.5 option 7 ip
192.168.3.5 option 4 ip 192.168.3.5 option 2 hex
0000.0000 lease 2 3 4 ! ip dhcp pool PC network
10.11.12.0 255.255.255.0 default-router 10.11.12.1 dns-
server 171.68.226.120 lease 10 1 11 ! packetcable
element_id 35417 ! interface FastEthernet0/0 ip address
192.168.1.11 255.255.255.0 no keepalive speed auto full-
duplex no cdp enable ! interface FastEthernet0/1 ip
address 192.168.2.11 255.255.255.0 keepalive 1 speed
auto full-duplex no cdp enable ! interface Cable3/0 no
ip address !--- There is no need to set the IP address,
because it will come from the Working card !--- via
SNMP. no keepalive !--- This defaults to 10 seconds with
the N+1 Cisco IOS code, but it is recommended that !---
you disable it on the Protect interface or set it to a
relatively high value. cable downstream annex B cable
downstream modulation 64qam cable downstream interleave-
depth 32 !--- The DS modulation, annex mode, and
interleave must be same on the Protect and on !--- the
Working of the same group. no shut !--- The interface
must be activated to start HCCP functionality. Do this
last. cable upstream 0 shutdown !--- This will
automatically become "no shut" when a failover occurs.
hccp 1 protect 1 192.168.1.7 !--- This is the Protect
for the first group. Remember to configure the Protect
!--- interface(s) last, after the Working interfaces are
configured. This is the HCCP !--- first group and it is
protecting member 1 with member 1's FastEthernet (FE) IP
!--- address. hccp 1 channel-switch 1 rfs1a rswitch-
group 192.168.1.5 44440400 1 !--- This is the IP address
of the Switch, and it is protecting member 1, which has
a !--- bitmap of 44440400 in Switch slot 1. hccp 1
channel-switch 1 uc31 wavecom-hd 192.168.1.2 1

```

```
192.168.1.4 1 !--- This is the IP address of the
upconverter, and it is module 1 (A) that is backing !---
module 1 (A) of another upconverter. This shows that one
upconverter could have !--- a module that backs up a
module in a different chassis with a different IP
address, !--- if need be. If this statement is not
present when you are using Cisco IOS Software !---
Release 15(BC2) or later, then IF-Muting is assumed, and
an external upconverter !--- with SNMP capability is not
needed. hccp 1 protect 2 192.168.1.8 !--- This is the
HCCP first group, and it is protecting member 2 with its
IP address. hccp 1 channel-switch 2 rfwsla rfs witch-
group 192.168.1.5 44440400 2 hccp 1 channel-switch 2
uc31 wavecom-hd 192.168.1.2 1 192.168.1.4 9 hccp 1
protect 3 192.168.1.9 hccp 1 channel-switch 3 rfwsla
rfs witch-group 192.168.1.5 44440400 3 hccp 1 channel-
switch 3 uc32 wavecom-hd 192.168.1.2 1 192.168.1.3 1
hccp 1 protect 4 192.168.1.10 hccp 1 channel-switch 4
rfwsla rfs witch-group 192.168.1.5 44440400 4 hccp 1
channel-switch 4 uc32 wavecom-hd 192.168.1.2 1
192.168.1.3 9 hccp 1 timers 666 2000 !--- hccp 1 timers
<hellotime> <holdtime> !--- This is for inter-chassis
communication. ! interface Cable3/1 hccp 2 protect 1
192.168.1.7 hccp 2 channel-switch 1 rfwsla rfs witch-
group 192.168.1.5 11110100 1 hccp 2 channel-switch 1
uc31 wavecom-hd 192.168.1.2 2 192.168.1.4 2 hccp 2
protect 2 192.168.1.8 hccp 2 channel-switch 2 rfwsla
rfs witch-group 192.168.1.5 11110100 2 hccp 2 channel-
switch 2 uc31 wavecom-hd 192.168.1.2 2 192.168.1.4 10
hccp 2 protect 3 192.168.1.9 hccp 2 channel-switch 3
rfwsla rfs witch-group 192.168.1.5 11110100 3 hccp 2
channel-switch 3 uc32 wavecom-hd 192.168.1.2 2
192.168.1.3 2 hccp 2 protect 4 192.168.1.10 hccp 2
channel-switch 4 rfwsla rfs witch-group 192.168.1.5
11110100 4 hccp 2 channel-switch 4 uc32 wavecom-hd
192.168.1.2 2 192.168.1.3 10 hccp 2 timers 666 2000 !
interface Cable4/0 hccp 3 protect 1 192.168.1.7 hccp 3
channel-switch 1 rfwslb rfs witch-group 192.168.1.5
88880800 1 hccp 3 channel-switch 1 uc31 wavecom-hd
192.168.1.2 3 192.168.1.4 3 hccp 3 protect 2 192.168.1.8
hccp 3 channel-switch 2 rfwslb rfs witch-group
192.168.1.5 88880800 2 hccp 3 channel-switch 2 uc31
wavecom-hd 192.168.1.2 3 192.168.1.4 11 hccp 3 protect 3
192.168.1.9 hccp 3 channel-switch 3 rfwslb rfs witch-
group 192.168.1.5 88880800 3 hccp 3 channel-switch 3
uc32 wavecom-hd 192.168.1.2 3 192.168.1.3 3 hccp 3
protect 4 192.168.1.10 hccp 3 channel-switch 4 rfwslb
rfs witch-group 192.168.1.5 88880800 4 hccp 3 channel-
switch 4 uc32 wavecom-hd 192.168.1.2 3 192.168.1.3 11
hccp 3 timers 666 2000 ! interface Cable4/1 hccp 4
protect 1 192.168.1.7 hccp 4 channel-switch 1 rfwslb
rfs witch-group 192.168.1.5 22220200 1 hccp 4 channel-
switch 1 uc31 wavecom-hd 192.168.1.2 4 192.168.1.4 4
hccp 4 protect 2 192.168.1.8 hccp 4 channel-switch 2
rfwslb rfs witch-group 192.168.1.5 22220200 2 hccp 4
channel-switch 2 uc31 wavecom-hd 192.168.1.2 4
192.168.1.4 12 hccp 4 protect 3 192.168.1.9 hccp 4
channel-switch 3 rfwslb rfs witch-group 192.168.1.5
22220200 3 hccp 4 channel-switch 3 uc32 wavecom-hd
192.168.1.2 4 192.168.1.3 4 hccp 4 protect 4
192.168.1.10 hccp 4 channel-switch 4 rfwslb rfs witch-
group 192.168.1.5 22220200 4 hccp 4 channel-switch 4
uc32 wavecom-hd 192.168.1.2 4 192.168.1.3 12 hccp 4
timers 666 2000 ! interface Cable5/0 hccp 5 protect 1
```

```
192.168.1.7 hccp 5 channel-switch 1 rfs2a rfs2a-
group 192.168.1.6 44440400 1 hccp 5 channel-switch 1
uc31 wavecom-hd 192.168.1.2 5 192.168.1.4 5 hccp 5
protect 2 192.168.1.8 hccp 5 channel-switch 2 rfs2a
rfs2a-group 192.168.1.6 44440400 2 hccp 5 channel-
switch 2 uc31 wavecom-hd 192.168.1.2 5 192.168.1.4 13
hccp 5 protect 3 192.168.1.9 hccp 5 channel-switch 3
rfs2a rfs2a-group 192.168.1.6 44440400 3 hccp 5
channel-switch 3 uc32 wavecom-hd 192.168.1.2 5
192.168.1.3 5 hccp 5 protect 4 192.168.1.10 hccp 5
channel-switch 4 rfs2a rfs2a-group 192.168.1.6
44440400 4 hccp 5 channel-switch 4 uc32 wavecom-hd
192.168.1.2 5 192.168.1.3 13 hccp 5 timers 666 2000 !
interface Cable5/1 hccp 6 protect 1 192.168.1.7 hccp 6
channel-switch 1 rfs2a rfs2a-group 192.168.1.6
11110100 1 hccp 6 channel-switch 1 uc31 wavecom-hd
192.168.1.2 6 192.168.1.4 6 hccp 6 protect 2 192.168.1.8
hccp 6 channel-switch 2 rfs2a rfs2a-group
192.168.1.6 11110100 2 hccp 6 channel-switch 2 uc31
wavecom-hd 192.168.1.2 6 192.168.1.4 14 hccp 6 protect 3
192.168.1.9 hccp 6 channel-switch 3 rfs2a rfs2a-
group 192.168.1.6 11110100 3 hccp 6 channel-switch 3
uc32 wavecom-hd 192.168.1.2 6 192.168.1.3 6 hccp 6
protect 4 192.168.1.10 hccp 6 channel-switch 4 rfs2a
rfs2a-group 192.168.1.6 11110100 4 hccp 6 channel-
switch 4 uc32 wavecom-hd 192.168.1.2 6 192.168.1.3 14
hccp 6 timers 666 2000 ! interface Cable6/0 hccp 7
protect 1 192.168.1.7 hccp 7 channel-switch 1 rfs2b
rfs2b-group 192.168.1.6 88880800 1 hccp 7 channel-
switch 1 uc31 wavecom-hd 192.168.1.2 7 192.168.1.4 7
hccp 7 protect 2 192.168.1.8 hccp 7 channel-switch 2
rfs2b rfs2b-group 192.168.1.6 88880800 2 hccp 7
channel-switch 2 uc31 wavecom-hd 192.168.1.2 7
192.168.1.4 15 hccp 7 protect 3 192.168.1.9 hccp 7
channel-switch 3 rfs2b rfs2b-group 192.168.1.6
88880800 3 hccp 7 channel-switch 3 uc32 wavecom-hd
192.168.1.2 7 192.168.1.3 7 hccp 7 protect 4
192.168.1.10 hccp 7 channel-switch 4 rfs2b rfs2b-
group 192.168.1.6 88880800 4 hccp 7 channel-switch 4
uc32 wavecom-hd 192.168.1.2 7 192.168.1.3 15 hccp 7
timers 666 2000 ! interface Cable6/1 hccp 8 protect 1
192.168.1.7 hccp 8 channel-switch 1 rfs2b rfs2b-
group 192.168.1.6 22220200 1 hccp 8 channel-switch 1
uc31 wavecom-hd 192.168.1.2 8 192.168.1.4 8 hccp 8
protect 2 192.168.1.8 hccp 8 channel-switch 2 rfs2b
rfs2b-group 192.168.1.6 22220200 2 hccp 8 channel-
switch 2 uc31 wavecom-hd 192.168.1.2 8 192.168.1.4 16
hccp 8 protect 3 192.168.1.9 hccp 8 channel-switch 3
rfs2b rfs2b-group 192.168.1.6 22220200 3 hccp 8
channel-switch 3 uc32 wavecom-hd 192.168.1.2 8
192.168.1.3 8 hccp 8 protect 4 192.168.1.10 hccp 8
channel-switch 4 rfs2b rfs2b-group 192.168.1.6
22220200 4 hccp 8 channel-switch 4 uc32 wavecom-hd
192.168.1.2 8 192.168.1.3 16 hccp 8 timers 666 2000 !
router eigrp 2500 network 10.11.12.0 0.0.0.255 network
10.11.13.0 0.0.0.255 network 192.168.1.0 network
192.168.3.0 network 192.168.5.0 no auto-summary no eigrp
log-neighbor-changes ! ip classless ip route 0.0.0.0
0.0.0.0 192.168.1.254 ip route 192.168.1.0 255.255.255.0
FastEthernet0/0 ip route 192.168.2.0 255.255.255.0
FastEthernet0/1 no ip http server ! cdp run ! snmp-
server community private RW snmp-server community public
RO snmp-server enable traps tty snmp-server enable traps
cable snmp-server manager alias exec shb show hccp brief
```

