



設定例

Cisco MWR 2941-DC は、Global System for Mobile Communications (GSM) 設定に基づき、各種トポロジ設計をサポートします。これには次の共通トポロジが含まれます。

- バックホールインターフェイスは、最適化された GSM トラフィックを転送するために使用されません。従来のバックホールインターフェイスは、1 つの マルチリンク接続を形成するために論理的に結合された 1 つ以上の T1/E1 コントローラから構成されています (T1/E1 回線のクロッキング用にバックホールインターフェイスを使用する High Speed Down link Packet Access (HSDPA) を除く)。
- ショートホールインターフェイスは、Base Transceiver Station (BTS; 無線基地局) / ノード B から Cisco MWR 2941-DC ルータへ、さらに Cisco MWR 2941-DC ルータから Base Station Controller/Radio Network Controller (BSC/RNC) へ GSM トラフィックを転送するために使用されます。Radio Access Network-Optimization (RAN-O; 無線アクセス ネットワーク最適化) デバイス上の従来のショートホール接続は、Cisco T1/E1 インターフェイス カードを介して接続されています。
- 3x2 や 4x3 などのトポロジの命名規則は、展開のタイプを説明するために使用されます。最初の数字は GSM ショートホール インターフェイス接続の番号を示し、2 番目の数字はマルチリンク バックホール インターフェイス接続の番号を示しています。

設定例

ここでは、Cisco MWR 2941-DC に関する次の実際の設定例について示します。

- 「疑似回線 (PW) の設定」 (P.A-2)
- 「GSM の設定」 (P.A-27)
- 「Generic Routing Encapsulation (GRE) トンネリングの設定」 (P.A-33)
- 「ルーティング設定例」 (P.A-35)
- 「Precision Timing Protocol (PTP) 設定例」 (P.A-44)
- 「レイヤ 3 バーチャルプライベートネットワーク (VPN) 設定例」 (P.A-46)
- 「Quality of Service (QoS) 設定例」 (P.A-48)
- 「Cisco Networking Services (CNS) ゼロ タッチ配置設定」 (P.A-51)



(注)

この例に記載されているネットワーク アドレスは汎用アドレスです。そのため、ネットワークで使用する実際のアドレスに置き換える必要があります。

疑似回線 (PW) の設定

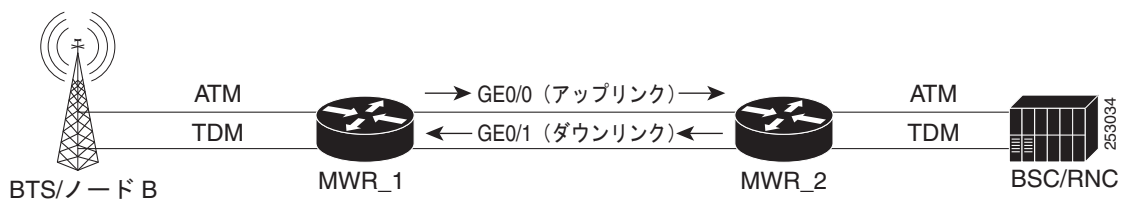
ここでは、Pseudowire (PW; 疑似回線) 接続の設定例を示します。

- 非対称 Pseudowire Emulation Edge-to-Edge (PWE3) の設定
- PWE3 冗長性 の設定
- TDM over MPLS の設定
- ATM over MPLS の設定
- Ethernet over MPLS (EoMPLS) の設定

非対称 Pseudowire Emulation Edge-to-Edge (PWE3) の設定

次に、非対称 Pseudowire Emulation Edge-to-Edge (PWE3) の設定例を示します (図 A-1)。

図 A-1 非対称 PWE3 の設定



MWR_1

```

version 12.4
service timestamps debug datetime msec localtime
service timestamps log datetime msec localtime

!
hostname MWR1
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
!
!
ip cef
!
!
controller E1 0/0
  clock source internal
  cem-group 1 unframed
!
controller E1 0/1
  clock source internal
  cem-group 20 unframed
!
controller E1 0/2
  clock source internal
  cem-group 12 unframed
!
controller E1 0/3
  clock source internal

```

```
    cem-group 30 unframed
!
controller E1 0/4
    clock source internal
    cem-group 8 unframed
!
controller E1 0/5
    clock source internal
    cem-group 25 unframed
!
controller E1 1/0
    mode atm
    clock source internal
!
controller E1 1/1
    mode atm
    clock source internal
!
controller E1 1/2
    mode atm
    clock source internal
!
controller E1 1/3
!
!
pseudowire-class mpls
    encapsulation mpls
    preferred-path peer 50.0.0.2
!
!
interface Loopback50
    ip address 50.0.0.1 255.255.255.255
!
interface CEM0/0
    no ip address
    cem 1
    xconnect 50.0.0.2 1 encapsulation mpls
!
!
interface GigabitEthernet0/0
    ip address 20.0.0.1 255.0.0.0
    load-interval 30
    duplex auto
    speed auto
    mpls label protocol ldp
    mpls ip
!
interface CEM0/1
    no ip address
    cem 20
    xconnect 50.0.0.2 2 encapsulation mpls
!
interface GigabitEthernet0/1
    ip address 60.0.0.1 255.0.0.0
    duplex auto
    speed auto
    mpls ip
!
interface CEM0/2
    no ip address
    cem 12
    xconnect 50.0.0.2 3 encapsulation mpls
!
!
```

```
interface CEM0/3
no ip address
cem 30
  xconnect 50.0.0.2 4 encapsulation mpls
!
interface CEM0/4
no ip address
cem 8
  xconnect 50.0.0.2 5 encapsulation mpls
!
!
interface CEM0/5
no ip address
cem 25
  xconnect 50.0.0.2 6 encapsulation mpls
!
!
interface ATM1/0
no ip address
load-interval 30
scrambling-payload
  mcpt-timers 1000 5000 10000
no ilmi-keepalive
pvc 0/5 l2transport
  encapsulation aal0
  cell-packing 10 mcpt-timer 3
  xconnect 50.0.0.2 10 pw-class mpls1
!
pvc 0/6 l2transport
  xconnect 50.0.0.2 20 pw-class mpls
!
pvc 0/7 l2transport
  encapsulation aal0
  cell-packing 28 mcpt-timer 3
  xconnect 50.0.0.2 30 encapsulation mpls pw-class mpls one-to-one
!
pvc 0/8 l2transport
  xconnect 50.0.0.2 40 pw-class mpls
!
pvc 0/9 l2transport
  encapsulation aal0
  xconnect 50.0.0.2 50 pw-class mpls one-to-one
!
!
interface ATM1/0.1 point-to-point
pvc 0/15 l2transport
  xconnect 50.0.0.2 13 pw-class mpls
!
!
interface ATM1/0.2 multipoint
  cell-packing 2 mcpt-timer 1
xconnect 50.0.0.2 12 encapsulation mpls
pvc 0/10 l2transport
  encapsulation aal0
!
pvc 0/11 l2transport
  encapsulation aal0
!
pvc 0/12 l2transport
  encapsulation aal0
!
pvc 0/13 l2transport
  encapsulation aal0
!
```

```
!  
interface ATM1/0.3 point-to-point  
  pvc 0/16 l2transport  
    encapsulation aal0  
    xconnect 50.0.0.2 14 encapsulation mpls  
  !  
!  
interface ATM1/0.4 point-to-point  
  pvc 0/17 l2transport  
    encapsulation aal0  
    xconnect 50.0.0.2 15 pw-class mpls one-to-one  
  !  
!  
interface ATM1/0.6 multipoint  
  pvc 0/26 l2transport  
    xconnect 50.0.0.2 16 pw-class mpls  
  !  
  pvc 0/27 l2transport  
    encapsulation aal0  
    cell-packing 8 mcpt-timer 3  
    xconnect 50.0.0.2 17 pw-class mpls  
  !  
  pvc 0/28 l2transport  
    encapsulation aal0  
    cell-packing 16 mcpt-timer 2  
    xconnect 50.0.0.2 18 pw-class mpls  
  !  
!  
interface ATM1/0.7 multipoint  
!  
interface ATM1/1  
  no ip address  
  scrambling-payload  
  mcpt-timers 1000 5000 10000  
  no ilmi-keepalive  
  cell-packing 20 mcpt-timer 2  
  xconnect 50.0.0.2 11 encapsulation mpls  
  pvc 0/21 l2transport  
    encapsulation aal0  
  !  
  pvc 0/22 l2transport  
    encapsulation aal0  
  !  
  pvc 0/23 l2transport  
    encapsulation aal0  
  !  
!  
interface ATM1/1.1 point-to-point  
!  
interface ATM1/1.2 multipoint  
!  
interface ATM1/2  
  no ip address  
  scrambling-payload  
  ima-group 0  
  no ilmi-keepalive  
!  
ip route 50.0.0.2 255.255.255.255 20.0.0.2  
!  
ip http server  
no ip http secure-server  
!  
!  
mpls ldp router-id Loopback50 force
```

```

!
!
line con 0
  exec-timeout 0 0
line aux 0
line vty 0 4
  login
!
network-clock-select 1 E1 1/3
!
end

```

MWR_2

```

version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname MWR2
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
!
enable password mypassword
!
no aaa new-model
!
ip cef
!
!
controller E1 0/0
  cem-group 1 unframed
!
controller E1 0/1
  cem-group 20 unframed
!
controller E1 0/2
  cem-group 12 unframed
!
controller E1 0/3
  cem-group 30 unframed
!
controller E1 0/4
  cem-group 8 unframed
!
controller E1 0/5
  cem-group 25 unframed
!
controller E1 1/0
  mode atm
  clock source internal
!
controller E1 1/1
  mode atm
  clock source internal
!
controller E1 1/2
  mode atm
  clock source internal
!

