

Interworking Multiservice Gateway Access Circuit Redundancy

Table 1: Feature History

Feature Name	Release Information	Description
Interworking Multiservice Gateway Access Circuit Redundancy (iMSG ACR) support for NCS 4200 1-Port OC-192 or 8-Port Low Rate CEM 20G Bandwidth Interface Module (NCS4200-1T8S-20CS)	Cisco IOS XE Amsterdam 17.3.1	The iMSG ACR feature is supported on serial interfaces for SONET and SDH ACR. DCC and MS features are also supported.

Interworking Multiservice Gateway Access Circuit Redundancy (iMSG ACR) enables local switching for serial interfaces by creating a virtual serial-ACR interface. All configuration changes made on the virtual serial-ACR interface are applied automatically on both the working and protect interfaces. Switching from working to protect or protect to working interface occurs within 250 milliseconds at different scaled levels with line rate traffic. For more information, see Serial Interfaces.

Note Interworking Multiservice Gateway Access Circuit Redundancy (iMSG ACR) is supported on Cisco NCS 4200 series routers from Cisco IOS XE Everest 16.5.1 release.

- SONET Supported Modes, on page 1
- SDH Supported Modes , on page 2
- Restrictions for iMSG ACR, on page 3
- How to Configure iMSG ACR, on page 3

SONET Supported Modes

Table 2: SONET Supported Modes for iMSG ACR

Mode	Ports
STS-3C	OC-3, OC-12, OC-48

Mode	Ports
DS3	OC-3, OC-12, OC-48
DS3-T1	OC-3, OC-12, OC-48
VT 1.5	OC-3, OC-12, OC-48

Table 3: SONET Supported Modes for iMSG non-ACR

Mode	Ports
STS-3C	OC-3, OC-12, OC-48
STS-12C	OC-12, OC-48
STS-48C	OC-48
DS3	OC-3, OC-12, OC-48
DS3-T1	OC-3, OC-12, OC-48
VT 1.5	OC-3, OC-12, OC-48

SDH Supported Modes

Table 4: SDH Supported Modes for iMSG ACR

Mode	Ports
VC4	STM1, STM4, STM16
TUG-3-E3	STM1, STM4, STM16
TUG-3-T3	STM1, STM4, STM16
TUG-2-E1	STM1, STM4, STM16
TUG-2-T1	STM1, STM4, STM16

Table 5: SDH Supported Modes for iMSG non-ACR

Mode	Ports
VC4	STM1, STM4, STM16
VC4-4c	STM4, STM16
VC4-16c	STM16

Modes not supported on SDH for iMSG ACR

- VC4—TUG-3—TUG-2—VC-12
- VC4— TUG-3—TUG-2—VC-11
- (AU-3) VC-3—TUG-2—VC-12
- (AU-3) VC-3—TUG-2—VC11
- SDH—AU3—VC12—E1

Restrictions for iMSG ACR

Table 6: Feature History

Feature Name	Release	Description
Interworking Support for nxDS0	Cisco IOS XE Amsterdam 17.3.1	Interworking function (IWF) for PPP/HDLC is supported on Ethernet for E1/STM1 ports. This support is extended at nxDS0 level to speed up the GSR TDM migration.

- A maximum number of 336 circuits are supported on ACR interface.
- Quality of Service (QoS) and default experimental bits (EXP) marking for MPLS pseudowires is not supported on the iMSG-ACR interface.
- Port license must be enabled on 3G IM port SONET or SDH ports.
- For iMSG IPv6 MTU, the change in configuring MTU value is not supported. Ensure that you configure the circuit with the default MTU value.

How to Configure iMSG ACR

Creating ACR Group

You can create virtual ACR groups with the following SONET ACR types:

- OC3
- OC12
- OC48

You can create virtual ACR groups with the following SDH ACR types:

- STM1
- STM4
- STM16

To create ACR group, enter the following commands:

```
rotuer(config)#ACR <id> type <type-id>
```

Configuring ACR Group on APS

You can configure ACR group on APS. The ACR group supported range is from 1 to 96. Any group number exceeding the range is not supported. You can configure the interface as working using the circuit number. The circuit number identies a particular channel in the APS pair. Since the interface only supports 1 + 1 redundancy, the only valid and the default value for working interface is 1.

The APS group created can be active or inactive:

- Active—The interface that is currently sending and receiving data.
- Inactive—The interface that is currently standing by to take over when the active fails.



Note APS is supported in revertive and non-revertive mode and can be configured as undirectional and bidirectional.

To configure ACR group on APS with SONET interface as a working interface, enter the following commands:

```
configure terminal
controller sonet slot/subslot/port
aps group acr-id
aps working circuit-number
 aps group acr <acr_id>
```

To configure ACR group on APS with SDH interface as a working interface, enter the following commands:

```
configure terminal
controller sdh slot/subslot/port
aps group acr-id
aps working circuit-number
 aps group acr <acr_id>
```

You can configure an interface to be protect interface in the APS pair. Because only 1+1 redundancy is supported, the only valid value is 1, and the protect interface defaults to 1.