```
alias exec shd show hccp detail alias exec scm show
cable modem alias exec scr show cable modem remote
```

## Scénario 2

Configurations d'échantillon de Haute disponibilité avec deux Commutateurs rf (configuration 3x10) dans 4+1 mode, cinq VXRr, et des vingt linecards MC28U.

La configuration physique est affichée dans la [figure 1](#), mais ignore les upconverters sur le dessus. Référez-vous à [câbler le commutateur de Cisco rf à Cisco uBR7246VXR](#) pour un document de câblage qui utilise les linecards 28C. Le câblage pour des linecards MC28U se compose d'un paquet de dix câbles qui vont de chaque linecard à chaque en-tête du commutateur rf. Référez-vous au document ha qui concerne cette solution N+1.

Cet empilement d'examen médical est assumé, avec les affectations IP qui commencent par 192.168.1.5 au dessus et continuent vers le bas. Puisqu'il sera en mode 4+1, le commutateur 1 rf est considéré deux Commutateurs : a et b, où a est les emplacements 1 à 4 et à b est les emplacements 5 à 8. que le rf Comm2 est également considéré deux Commutateurs : a et B.

### Fonctionner la configuration VXR1

```
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname "WorkingVXR1"
!
boot system disk0:ubr7200-ik8s-mz.BC....
no logging console
enable secret 5 $1$5YHG$mquxabcqzFoUUKhp/c9WT4/
!
cab modem remote-query 10 public
!--- This is an easy way to track modem transmit and
receive levels, especially after a !--- failover. You
might want to increase the time period or remove this
command, after !--- you have confirmed that everything
is OK. cable modulation-profile 41 request 0 16 0 8 qpsk
scrambler 152 no-diff 64 fixed cable modulation-profile
41 initial 5 34 0 48 qpsk scrambler 152 no-diff 128
fixed cable modulation-profile 41 station 5 34 0 48 qpsk
scrambler 152 no-diff 128 fixed cable modulation-profile
41 short 3 78 35 25 qpsk scrambler 152 no-diff 100 short
cable modulation-profile 41 long 9 232 0 137 qpsk
scrambler 152 no-diff 80 short cable modulation-profile
42 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed
cable modulation-profile 42 initial 5 34 0 48 qpsk
scrambler 152 no-diff 128 fixed cable modulation-profile
42 station 5 34 0 48 qpsk scrambler 152 no-diff 128
fixed cable modulation-profile 42 short 3 78 17 10 16qam
scrambler 152 no-diff 136 short cable modulation-profile
42 long 9 232 0 77 16qam scrambler 152 no-diff 216 short
no cable qos permission create no cable qos permission
update cable qos permission modems no cable clock
source-midplane no cable clock force primary no cable
clock force secondary ! cable config-file docsis.cm
frequency 453000000 service-class 1 max-upstream 10000
service-class 1 max-downstream 10000 service-class 1
max-burst 1522 ! ip subnet-zero ip cef ! ip name-server
```



```
171.68.226.120 ! ip dhcp pool MODEMS1 network
192.168.3.0 255.255.255.0 bootfile docsis.cm next-server
192.168.3.5 default-router 192.168.3.5 option 7 ip
192.168.3.5 option 4 ip 192.168.3.5 option 2 hex
0000.0000 lease 2 3 4 ! ip dhcp pool PC network
10.11.12.0 255.255.255.0 default-router 10.11.12.1 dns-
server 171.68.226.120 lease 10 1 11 ! packetcable
element_id 35417 ! interface FastEthernet0/0 ip address
192.168.1.7 255.255.255.0 no keepalive speed auto full-
duplex !--- This interface is used for HCCP traffic. !
interface FastEthernet0/1 ip address 192.168.2.7
255.255.255.0 keepalive 1 !--- This is set to 1 second
so that, if the cable is disconnected, this interface !-
-- will failover within 3 seconds. speed auto full-
duplex ! interface Cable3/0 ip address 10.11.12.1
255.255.255.0 secondary ip address 192.168.3.5
255.255.255.0 load-interval 30 cable dynamic-secret mark
nocrypt cable map-advance dynamic 500 1000 keepalive 1
!--- The keepalive time is in seconds, and the default
is 10 seconds for HCCP code. cable downstream channel-id
0 cable bundle 1 master !--- Interface bundling is
supported, as are subinterfaces. !--- Note: Bundles
failover together. cable downstream annex B cable
downstream modulation 256qam cable downstream
interleave-depth 32 no cable downstream rf-shutdown
cable downstream frequency 453000000 !--- This is the DS
frequency, which used to be informational only when you
are using !--- an external UPx. This must be set when
using the MC28U cards with internal UPxs. cable upstream
0 frequency 24000000 !--- If you are doing dense mode
combining, the US frequencies must be different. !--- If
no two US ports are shared, the same frequency can be
used. cable upstream 0 ingress-noise-cancellation 200
cable upstream 0 power-level 0 cable upstream 0 channel-
width 3200000 3200000 cable upstream 0 minislots-size 4
cable upstream 0 fragment-force 3500 3 cable upstream 0
range-backoff 2 6 cable upstream 0 data-backoff 3 5
cable upstream 0 modulation-profile 42 no cable upstream
0 shutdown cable dhcp-giaddr policy !--- This tells the
CMs to get an IP address from the primary scope, and it
tells the !--- CPE to use the secondary scope. hccp 1
working 1 !--- This is the Working first group, member
1. hccp 1 channel-switch 1 rfs1a rfs1a-switch-group
192.168.1.5 44440400 1 !--- This is the IP address of
the Switch, and it is protecting member 1 in the !---
left side of Switch slot 1. hccp 1 track FastEthernet0/1
!--- Tracking is enabled for the egress port, in the
event that the WAN-backhaul is !--- disrupted. This
cable interface will failover to the Protect. hccp 1
reverttime 120 !--- This is the time in minutes (plus a
2 minute suspend) for the card to switch back !--- to
normal mode, if the fault has cleared. If there is a
fault on the Protect card, !--- then it will revert back
after the suspend time, and it will not wait for the
full !--- revert time. ! interface Cable3/1 hccp 2
working 1 hccp 2 channel-switch 1 rfs1a rfs1a-switch-group
192.168.1.5 11110100 1 !--- This is the IP address of
the Switch, and it is protecting member 1 in the !---
right side of Switch slot 1. hccp 2 reverttime 120 !
interface Cable4/0 hccp 3 working 1 hccp 3 channel-
switch 1 rfs1b rfs1b-switch-group 192.168.1.5 88880800 1 !-
-- This is the IP address of the Switch, and it is
protecting member 1 in the !--- left side of Switch slot
5. Because the RF Switch is in 4+1 mode, slot 5 is !---
```

```

considered to be slot 1 again. hccp 3 reverttime 120 !
interface Cable 4/1 hccp 4 working 1 hccp 4 channel-
switch 1 rfswl b rfs w i t c h - g r o u p 1 9 2 . 1 6 8 . 1 . 5 2 2 2 2 0 2 0 0 1 ! -
-- This is the IP address of the Switch, and it is
protecting member 1 in the !--- right side of Switch
slot 5. Because the RF Switch is in 4+1 mode, slot 5 is
!--- considered to be slot 1 again. hccp 4 reverttime
120 ! interface Cable5/0 hccp 5 working 1 hccp 5
channel-switch 1 rfs w 2 a r f s w i t c h - g r o u p 1 9 2 . 1 6 8 . 1 . 6
44440400 1 hccp 5 reverttime 120 ! interface Cable 5/1
hccp 6 working 1 hccp 6 channel-switch 1 rfs w 2 a
r f s w i t c h - g r o u p 1 9 2 . 1 6 8 . 1 . 6 1 1 1 1 0 1 0 0 1 hccp 6 reverttime
120 ! interface Cable 6/0 hccp 7 working 1 hccp 7
channel-switch 1 rfs w 2 b r f s w i t c h - g r o u p 1 9 2 . 1 6 8 . 1 . 6
88880800 1 hccp 7 reverttime 120 ! interface Cable 6/1
hccp 8 working 1 hccp 8 channel-switch 1 rfs w 2 b
r f s w i t c h - g r o u p 1 9 2 . 1 6 8 . 1 . 6 2 2 2 2 0 2 0 0 1 hccp 8 reverttime
120 ! router eigrp 2500 network 10.11.12.0 0.0.0.255
network 192.168.1.0 network 192.168.3.0 no auto-summary
no eigrp log-neighbor-changes !--- Open Shortest Path
First (OSPF) may be the best routing protocol, with its
new !--- fast-hellos. ip classless ip route 0.0.0.0
0.0.0.0 192.168.1.254 ip route 192.168.1.0 255.255.255.0
FastEthernet0/0 ip route 192.168.2.0 255.255.255.0
FastEthernet0/1 no ip http server ! cdp run ! snmp-
server community private RW !--- This does not affect
the HCCP communications between the Switch and the VXR,
but !--- it must be set to Private on the RF Switch.
snmp-server community public RO snmp-server enable traps
tty snmp-server manager tftp-server disk0: tftp-server
disk1: tftp-server disk1:rfs w 2 5 0 - f l - 1 9 3 5 0 3 0 e t f t p - s e r v e r
disk1:rfs w 2 5 0 - b f - 1 9 3 5 0 2 2 d a l i a s e x e c s h b s h o w h c c p b r i e f
alias exec shd show hccp detail alias exec scm show
cable modem alias exec scr show cable modem remote alias
exec sm show cab modu alias exec sch show cab hop alias
exec sc300 show cont c3/0 u0 alias exec sint300 show int
c3/0 u0 alias exec scs show cable spec

```

## Protégez les configurations VXR

```

version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname "ProtectVXR"
!
boot system disk0:ubr7200-ik8s-mz.BC.28July03
no logging console
enable secret 5 $1$5YHG$mquxabcqzFoUUKhp/c9WT4/
!
cab modem remote-query 10 public
cable modulation-profile 41 request 0 16 0 8 qpsk
scrambler 152 no-diff 64 fixed
cable modulation-profile 41 initial 5 34 0 48 qpsk
scrambler 152 no-diff 128 fixed
cable modulation-profile 41 station 5 34 0 48 qpsk
scrambler 152 no-diff 128 fixed
cable modulation-profile 41 short 3 78 35 25 qpsk
scrambler 152 no-diff 100 short
cable modulation-profile 41 long 9 232 0 137 qpsk
scrambler 152 no-diff 80 short
cable modulation-profile 42 request 0 16 0 8 qpsk
scrambler 152 no-diff 64 fixed
cable modulation-profile 42 initial 5 34 0 48 qpsk

```