```

```
controller E1 1/3
  clock source internal
!
pseudowire-class mpls
  encapsulation mpls
  preferred-path peer 50.0.0.1
!
pseudowire-class mpls1
  encapsulation mpls
  ip local interface Loopback50
!
!
interface Loopback50
  ip address 50.0.0.2 255.255.255.255
!
interface CEM0/0
  no ip address
  cem 1
  xconnect 50.0.0.1 1 encapsulation mpls
!
!
interface Vlan20
  ip address 20.0.0.2 255.0.0.0
  mpls ip
!
interface Vlan60
  ip address 60.0.0.2 255.0.0.0
  mpls ip
!
interface GigabitEthernet0/0
  switchport access vlan 20
  duplex auto
  speed auto
!
interface GigabitEthernet0/1
  switchport access vlan 60
  duplex auto
  speed auto
!
!
interface CEM0/1
  no ip address
  cem 20
  xconnect 50.0.0.1 2 encapsulation mpls
!
!
interface CEM0/2
  no ip address
  cem 12
  xconnect 50.0.0.1 3 encapsulation mpls
!
!
interface CEM0/3
  no ip address
  cem 30
  xconnect 50.0.0.1 4 encapsulation mpls
!
!
interface CEM0/4
  no ip address
  cem 8
  xconnect 50.0.0.1 5 encapsulation mpls
!
!
```

```

interface CEM0/5
no ip address
cem 25
  xconnect 50.0.0.1 6 encapsulation mpls
!
!
interface ATM1/0
ip address 1.1.1.2 255.0.0.0
load-interval 30
scrambling-payload
  mcpt-timers 1000 5000 10000
no ilmi-keepalive
pvc 0/5 l2transport
  encapsulation aal0
  cell-packing 25 mcpt-timer 3
  xconnect 50.0.0.1 10 pw-class mpls1
!
pvc 0/6 l2transport
  xconnect 50.0.0.1 20 pw-class mpls1
!
pvc 0/7 l2transport
  encapsulation aal0
  cell-packing 12 mcpt-timer 2
  xconnect 50.0.0.1 30 encapsulation mpls pw-class mpls one-to-one
!
pvc 0/8 l2transport
  xconnect 50.0.0.1 40 pw-class mpls
!
pvc 0/9 l2transport
  encapsulation aal0
  xconnect 50.0.0.1 50 pw-class mpls one-to-one
!
pvc 0/99
  protocol ip 1.1.1.1 broadcast
  encapsulation aal5snap
!
!
interface ATM1/0.1 point-to-point
pvc 0/15 l2transport
  xconnect 50.0.0.1 13 pw-class mpls
!
!
interface ATM1/0.2 multipoint
  cell-packing 10 mcpt-timer 2
  xconnect 50.0.0.1 12 encapsulation mpls
pvc 0/10 l2transport
  encapsulation aal0
!
pvc 0/11 l2transport
  encapsulation aal0
!
pvc 0/12 l2transport
  encapsulation aal0
!
pvc 0/13 l2transport
  encapsulation aal0
!
!
interface ATM1/0.3 point-to-point
pvc 0/16 l2transport
  encapsulation aal0
  xconnect 50.0.0.1 14 encapsulation mpls
!
!

```



```
interface ATM1/0.4 point-to-point
 pvc 0/17 l2transport
  encapsulation aal0
  xconnect 50.0.0.1 15 pw-class mpls one-to-one
 !
!
interface ATM1/0.6 multipoint
 pvc 0/26 l2transport
  xconnect 50.0.0.1 16 pw-class mpls
 !
 pvc 0/27 l2transport
  encapsulation aal0
  cell-packing 18 mcpt-timer 3
  xconnect 50.0.0.1 17 pw-class mpls
 !
 pvc 0/28 l2transport
  encapsulation aal0
  cell-packing 24 mcpt-timer 2
  xconnect 50.0.0.1 18 pw-class mpls
 !
!
interface ATM1/0.7 multipoint
!
interface ATM1/1
 no ip address
 scrambling-payload
  mcpt-timers 1000 5000 10000
 no ilmi-keepalive
  cell-packing 20 mcpt-timer 2
 xconnect 50.0.0.1 11 encapsulation mpls
 pvc 0/21 l2transport
  encapsulation aal0
 !
 pvc 0/22 l2transport
  encapsulation aal0
 !
 pvc 0/23 l2transport
  encapsulation aal0
 !
!
interface ATM1/2
 no ip address
 scrambling-payload
 ima-group 0
 no ilmi-keepalive
 !
 ip route 50.0.0.1 255.255.255.255 60.0.0.1
 !
!
 ip http server
 no ip http secure-server
 !
!
 mpls ldp router-id Loopback50 force
 !
!
!
 line con 0
  exec-timeout 0 0
 line aux 0
 line vty 0 4
  exec-timeout 0 0
  login
 !
```

```

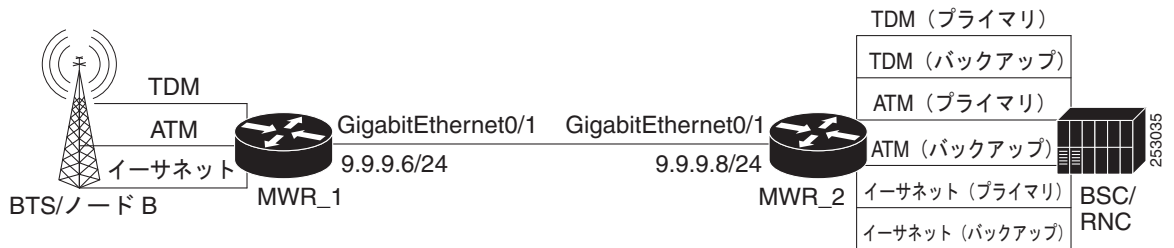
network-clock-select 1 BITS
!
end

```

PWE3 冗長性の設定

次に、PWE3 冗長性の設定例を示します (図 A-2)。

図 A-2 PWE3 冗長性の設定



MWR_1

```

version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname mwr-pe1
!
boot-start-marker
boot-end-marker
!
card type e1 0 1
card type e1 0 2
card type e1 1 0
card type e1 1 1
logging buffered 10000000
enable password lab
!
no aaa new-model
!
network-clock-select 1 E1 1/2
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip cef
!
!
no ip domain lookup
vlan ifdescr detail
multilink bundle-name authenticated
mpls label protocol ldp
vpdn enable
!
archive
 log config
  hidekeys
!
!
controller E1 0/0

```

```
clock source internal
cem-group 0 unframed
!
controller E1 0/1
!
controller E1 0/2
!
controller E1 0/3
clock source internal
!
controller E1 1/0
mode aim 1
clock source internal
!
controller E1 1/1
!
controller E1 1/2
!
controller E1 1/3
clock source internal
!
interface cem0/0
cem 0
xconnect 2.2.2.2 1 encapsulation mpls
backup peer 2.2.2.2 2
backup delay 20 20
!
interface ATM1/0
no ip address
scrambling-payload
no ilmi-keepalive
xconnect 2.2.2.2 3 encapsulation mpls
backup peer 2.2.2.2 4
backup delay 20 20
pvc 0/1 l2transport
encapsulation aal0
!
interface Loopback0
no ip address
!
interface Loopback1
ip address 1.1.1.1 255.255.255.255
load-interval 30
!
interface Loopback101
no ip address
!
!
interface GigabitEthernet0/1
ip address 9.9.9.6 255.255.255.0
load-interval 30
speed 100
full-duplex
mpls ip
!
!
ip forward-protocol nd
ip route 2.2.2.2 255.255.255.255 9.9.9.8
!
ip http server
no ip http secure-server
!
!
snmp-server community public RO
```

```

!
!
!
control-plane
!
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 0 0
  password lab
  login
!
exception data-corruption buffer truncate
!
end