While specifying ACR ID, you need to specify an IP address for the loopback interface. The protect interface uses this IP address to communicate with the working interface.

To configure ACR group on APS with SONET interface as a protect interface, enter the following commands:

```
configure terminal
controller sonet slot/subslot/port
aps group acr-id
aps protect <acr_id> <any-loopback-ip-address>
 aps group acr <acr_id>
```

To configure ACR group on APS with SDH interface as a protect interface, enter the following commands:

```
configure terminal
controller sdh slot/subslot/port
```

```
aps group acr-id
aps protect <acr_id> <any-loopback-ip-address>
 aps group acr <acr_id>
```

The following example explains how to configure ACR group on APS with SONET interface as working interface:

```
Router# configure  terminal
Router (config)# controller sonet  0/1/0
Router(config-controller)# aps  group  1
Router (config-controller)# aps  working  1
Router (config-controller)# aps group acr 1
```

The following example explains how to configure ACR group on APS with SONET interface as protect interface:

```
Router# configure  terminal
Router (config)# controller  sonet  0/2/0
Router(config-controller)# aps  group  1
Router (config-controller)# aps protect  1 10.1.1.1
Router (config-controller)# aps group acr 1
```

The following example explains how to configure ACR group on APS with SDH interface as working interface:

```
Router# configure  terminal
Router (config)# controller sdh  0/3/0
Router(config-controller)# aps  group  1
Router (config-controller)# aps  working  1
Router (config-controller)# aps group acr 1
```

The following example explains how to configure ACR group on APS with SDH interface as protect interface:

```
Router# configure  terminal
Router (config)# controller  sdh  0/4/0
Router(config-controller)# aps  group  1
Router (config-controller)# aps protect  1 10.1.1.1
Router (config-controller)# aps group acr 1
```

Creating Serial Interface for SONET ACR

You can create serial interface for SONET ACR on VT 1.5, CT-3, and T3 modes.

Creating Serial Interface for SONET ACR on VT 1.5 Mode

To create serial interface for SONET ACR on VT 1.5 mode, enter the following commands:

```
controller SONET-ACR <ACR-ID>
 sts-1 1
 mode vt-15
 vtg <vtg_num> t1 <t1_num> channel-group <channel_num> timeslots 1-24
 vtg <vtg_num> t1 <t1_num> channel-group <channel_num> timeslots 1
```

The following example describes how to create serial interface on VT 1.5 mode for SONET controller:

```
controller SONET-ACR 100
 sts-1 2
```

```
 mode vt-15
 vtg 1 t1 1 channel-group 0 timeslots 1-24
 vtg 2 t1 2 channel-group 1 timeslots 1
```

Creating Serial Interface for SONET ACR on CT3 Mode

To create serial interface for SONET ACR on CT-3 mode, enter the following commands:

```
controller SONET-ACR <ACR-ID>
 sts-1 1
 mode ct3
 t3 framing c-bit
 t1 <t1_num> channel-group <channel_num> timeslots 1-24
```

The following example describes how to create serial interface on CT-3 mode for SONET controller:

```
controller SONET-ACR 100
  sts-1 1
  mode ct3
  t3 framing c-bit
  t1 1 channel-group 0 timeslots 1-24
```

Creating Serial Interface for SONET ACR on T3 Mode

To create serial interface for SONET ACR on T3 mode, enter the following commands:

```
controller SONET-ACR <ACR-ID>
 sts-1 3
 mode t3
 t3 framing c-bit
 t3 channel-group 0
```

The following example describes how to create serial interface on T3 mode for SONET controller:

```
controller SONET-ACR 100
 sts-1 3
  mode t3
  t3 framing c-bit
  t3 channel-group 0
 !
```

Creating Serial Interface for SONET ACR on PoS Mode

To create serial interface for SONET ACR on PoS mode, enter the following commands

```
controller SONET-ACR 50
 sts-1 1 - 3 mode sts-3c
  channel-group 0
```

Creating Serial Interface for SONET non-ACR on PoS Mode

To create serial interface for SONET non-ACR on STS-12c mode, enter the following commands:

```
configure terminal
controller SONET <slot>/<subslot>/<port>
   rate OC12
   sts-1 1 - 12 mode sts-12c
   channel-group 0
```

To create serial interface for SONET non-ACR on STS-48c mode, enter the following commands:

```
configure terminal
controller SONET <slot>/<subslot>/<port>
  rate OC48
  sts-1 1 - 48 mode sts-48c
  channel-group 0
```