```
scrambler 152 no-diff 128 fixed
cable modulation-profile 42 station 5 34 0 48 qpsk
scrambler 152 no-diff 128 fixed
cable modulation-profile 42 short 3 78 17 10 16qam
scrambler 152 no-diff 136 short
cable modulation-profile 42 long 9 232 0 77 16qam
scrambler 152 no-diff 216 short
  !--- Be sure to pre-configure all global configurations
  on the Protect, such as !--- modulation profiles,
  spectrum groups, load balancing, and so forth. no cable
  qos permission create no cable qos permission update
  cable qos permission modems no cable clock source-
  midplane no cable clock force primary no cable clock
  force secondary ! cable config-file docsis.cm frequency
  453000000 service-class 1 max-upstream 10000 service-
  class 1 max-downstream 10000 service-class 1 max-burst
  1522 ! ip subnet-zero ip cef ! ip name-server
  171.68.226.120 ! ip dhcp pool MODEMS1 network
  192.168.3.0 255.255.255.0 bootfile docsis.cm next-server
  192.168.3.5 default-router 192.168.3.5 option 7 ip
  192.168.3.5 option 4 ip 192.168.3.5 option 2 hex
  0000.0000 lease 2 3 4 ! ip dhcp pool PC network
  10.11.12.0 255.255.255.0 default-router 10.11.12.1 dns-
  server 171.68.226.120 lease 10 1 11 ! packetcable
  element_id 35417 ! interface FastEthernet0/0 ip address
  192.168.1.11 255.255.255.0 no keepalive speed auto full-
  duplex no cdp enable !--- This interface is used for
  HCCP traffic. ! interface FastEthernet0/1 ip address
  192.168.2.11 255.255.255.0 keepalive 1 speed auto full-
  duplex no cdp enable ! interface Cable3/0 no ip address
  !--- There is no need to set the IP address, because it
  will come from the Working card !--- via SNMP. no
  keepalive !--- This defaults to 10 seconds with the N+1
  Cisco IOS code, but it is recommended that !--- you
  disable it on the Protect interface or set it to a
  relatively high value. cable downstream annex B cable
  downstream modulation 64qam cable downstream interleave-
  depth 32 !--- The DS modulation, annex mode, and
  interleave must be pre-configured and must be !--- the
  same on the Protect and on the Working of the same
  group. no shut !--- The interface must be activated to
  start HCCP functionality. Do this last. cable upstream 0
  shutdown !--- This will automatically become "no shut"
  when a failover occurs. hccp 1 protect 1 192.168.1.7 !---
  - This is the Protect for the first group. Remember to
  configure the Protect !--- interface(s) last, after the
  Working interfaces are configured. This is the HCCP !---
  first group, and it is protecting member 1 with member
  1's FE IP address. hccp 1 channel-switch 1 rfsvla
  rfswitch-group 192.168.1.5 44440400 1 !--- This is the
  IP address of the Switch, and it is protecting member 1,
  which has a !--- bitmap of 44440400 in Switch slot 1.
  hccp 1 protect 2 192.168.1.8 !--- This is the HCCP first
  group, and it is protecting member 2 with its IP
  address. hccp 1 channel-switch 2 rfsvla rfswitch-group
  192.168.1.5 44440400 2 hccp 1 protect 3 192.168.1.9 hccp
  1 channel-switch 3 rfsvla rfswitch-group 192.168.1.5
  44440400 3 hccp 1 protect 4 192.168.1.10 hccp 1 channel-
  switch 4 rfsvla rfswitch-group 192.168.1.5 44440400 4
  hccp 1 timers 666 2000 !--- hccp 1 timers <hellotime>
  <holdtime> !--- This is for inter-chassis communication.
  ! interface Cable3/1 hccp 2 protect 1 192.168.1.7 hccp 2
  channel-switch 1 rfsvla rfswitch-group 192.168.1.5
  11110100 1 hccp 2 protect 2 192.168.1.8 hccp 2 channel-
```

```
switch 2 rfwsla rfswitch-group 192.168.1.5 11110100 2
hccp 2 protect 3 192.168.1.9 hccp 2 channel-switch 3
rfwsla rfswitch-group 192.168.1.5 11110100 3 hccp 2
protect 4 192.168.1.10 hccp 2 channel-switch 4 rfwsla
rfswitch-group 192.168.1.5 11110100 4 hccp 2 timers 666
2000 ! interface Cable4/0 hccp 3 protect 1 192.168.1.7
hccp 3 channel-switch 1 rfwslb rfswitch-group
192.168.1.5 88880800 1 hccp 3 protect 2 192.168.1.8 hccp
3 channel-switch 2 rfwslb rfswitch-group 192.168.1.5
88880800 2 hccp 3 protect 3 192.168.1.9 hccp 3 channel-
switch 3 rfwslb rfswitch-group 192.168.1.5 88880800 3
hccp 3 protect 4 192.168.1.10 hccp 3 channel-switch 4
rfwslb rfswitch-group 192.168.1.5 88880800 4 hccp 3
timers 666 2000 ! interface Cable4/1 hccp 4 protect 1
192.168.1.7 hccp 4 channel-switch 1 rfwslb rfswitch-
group 192.168.1.5 22220200 1 hccp 4 protect 2
192.168.1.8 hccp 4 channel-switch 2 rfwslb rfswitch-
group 192.168.1.5 22220200 2 hccp 4 protect 3
192.168.1.9 hccp 4 channel-switch 3 rfwslb rfswitch-
group 192.168.1.5 22220200 3 hccp 4 protect 4
192.168.1.10 hccp 4 channel-switch 4 rfwslb rfswitch-
group 192.168.1.5 22220200 4 hccp 4 timers 666 2000 !
interface Cable5/0 hccp 5 protect 1 192.168.1.7 hccp 5
channel-switch 1 rfw2a rfswitch-group 192.168.1.6
44440400 1 hccp 5 protect 2 192.168.1.8 hccp 5 channel-
switch 2 rfw2a rfswitch-group 192.168.1.6 44440400 2
hccp 5 protect 3 192.168.1.9 hccp 5 channel-switch 3
rfw2a rfswitch-group 192.168.1.6 44440400 3 hccp 5
protect 4 192.168.1.10 hccp 5 channel-switch 4 rfw2a
rfswitch-group 192.168.1.6 44440400 4 hccp 5 timers 666
2000 ! interface Cable5/1 hccp 6 protect 1 192.168.1.7
hccp 6 channel-switch 1 rfw2a rfswitch-group
192.168.1.6 11110100 1 hccp 6 protect 2 192.168.1.8 hccp
6 channel-switch 2 rfw2a rfswitch-group 192.168.1.6
11110100 2 hccp 6 protect 3 192.168.1.9 hccp 6 channel-
switch 3 rfw2a rfswitch-group 192.168.1.6 11110100 3
hccp 6 protect 4 192.168.1.10 hccp 6 channel-switch 4
rfw2a rfswitch-group 192.168.1.6 11110100 4 hccp 6
timers 666 2000 ! interface Cable6/0 hccp 7 protect 1
192.168.1.7 hccp 7 channel-switch 1 rfw2b rfswitch-
group 192.168.1.6 88880800 1 hccp 7 protect 2
192.168.1.8 hccp 7 channel-switch 2 rfw2b rfswitch-
group 192.168.1.6 88880800 2 hccp 7 protect 3
192.168.1.9 hccp 7 channel-switch 3 rfw2b rfswitch-
group 192.168.1.6 88880800 3 hccp 7 protect 4
192.168.1.10 hccp 7 channel-switch 4 rfw2b rfswitch-
group 192.168.1.6 88880800 4 hccp 7 timers 666 2000 !
interface Cable6/1 hccp 8 protect 1 192.168.1.7 hccp 8
channel-switch 1 rfw2b rfswitch-group 192.168.1.6
22220200 1 hccp 8 protect 2 192.168.1.8 hccp 8 channel-
switch 2 rfw2b rfswitch-group 192.168.1.6 22220200 2
hccp 8 protect 3 192.168.1.9 hccp 8 channel-switch 3
rfw2b rfswitch-group 192.168.1.6 22220200 3 hccp 8
protect 4 192.168.1.10 hccp 8 channel-switch 4 rfw2b
rfswitch-group 192.168.1.6 22220200 4 hccp 8 timers 666
2000 ! router eigrp 2500 network 10.11.12.0 0.0.0.255
network 10.11.13.0 0.0.0.255 network 192.168.1.0 network
192.168.3.0 network 192.168.5.0 no auto-summary no eigrp
log-neighbor-changes !--- OSPF may be the best routing
protocol, with its new fast-hellos. ! ip classless ip
route 0.0.0.0 0.0.0.0 192.168.1.254 ip route 192.168.1.0
255.255.255.0 FastEthernet0/0 ip route 192.168.2.0
255.255.255.0 FastEthernet0/1 no ip http server ! cdp
run ! snmp-server community private RW snmp-server
```

```
community public RO snmp-server enable traps tty snmp-
server enable traps cable snmp-server manager alias exec
shb show hccp brief alias exec shd show hccp detail
alias exec scm show cable modem alias exec scr show
cable modem remote
```

## Scénario 3

configuration d'échantillon uBR10K N+1 avec des linecards MC28C.

Figure 2 – Belden 1855A (coaxial mini-RG-59) avec f ou connecteurs BNC

### configuration uBR10k