```

MWR_2

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname mwr-pe2
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
card type e1 0 2
card type e1 1 0
card type e1 1 1
logging buffered 10000000
enable password lab
!
no aaa new-model
!
network-clock-select 1 E1 0/0
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip arp proxy disable
ip cef
!
!
no ip domain lookup
vlan ifdescr detail
multilink bundle-name authenticated
mpls label protocol ldp
mpls ldp session protection
mpls oam
  echo revision 4
vpdn enable
!
!
!
archive
  log config

```

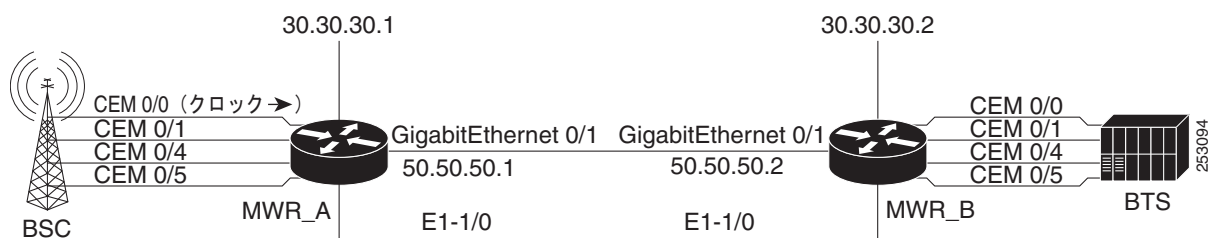
```
hidekeys
!
!
controller E1 0/0
cem-group 0 unframed
!
controller E1 0/1
clock source internal
cem-group 0 unframed
!
controller E1 0/2
!
controller E1 0/3
clock source internal
!
controller E1 0/4
clock source internal
!
controller E1 0/5
!
controller E1 1/0
mode aim 1
clock source internal
!
controller E1 1/1
clock source internal
!
controller E1 1/2
clock source internal
!
controller E1 1/3
mode aim 1
clock source internal
!
! Primary
interface cem0/0
cem 0
xconnect 1.1.1.1 1 encapsulation mpls
!
! Backup
interface cem0/1
cem 0
xconnect 1.1.1.1 2 encapsulation mpls
!
! Primary
interface ATM1/0
no ip address
scrambling-payload
no ilmi-keepalive
xconnect 1.1.1.1 3 encapsulation mpls
pvc 0/1 l2transport
encapsulation aal0
!
! Backup
interface ATM1/3
no ip address
scrambling-payload
no ilmi-keepalive
xconnect 1.1.1.1 4 encapsulation mpls
pvc 0/1 l2transport
encapsulation aal0
!
!
interface Loopback1
```

```
ip address 2.2.2.2 255.255.255.255
!
!
interface GigabitEthernet0/1
ip address 9.9.9.8 255.255.255.0
load-interval 30
speed 100
full-duplex
mpls ip
no cdp enable
!
ip forward-protocol nd
ip route 1.1.1.1 255.255.255.255 9.9.9.6
!
no ip http server
no ip http secure-server
!
!
snmp-server community private RW
snmp-server community public RO
snmp-server ifindex persist
snmp-server trap link ietf
no snmp-server sparse-tables
snmp-server queue-length 100
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps ipran
no cdp run
route-map test permit 10
match mpls-label
!
!
!
mpls ldp router-id Loopback1 force
!
control-plane
!
no call rsvp-sync
!
!
!
line con 0
exec-timeout 0 0
logging synchronous
line aux 0
line vty 0 4
exec-timeout 0 0
password lab
login
!
exception data-corruption buffer truncate
!
end
```

TDM over MPLS の設定

図 A-3 は、TDM over MPLS の設定を示しています。この設定は、E1 および T1 で Structure-Agnostic TDM over Packet (SAToP) と Circuit Emulation Service over Packet-Switched Network (CESoPSN) の両方を使用します。

図 A-3 TDM over MPLS の設定



MWR_A

```
!
version 12.4
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname mwr_A
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
enable password xxx
!
no aaa new-model
clock timezone est -5
!
ip cef
!
controller E1 0/0
cem-group 0 timeslots 1-31
description E1 CESoPSN example
!
controller E1 0/1
clock source internal
cem-group 1 unframed
description E1 SATOP example
!
controller E1 0/4
clock source internal
cem-group 4 unframed
description E1 SATOP example
!
controller E1 0/5
clock source internal
cem-group 5 timeslots 1-24
description E1 CESoPSN example
!
controller E1 1/0
clock source internal
!
```

```

controller E1 1/1
!
interface Loopback0
ip address 30.30.30.1 255.255.255.255
!
interface GigabitEthernet0/1
ip address 50.50.50.1 255.255.255.0
mpls ip
!
interface CEM0/0
no ip address
cem 0
  xconnect 30.30.30.2 300 encapsulation mpls
!
interface CEM0/1
no ip address
cem 1
  xconnect 30.30.30.2 301 encapsulation mpls
!
!
interface CEM0/4
no ip address
cem 4
  xconnect 30.30.30.2 304 encapsulation mpls
!
!
interface CEM0/5
no ip address
cem 5
  xconnect 30.30.30.2 305 encapsulation mpls
!
!
no ip classless
ip route 30.30.30.2 255.255.255.255 50.50.50.2
!
no ip http server
no ip http secure-server
!
line con 0
password xxx
login
line aux 0
password xxx
login
no exec
line vty 0 4
password xxx
login
!
network-clock-select 1 BITS
end

```

MWR_B

```

!
version 12.4
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname mwr_B
!
boot-start-marker

```



```
boot-end-marker
!
card type e1 0 0
card type e1 0 1
enable password xxx
!
no aaa new-model
clock timezone est -5
!
ip cef
!
controller E1 0/0
clock source internal
cem-group 0 timeslots 1-31
description E1 CESoPSN example
!
controller E1 0/1
clock source internal
cem-group 1 unframed
description E1 SATOP example
!
controller E1 0/4
clock source internal
cem-group 4 unframed
description T1 SATOP example
!
controller E1 0/5
clock source internal
cem-group 5 timeslots 1-24
description T1 CESoPSN example
!
controller E1 1/0

!
controller E1 1/1
!
interface Loopback0
ip address 30.30.30.2 255.255.255.255
!
!
interface GigabitEthernet0/1
ip address 50.50.50.2 255.255.255.0
mpls ip
!
interface CEM0/0
no ip address
cem 0
  xconnect 30.30.30.1 300 encapsulation mpls
!
interface CEM0/1
no ip address
cem 1
  xconnect 30.30.30.1 301 encapsulation mpls
!
interface CEM0/4
no ip address
cem 4
  xconnect 30.30.30.1 304 encapsulation mpls
!
!
interface CEM0/5
no ip address
cem 5
  xconnect 30.30.30.1 305 encapsulation mpls
```

```

!
!
no ip classless
ip route 30.30.30.1 255.255.255.255 50.50.50.1
!
no ip http server
no ip http secure-server
!
line con 0
password xxx
login
line aux 0
password xxx
login
no exec
line vty 0 4
password xxx
login
!
network-clock-select 1 E1 1/0
end

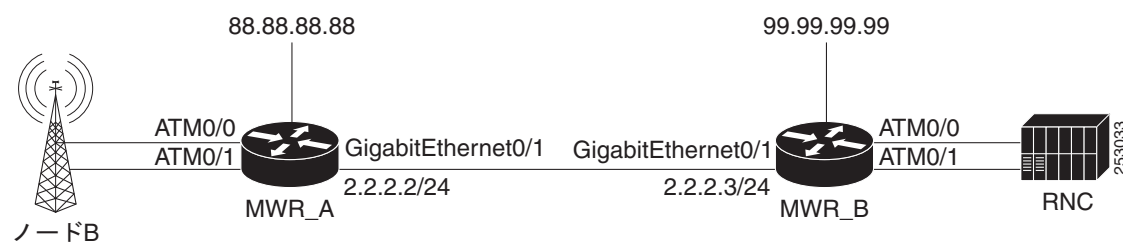
```

ATM over MPLS の設定

ここでは、次の内容を設定する方法を示しています (図 A-4)。

- 0/1 Permanent Virtual Circuit (PVC; 相手先固定接続) 0/100 に Asynchronous Transfer Mode (ATM; 非同期転送モード) Adaptation Layer 5 (AAL5; ATM アダプテーション レイヤ 5) SDU モード PW
- 0/1 PVC 0/101 に N:1 Virtual Channel Connection (VCC; 仮想チャネル接続) セル モード PW
- 0/1.1 に複数 PVC の N:1 VCC セル モード PW
- 0/1 PVC 0/102 に 1:1 VCC セル モード PW
- ポート モード PW のセル パッキング
- VCC セル リレー モード PW
- 0/1.1 N:1 VCC セル リレー PW の PVC マッピング

図 A-4 ATM over MPLS の設定



MWR_A

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
!
hostname mwr_A
!