Creating Serial Interface for SDH ACR

To create serial interface for SDH ACR on T1, enter the following commands:

```
configure terminal
controller sdh-acr <acr-ID>
aug mapping au-4
au-4 1
mode tug-3
tug-3 1
mode vc1x
Tug-2 1 payload vc12
t1 1 channel-group 0 timeslots 1 - 24
```

To create serial interface for SDH ACR on E1, enter the following commands:

```
enable
configure terminal
controller sdh-acr 200
aug mapping au-4
au-4 1
mode tug-3
tug-3 1
mode vc1x
Tug-2 1 payload vc12
e1 1 channel-group 0 timeslots 1 - 31
```

The following example explains how to create serial interface for SDH ACR on T1:

```
configure terminal
controller sdh-acr 200
aug mapping au-4
au-4 1
mode tug-3
tug-3 1
mode vc1x
Tug-2 1 payload vc12
t1 1 channel-group 0 timeslots 1 - 24
```

The following example explains how to create serial interface for SDH ACR on E1:

```
enable
configure terminal
```

```
controller sdh-acr 300
aug mapping au-4
au-4 1
mode tug-3
tug-3 1
mode vc1x
Tug-2 1 payload vc12
e1 1 channel-group 0 timeslots 1 - 31
```

Creating Serial Interface for SDH ACR on PoS Mode

To create serial interface for SDH ACR on PoS mode, enter the following commands

```
controller SDH-ACR 50
 aug mapping au-4
 au-4 1
  mode vc4
  Channel-group 0
```

Creating Serial Interface for SDH non-ACR on PoS Mode

To create serial interface for SDH non-ACR on VC4-4c Mode, enter following commands under physical controller:

```
configure terminal
controller SDH <slot>/<subslot>/<port>
  rate STM
  au-4 1 - 4 mode vc4-4c
   channel-group 0
```

To create serial interface for SDH non-ACR on VC4-16c Mode, enter following commands under physical controller:

```
configure terminal
controller SDH <slot>/<subslot>/<port>
  rate STM16
  au-4 1 - 16 mode vc4-16c
  channel-group 0
```

Modifying Encapsulation to PPP

By default the encapsulation is HDLC, and you can change the encapsulation to PPP.

To modify encapsulation to PPP, enter the following commands:

```
router(config)#interface SERIAL-ACR148.1
router(config-if)#no ip address
router(config-if)# encapsulation ppp
```

Configuring IPv4 and IPv6 Interworking Pseudowire

To configure IPv4 interworking pseudowire class, enter the following commands:

```
pseudowire-class <PW_class_name>
```

```
 encapsulation mpls
 interworking ip
 control-word
```

To configure IPv6 interworking pseudowire interface, enter the following commands:

```
interface pseudowire<pw-number>
 encapsulation mpls
 neighbor <peer-address> <vcid-value>
 control-word include
```



Note Based on the far-end router, the control-word needs to be enabled or disabled.

The following example describes how to configure IPv4 interworking pseudowire class:

```
pseudowire-class PW_class_name
 encapsulation mpls
 interworking ip
 control-word
```

The following example describes how to configure IPv6 interworking pseudowire interface:

```
interface pseudowire30
 encapsulation mpls
 neighbor 10.2.2.2 30
 control-word include
```

Configuring Cross-Connect on Serial Interface

The **xconnect** command binds the attachment circuit to a pseudowire for cross connect service. The identifier creates the binding between a pseudowire that is configured on a PE router and an attachment circuit in a CE device.

To perform IPv4 cross connection between a pseudowire and attachment circuit, use the following commands:

```
router(config)#interface serial-ACR1.29
router(config-if)#xconnect ip-address vc_num pw-class  class-name
```

To perform IPv6 cross connection between a pseudowire and attachment circuit, use the following commands:

```
router(config)#l2vpn xconnect context <xconnect name>
router(config-xconnect)#interworking ipv6
router(config-xconnect)#member pseudowire pw-number
router(config-xconnect)#member serial-ACR
```

The following example shows IPv6 cross connection between a pseudowire and attachment circuit:

```
l2vpn xconnect context pw_30_acr_vt15
interworking ipv6
member pseudowire30
member serial-ACR1.29
```