```
uBR10012-1# show run Current configuration : 8567 bytes
! version 12.2 no parser cache no service single-slot-
reload-enable no service pad service timestamps debug
uptime service timestamps log uptime no service
password-encryption ! hostname uBR10k ! boot system
flash slot0: ubr10k-k8p6-mz.122-4.BClb logging rate-
limit console all 10 except critical enable secret 5
$1$.Dvy$fcPOhshUNjyfePH73FHRG. ! no cable qos permission
create no cable qos permission update cable qos
permission modems cable time-server ! cable config-file
docsis.cm frequency 453000000 service-class 1 max-
upstream 10000 service-class 1 max-downstream 10000
service-class 1 max-burst 1522 ! redundancy main-cpu
auto-sync standard facility-alarm intake-temperature
major 49 facility-alarm intake-temperature minor 40
facility-alarm core-temperature major 53 facility-alarm
core-temperature minor 45 card 1/0 lgigetherne-1 card
1/1 2cable-tccplus card 2/0 lgigetherne-1 card 2/1
2cable-tccplus card 5/0 2cable-mc28c card 5/1 2cable-
mc28c card 6/0 2cable-mc28c card 6/1 2cable-mc28c card
7/0 2cable-mc28c card 7/1 2cable-mc28c card 8/0 2cable-
mc28c card 8/1 2cable-mc28c ip subnet-zero ip host
rfs witch 2001 10.10.10.1 !--- This is set for console
access from the 10K to the Switch. The IP address is for
!--- Loopback0. ip dhcp pool MODEMS1 network 172.25.1.0
255.255.255.0 bootfile docsis.cm next-server 172.25.1.1
default-router 172.25.1.1 option 7 ip 172.25.1.1 option
4 ip 172.25.1.1 option 2 hex 0000.0000 lease 2 3 4 ! ip
dhcp pool MODEMS2 network 172.25.2.0 255.255.255.0
bootfile docsis.cm next-server 172.25.2.1 default-router
172.25.2.1 option 7 ip 172.25.2.1 option 4 ip 172.25.2.1
option 2 hex 0000.0000 lease 2 3 4 ! ip dhcp-client
network-discovery informs 2 discovers 2 period 15 !---
An internal DHCP server was used for testing, instead of
external servers (cable !--- helper, Time-of-Day [ToD],
TFTP, and so forth). External servers are recommended !-
-- in a "real" production network. ! interface Loopback0
ip address 10.10.10.1 255.255.255.252 ! interface
FastEthernet0/0/0 ip address 10.97.1.8 255.255.255.0 ip
rip receive version 2 no ip split-horizon no keepalive !
interface GigabitEthernet1/0/0 no ip address negotiation
auto ! interface GigabitEthernet2/0/0 no ip address
negotiation auto ! interface Cable5/1/0 !--- This is the
Protect for the first group. Remember to configure the
Protect !--- interface(s) last, after the Working
interfaces are configured. no ip address !--- There is
no need to set the IP address because it will come from
the Working card !--- via SNMP. no keepalive !--- This
```

```
defaults to 10 seconds with the N+1 Cisco IOS code, but
it is recommended !--- that you disable it on the
Protect interface or set it to a relatively high value.
cable downstream annex B cable downstream modulation
64qam cable downstream interleave-depth 32 !--- The DS
modulation, annex mode, and interleave must be same on
the Protect and on !--- the Working of the same group.
cable upstream 0 shutdown !--- This will automatically
become "no shut" when a failover occurs. cable upstream
1 shutdown cable upstream 2 shutdown cable upstream 3
shutdown cable dhcp-giaddr policy hccp 1 protect 1
10.10.10.1 !--- This is the HCCP first group, and it is
protecting member 1 with member 1's FE IP !--- address.
If it is intra-chassis, you can use the Loopback0 IP
address. hccp 1 channel-switch 1 uc wavecom-hd
10.97.1.21 2 10.97.1.21 16 !--- This is the IP address
of the upconverter, and it is module 2 (B) that is
backing !--- module 16 (P) of the upconverter. This
shows that one upconverter could have a !--- module that
backs up a module in a different chassis with a
different IP address, !--- if need be. If this statement
is not present when you are using Cisco IOS Software !--
- Release 15(BC2) or later, then IF-Muting is assumed,
and an external upconverter !--- with SNMP capability is
not needed. hccp 1 channel-switch 1 rfswitch rfswitch-
group 10.97.1.20 AA200000 1 !--- This is the IP address
of the Switch, and it is protecting member 1, which has
a !--- bitmap of AA200000 in Switch slot 1. hccp 1
protect 2 10.10.10.1 !--- This is the HCCP first group,
and it is protecting member 2 with its IP address. hccp
1 channel-switch 2 uc wavecom-hd 10.97.1.21 2 10.97.1.21
14 !--- This is the IP address of the upconverter, and
it is module 2 (B) that is backing !--- module 14 (N).
hccp 1 channel-switch 2 rfswitch rfswitch-group
10.97.1.20 AA200000 2 !--- This is the IP address of the
Switch, and it is protecting member 2, with a bitmap !--
- of AA200000 in Switch slot 2. hccp 1 protect 3
10.10.10.1 hccp 1 channel-switch 3 uc wavecom-hd
10.97.1.21 2 10.97.1.21 12 hccp 1 channel-switch 3
rfswitch rfswitch-group 10.97.1.20 AA200000 3 hccp 1
protect 4 10.10.10.1 hccp 1 channel-switch 4 uc wavecom-
hd 10.97.1.21 2 10.97.1.21 10 hccp 1 channel-switch 4
rfswitch rfswitch-group 10.97.1.20 AA200000 4 hccp 1
protect 5 10.10.10.1 hccp 1 channel-switch 5 uc wavecom-
hd 10.97.1.21 2 10.97.1.21 8 hccp 1 channel-switch 5
rfswitch rfswitch-group 10.97.1.20 AA200000 5 hccp 1
protect 6 10.10.10.1 hccp 1 channel-switch 6 uc wavecom-
hd 10.97.1.21 2 10.97.1.21 6 hccp 1 channel-switch 6
rfswitch rfswitch-group 10.97.1.20 AA200000 6 hccp 1
protect 7 10.10.10.1 hccp 1 channel-switch 7 uc wavecom-
hd 10.97.1.21 2 10.97.1.21 4 hccp 1 channel-switch 7
rfswitch rfswitch-group 10.97.1.20 AA200000 7 hccp 1
timers 5000 15000 !--- hccp 1 timers <hellotime>
<holdtime> !--- This is for inter-chassis communication,
so set high for the 10K. ! interface Cable5/1/1 !---
This is the Protect for the second group. no ip address
no keepalive cable downstream annex B cable downstream
modulation 64qam cable downstream interleave-depth 32
cable upstream 0 shutdown cable upstream 1 shutdown
cable upstream 2 shutdown cable upstream 3 shutdown
cable dhcp-giaddr policy ! hccp 2 protect 1 10.10.10.1
hccp 2 channel-switch 1 uc wavecom-hd 10.97.1.21 1
10.97.1.21 15 hccp 2 channel-switch 1 rfswitch rfswitch-
group 10.97.1.20 55100000 1 !--- Because this MAC domain
```

```
is on right side of header, the bitmap in hexadecimal
code !--- is 55100000. hccp 2 protect 2 10.10.10.1 hccp
2 channel-switch 2 uc wavecom-hd 10.97.1.21 1 10.97.1.21
13 hccp 2 channel-switch 2 rfswitch rfswitch-group
10.97.1.20 55100000 2 hccp 2 protect 3 10.10.10.1 hccp 2
channel-switch 3 uc wavecom-hd 10.97.1.21 1 10.97.1.21
11 hccp 2 channel-switch 3 rfswitch rfswitch-group
10.97.1.20 55100000 3 hccp 2 protect 4 10.10.10.1 hccp 2
channel-switch 4 uc wavecom-hd 10.97.1.21 1 10.97.1.21 9
hccp 2 channel-switch 4 rfswitch rfswitch-group
10.97.1.20 55100000 4 hccp 2 protect 5 10.10.10.1 hccp 2
channel-switch 5 uc wavecom-hd 10.97.1.21 1 10.97.1.21 7
hccp 2 channel-switch 5 rfswitch rfswitch-group
10.97.1.20 55100000 5 hccp 2 protect 6 10.10.10.1 hccp 2
channel-switch 6 uc wavecom-hd 10.97.1.21 1 10.97.1.21 5
hccp 2 channel-switch 6 rfswitch rfswitch- group
10.97.1.20 55100000 6 hccp 2 protect 7 10.10.10.1 hccp 2
channel-switch 7 uc wavecom-hd 10.97.1.21 1 10.97.1.21 3
hccp 2 channel-switch 7 rfswitch rfswitch-group
10.97.1.20 55100000 7 hccp 2 timers 5000 15000 !
interface Cable8/1/0 !--- This is the Working for the
first group. ip address 10.192.5.1 255.255.255.0
secondary ip address 172.25.1.1 255.255.255.0 !---
Interface bundling is supported, as are subinterfaces.
ip rip send version 2 ip rip receive version 2 keepalive
1 !--- The keepalive time is in seconds, and the default
is 10 seconds for HCCP code. cable downstream annex B
cable downstream modulation 64qam cable downstream
interleave-depth 32 cable downstream frequency 453000000
!--- This is the DS frequency, which used to be
informational only when you are using !--- an external
upconverter. This must be set when doing N+1, so the
Protect !--- upconverter knows what frequency to use.
cable upstream 0 frequency 24000000 !--- If you are
doing dense mode combining, the US frequencies must be
different. !--- If no two US ports are shared, the same
frequency can be used. cable upstream 0 power-level 0 no
cable upstream 0 shutdown cable upstream 1 power-level 0
cable upstream 1 shutdown cable upstream 2 power-level 0
cable upstream 2 shutdown cable upstream 3 power-level 0
cable upstream 3 shutdown cable dhcp-giaddr policy !---
This tells the CMs to get an IP address from the primary
scope, and it tells the !--- CPE to use the secondary
scope. hccp 1 working 1 !--- This is Working member 1 of
HCCP Group 1. hccp 1 channel-switch 1 uc wavecom-hd
10.97.1.21 2 10.97.1.21 16 !--- This is the IP address
of the upconverter, and it is module 2 (B) that is
backing !--- module 16 (P). hccp 1 channel-switch 1
rfswitch rfswitch-group 10.97.1.20 AA200000 1 !--- This
is the IP address of the Switch and of member 1, which
has a bitmap of !--- AA200000 in Switch slot 1. hccp 1
reverttime 120 !--- This is the time in minutes (plus a
2 minute suspend) for the card to switch back !--- to
normal mode, if the fault has cleared. If a fault is
initiated by a keepalive !--- and you have a fault on
the Protect card, then it will revert back after the !---
- suspend time, and it will not wait for the full revert
time. ! interface Cable8/1/1 !--- This is the Working
interface for the second HCCP group. ip address
10.192.5.1 255.255.255.0 secondary ip address 172.25.2.1
255.255.255.0 ip rip send version 2 ip rip receive
version 2 keepalive 1 cable downstream annex B cable
downstream modulation 64qam cable downstream interleave-
depth 32 cable downstream frequency 453000000 cable
```

```

upstream 0 frequency 24000000 cable upstream 0 power-
level 0 no cable upstream 0 shutdown cable upstream 1
power-level 0 cable upstream 1 shutdown cable upstream 2
power-level 0 cable upstream 2 shutdown cable upstream 3
power-level 0 cable upstream 3 shutdown cable dhcp-
giaddr policy hccp 2 working 1 !--- This is Working
member 1 of HCCP Group 2. hccp 2 channel-switch 1 uc
wavecom-hd 10.97.1.21 1 10.97.1.21 15 hccp 2 channel-
switch 1 rfswitch rfswitch-group 10.97.1.20 55100000 1
!--- This is the IP address of the Switch and of member
1 of Group 2, which has a !--- bitmap of 55100000 in
Switch slot 1. hccp 2 reverttime 120 ! ip classless no
ip http server ! no cdp run snmp-server community
private RW !--- This does not affect the HCCP
communications between the upconverter, the Switch, !---
and the 10K. snmp-server enable traps cable no cdp run
snmp-server manager tftp-server server tftp-server
ios.cf alias ios.cf ! line con 0 logging synchronous
line aux 0 no exec transport input all !--- The previous
three lines are used to console from the Auxiliary port
of the 10K to !--- the Switch. line vty 0 4 session-
timeout 400 password xx login endBuilding
configuration...

```

## Scénario 4

Configuration d'échantillon pour les linecards 5x20 en mode 8+1.

Figure 3 – Coaxial de Belden mini-RG-59 avec MCX des connecteurs