```

```
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
logging buffered 4096
enable password lab
!
!
ip cef
!
!
no ip domain lookup
!
!
controller E1 0/0
mode atm
clock source internal
!
controller E1 0/1
mode atm
clock source internal
!
controller E1 0/2
mode atm
clock source internal
!
controller E1 0/3
mode atm
clock source internal
!
controller E1 0/4
!
controller E1 0/5
!
controller E1 1/0
!
controller E1 1/1
!
pseudowire-class mpls-exp-5
encapsulation mpls
mpls experimental 5
!
!
interface Loopback0
ip address 88.88.88.88 255.255.255.255
!
interface ATM0/0
no ip address
scrambling-payload
mcpt-timers 1000 2000 3000
no ilmi-keepalive
cell-packing 28 mcpt-timer 3
xconnect 99.99.99.99 100 encapsulation mpls
pvc 1/35 l2transport
encapsulation aal0
!
pvc 1/36 l2transport
encapsulation aal0
!
pvc 1/37 l2transport
encapsulation aal0
!
interface GigabitEthernet0/0
```

```
!  
interface ATM0/1  
  no ip address  
  load-interval 30  
  scrambling-payload  
  mcpt-timers 1000 2000 3000  
  no ilmi-keepalive  
  pvc 0/10  
  !  
  pvc 0/100 l2transport  
    encapsulation aal5  
    xconnect 99.99.99.99 1100 encapsulation mpls  
  !  
  pvc 0/101 l2transport  
    encapsulation aal0  
    cell-packing 28 mcpt-timer 3  
    xconnect 99.99.99.99 1101 encapsulation mpls  
  !  
  pvc 0/102 l2transport  
    encapsulation aal0  
    cell-packing 28 mcpt-timer 3  
    xconnect 99.99.99.99 1102 encapsulation mpls  
  !  
  pvc 0/103 l2transport  
    encapsulation aal0  
    cell-packing 28 mcpt-timer 3  
    xconnect 99.99.99.99 1103 pw-class mpls-exp-5  
  !  
!  
interface ATM0/1.1 multipoint  
  cell-packing 28 mcpt-timer 3  
  xconnect 99.99.99.99 1200 encapsulation mpls  
  pvc 1/35 l2transport  
    encapsulation aal0  
    pw-pvc 2/135  
  !  
  pvc 1/36 l2transport  
    encapsulation aal0  
    pw-pvc 2/136  
  !  
  pvc 1/37 l2transport  
    encapsulation aal0  
    pw-pvc 2/137  
  !  
!  
interface GigabitEthernet0/1  
  description interface to 7600 fas 3/5  
  ip address 2.2.2.2 255.255.255.0  
  duplex auto  
  speed auto  
  mpls ip  
  no keepalive  
!  
interface ATM0/2  
  no ip address  
  scrambling-payload  
  no ilmi-keepalive  
!  
interface ATM0/3  
  no ip address  
  scrambling-payload  
  no ilmi-keepalive  
!  
ip route 99.99.99.99 255.255.255.255 2.2.2.3
```

```
!  
!  
ip http server  
no ip http secure-server  
!  
!  
mpls ldp router-id Loopback0  
!  
!  
line con 0  
  exec-timeout 0 0  
line aux 0  
line vty 0 4  
  exec-timeout 0 0  
  privilege level 15  
  password lab  
  login  
!  
network-clock-select 1 E1 1/0  
!  
end
```

MWR_B

```
!  
version 12.4  
service timestamps debug datetime msec  
service timestamps log datetime msec  
!  
hostname mwr_B  
!  
boot-start-marker  
boot-end-marker  
!  
card type e1 0 0  
card type e1 0 1  
logging buffered 4096  
enable password lab  
!  
!  
ip cef  
!  
!  
no ip domain lookup  
!  
!  
controller E1 0/0  
  mode atm  
!  
controller E1 0/1  
  mode atm  
!  
controller E1 0/2  
  mode atm  
!  
controller E1 0/3  
  mode atm  
!  
controller E1 0/4  
!  
controller E1 0/5  
!  
pseudowire-class mpls-exp-5  
  encapsulation mpls
```

```
mpls experimental 5
!
!
interface Loopback0
 ip address 99.99.99.99 255.255.255.255
!
interface ATM0/0
 no ip address
 scrambling-payload
  mcpt-timers 1000 2000 3000
 no ilmi-keepalive
  cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 100 encapsulation mpls
 pvc 1/35 l2transport
  encapsulation aal0
!
 pvc 1/36 l2transport
  encapsulation aal0
!
 pvc 1/37 l2transport
  encapsulation aal0
!
!
interface GigabitEthernet0/0
!
interface ATM0/1
 no ip address
 scrambling-payload
  mcpt-timers 1000 2000 3000
 no ilmi-keepalive
 pvc 0/2
!
 pvc 0/100 l2transport
  encapsulation aal5
  xconnect 88.88.88.88 1100 encapsulation mpls
!
 pvc 0/101 l2transport
  encapsulation aal0
  cell-packing 28 mcpt-timer 3
  xconnect 88.88.88.88 1101 encapsulation mpls
!
 pvc 0/102 l2transport
  encapsulation aal0
  cell-packing 28 mcpt-timer 3
  xconnect 88.88.88.88 1102 encapsulation mpls
!
 pvc 0/103 l2transport
  encapsulation aal0
  cell-packing 28 mcpt-timer 3
  xconnect 88.88.88.88 1103 pw-class mpls-exp-5
!
interface ATM0/1.1 multipoint
  cell-packing 28 mcpt-timer 3
 xconnect 88.88.88.88 1200 encapsulation mpls
 pvc 2/135 l2transport
  encapsulation aal0
!
 pvc 2/136 l2transport
  encapsulation aal0
!
 pvc 2/137 l2transport
  encapsulation aal0
!
!
```

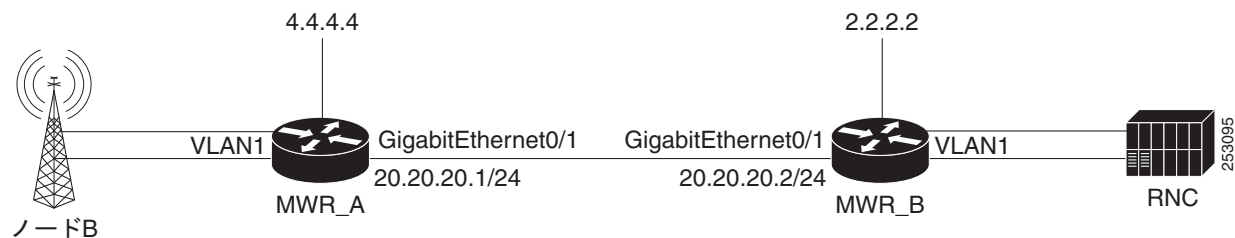
```

interface GigabitEthernet0/1
 ip address 2.2.2.3 255.255.255.0
 duplex auto
 speed auto
 mpls ip
 !
interface ATM0/2
 no ip address
 scrambling-payload
 ima-group 0
 no ilmi-keepalive
 !
interface ATM0/3
 no ip address
 scrambling-payload
 ima-group 0
 no ilmi-keepalive
 !
ip route 88.88.88.88 255.255.255.255 2.2.2.2
 !
 !
ip http server
no ip http secure-server
 !
 !
mpls ldp router-id Loopback0
 !
 !
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 exec-timeout 0 0
 password lab
 login
 !
network-clock-select 1 E1 0/0
 !
end

```

Ethernet over MPLS (EoMPLS) の設定

次に、イーサネット疑似回線（別名 Ethernet over MPLS (EoMPLS)）の設定例を示します。



MWR_A

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec

```

```

no service password-encryption
!
hostname mwr_A
!
boot-start-marker
boot-end-marker
!
card type e1 0 0
card type e1 0 1
logging buffered 4096
enable password mypassword
!
no aaa new-model
!
network-clock-select 1 E1 0/0
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip cef
!
no ip domain lookup
ip domain name cisco.com
multilink bundle-name authenticated
mpls label protocol ldp
vpdn enable
!
!
controller E1 0/0
mode aim 1
!
controller E1 0/1
mode aim 1
!
controller E1 0/2
mode aim 1
!
controller E1 0/3
mode aim 1
!
controller E1 0/4
!
controller E1 0/5
!
interface Loopback0
ip address 4.4.4.4 255.255.255.255
!
interface GigabitEthernet0/4
switchport trunk allowed vlan 1,2,20,1002-1005
switchport mode trunk
!
interface GigabitEthernet0/5
switchport trunk allowed vlan 1,2,40,1002-1005
switchport mode trunk
!
interface Vlan20
ip address 20.20.20.1 255.255.255.0
no ptp enable
mpls ip
!
interface Vlan40
no ip address
no ptp enable
xconnect 2.2.2.2 10 encapsulation mpls

```



```
!  
ip route 2.2.2.2 255.255.255.255 20.20.20.2  
!  
no ip http server  
no ip http secure-server  
!  
!  
mpls ldp router-id Loopback0  
!  
!  
line con 0  
  exec-timeout 0 0  
line aux 0  
line vty 0 4  
  exec-timeout 0 0  
  password lab  
  login  
!  
end
```

MWR_B

```
!  
version 12.4  
service timestamps debug datetime msec  
service timestamps log datetime msec  
no service password-encryption  
!  
hostname mwr_B  
!  
boot-start-marker  
boot-end-marker  
!  
card type e1 0 0  
card type e1 0 1  
logging buffered 4096  
enable password mypassword  
!  
no aaa new-model  
!  
network-clock-select 1 E1 0/0  
mmi polling-interval 60  
no mmi auto-configure  
no mmi pvc  
mmi snmp-timeout 180  
ip cef  
!  
no ip domain lookup  
ip domain name cisco.com  
multilink bundle-name authenticated  
mpls label protocol ldp  
vpdn enable  
!  
!  
controller E1 0/0  
  mode aim 1  
!  
controller E1 0/1  
  mode aim 1  
!  
controller E1 0/2  
  mode aim 1
```