Verifying iMSG ACR

Verifying iMSG ACR with HDLC Encapsulation

Use the following **show aps group** and **show interface SERIAL-ACR** commands to verify iMSG ACR with HDLC encapsulation on the SONET or SDH controller:

```
router# show aps group 100
SONET 0/1/16 APS Group 100: protect channel 0 (Inactive) (HA)
        Working channel 1 at 10.1.1.3 (Enabled)  (HA)
        unidirectional, ADM, non-revertive
        PGP timers (extended for HA): hello time=1; hold time=10
                hello fail revert time=120
        SONET framing; SONET APS signalling by default
        Received K1K2: 0x11 0x04
                Do Not Revert (working)
        Transmitted K1K2: 0x00 0x04
                No Request (Null)
        Remote APS configuration: (null)

SONET 0/4/16 APS Group 100: working channel 1 (Active) (HA)
        Protect at 10.1.1.3 (unidirectional, non-revertive)
        PGP timers (from protect): hello time=1; hold time=10
        SONET framing
        Remote APS configuration: (null)


router# show aps group 300
SDH 0/3/0 APS Group 300: protect channel 0 (Inactive) (HA)
        Working channel 1 at 10.1.1.3 (Enabled)  (HA)
        unidirectional, ADM, non-revertive
        PGP timers (extended for HA): hello time=1; hold time=10
                hello fail revert time=120
        SDH framing; SDH APS signalling by default
        Received K1K2: 0x11 0x04
                Do Not Revert (working)
        Transmitted K1K2: 0x00 0x04
                No Request (Null)
        Remote APS configuration: (null)

SDH 0/3/1 APS Group 300: working channel 1 (Active) (HA)
        Protect at 10.1.1.3 (unidirectional, non-revertive)
        PGP timers (from protect): hello time=1; hold time=10
        SDH framing
        Remote APS configuration: (null)


router#show interface SERIAL-ACR100.1
SERIAL-ACR100.1 is up, line protocol is up
  Hardware is N/A
  MTU 1500 bytes, BW 1536 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:05, output 00:00:02, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
     70 packets input, 10902 bytes, 0 no buffer
```

```
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     57 packets output, 2508 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     20 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     7 carrier transitions no alarm present
  VC 1: timeslot(s): 1-24, Transmitter delay 0, non-inverted data
```

Use the following **show interface SERIAL-ACR** commands to verify HDLC ACR configuration on the SDH controller:

```
router#show int SERIAL-ACR148.1
SERIAL-ACR148.1 is up, line protocol is up
  Hardware is N/A
  MTU 1500 bytes, BW 44210 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:07, output 00:00:06, output hang never
  Last clearing of "show interface" counters 01:16:15
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
     122925 packets input, 16492939 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     744239 packets output, 41162791 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     85 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions alarm present
  DSU mode 0, bandwidth 0 Kbit, scramble 0, VC 1, non-inverted data
```

Verifying iMSG ACR with PPP Encapsulation

Use the following **show interface SERIAL-ACR** command to verify iMSG ACR with PPP encapsulation on the SONET or SDH controller:

```
router#show interface SERIAL-ACR100.1
SERIAL-ACR100.1 is up, line protocol is up
  Hardware is N/A
  MTU 1500 bytes, BW 1536 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 2/255, rxload 2/255
  Encapsulation PPP, LCP Open
  Stopped: TAGCP
  Open: IPCP, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters 03:28:29
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 14000 bits/sec, 1185 packets/sec
  5 minute output rate 14000 bits/sec, 1185 packets/sec
     14628274 packets input, 25965577 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
```

```
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     14628402 packets output, 26013374 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     2 carrier transitions
 PW stats
 14625804 input packets ,14625930 output packets,
 1872102912 input bytes, 1872119040 output bytes, 0 input packet drop
 no alarm present
  VC 1: timeslot(s): 1-24, Transmitter delay 0, non-inverted data
```

Verifying iMSG ACR with HDLC Encapsulation on PoS Mode

Use the following **show interfaces SERIAL-ACR<*acr-id*>.<*path-number*>** command to verify iMSG ACR with HDLC encapsulation on PoS mode for SONET or SDH controller.

```
Router#show interfaces serial-acr50.1
SERIAL-ACR50.1 is up, line protocol is up
  Hardware is N/A
  MTU 1500 bytes, BW 155000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:09, output 00:00:05, output hang never
  Last clearing of "show interface" counters 00:00:27
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     102 packets input, 10688 bytes
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     103 packets output, 10732 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
PW stats
100 input packets ,100 output packets,
10000 input bytes, 10000 output bytes, 0 input packet drop
no alarm present
  VC:1, Non-inverted data
```

Verifying iMSG ACR with PPP Encapsulation on PoS Mode

Use the following **show interfaces SERIAL-ACR<*acr-id*>.<*path-number*>** command to verify iMSG ACR with PPP encapsulation on PoS mode for SONET or SDH controller.

```
Router#show interfaces serial-acr50.85
SERIAL-ACR50.85 is up, line protocol is up
  Hardware is N/A
  MTU 1500 bytes, BW 155000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, LCP Open
  Stopped: TAGCP
```

```
  Open: IPCP, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:01, output 00:00:01, output hang never
  Last clearing of "show interface" counters 00:00:11
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     104 packets input, 10776 bytes
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     104 packets output, 10776 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
PW stats
100 input packets ,100 output packets,
10000 input bytes, 10000 output bytes, 0 input packet drop
no alarm present
  VC:85, Non-inverted data
```