```

configuration uBR10k
uBR10012-1# show run Current configuration : 8567 bytes
! version 12.2 no parser cache no service single-slot-
reload-enable no service pad service timestamps debug
uptime service timestamps log uptime no service
password-encryption ! hostname uBR10k ! boot system
flash slot0: ubr10k-k8p6-mz.122-15.BC1 logging rate-
limit console all 10 except critical enable secret 5
$1$.Dvy$fcPOhshUNjyfePH73FHRG cable modulation-profile
21 request 0 16 0 22 qpsk scrambler 152 no-diff 32 fixed
cable modulation-profile 21 initial 5 34 0 48 qpsk
scrambler 152 no-diff 64 fixed cable modulation-profile
21 station 5 34 0 48 qpsk scrambler 152 no-diff 64 fixed
cable modulation-profile 21 short 3 76 12 22 qpsk
scrambler 152 no-diff 64 shortened cable modulation-
profile 21 long 7 231 0 22 qpsk scrambler 152 no-diff 64
shortened !--- Advanced time division multiplex access
(ATDMA) Cisco IOS has different !--- modulation profiles
and requirements. ! no cable qos permission create no
cable qos permission update cable qos permission modems
cable time-server ! cable config-file docsis.cm
frequency 453000000 service-class 1 max-upstream 10000
service-class 1 max-downstream 10000 service-class 1
max-burst 1522 ! redundancy main-cpu auto-sync standard
facility-alarm intake-temperature major 49 facility-
alarm intake-temperature minor 40 facility-alarm core-
temperature major 53 facility-alarm core-temperature
minor 45 card 1/0 lgigetherne-1 card 1/1 2cable-tccplus
card 2/0 lgigetherne-1 card 2/1 2cable-tccplus card 5/0
5cable-mc520s-d card 5/1 5cable-mc520s-d card 6/0
5cable-mc520s-d card 6/1 5cable-mc520s-d card 7/0

```



```
5cable-mc520s-d card 7/1 5cable-mc520s-d card 8/0
5cable-mc520s-d card 8/1 5cable-mc520s-d ip subnet-zero
ip host rfs witch 2001 10.10.10.1 !--- This is set for
console access from the 10K to the Switch. The IP
address is for !--- Loopback0. ip dhcp pool MODEMS1
network 172.25.1.0 255.255.255.0 bootfile docsis.cm
next-server 172.25.1.1 default-router 172.25.1.1 option
7 ip 172.25.1.1 option 4 ip 172.25.1.1 option 2 hex
0000.0000 lease 2 3 4 ! ip dhcp pool MODEMS2 network
172.25.2.0 255.255.255.0 bootfile docsis.cm next-server
172.25.2.1 default-router 172.25.2.1 option 7 ip
172.25.2.1 option 4 ip 172.25.2.1 option 2 hex 0000.0000
lease 2 3 4 ! ip dhcp-client network-discovery informs 2
discovers 2 period 15 !--- An internal DHCP server was
used for testing instead of external servers (cable !---
helper, ToD, TFTP, and so forth). External servers are
recommended in a "real" !--- production network. !
interface Loopback0 ip address 10.10.10.1
255.255.255.252 ! interface FastEthernet0/0/0 ip address
10.97.1.8 255.255.255.0 ip rip receive version 2 no ip
split-horizon no keepalive ! interface
GigabitEthernet1/0/0 no ip address negotiation auto !
interface GigabitEthernet2/0/0 no ip address negotiation
auto !--- This assumes rfs w2 is on the top, as shown in
the cable reference guide. Other !--- interfaces will be
the same, except they will have a different member
number !--- for each HCCP group. interface Cable5/1/0 !-
- This is the Protect for the first group. It may be
best to configure the Protect !--- interface(s) last,
after the Working interfaces are configured, or keep the
!--- interface "shut" until you are finished with all
configurations. no ip address !--- There is no need to
set the IP address, because it will come from the
Working card !--- via SNMP. no keepalive !--- This
defaults to 10 seconds with the N+1 Cisco IOS code, but
it is recommended !--- that you disable it on the
Protect interface or set it to a relatively high value.
cable downstream annex B cable downstream modulation
64qam cable downstream interleave-depth 32 !--- The DS
modulation and interleave must be the same on the
Protect and on the !--- Working of the same group. The
Protect interface itself must be "no shut" for !--- HCCP
to activate. cable downstream rf-shutdown cable upstream
0 shutdown !--- These will automatically become "no
shut" when a failover occurs. cable upstream 1 shutdown
cable upstream 2 shutdown cable upstream 3 shutdown hccp
1 protect 1 10.10.10.1 !--- This is the HCCP first
group, and it is protecting member 1 with member 1's FE
IP !--- address. If it is intra-chassis, you can use the
Loopback0 IP address. hccp 1 channel-switch 1 rfs w2
rfs witch-group 10.97.1.20 AA200000 1 !--- This is the IP
address of the Switch, and it is protecting member 1,
which has a !--- bitmap of AA200000 in Switch slot 1.
hccp 1 protect 2 10.10.10.1 !--- This is the HCCP first
group, and it is protecting member 2 with the loopback
IP !--- address. hccp 1 channel-switch 2 rfs w2 rfs witch-
group 10.97.1.20 AA200000 2 !--- This is the IP address
of the Switch, and it is protecting member 2, with a
bitmap !--- of AA200000 in Switch slot 2. hccp 1 protect
3 10.10.10.1 hccp 1 channel-switch 3 rfs w2 rfs witch-
group 10.97.1.20 AA200000 3 hccp 1 protect 4 10.10.10.1
hccp 1 channel-switch 4 rfs w2 rfs witch-group 10.97.1.20
AA200000 4 hccp 1 protect 5 10.10.10.1 hccp 1 channel-
switch 5 rfs w2 rfs witch-group 10.97.1.20 AA200000 5 hccp
```

```
1 protect 6 10.10.10.1 hccp 1 channel-switch 6 rfs2
rfs2switch-group 10.97.1.20 AA200000 6 hccp 1 protect 7
10.10.10.1 hccp 1 channel-switch 7 rfs2 rfs2switch-group
10.97.1.20 AA200000 7 !--- These channel-switch
configurations can be copied and pasted into their
respective !--- Working interfaces. hccp 1 timers 5000
15000 !--- hccp 1 timers <hellotime> <holdtime> !---
This is mostly for inter-chassis communication, so set
it high for the 10K, as !--- this can create extra CPU
load. no hccp 1 revertive ! interface Cable5/1/1 !---
This is the Protect for the second group. no ip address
no keepalive cable downstream annex B cable downstream
modulation 64qam cable downstream interleave-depth 32
cable downstream rf-shutdown cable upstream 0 shutdown
cable upstream 1 shutdown cable upstream 2 shutdown
cable upstream 3 shutdown ! hccp 2 protect 1 10.10.10.1
hccp 2 channel-switch 1 rfs2 rfs2switch-group 10.97.1.20
55100000 1 !--- Because this MAC domain is on right side
of header, the bitmap in hexadecimal code !--- is
55100000. hccp 2 protect 2 10.10.10.1 hccp 2 channel-
switch 2 rfs2 rfs2switch-group 10.97.1.20 55100000 2 hccp
2 protect 3 10.10.10.1 hccp 2 channel-switch 3 rfs2
rfs2switch-group 10.97.1.20 55100000 3 hccp 2 protect 4
10.10.10.1 hccp 2 channel-switch 4 rfs2 rfs2switch-group
10.97.1.20 55100000 4 hccp 2 protect 5 10.10.10.1 hccp 2
channel-switch 5 rfs2 rfs2switch-group 10.97.1.20
55100000 5 hccp 2 protect 6 10.10.10.1 hccp 2 channel-
switch 6 rfs2 rfs2switch-group 10.97.1.20 55100000 6 hccp
2 protect 7 10.10.10.1 hccp 2 channel-switch 7 rfs2
rfs2switch-group 10.97.1.20 55100000 7 hccp 2 timers 5000
15000 no hccp 2 revertive ! interface Cable5/1/2 !---
This is the Protect for the third group. no ip address
no keepalive cable downstream annex B cable downstream
modulation 64qam cable downstream interleave-depth 32
cable downstream rf-shutdown cable upstream 0 shutdown
cable upstream 1 shutdown cable upstream 2 shutdown
cable upstream 3 shutdown hccp 3 protect 1 10.10.10.1
hccp 3 channel-switch 1 rfs1 rfs2switch-group 10.97.1.19
00C80000 1 hccp 3 channel-switch 1 rfs2 rfs2switch-group
10.97.1.20 00C00000 1 !--- Because the third MAC domain
will traverse both Switches, two statements are !---
needed. The 00 in front of the bitmaps will be dropped,
when the running !--- configuration is viewed. no hccp 3
revertive ! interface Cable5/1/3 !--- This is the
Protect for the fourth group. hccp 4 protect 1
10.10.10.1 hccp 4 channel-switch 1 rfs1 rfs2switch-group
10.97.1.19 AA200000 1 hccp 4 protect 2 10.10.10.1 hccp 4
channel-switch 2 rfs1 rfs2switch-group 10.97.1.19
AA200000 2 hccp 4 protect 3 10.10.10.1 hccp 4 channel-
switch 3 rfs1 rfs2switch-group 10.97.1.19 AA200000 3 hccp
4 protect 4 10.10.10.1 hccp 4 channel-switch 4 rfs1
rfs2switch-group 10.97.1.19 AA200000 4 hccp 4 protect 5
10.10.10.1 hccp 4 channel-switch 5 rfs1 rfs2switch-group
10.97.1.19 AA200000 5 hccp 4 protect 6 10.10.10.1 hccp 4
channel-switch 6 rfs1 rfs2switch-group 10.97.1.19
AA200000 6 hccp 4 protect 7 10.10.10.1 hccp 4 channel-
switch 7 rfs1 rfs2switch-group 10.97.1.19 AA200000 7 no
hccp 4 revertive ! interface Cable5/1/4 !--- This is the
Protect for the fifth group. hccp 5 protect 1 10.10.10.1
hccp 5 channel-switch 1 rfs1 rfs2switch-group 10.97.1.19
55100000 1 hccp 5 protect 2 10.10.10.1 hccp 5 channel-
switch 2 rfs1 rfs2switch-group 10.97.1.19 55100000 2 hccp
5 protect 3 10.10.10.1 hccp 5 channel-switch 3 rfs1
rfs2switch-group 10.97.1.19 55100000 3 hccp 5 protect 4
```