```
!  
controller E1 0/3  
  mode aim 1  
!  
controller E1 0/4  
!  
controller E1 0/5  
!  
interface Loopback0  
  ip address 2.2.2.2 255.255.255.255  
!  
interface GigabitEthernet0/4  
  switchport trunk allowed vlan 1,2,20,1002-1005  
  switchport mode trunk  
!  
interface GigabitEthernet0/5  
  switchport trunk allowed vlan 1,2,40,1002-1005  
  switchport mode trunk  
!  
interface Vlan20  
  ip address 20.20.20.2 255.255.255.0  
  no ptp enable  
  mpls ip  
!  
interface Vlan40  
  no ip address  
  no ptp enable  
  xconnect 4.4.4.4 10 encapsulation mpls  
!  
ip route 4.4.4.4 255.255.255.255 20.20.20.1  
!  
no ip http server  
no ip http secure-server  
!  
!  
mpls ldp router-id Loopback0  
!  
!  
line con 0  
  exec-timeout 0 0  
line aux 0  
line vty 0 4  
  exec-timeout 0 0  
  password lab  
  login  
!  
end
```

GSM の設定

- [GSM だけの設定](#)
- [衛星を使用する GSM だけの設定](#)
- [GSM 輻輳管理](#)

GSM だけの設定

標準の GSM トポロジには、個別の T1/E1 接続を経由する BTS から Cisco MWR 2941-DC への 1 つまたは複数のショートホール インターフェイス接続が含まれます。Cisco MWR 2941-DC ルータは、Multilink Point-to-Point Protocol (PPP; ポイントツーポイント プロトコル) (MLPPP; マルチリンク PPP) バックホール接続 (2 つ以上の T1/E1 接続) を使用してバックツーバックで接続されます。BSC 側の Cisco MWR 2941-DC と BSC との間の接続は、BTS と Cisco MWR 2941-DC との間の接続と同じです。この例では、GSM トラフィックだけがトポロジを経由します (図 A-5)。

図 A-5 GSM だけの設定



MWR_A

```
!
card type E1 0 0
!
!
controller E1 0/0
 framing NO-CRC4
 clock source internal
 channel-group 0 timeslots 1-31
!
controller E1 0/1
 channel-group 0 timeslots 1-31
!
controller E1 0/2
 framing NO-CRC4
 clock source internal
 channel-group 0 timeslots 1-31
!
!
class-map match-any llq-class
 match ip dscp ef
!
!
policy-map llq-policy
 class llq-class
  priority percent 99
 class class-default
  bandwidth remaining percent 1
  queue-limit 45
!
interface Multilink1
 ip address 10.10.10.1 255.255.255.252
```

```

load-interval 30
ppp pfc local request
ppp pfc remote apply
ppp acfc local request
ppp acfc remote apply
ppp multilink
ppp multilink interleave
ppp multilink group 1
ppp multilink fragment delay 0 1
ppp multilink multiclass
max-reserved-bandwidth 100
service-policy output llq-policy
hold-queue 50 out
ip rtp header-compression ietf-format
!
!
interface Serial0/0:0
no ip address
encapsulation gsm-abis
gsm-abis local 10.10.10.1 4444
gsm-abis remote 10.10.10.2 4444
gsm-abis set dscp ef
no keepalive
!
interface Serial0/1:0
no ip address
encapsulation ppp
keepalive 1
ppp multilink
ppp multilink group 1
max-reserved-bandwidth 100
!
interface Serial0/2:0
no ip address
encapsulation gsm-abis
gsm-abis local 10.10.10.1 4446
gsm-abis remote 10.10.10.2 4446
gsm-abis set dscp ef
no keepalive
!
logging history size 500
logging history debugging
logging trap warnings
snmp-server community public RO
snmp-server queue-length 100
snmp-server enable traps snmp linkdown linkup coldstart warmstart
snmp-server enable traps ipran
snmp-server enable traps syslog
snmp-server trap link ietf
snmp-server ifIndex persist
snmp-server host 64.50.100.254 version 2c V2C
!
network-clock-select 1 E1 0/1
!

```

MWR_B

```

!
card type E1 0 0
!
!
controller E1 0/0
framing NO-CRC4
channel-group 0 timeslots 1-31

```

```
!  
controller E1 0/1  
  clock source internal  
  channel-group 0 timeslots 1-31  
!  
controller E1 0/2  
  framing NO-CRC4  
  channel-group 0 timeslots 1-31  
!  
!  
class-map match-any llq-class  
match ip dscp ef  
!  
!  
policy-map llq-policy  
class llq-class  
  priority percent 99  
class class-default  
  bandwidth remaining percent 1  
  queue-limit 45  
!  
interface Multilink1  
ip address 10.10.10.2 255.255.255.252  
load-interval 30  
ppp pfc local request  
ppp pfc remote apply  
ppp acfc local request  
ppp acfc remote apply  
ppp multilink  
ppp multilink interleave  
ppp multilink group 1  
ppp multilink fragment delay 0 1  
ppp multilink multiclass  
max-reserved-bandwidth 100  
service-policy output llq-policy  
hold-queue 50 out  
ip rtp header-compression ietf-format  
!  
!  
interface Serial0/0:0  
no ip address  
encapsulation gsm-abis  
gsm-abis local 10.10.10.2 4444  
gsm-abis remote 10.10.10.1 4444  
gsm-abis set dscp ef  
no keepalive  
!  
interface Serial0/1:0  
no ip address  
encapsulation ppp  
keepalive 1  
ppp multilink  
ppp multilink group 1  
max-reserved-bandwidth 100  
!  
interface Serial0/2:0  
no ip address  
encapsulation gsm-abis  
gsm-abis local 10.10.10.2 4446  
gsm-abis remote 10.10.10.1 4446  
gsm-abis set dscp ef  
no keepalive  
!  
logging history size 500
```

```

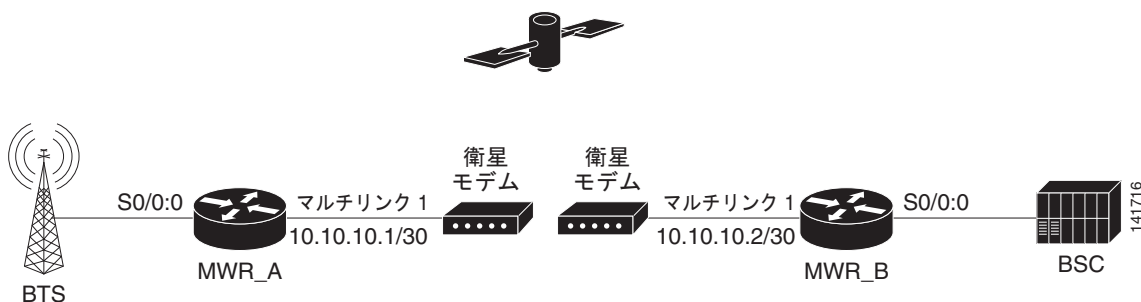
logging history debugging
logging trap warnings
snmp-server community public RO
snmp-server queue-length 100
snmp-server enable traps snmp linkdown linkup coldstart warmstart
snmp-server enable traps ipran
snmp-server enable traps syslog
snmp-server trap link ietf
snmp-server ifIndex persist
snmp-server host 64.50.100.254 version 2c V2C
!
network-clock-select 1 E1 0/0
network-clock-select 2 E1 0/2
!

```

衛星を使用する GSM だけの設定

衛星を使用する GSM だけの設定により、ポイントツーポイントでネットワークを最適化できます (図 A-6)。

図 A-6 衛星を使用する GSM だけの設定



MWR_A

```

!
card type E1 0 0
!
!
controller E1 0/0
 framing NO-CRC4
 clock source internal
 channel-group 0 timeslots 1-20
!
controller E1 0/1
 channel-group 0 timeslots 1-20
!
!
class-map match-any llq-class
 match ip dscp ef
!
!
policy-map llq-policy
 class llq-class
  priority percent 99
 class class-default
  bandwidth remaining percent 1
  queue-limit 45
!
interface Multilink1

```

```
ip address 10.10.10.1 255.255.255.252
load-interval 30
no keepalive
no cdp enable
ppp pfc local request
ppp pfc remote apply
ppp acfc local request
ppp acfc remote apply
ppp multilink
ppp multilink interleave
ppp multilink group 1
ppp multilink fragment delay 0 1
ppp multilink multiclass
max-reserved-bandwidth 100
service-policy output llq-policy
hold-queue 50 out
ip rtp header-compression ietf-format
!
!
interface Serial0/0:0
no ip address
encapsulation gsm-abis
gsm-abis local 10.10.10.1 4444
gsm-abis remote 10.10.10.2 4444
gsm-abis jitter 10
gsm-abis retransmit 5
gsm-abis set dscp ef
no keepalive
!
interface Serial0/1:0
no ip address
encapsulation ppp
keepalive 1
ppp multilink
ppp multilink group 1
max-reserved-bandwidth 100
!
logging history size 500
logging history debugging
logging trap warnings
snmp-server community public RO
snmp-server queue-length 100
snmp-server enable traps snmp linkdown linkup coldstart warmstart
snmp-server enable traps ipran
snmp-server enable traps syslog
snmp-server trap link ietf
snmp-server ifIndex persist
snmp-server host 64.50.100.254 version 2c V2C
!
network-clock-select 1 E1 0/1
```

MWR_B

```
!
card type E1 0 0
!
!
controller E1 0/0
framing NO-CRC4
channel-group 0 timeslots 1-20
!
controller E1 0/1
clock source internal
```