```
10.10.10.1 hccp 5 channel-switch 4 rfswl rfswitch-group
10.97.1.19 55100000 4 hccp 5 protect 5 10.10.10.1 hccp 5
channel-switch 5 rfswl rfswitch-group 10.97.1.19
55100000 5 hccp 5 protect 6 10.10.10.1 hccp 5 channel-
switch 6 rfswl rfswitch-group 10.97.1.19 55100000 6 hccp
5 protect 7 10.10.10.1 hccp 5 channel-switch 7 rfswl
rfswitch-group 10.97.1.19 55100000 7 !--- Output
suppressed. ! interface Cable8/1/0 !--- This is the
Working for the first group. ip address 10.192.5.1
255.255.255.0 secondary ip address 172.25.1.1
255.255.255.0 !--- Interface bundling is supported, as
are subinterfaces. ip rip send version 2 ip rip receive
version 2 keepalive 1 !--- The keepalive time is in
seconds, and the default is 10 seconds for HCCP code. !-
-- Only set this after the modems have stabilized. cable
downstream annex B cable downstream modulation 64qam
cable downstream interleave-depth 32 cable downstream
frequency 453000000 !--- This is the DS frequency, which
must be set for the internal upconverter to !---
operate. cable downstream channel-id 0 no cable
downstream rf-shutdown !--- This is needed to turn on
the DS RF output. cable upstream 0 frequency 24000000 !-
-- If you are doing dense mode combining, the US
frequencies must be different. !--- If no two US ports
are shared, the same frequency can be used. cable
upstream 0 power-level 0 cable upstream 0 connector 0 !-
-- This is a new command for virtual interfaces, where
USs can be used for different !--- DS MAC domains. cable
upstream 0 channel-width 3200000 cable upstream 0
minislot-size 2 cable upstream 0 modulation-profile 22
no cable upstream 0 shutdown !--- Output suppressed.
cable dhcp-giaddr policy !--- This tells the the CMs to
get an IP address from the primary scope, and it tells
!--- the CPE to use the secondary scope. hccp 1 working
1 !--- This is Working member 1 of HCCP Group 1. hccp 1
channel-switch 1 rfsw2 rfswitch-group 10.97.1.20
AA200000 1 !--- This is the IP address of the Switch and
of member 1, which has a bitmap of !--- AA200000 in
Switch slot 1. hccp 1 reverttime 120 !--- This is the
time in minutes (plus a 2 minute suspend) for the card
to switch back !--- to normal mode, if the fault has
cleared. If a fault is initiated by a keepalive !--- and
you have a fault on the Protect card, then it will
revert back after the !--- suspend time, and it will not
wait for the full revert time. ! interface Cable8/1/1 !-
-- This is the Working interface for the second HCCP
group. ip address 10.192.5.1 255.255.255.0 secondary ip
address 172.25.2.1 255.255.255.0 ip rip send version 2
ip rip receive version 2 keepalive 1 cable downstream
annex B cable downstream modulation 64qam cable
downstream interleave-depth 32 cable downstream
frequency 453000000 cable downstream channel-id 1 no
cable downstream rf-shutdown cable upstream 0 frequency
24000000 cable upstream 0 power-level 0 cable upstream 0
connector 4 cable upstream 0 channel-width 3200000 cable
upstream 0 minislot-size 22 cable upstream 0 modulation-
profile 2 no cable upstream 0 shutdown !--- Output
suppressed. cable dhcp-giaddr policy hccp 2 working 1 !-
-- This is Working member 1 of HCCP Group 2. hccp 2
channel-switch 1 rfsw2 rfswitch-group 10.97.1.20
55100000 1 !--- This is the IP address of the Switch and
of member 1 of Group 2, which has a !--- bitmap of
55100000 in Switch slot 1. hccp 2 reverttime 120 !
interface Cable8/1/2 !--- This is the Working interface
```

```

for the third HCCP group. ip address 10.192.5.1
255.255.255.0 secondary ip address 172.25.3.1
255.255.255.0 ip rip send version 2 ip rip receive
version 2 keepalive 1 cable downstream annex B cable
downstream modulation 64qam cable downstream interleave-
depth 32 cable downstream frequency 453000000 cable
downstream channel-id 2 no cable downstream rf-shutdown
cable upstream 0 frequency 24000000 cable upstream 0
power-level 0 cable upstream 0 connector 8 cable
upstream 0 channel-width 3200000 cable upstream 0
minislot-size 2 cable upstream 0 modulation-profile 22
no cable upstream 0 shutdown cable dhcp-giaddr policy !-
-- Output suppressed. hccp 3 working 1 !--- This is
Working member 1 of HCCP Group 3. hccp 3 channel-switch
1 rfs1 rfs1-switch-group 10.97.1.19 00c80000 1 hccp 3
channel-switch 1 rfs2 rfs2-switch-group 10.97.1.20
00c00000 1 hccp 3 reverttime 120 ! interface Cable8/1/3
!--- This is the Working interface for the fourth HCCP
group. hccp 4 working 1 hccp 4 channel-switch 1 rfs1
rfs1-switch-group 10.97.1.19 AA200000 1 hccp 4 reverttime
120 ! interface Cable8/1/4 !--- This is the Working
interface for the fifth HCCP group. hccp 5 working 1
hccp 5 channel-switch 1 rfs1 rfs1-switch-group 10.97.1.19
55100000 1 hccp 5 reverttime 120 ! ip classless no ip
http server ! no cdp run snmp-server community private
RW !--- This does not affect the HCCP communications
between the Switch and 10K. snmp-server enable traps
cable no cdp run snmp-server manager tftp-server server
tftp-server ios.cf alias ios.cf ! alias exec t configure
terminal alias exec scm show cable modem alias exec scr
sh cab mode remote alias exec shb sh hccp br alias exec
shd sh hccp detail alias exec shc sh hccp chan ! line
con 0 logging synchronous line aux 0 no exec transport
input all !--- The three previous lines are used to
console from the Auxiliary port of the 10K !--- to the
Switch. line vty 0 4 session-timeout 400 password xx
login endBuilding configuration...

```

## Scénario 5

Configuration d'échantillon pour les linecards 5x20 en mode 4+1 avec un commutateur rf.

Figure 4 – uBR10K avec MC5x20 et 1 commutateur rf (4+1) Commutateur rf

Adresse IP	10.1.1.10	
La Communauté SNMP	Privé	
Mode de protection	4	
Bitmap	Group1	0x44440400
	Group2	0x11110100
	Group3	0x00005000
	Group4	0x0000a080
	Group5	0x88880800
	Group6	0x22220200

Figure 5 – Bitmap

La prochaine configuration d'échantillon est pour 4+1 que la Haute disponibilité pour cinq cartes

MC5x20 avec un ubr-RFSW dans les 4+1 protègent le mode. Le mode de protection affecte les bitmap du commutateur et de la configuration du système de terminaison par modem câble (CMTS). Si vous ajoutez un 5x20 supplémentaire, le sujet d'ensemble doit être changé.

Référez-vous au câblage [en câblant des Commutateurs de l'ubr 3x10 rf de Cisco aux linecards d'interface de câble de Cisco uBR10-MC5X20S/U à Cisco uBR10012 CMTS](#).

1. Prenez l'en-tête qui indique le rf Comm2 (commutateur supérieur) et le congé dans les emplacements 1, 2, 3, et 4.
2. Prenez l'en-tête qui indique le commutateur 1 rf et l'endroit dans les emplacements 5, 6, 7, et 8 du rf Comm2.
3. Prenez la protection contre le rf Comm2 et mettez-la protégé dedans 2.
4. Prenez la protection contre le commutateur 1 rf et mettez-la protégé dedans 1 du rf Comm2.
5. Une fois que vous obtenez à cinq cartes 5x20 fonctionnantes, la configuration à mémoire d'image doit être changée et les en-têtes doivent être déplacées autour, d'un commutateur rf à l'autre. Par exemple, l'en-tête de l'emplacement 5 du rf Comm2 se déplacera à l'en-tête de l'emplacement 1 du commutateur 1. rf.

La configuration est étiquetée `rfswa`, car elle concerne les emplacements 1 à 4 et leurs respectifs protégé l'emplacement, qui est protégé 2. protégé les emplacements de 1 couvertures 5 à 8 sur le commutateur rf, et c'est étiqueté `rfswb`. En mode 4+1, les emplacements de commutateur rf 5 à 8 sont considérés les emplacements 1 à 4 pour des raisons de configuration.

Substituez votre adresse IP de commutateur rf à celle qui est affichée dans l'exemple suivant (10.10.10.10).

#### Configuration en cours 4+1

```
interface c7/1/0
hccp 1 working 1
hccp 1 channel-switch 1 rfswa rfswitch-group 10.10.10.10
44440400 1
interface c7/1/1
hccp 2 working 1
hccp 2 channel-switch 1 rfswa rfswitch-group 10.10.10.10
11110100 1
interface c7/1/2
hccp 3 working 1
hccp 3 channel-switch 1 rfswa rfswitch-group 10.10.10.10
00005000 1
hccp 3 channel-switch 1 rfswb rfswitch-group 10.10.10.10
0000a080 1
!--- Prepended 0s will not show up when you execute a
show run !--- command. Do not blindly copy and paste an
interface !--- configuration. interface c7/1/3 hccp 4
working 1 hccp 4 channel-switch 1 rfswb rfswitch-group
10.10.10.10 88880800 1 interface c7/1/4 hccp 5 working 1
hccp 5 channel-switch 1 rfswb rfswitch-group 10.10.10.10
22220200 1 -----
----- interface c6/0/0 hccp 1 working 2
hccp 1 channel-switch 2 rfswa rfswitch-group 10.10.10.10
44440400 2 interface c6/0/1 hccp 2 working 2 hccp 2
channel-switch 2 rfswa rfswitch-group 10.10.10.10
11110100 2 interface c6/0/2 hccp 3 working 2 hccp 3
channel-switch 2 rfswa rfswitch-group 10.10.10.10
00005000 2 hccp 3 channel-switch 2 rfswb rfswitch-group
10.10.10.10 0000a080 2 interface c6/0/3 hccp 4 working 2
```