```

channel-group 0 timeslots 1-20
!
!
class-map match-any llq-class
match ip dscp ef
!
!
policy-map llq-policy
class llq-class
  priority percent 99
class class-default
  bandwidth remaining percent 1
  queue-limit 45
!
interface Multilink1
ip address 10.10.10.2 255.255.255.252
load-interval 30
no keepalive
no cdp enable
ppp pfc local request
ppp pfc remote apply
ppp acfc local request
ppp acfc remote apply
ppp multilink
ppp multilink interleave
ppp multilink group 1
ppp multilink fragment delay 0 1
ppp multilink multiclass
max-reserved-bandwidth 100
service-policy output llq-policy
hold-queue 50 out
ip rtp header-compression ietf-format
!
!
interface Serial0/0:0
no ip address
encapsulation gsm-abis
gsm-abis local 10.10.10.2 4444
gsm-abis remote 10.10.10.1 4444
gsm-abis jitter 10
gsm-abis retransmit 5
gsm-abis set dscp ef
no keepalive
!
interface Serial0/1:0
no ip address
encapsulation ppp
keepalive 1
ppp multilink
ppp multilink group 1
max-reserved-bandwidth 100
!
logging history size 500
logging history debugging
logging trap warnings
snmp-server community public RO
snmp-server queue-length 100
snmp-server enable traps snmp linkdown linkup coldstart warmstart
snmp-server enable traps ipran
snmp-server enable traps syslog
snmp-server trap link ietf
snmp-server ifIndex persist
snmp-server host 64.50.100.254 version 2c V2C
!
network-clock-select 1 E1 0/0

```


GSM 輻輳管理

次に、BTS 側および BSC 側の GSM 輻輳管理を設定する例を示します。



(注)

ここでは、特定の機能を紹介する目的で設定の一部を示しています。

BTS 側

```
interface Serial0/0:0
no ip address
encapsulation gsm-abis
gsm-abis local 10.10.10.1 4444
gsm-abis remote 10.10.10.2 4444
gsm-abis congestion enable
gsm-abis congestion critical 1-2
gsm-abis congestion critical 31
gsm-abis set dscp ef
no keepalive
```

BSC 側

```
interface Serial0/0:0
no ip address
encapsulation gsm-abis
gsm-abis local 10.10.10.2 4444
gsm-abis remote 10.10.10.1 4444
gsm-abis congestion enable
gsm-abis congestion critical 1-2
gsm-abis congestion critical 31
gsm-abis set dscp ef
no keepalive
```

Generic Routing Encapsulation (GRE) トンネリングの設定

次の設定では、Generic Routing Encapsulation (GRE) トンネルを使用する疑似回線接続を作成します。

- [CESoPSN と GRE トンネル バックホール](#)
- [ATM over MPLS AAL5 SDU モードと GRE バックホール](#)

GRE の設定方法の詳細については、「[GRE トンネリングの設定](#)」(P.4-36) を参照してください。



(注)

ここでは、特定の機能を紹介する目的で設定の一部を示しています。

CESoPSN と GRE トンネル バックホール

```
!  
controller E1 0/15  
framing NO-CRC4  
clock source line  
cem-group 0 timeslots 1-31  
description TDM Shorthaul for CESoPSN PW  
!  
interface Loopback0  
description Loopback for MPLS and PWE3  
ip address 10.10.10.1 255.255.255.255  
!  
interface CEM0/15  
description CESoPSN  
no ip address  
cem 0  
xconnect 10.10.10.2 111 encapsulation mpls  
!  
!  
interface Tunnel3  
ip address 9.9.9.9 255.255.255.0  
tunnel mode gre ip  
mpls ip  
tunnel source Vlan3  
tunnel destination 3.3.3.3  
!  
ip route 10.10.10.2 255.255.255.255 9.9.9.1  
!  
mpls ldp router-id Loopback0 force  
!
```

ATM over MPLS AAL5 SDU モードと GRE バックホール

```
!  
interface ATM0/0  
no ip address  
scrambling-payload  
no atm ilmi-keepalive  
pvc 0/10 l2transport  
encapsulation aal5  
xconnect 10.10.10.1 300 encapsulation mpls  
!  
interface Tunnel3  
ip address 9.9.9.9 255.255.255.0  
tunnel mode gre ip  
mpls ip  
tunnel source Vlan3  
tunnel destination 3.3.3.3  
!  
interface Loopback0  
description Loopback for MPLS and PWE3  
ip address 10.10.10.1 255.255.255.255  
!  
ip route 10.10.10.2 255.255.255.255 9.9.9.1  
!  
mpls ldp router-id Loopback0 force
```

ルーティング設定例

ここでは、Bidirectional Forwarding Detection (BFD; 双方向フォワーディング検出) を使用する各ルーティング プロトコルの設定例を示します。

- [Open Shortest Path First \(OSPF\) と BFD](#)
- [Border Gateway Protocol \(BGP; ボーダー ゲートウェイ プロトコル\) と BFD](#)
- [Intermediate System-to-Intermediate System \(IS-IS\) と BFD](#)

Cisco MWR 2941-DC のルーティング設定方法の詳細については、「[ルーティング プロトコルの設定 \(P.4-62\)](#)」および「[BFD の設定 \(P.4-62\)](#)」を参照してください。

Open Shortest Path First (OSPF) と BFD

```
!  
version 12.4  
service timestamps debug datetime msec  
service timestamps log datetime msec  
no service password-encryption  
!  
hostname BFD2941  
!  
boot-start-marker  
boot-end-marker  
!  
card type t1 0 0  
logging buffered 1000000  
no logging console  
!  
no aaa new-model  
ip source-route  
!  
!  
ip cef  
no ip domain lookup  
ip host tftp 64.102.116.25  
ptp mode ordinary  
ptp priority1 128  
ptp priority2 128  
ptp domain 0  
multilink bundle-name authenticated  
!  
archive  
  log config  
    hidekeys  
!  
controller T1 0/0  
  mode atm  
  clock source line  
!  
controller T1 0/1  
  clock source line  
  cem-group 0 timeslots 1-31  
!  
controller T1 0/2  
  clock source internal  
!  
controller T1 0/3  
  clock source internal  
!
```

```
controller T1 0/4
  clock source internal
!
controller T1 0/5
  clock source internal
!
controller T1 0/6
  clock source internal
!
controller T1 0/7
  clock source internal
!
controller T1 0/8
  clock source internal
!
controller T1 0/9
  clock source internal
!
controller T1 0/10
  clock source internal
!
controller T1 0/11
  clock source internal
!
controller T1 0/12
  clock source internal
!
controller T1 0/13
  clock source internal
!
controller T1 0/14
  clock source internal
!
controller T1 0/15
  clock source internal
!
controller BITS
  applique E1
!
!
interface Loopback0
  ip address 88.88.88.150 255.255.255.255
!
interface GigabitEthernet0/0
  switchport trunk allowed vlan 1-9,11-4094
  switchport mode trunk
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
  switchport access vlan 10
!
interface GigabitEthernet0/3
!
interface GigabitEthernet0/4
!
interface GigabitEthernet0/5
!
interface ATM0/0
  no ip address
  scrambling-payload
  atm pvp 1 l2transport
  xconnect 10.10.10.2 10001 encapsulation mpls
  no atm ilmi-keepalive
```

```
pvc 0/20 l2transport
vc-hold-queue 80
encapsulation aal0
xconnect 10.10.10.2 10020 encapsulation mpls
!
pvc 0/30 l2transport
encapsulation aal5
xconnect 10.10.10.2 10030 encapsulation mpls
!
pvc 0/40
vc-hold-queue 50
encapsulation aal5snap
!
!
interface CEM0/1
no ip address
cem 0
xconnect 10.10.10.2 222 encapsulation mpls
!
!
interface Vlan1
no ip address
shutdown
no ptp enable
!
interface Vlan10
ip address 192.168.52.88 255.255.255.0
no ptp enable
!
interface Vlan100
description Primary EVC
ip address 172.22.41.2 255.255.255.0
ip ospf cost 4
ip ospf hello-interval 1
ip ospf dead-interval 3
no ptp enable
mpls ip
bfd interval 50 min_rx 50 multiplier 3
!
interface Vlan200
description Secondary EVC
ip address 172.22.42.2 255.255.255.0
ip ospf cost 5
ip ospf hello-interval 1
ip ospf dead-interval 3
no ptp enable
mpls ip
!
router ospf 100
router-id 88.88.88.150
log-adjacency-changes
timers throttle spf 50 50 1000
timers throttle lsa all 0 25 10000
timers lsa arrival 0
timers pacing flood 20
timers pacing retransmission 30
redistribute static subnets
network 88.88.88.150 0.0.0.0 area 0
network 172.22.41.0 0.0.0.255 area 0
network 172.22.42.0 0.0.0.255 area 0
bfd all-interfaces
!
ip default-gateway 192.168.52.1
ip forward-protocol nd
```

```

ip route 0.0.0.0 0.0.0.0 192.168.52.1
ip route 64.102.116.25 255.255.255.255 192.168.52.1
!
!
ip http server
no ip http secure-server
!
control-plane
!
line con 0
  exec-timeout 0 0
  no modem enable
line aux 0
line vty 0 4
  exec-timeout 0 0
  privilege level 15
  password xxxxx
  login
!
exception data-corruption buffer truncate
network-clock-select hold-timeout infinite
network-clock-select mode nonrevert
network-clock-select 1 E1 0/0
end

```

Border Gateway Protocol (BGP; ボーダー ゲートウェイ プロトコル) と BFD

```

!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname BFD2941
!
boot-start-marker
boot-end-marker
!
card type t1 0 0
logging buffered 1000000
no logging console
!
no aaa new-model
ip source-route
!
!
ip cef
no ip domain lookup
ip host tftp 64.102.116.25
ptp mode ordinary
ptp priority1 128
ptp priority2 128
ptp domain 0
multilink bundle-name authenticated
!
archive
  log config
  hidekeys
!
controller T1 0/0
  mode atm

```

```
clock source line
!
controller T1 0/1
clock source line
cem-group 0 timeslots 1-31
!
controller T1 0/2
clock source internal
!
controller T1 0/3
clock source internal
!
controller T1 0/4
clock source internal
!
controller T1 0/5
clock source internal
!
controller T1 0/6
clock source internal
!
controller T1 0/7
clock source internal
!
controller T1 0/8
clock source internal
!
controller T1 0/9
clock source internal
!
controller T1 0/10
clock source internal
!
controller T1 0/11
clock source internal
!
controller T1 0/12
clock source internal
!
controller T1 0/13
clock source internal
!
controller T1 0/14
clock source internal
!
controller T1 0/15
clock source internal
!
controller BITS
  applique E1
!
interface Loopback0
  ip address 20.20.20.20 255.255.255.255
!
interface GigabitEthernet0/2
  switchport access vlan 10
  load-interval 30
  duplex full
  speed 100
!
interface GigabitEthernet0/3
  switchport access vlan 200
  load-interval 30
  duplex full
```

```
    speed 100
    !
interface GigabitEthernet0/4
    switchport access vlan 4
    load-interval 30
    duplex full
    speed 100
    !
interface GigabitEthernet0/5
    switchport access vlan 100
    load-interval 30
    duplex full
    speed 100
    !
interface ATM0/0
    no ip address
    scrambling-payload
    atm bandwidth dynamic
    pvc 0/100 l2transport
    !
    !
interface ATM0/0.1 multipoint
    pvc 1/5 l2transport
        encapsulation aal0
        xconnect 10.10.10.10 10010 encapsulation mpls
    !
    pvc 1/6 l2transport
        encapsulation aal5
        xconnect 10.10.10.10 10020 encapsulation mpls
    !
    !
interface ATM0/0.2 multipoint
    xconnect 10.10.10.10 10030 encapsulation mpls
    pvc 2/5 l2transport
        encapsulation aal0
    !
    pvc 2/6 l2transport
        encapsulation aal0
    !
    !
interface ATM0/1
    no ip address
    scrambling-payload
    no atm ilmi-keepalive
    pvc 0/100 l2transport
    !
    !
interface Vlan4 (connected to 7600)
    ip address 11.1.1.2 255.255.255.0
    no ptp enable
    bfd interval 50 min_rx 50 multiplier 3
    !
interface Vlan10
    ip address 192.168.40.61 255.255.255.128
    no ptp enable
    mpls ip
    !
interface Vlan100
    ip address 12.1.1.2 255.255.255.0
    no ptp enable
    mpls bgp forwarding
    mpls ip
    bfd interval 50 min_rx 50 multiplier 3
    !
```



```
interface Vlan200
 ip address 12.1.2.2 255.255.255.0
 no ptp enable
 mpls bgp forwarding
 mpls ip
 bfd interval 50 min_rx 50 multiplier 3
!
router bgp 200
 no synchronization
 bgp log-neighbor-changes
 network 11.1.1.0
 network 12.1.1.0
 network 12.1.2.0
 redistribute connected
 neighbor 11.1.1.1 remote-as 100
 neighbor 11.1.1.1 fall-over bfd
 neighbor 11.1.1.1 send-label
 neighbor 12.1.1.1 remote-as 300
 neighbor 12.1.1.1 fall-over bfd
 neighbor 12.1.1.1 send-label
 neighbor 12.1.2.1 remote-as 300
 neighbor 12.1.2.1 fall-over bfd
 neighbor 12.1.2.1 send-label
 no auto-summary
!
connect atmcellsw ATM0/0 0/100 ATM0/1 0/100
!
!
mpls ldp router-id Loopback0 force
!
```

Intermediate System-to-Intermediate System (IS-IS) と BFD

```
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname BFD2941
!
boot-start-marker
boot-end-marker
!
card type t1 0 0
logging buffered 1000000
no logging console
!
no aaa new-model
ip source-route
!
!
ip cef
no ip domain lookup
ip host tftp 64.102.116.25
ptp mode ordinary
ptp priority1 128
ptp priority2 128
ptp domain 0
multilink bundle-name authenticated
!
```

```
archive
 log config
  hidekeys
!
controller T1 0/0
 mode atm
  clock source line
!
controller T1 0/1
  clock source line
  cem-group 0 timeslots 1-31
!
controller T1 0/2
  clock source internal
!
controller T1 0/3
  clock source internal
!
controller T1 0/4
  clock source internal
!
controller T1 0/5
  clock source internal
!
controller T1 0/6
  clock source internal
!
controller T1 0/7
  clock source internal
!
controller T1 0/8
  clock source internal
!
controller T1 0/9
  clock source internal
!
controller T1 0/10
  clock source internal
!
controller T1 0/11
  clock source internal
!
controller T1 0/12
  clock source internal
!
controller T1 0/13
  clock source internal
!
controller T1 0/14
  clock source internal
!
controller T1 0/15
  clock source internal
!
controller BITS
  applique E1
!
interface Loopback0
 ip address 20.20.20.20 255.255.255.255
!
interface GigabitEthernet0/2
 switchport access vlan 10
 load-interval 30
 duplex full
```

```
speed 100
!
interface GigabitEthernet0/3
switchport access vlan 200
load-interval 30
duplex full
speed 100
!
interface GigabitEthernet0/4
switchport access vlan 4
load-interval 30
duplex full
speed 100
!
interface GigabitEthernet0/5
switchport access vlan 100
load-interval 30
duplex full
speed 100
!
interface ATM0/0
no ip address
scrambling-payload
atm bandwidth dynamic
pvc 0/100 l2transport
!
!
interface ATM0/0.1 multipoint
pvc 1/5 l2transport
encapsulation aal0
xconnect 10.10.10.10 10010 encapsulation mpls
!
pvc 1/6 l2transport
encapsulation aal5
xconnect 10.10.10.10 10020 encapsulation mpls
!
!
interface ATM0/0.2 multipoint
xconnect 10.10.10.10 10030 encapsulation mpls
pvc 2/5 l2transport
encapsulation aal0
!
pvc 2/6 l2transport
encapsulation aal0
!
!
interface ATM0/1
no ip address
scrambling-payload
no atm ilmi-keepalive
pvc 0/100 l2transport
!
!
interface Vlan4
ip address 11.1.1.2 255.255.255.0
ip router isis test_ip_isis
no ptp enable
isis bfd
!
interface Vlan10
ip address 192.168.40.61 255.255.255.128
no ptp enable
mpls ip
!
```

```

interface Vlan100
 ip address 12.1.1.2 255.255.255.0
 ip router isis test_ip_isis
 no ptp enable
 mpls ip
 bfd interval 50 min_rx 50 multiplier 3
 isis bfd
!
interface Vlan200
 ip address 12.1.2.2 255.255.255.0
 ip router isis test_ip_isis
 no ptp enable
 mpls ip
 bfd interval 50 min_rx 50 multiplier 3
 isis bfd
!
router isis test_ip_isis
 net 47.0004.004d.0055.0000.0c00.0002.00
 net 47.0004.004d.0056.0000.0c00.0002.00
 is-type level-2-only
 redistribute connected
 bfd all-interfaces
!

```

Precision Timing Protocol (PTP) 設定例

ここでは、Precision Timing Protocol (PTP) の設定例を示します。PTP の設定方法の詳細については、「クロッキングとタイミングの設定」(P.4-17) を参照してください。

PTP の冗長性

次の設定では、PTP で PTP の冗長性を使用しています。



(注)

ここでは、特定の機能を紹介する目的で設定の一部を示しています。

MWR_A

```

!
interface Loopback0
 ip address 6.6.6.3 255.255.255.255
end
!
interface GigabitEthernet0/0
 switchport access vlan 10
!
interface GigabitEthernet0/1
 switchport access vlan 5
!
interface Vlan5
 ip address 5.5.5.2 255.255.255.0
 ip router isis
 ip pim sparse-mode
 no ptp enable
!
interface Vlan10
 ip address 10.10.10.2 255.255.255.0
 ip router isis

```

```
ip pim sparse-mode
no ptp enable
!
router isis
net 49.0001.1720.1600.3003.00
passive-interface Loopback0
!
ip pim rp-address 6.6.6.1 override
!
```

MWR_B

```
!
interface Loopback0
ip address 6.6.6.2 255.255.255.255
ip pim sparse-mode
end
!
interface GigabitEthernet0/0
switchport access vlan 10
!
interface GigabitEthernet0/4
switchport access vlan 4
load-interval 30
!
!
interface Vlan4
ip address 7.7.7.2 255.255.255.0
ip router isis
ip pim sparse-mode
no ptp enable
!
!
interface Vlan10
ip address 10.10.10.1 255.255.255.0
ip router isis
ip pim sparse-mode
no ptp enable
!
router isis
net 49.0001.1720.1600.9009.00
passive-interface Loopback0
!
ip pim rp-address 6.6.6.1 override
```

レイヤ 3 バーチャル プライベート ネットワーク (VPN) 設定例

次に、レイヤ 3 Virtual Private Network (VPN; バーチャルプライベートネットワーク) の設定例を示します。レイヤ 3 VPN の設定方法の詳細については、「レイヤ 3 バーチャルプライベートネットワーク (VPN) の設定」(P.4-67) を参照してください。



(注) ここでは、特定の機能を紹介する目的で設定の一部を示しています。