```

hccp 4 channel-switch 2 rfswb rfs witch-group 10.10.10.10
88880800 2 interface c6/0/4 hccp 5 working 2 hccp 5
channel-switch 2 rfswb rfs witch-group 10.10.10.10
22220200 2 -----
----- interface c6/1/0 hccp 1 working 3
hccp 1 channel-switch 3 rfs wa rfs witch-group 10.10.10.10
44440400 3 interface c6/1/1 hccp 2 working 3 hccp 2
channel-switch 3 rfs wa rfs witch-group 10.10.10.10
11110100 3 interface c6/1/2 hccp 3 working 3 hccp 3
channel-switch 3 rfs wa rfs witch-group 10.10.10.10
00005000 3 hccp 3 channel-switch 3 rfs wb rfs witch-group
10.10.10.10 0000a080 3 interface c6/1/3 hccp 4 working 3
hccp 4 channel-switch 3 rfs wb rfs witch-group 10.10.10.10
88880800 3 interface c6/1/4 hccp 5 working 3 hccp 5
channel-switch 3 rfs wb rfs witch-group 10.10.10.10
22220200 3 -----
----- interface c5/0/0 hccp 1 working 4
hccp 1 channel-switch 4 rfs wa rfs witch-group 10.10.10.10
44440400 4 interface c5/0/1 hccp 2 working 4 hccp 2
channel-switch 4 rfs wa rfs witch-group 10.10.10.10
11110100 4 interface c5/0/2 hccp 3 working 4 hccp 3
channel-switch 4 rfs wa rfs witch-group 10.10.10.10
00005000 4 hccp 3 channel-switch 4 rfs wb rfs witch-group
10.10.10.10 0000a080 4 interface c5/0/3 hccp 4 working 4
hccp 4 channel-switch 4 rfs wb rfs witch-group 10.10.10.10
88880800 4 interface c5/0/4 hccp 5 working 4 hccp 5
channel-switch 4 rfs wb rfs witch-group 10.10.10.10
22220200 4

```

## Protégez les configurations d'interface

```

interface c5/1/0
hccp 1 protect 1 10.10.10.1
hccp 1 channel-switch 1 rfs wa rfs witch-group 10.10.10.10
44440400 1
hccp 1 protect 2 10.10.10.1
hccp 1 channel-switch 2 rfs wa rfs witch-group 10.10.10.10
44440400 2
hccp 1 protect 3 10.10.10.1
hccp 1 channel-switch 3 rfs wa rfs witch-group 10.10.10.10
44440400 3
hccp 1 protect 4 10.10.10.1
hccp 1 channel-switch 4 rfs wa rfs witch-group 10.10.10.10
44440400 4
-----
-----
interface c5/1/1
hccp 2 protect 1 10.10.10.1
hccp 2 channel-switch 1 rfs wa rfs witch-group 10.10.10.10
11110100 1
hccp 2 protect 2 10.10.10.1
hccp 2 channel-switch 2 rfs wa rfs witch-group 10.10.10.10
11110100 2
hccp 2 protect 3 10.10.10.1
hccp 2 channel-switch 3 rfs wa rfs witch-group 10.10.10.10
11110100 3
hccp 2 protect 4 10.10.10.1
hccp 2 channel-switch 4 rfs wa rfs witch-group 10.10.10.10
11110100 4
-----
-----
interface c5/1/2
hccp 3 protect 1 10.10.10.1
hccp 3 channel-switch 1 rfs wa rfs witch-group 10.10.10.10
00005000 1

```

```

hccp 3 channel-switch 1 rfswb rfs switch-group 10.10.10.10
0000a080 1
hccp 3 protect 2 10.10.10.1
hccp 3 channel-switch 2 rfs wa rfs switch-group 10.10.10.10
00005000 2
hccp 3 channel-switch 2 rfs wb rfs switch-group 10.10.10.10
0000a080 2
hccp 3 protect 3 10.10.10.1
hccp 3 channel-switch 3 rfs wa rfs switch-group 10.10.10.10
00005000 3
hccp 3 channel-switch 3 rfs wb rfs switch-group 10.10.10.10
0000a080 3
hccp 3 protect 4 10.10.10.1
hccp 3 channel-switch 4 rfs wa rfs switch-group 10.10.10.10
00005000 4
hccp 3 channel-switch 4 rfs wb rfs switch-group 10.10.10.10
0000a080 4
-----
interface c5/1/3
hccp 4 protect 1 10.10.10.1
hccp 4 channel-switch 1 rfs wb rfs switch-group 10.10.10.10
88880800 1
hccp 4 protect 2 10.10.10.1
hccp 4 channel-switch 2 rfs wb rfs switch-group 10.10.10.10
88880800 2
hccp 4 protect 3 10.10.10.1
hccp 4 channel-switch 3 rfs wb rfs switch-group 10.10.10.10
88880800 3
hccp 4 protect 4 10.10.10.1
hccp 4 channel-switch 4 rfs wb rfs switch-group 10.10.10.10
88880800 4
-----
interface c5/1/4
hccp 5 protect 1 10.10.10.1
hccp 5 channel-switch 1 rfs wb rfs switch-group 10.10.10.10
22220200 1
hccp 5 protect 2 10.10.10.1
hccp 5 channel-switch 2 rfs wb rfs switch-group 10.10.10.10
22220200 2
hccp 5 protect 3 10.10.10.1
hccp 5 channel-switch 3 rfs wb rfs switch-group 10.10.10.10
22220200 3
hccp 5 protect 4 10.10.10.1
hccp 5 channel-switch 4 rfs wb rfs switch-group 10.10.10.10
22220200 4

```

Ces configurations sont pour des Basculements d'interface de MAC, mais maintiennent dans l'esprit qu'une POTENCE entière (circuit intégré spécifique à l'application [ASIC]) échouera ensemble. Le partage du DSS 0 et 1 le même ASIC, le DSS 2 et 3 partagent le même ASIC, et DS 4 est sur son propre ASIC. Si une interface n'a pas HCCP configuré, alors elle pas Basculement, même si elle partage le même ASIC.

Si vous configurez les hôtes maximum en amont de cabine X et ou connecteur y de la cabine u4, alors vous avez configuré un VI (interface virtuelle), également connu en tant que domaines configurables de MAC. Maintenant, le linecard entier Basculement comme paquet quand vous avez n'importe quelle panne d'interface. Si des commandes de connecteur sont supprimées, la seule manière d'annuler l'affect d'interface virtuelle sur des Basculements est de recharger le routeur.

## Configuration d'échantillon 8+1

```
uBR10012-1# show run Current configuration : 8567 bytes
! version 12.2 no parser cache no service single-slot-
reload-enable no service pad service timestamps debug
uptime service timestamps log uptime no service
password-encryption ! hostname uBR10k ! boot system
flash slot0: ubr10k-k8p6-mz.122-15.BC1 logging rate-
limit console all 10 except critical enable secret 5
$1$.Dvy$fcPOhshUNjyfePH73FHRG cable modulation-profile
21 request 0 16 0 22 qpsk scrambler 152 no-diff 32 fixed
cable modulation-profile 21 initial 5 34 0 48 qpsk
scrambler 152 no-diff 64 fixed cable modulation-profile
21 station 5 34 0 48 qpsk scrambler 152 no-diff 64 fixed
cable modulation-profile 21 short 3 76 12 22 qpsk
scrambler 152 no-diff 64 shortened cable modulation-
profile 21 long 9 232 0 22 qpsk scrambler 152 no-diff 64
shortened ! no cable qos permission create no cable qos
permission update cable qos permission modems cable
time-server ! cable config-file docsis.cm frequency
453000000 service-class 1 max-upstream 10000 service-
class 1 max-downstream 10000 service-class 1 max-burst
1522 ! redundancy main-cpu auto-sync standard facility-
alarm intake-temperature major 49 facility-alarm intake-
temperature minor 40 facility-alarm core-temperature
major 53 facility-alarm core-temperature minor 45 card
1/0 lgigethernet-1 card 1/1 2cable-tccplus card 2/0
lgigethernet-1 card 2/1 2cable-tccplus card 5/0 5cable-
mc520s-d card 5/1 5cable-mc520s-d card 6/0 5cable-
mc520s-d card 6/1 5cable-mc520s-d card 7/0 5cable-
mc520s-d card 7/1 5cable-mc520s-d card 8/0 5cable-
mc520s-d card 8/1 5cable-mc520s-d ip subnet-zero ip host
rfs witch 2001 10.10.10.1 !--- This is set for console
access from the 10K to the Switch. !--- The IP address
is for Loopback0. ip dhcp pool MODEMS1 network
172.25.1.0 255.255.255.0 bootfile docsis.cm next-server
172.25.1.1 default-router 172.25.1.1 option 7 ip
172.25.1.1 option 4 ip 172.25.1.1 option 2 hex 0000.0000
lease 2 3 4 ! ip dhcp pool MODEMS2 network 172.25.2.0
255.255.255.0 bootfile docsis.cm next-server 172.25.2.1
default-router 172.25.2.1 option 7 ip 172.25.2.1 option
4 ip 172.25.2.1 option 2 hex 0000.0000 lease 2 3 4 ! ip
dhcp-client network-discovery informs 2 discovers 2
period 15 !--- An internal DHCP server was used for
testing instead of external servers !--- (cable helper,
TOD, TFTP, and so forth). External servers are
recommended !--- in a "real" production network. !
interface Loopback0 ip address 10.10.10.1
255.255.255.252 ! interface FastEthernet0/0/0 ip address
10.97.1.8 255.255.255.0 ip rip receive version 2 no ip
split-horizon no keepalive ! interface
GigabitEthernet1/0/0 no ip address negotiation auto !
interface GigabitEthernet2/0/0 no ip address negotiation
auto !
```

## Configuration d'interface de l'échantillon N+1

```
!--- This assumes rfs2 is on the top, as shown in the
cable reference guide. !--- Other interfaces will be the
same, except a different member number for each !---
HCCP group. interface Cable5/1/0 !--- This is the
Protect for the first group. It may be best to configure
the Protect !--- interface(s) last, after the Working
interfaces are configured, or keep the !--- interface
```