```

!
-----Customer definitions for 2 customers-----
vrf definition customer_a
rd 192.168.1.1:100
route-target export 192.168.1.1:100
route-target import 192.168.1.1:100
!
address-family ipv4
exit-address-family
!
vrf definition customer_b
rd 192.168.2.1:200
route-target export 192.168.2.1:200
route-target import 192.168.2.1:200
!
address-family ipv4
exit-address-family
!
-----Loopback addresses for 2 customers-----
interface Loopback100
vrf forwarding customer_a
ip address 192.169.1.3 255.255.255.255
!
interface Loopback101
vrf forwarding customer_b
ip address 192.168.100.1 255.255.255.255
!
-----Core-facing OSPF instance-----
router ospf 1
log-adjacency-changes
network 100.0.0.0 0.255.255.255 area 0
network 192.168.0.0 0.0.255.255 area 0
network 192.169.0.0 0.0.255.255 area 0
!
-----VRF OSPF instances for 2 customers -----
router ospf 100 vrf customer_a
router-id 192.168.1.3
log-adjacency-changes
redistribute bgp 101 metric-type 1 subnets
network 192.168.0.0 0.0.255.255 area 0
network 192.169.0.0 0.0.255.255 area 0
!
router ospf 100 vrf customer_b
router-id 192.168.100.1
log-adjacency-changes
redistribute bgp 101 metric-type 1 subnets
network 192.168.0.0 0.0.255.255 area 0
network 192.169.0.0 0.0.255.255 area 0
!
-----MP-BGP with 2 VRF customers -----
router bgp 101
bgp router-id 100.1.1.1

```

```
bgp log-neighbor-changes
neighbor 100.1.1.2 remote-as 101
neighbor 100.1.1.2 update-source Loopback1
!
address-family ipv4
redistribute connected
neighbor 100.1.1.2 activate
no auto-summary
no synchronization
exit-address-family
!
address-family vpnv4
neighbor 100.1.1.2 activate
neighbor 100.1.1.2 send-community extended
bgp scan-time import 5
exit-address-family
!
address-family ipv4 vrf customer_b
redistribute connected
neighbor 100.1.1.2 remote-as 101
neighbor 100.1.1.2 update-source Loopback1
neighbor 100.1.1.2 activate
no synchronization
exit-address-family
!
address-family ipv4 vrf customer_a
redistribute connected
neighbor 100.1.1.2 remote-as 101
neighbor 100.1.1.2 update-source Loopback1
neighbor 100.1.1.2 activate
no synchronization
exit-address-family
!
-----MP-BGP loopback interface -----
interface Loopback1
ip address 100.1.1.1 255.255.255.255
!
-----Core-facing Vlan interface -----
interface GigabitEthernet0/1
switchport access vlan 20
switchport trunk allowed vlan 1,2,20-23,1002-1005
switchport mode trunk
load-interval 30
!
interface Vlan20
ip address 192.169.10.1 255.255.255.0
load-interval 30
no ptp enable
mpls ip
!
-----CE-facing Vlan interfaces for 2 customers-----
interface GigabitEthernet0/4
switchport access vlan 100
load-interval 30
duplex full
!
interface Vlan100
vrf forwarding customer_a
ip address 192.169.3.2 255.255.255.0
!
interface GigabitEthernet0/5
switchport access vlan 99
load-interval 30
duplex full
```

```
!
interface Vlan99
vrf forwarding customer_b
ip address 192.169.3.2 255.255.255.0
!
```

Quality of Service (QoS) 設定例

次の設定例では、Cisco MWR 2941-DC に QoS 設定を適用する方法を示します。



(注) ここでは、特定の機能を紹介する目的で設定の一部を示しています。

ここでは、Cisco MWR 2941-DC の QoS の設定例を示します。

- [スイッチポート プライオリティ](#)
- [分類およびマーキング](#)
- [プライオリティ キューイング](#)

QoS 設定方法の詳細については、「[Quality of Service \(QoS\) の設定](#)」(P.4-67) を参照してください。

スイッチポート プライオリティ

次の設定例では、9ESW High-speed WAN Interface Card (HWIC; 高速 WAN インターフェイス カード) インターフェイスの着信トラフィックに P ビット値をマーク付けする方法を示しています。

```
.....
interface GigabitEthernet0/2
no ip address
  switchport stacking-partner interface FastEthernet1/8
.....
interface FastEthernet1/7
switchport mode trunk
switchport priority override 7    ! set all ingress traffic to priority 7
                                   ! regardless of current priority values.

interface FastEthernet1/7
switchport mode access
switchport access vlan 100
switchport priority default 5    ! set all ingress traffic to priority 5

interface FastEthernet1/8
no IP address
switchport stacking-partner interface GigabitEthernet0/2
```


分類およびマーキング

次に、入力イーサネットトラフィックの Differentiated Service Code Point (DSCP; DiffServ コードポイント) 値をマーク付けして QoS グループに割り当てた後、P ビットをマーク付けする例を示します。出トラフィックは、Weighted Round-Robin (WRR) でキューイングし、各グループに帯域幅の割合を割り当てます。

```
! Note 1: these class-maps are applied on ingress
class-map match-any common-channels
  match dscp af31 af32 af33
class-map match-any HSDPA
  match dscp default
class-map match-any R99
  match dscp af21 af22 af23
class-map match-any synchronization
  match dscp ef cs6
class-map match-any signaling
  match dscp af41 af42 af43
!
! Note 2: these classp-maps are applied on egress
Class-map match-any group1
  Match qos-group 1
Class-map match-any group2
  Match qos-group 2
Class-map match-any group3
  Match qos-group 3
Class-map match-any group4
  Match qos-group 4
Class-map match-any group5
  Match qos-group 5
Class-map match-any group6
  Match qos-group 6

! Note 3:The input policy performs the DSCP match and all marking
policy-map input-policy
  class synchronization
    set qos-group 6
    set cos 6
  class signaling
    set qos-group 5
    set cos 5
  class common-channels
    set qos-group 4
    set cos 4
  class R99
    set qos-group 3
    set cos 3
  class HSDPA
    set qos-group 1
  class default
    set qos-group 1
!
! Note 4: the hierarchical output policy handles WRR and shaping
policy-map QOS-child
  class group6
    priority percent 5
  class group5
    bandwidth percent 20
  class group4
    bandwidth percent 20
  class group3
    bandwidth percent 20
  class group1
```

```

    bandwidth percent 20
  policy-map output-policy
    class class-default
      shape average 38000000
      service-policy QOS-child
  !
Interface GigabitEthernet 0/0
  service-policy input input-policy
Interface GigabitEthernet 0/1
  service-policy output output-policy

```

MPLS ビット マーキング

次に、疑似回線クラス Universal Mobile Telecommunications System (UMTS) _3 を通過するトラフィックに MPLS Experimental (Exp) ビットをマーク付けする例を示します。Exp ビット値は、MLPPP 出力インターフェイス、MLPPP キュー、またはレイヤ 2 イーサネット キューの QoS グループにマッピングできます。

```

!
pseudowire-class UMTS_3
encapsulation mpls
mpls experimental 3
!
interface ATM0/IMA0
  pvc 2/1 l2transport
  encapsulation aal0
  xconnect 10.10.10.1 121 pw-class UMTS_3
!
!

```

プライオリティ キューイング

次に、DSCP 値が **ef** のトラフィックを、MLPPP マルチリンク インターフェイスのプライオリティ キューに配置する例を示します。

```

class-map match-any gsm-abis
  match dscp ef
!
!
policy-map gsm-abis ? note that without multiclass up to 4 queues supported
  class gsm-abis
    priority percent 99
  class class-default
    bandwidth remaining percent 1
!

interface Multilink1
  ip address 50.50.50.49 255.255.255.0
  ip tcp header-compression ietf-format
  load-interval 30
  keepalive 1
  ppp pfc local request
  ppp pfc remote apply
  ppp acfc local request
  ppp acfc remote apply
  ppp multilink
  ppp multilink interleave
  ppp multilink group 1
  ppp multilink fragment delay 0 1
  ppp multilink multiclass

```

```
ppp timeout multilink lost-fragment 1
max-reserved-bandwidth 100
service-policy output gsm-abis
hold-queue 50 out
ip rtp header-compression ietf-format
```

Cisco Networking Services (CNS) ゼロ タッチ配置設定

次に、IP アドレス 30.30.1.20 の Cisco Networking Services (CNS) –Customer Edge (CE; カスタマーエッジ) サーバに保存されたコンフィギュレーションを使用して Cisco MWR 2941-DC を起動するように設定する例を示します。CNS の設定の詳細については、「[Cisco Networking Services \(CNS\) の設定](#)」(P.4-98) を参照してください。



(注)

ここでは、特定の機能を紹介する目的で設定の一部を示しています。

```
hostname 2941
!
cns trusted-server all-agents 30.30.1.20
cns event 30.30.1.20 11011 keepalive 60 3
cns config initial 30.30.1.20 80
cns config partial 30.30.1.20 80
cns id hostname
cns id hostname event
cns id hostname image
cns exec 80
logging buffered 20000
!
end
```