```
"shut" until finished with all configurations. no ip
address !-- No need to set the IP address because it
will come from the Working card via SNMP. no keepalive
!--- This defaults to 10 seconds with the N+1 Cisco IOS
code, but it should be disabled !--- on the Protect
interface or set relatively high. cable downstream annex
B cable downstream modulation 64qam cable downstream
interleave-depth 32 !--- The DS modulation and
Interleave must be the same on Protect and Working !---
of the same group. The Protect interface itself must be
"no shut" for HCCP !--- to activate. cable downstream
rf-shutdown cable upstream 0 shutdown !--- These will
automatically become "no shut" when a failover occurs.
cable upstream 1 shutdown cable upstream 2 shutdown
cable upstream 3 shutdown hccp 1 protect 1 10.10.10.1 !-
-- This is the HCCP first group and it is protecting
member 1 with member one's !--- FE IP address. If it is
intra-chassis, you can use the Loopback0 IP address.
hccp 1 channel-switch 1 rfs2 rfs2switch-group 10.97.1.20
AA200000 1 !--- This is the IP address of the Switch and
it is protecting member 1, !--- which has a bitmap of
AA200000 in Switch slot 1. hccp 1 protect 2 10.10.10.1
!--- This is the HCCP first group and it is protecting
member 2 with the loopback !--- IP address. hccp 1
channel-switch 2 rfs2 rfs2switch-group 10.97.1.20
AA200000 2 !--- This is the IP address of the Switch and
it is protecting member 2, !--- with a bitmap of
AA200000 in Switch slot 2. hccp 1 protect 3 10.10.10.1
hccp 1 channel-switch 3 rfs2 rfs2switch-group 10.97.1.20
AA200000 3 hccp 1 protect 4 10.10.10.1 hccp 1 channel-
switch 4 rfs2 rfs2switch-group 10.97.1.20 AA200000 4 hccp
1 protect 5 10.10.10.1 hccp 1 channel-switch 5 rfs2
rfs2switch-group 10.97.1.20 AA200000 5 hccp 1 protect 6
10.10.10.1 hccp 1 channel-switch 6 rfs2 rfs2switch-group
10.97.1.20 AA200000 6 hccp 1 protect 7 10.10.10.1 hccp 1
channel-switch 7 rfs2 rfs2switch-group 10.97.1.20
AA200000 7 !--- These channel-switch configurations can
be copied and pasted into their !--- respective Working
interfaces. hccp 1 timers 5000 15000 !--- hccp 1 timers
<hellotime> <holdtime> !--- This is mostly for inter
chassis communication, so set it high for the 10K !---
as this can create extra CPU load. no hccp 1 revertive !
interface Cable5/1/1 !--- This is the Protect for the
second group. no ip address no keepalive cable
downstream annex B cable downstream modulation 64qam
cable downstream interleave-depth 32 cable downstream
rf-shutdown cable upstream 0 shutdown cable upstream 1
shutdown cable upstream 2 shutdown cable upstream 3
shutdown ! hccp 2 protect 1 10.10.10.1 hccp 2 channel-
switch 1 rfs2 rfs2switch-group 10.97.1.20 55100000 1 !---
Because this MAC domain is on right side of header, the
bitmap in hexadecimal !--- code is 55100000. hccp 2
protect 2 10.10.10.1 hccp 2 channel-switch 2 rfs2
rfs2switch-group 10.97.1.20 55100000 2 hccp 2 protect 3
10.10.10.1 hccp 2 channel-switch 3 rfs2 rfs2switch-group
10.97.1.20 55100000 3 hccp 2 protect 4 10.10.10.1 hccp 2
channel-switch 4 rfs2 rfs2switch-group 10.97.1.20
55100000 4 hccp 2 protect 5 10.10.10.1 hccp 2 channel-
switch 5 rfs2 rfs2switch-group 10.97.1.20 55100000 5 hccp
2 protect 6 10.10.10.1 hccp 2 channel-switch 6 rfs2
rfs2switch-group 10.97.1.20 55100000 6 hccp 2 protect 7
10.10.10.1 hccp 2 channel-switch 7 rfs2 rfs2switch-group
10.97.1.20 55100000 7 hccp 2 timers 5000 15000 no hccp 2
revertive interface Cable5/1/2 !--- This is the Protect
```

```
for the third group. no ip address no keepalive cable
downstream annex B cable downstream modulation 64qam
cable downstream interleave-depth 32 cable downstream
rf-shutdown cable upstream 0 shutdown cable upstream 1
shutdown cable upstream 2 shutdown cable upstream 3
shutdown hccp 3 protect 1 10.10.10.1 hccp 3 channel-
switch 1 rfswl rfswitch-group 10.97.1.19 00C80000 1 hccp
3 channel-switch 1 rfsw2 rfswitch-group 10.97.1.20
00C00000 1 !--- Because the third MAC domain will
traverse both Switches, two statements are !--- needed.
The "00" in front of the bitmaps will be dropped when
viewing the !--- running configuration. no hccp 3
revertive interface Cable5/1/3 !--- This is the Protect
for the fourth group. hccp 4 protect 1 10.10.10.1 hccp 4
channel-switch 1 rfswl rfswitch-group 10.97.1.19
AA200000 1 hccp 4 protect 2 10.10.10.1 hccp 4 channel-
switch 2 rfswl rfswitch-group 10.97.1. 19 AA200000 2
hccp 4 protect 3 10.10.10.1 hccp 4 channel-switch 3
rfswl rfswitch-group 10.97.1. 19 AA200000 3 hccp 4
protect 4 10.10.10.1 hccp 4 channel-switch 4 rfswl
rfswitch-group 10.97.1. 19 AA200000 4 hccp 4 protect 5
10.10.10.1 hccp 4 channel-switch 5 rfswl rfswitch-group
10.97.1. 19 AA200000 5 hccp 4 protect 6 10.10.10.1 hccp
4 channel-switch 6 rfswl rfswitch-group 10.97.1. 19
AA200000 6 hccp 4 protect 7 10.10.10.1 hccp 4 channel-
switch 7 rfswl rfswitch-group 10.97.1. 19 AA200000 7 no
hccp 4 revertive interface Cable5/1/4 !--- This is the
Protect for the fifth group. hccp 5 protect 1 10.10.10.1
hccp 5 channel-switch 1 rfswl rfswitch-group 10.97.1.19
55100000 1 hccp 5 protect 2 10.10.10.1 hccp 5 channel-
switch 2 rfswl rfswitch-group 10.97.1. 19 55100000 2
hccp 5 protect 3 10.10.10.1 hccp 5 channel-switch 3
rfswl rfswitch-group 10.97.1. 19 55100000 3 hccp 5
protect 4 10.10.10.1 hccp 5 channel-switch 4 rfswl
rfswitch-group 10.97.1. 19 55100000 4 hccp 5 protect 5
10.10.10.1 hccp 5 channel-switch 5 rfswl rfswitch-group
10.97.1. 19 55100000 5 hccp 5 protect 6 10.10.10.1 hccp
5 channel-switch 6 rfswl rfswitch-group 10.97.1. 19
55100000 6 hccp 5 protect 7 10.10.10.1 hccp 5 channel-
switch 7 rfswl rfswitch-group 10.97.1. 19 55100000 7 !--
- Output suppressed. ! interface Cable8/1/0 !--- This is
the Working for the first group. ip address 10.192.5.1
255.255.255.0 secondary ip address 172.25.1.1
255.255.255.0 !--- Interface bundling is supported as
well as subinterfaces. ip rip send version 2 ip rip
receive version 2 keepalive 1 !--- The keepalive time is
in seconds and the default is 10 seconds for HCCP code.
!--- Only set this when modems have stabilized. cable
downstream annex B cable downstream modulation 64qam
cable downstream interleave-depth 32 cable downstream
frequency 453000000 !--- This is DS frequency, which
must be set for the internal upconverter to operate.
cable downstream channel-id 0 no cable downstream rf-
shutdown !--- This is needed to turn on the DS RF
output. cable upstream 0 frequency 24000000 !--- If you
are doing dense mode combining, the upstream frequencies
must be different. !--- If no two US ports are shared,
then the same frequency can be used. cable upstream 0
power-level 0 cable upstream 0 connector 0 !--- This is
a new command for virtual interfaces, where USS can be
used for different !--- DS MAC domains. cable upstream 0
channel-width 3200000 cable upstream 0 minislots-size 2
cable upstream 0 modulation-profile 21 no cable upstream
0 shutdown !--- Output suppressed. cable dhcp-giaddr
```

```
policy !--- This tells CMS to get an IP address from the
primary scope and !--- tells CPEs to use the secondary
scope. hccp 1 working 1 !--- This is Working member 1 of
HCCP Group 1. hccp 1 channel-switch 1 rfs2 rfs2switch-
group 10.97.1.20 AA200000 1 !--- This is the IP address
of Switch and member 1, which has a bitmap of !---
AA200000 in Switch slot 1. hccp 1 reverttime 120 !---
This is the time in minutes (plus 2 minute suspend) for
the card to switch back !--- to normal mode, if the
fault has cleared. If a fault was initiated by a
keepalive !--- and you had a fault on the Protect card,
it would revert back after the suspend !--- time and not
wait the full revert time. ! interface Cable8/1/1 !---
This is the Working interface for the second HCCP group.
ip address 10.192.5.1 255.255.255.0 secondary ip address
172.25.2.1 255.255.255.0 ip rip send version 2 ip rip
receive version 2 keepalive 1 cable downstream annex B
cable downstream modulation 64qam cable downstream
interleave-depth 32 cable downstream frequency 453000000
cable downstream channel-id 1 no cable downstream rf-
shutdown cable upstream 0 frequency 24000000 cable
upstream 0 power-level 0 cable upstream 0 connector 4
cable upstream 0 channel-width 3200000 cable upstream 0
minislot-size 22 cable upstream 0 modulation-profile 21
no cable upstream 0 shutdown !--- Output suppressed.
cable dhcp-giaddr policy hccp 2 working 1 !--- This is
Working member 1 of HCCP Group 2. hccp 2 channel-switch
1 rfs2 rfs2switch-group 10.97.1.20 55100000 1 !--- This
is the IP address of the Switch and Member 1 of Group 2,
which has a bitmap !--- of 55100000 in Switch slot 1.
hccp 2 reverttime 120 ! interface Cable8/1/2 !--- This
is the Working interface for the third HCCP group. ip
address 10.192.5.1 255.255.255.0 secondary ip address
172.25.3.1 255.255.255.0 ip rip send version 2 ip rip
receive version 2 keepalive 1 cable downstream annex B
cable downstream modulation 64qam cable downstream
interleave-depth 32 cable downstream frequency 453000000
cable downstream channel-id 2 no cable downstream rf-
shutdown cable upstream 0 frequency 24000000 cable
upstream 0 power-level 0 cable upstream 0 connector 8
cable upstream 0 channel-width 3200000 cable upstream 0
minislot-size 2 cable upstream 0 modulation-profile 21
no cable upstream 0 shutdown cable dhcp-giaddr policy !-
-- Output suppressed. hccp 3 working 1 !--- This is
Working member 1 of HCCP Group 3. hccp 3 channel-switch
1 rfs1 rfs1switch-group 10.97.1.19 00c80000 1 hccp 3
channel-switch 1 rfs2 rfs2switch-group 10. 97.1.20
00c00000 1 hccp 3 reverttime 120 interface Cable8/1/3 !-
--This is the Working interface for the fourth HCCP
group. hccp 4 working 1 hccp 4 channel-switch 1 rfs1
rfs1switch-group 10.97.1.19 AA200000 1 hccp 4 reverttime
120 interface Cable8/1/4 !--- This is the Working
interface for the fifth HCCP group. hccp 5 working 1
hccp 5 channel-switch 1 rfs1 rfs1switch-group 10.97.1.19
55100000 1 hccp 5 reverttime 120 ! ip classless no ip
http server ! no cdp run snmp-server community private
RW !--- This does not affect the HCCP communications
between the Switch and 10K, !--- unless it is changed.
snmp-server enable traps cable no cdp run snmp-server
manager tftp-server server tftp-server ios.cf alias
ios.cf ! alias exec t configure terminal alias exec scm
show cable modem alias exec scr sh cab mode remote alias
exec shb sh hccp br alias exec shd sh hccp detail alias
exec shc sh hccp chan ! line con 0 logging synchronous
```

```
line aux 0 no exec transport input all !--- The three  
lines above were used to console from the Auxiliary port  
of the 10K !--- to the Switch. line vty 0 4 session-  
timeout 400 password xx login endBuilding  
configuration...
```

## Informations connexes

- [Support pour la technologie de câble haut débit](#)
- [Support technique - Cisco Systems](#)