



Media Redundancy Protocol (MRP)

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Information About MRP

Media Redundancy Protocol (MRP), defined in International Electrotechnical Commission (IEC) standard 62439-2, provides fast convergence in a ring network topology for Industrial Automation networks. MRP Media Redundancy Manager (MRM) defines its maximum recovery times for a ring in the following range: 10 ms, 30 ms, 200 ms and 500 ms.



Note The default maximum recovery time on the Cisco IE switch is 200 ms for a ring composed of up to 50 nodes. You can configure the switch to use the 30 ms or the 500 ms recovery time profile as described in [Configuring MRP Manager](#). The 10 ms recovery time profile is not supported.

MRP is supported on the following switches:

- Cisco Catalyst IE3x00 Rugged Series Switches (IE3200, IE3300, and IE3400)

- Cisco Catalyst IE3400 Heavy Duty Series Switches
- Cisco Catalyst IE3100 Rugged Series Switches (IE3100 and IE3105)



Note MRP is not supported on Cisco Catalyst ESS3300 Switches.

MRP operates at the MAC layer and is commonly used in conjunction with the PROFINET standard for industrial networking in manufacturing.

MRP Modes

There are two modes of MRP supported on the switch; however, only one mode can be enabled to operate on the switch at any given time:

- PROFINET MRP mode—Deployed in a PROFINET environment, the switch is added and managed by Siemens Totally Integrated Automation (TIA) Framework. This is the default MRP mode if the MRP manager or client license is activated through the web interface or command line.



Note When managing the switch with TIA, do not use the CLI or WebUI to configure MRP.

- MRP Command-line interface (CLI) mode—This mode is managed by the Cisco IOS CLI and WebUI, a web-based user interface (UI).



Note When managing the switch in MRP CLI mode, you cannot download the MRP configuration from Siemens STEP7/TIA.

Protocol Operation

In an MRP ring, the MRM serves as the ring manager, while the Media Redundancy Clients (MRCs) act as member nodes of the ring. Each node (MRM or MRC) has a pair of ports to participate in the ring. The MRM initiates and controls the ring topology to react to network faults by sending control frames on one ring port over the ring and receiving them from the ring over its other ring port, and conversely in the other direction. An MRC reacts to received reconfiguration frames from the MRM and can detect and signal link changes on its ring ports.

On Cisco Catalyst IE3x00 and IE3100 Rugged Series and IE3400 Heavy-Duty Switches, certain nodes or all nodes in the ring can also be configured to start as a Media Redundancy Automanager (MRA). MRAs select one MRM among each other by using a voting protocol and a configured priority value. The remaining MRAs transition to the MRC role.

All MRM and MRC ring ports support the following states:

- Disabled: Ring ports drop all received frames.

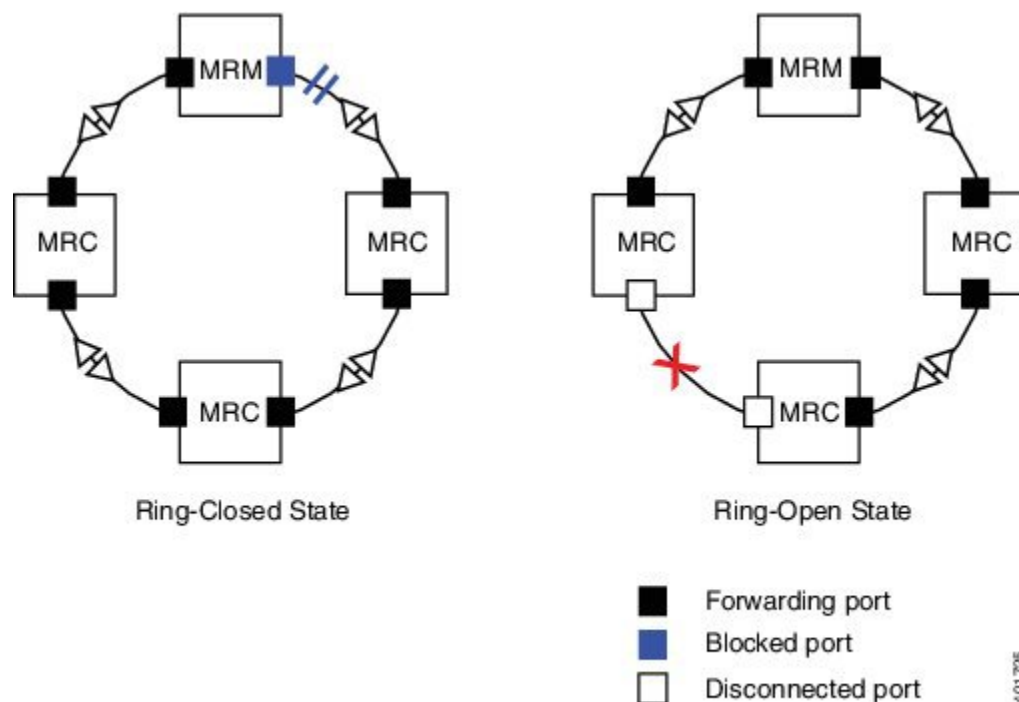
- Blocked: Ring ports drop all received frames except MRP control frames and some standard frames, for example, LLDP.
- Forwarding: Ring ports forward all received frames.
- Not Connected: The link is physically down or disconnected. (This state differs from the Disabled state, in which the MRP Port is manually disabled through software.)

During normal operation, the network operates in the Ring-Closed state (see figure below). To prevent a loop, one of the MRM ring ports is blocked, while the other port is forwarding. Most of the time, both ring ports of all MRCs are in the forwarding state. With this loop avoidance, the physical ring topology becomes a logical stub topology.

In the figure, note the following details about the two rings, left and right:

- Left Ring: The connection (small blue square, top) on the MRM is in a blocked state (as shown by the two parallel lines) because no ports are disconnected.
- Right Ring: Two MRC connections (left and center small white squares) are in the disabled state because the link between them is broken, as marked by a red “x”.

Figure 1: MRP Ring States



If a network failure occurs:

- The network shifts into the Ring-Open state.
- In the case of failure of a link connecting two MRCs, both ring ports of the MRM change to the forwarding state, the MRCs adjacent to the failure have a disabled and a forwarding ring port, and the other MRCs have both ring ports forwarding.

In the Ring-Open state, the network logical topology becomes a stub.

Layer 2 Ethernet frames will be lost during the time required for the transition between these two ring states. The MRP protocol defines the procedures to automatically manage the switchover to minimize the switchover time. A recovery time profile, composed of various parameters, drives the MRP topology convergence performance. The 200 ms profile supports a maximum recovery time of 200 ms.

MRP uses three types of control frames:

- To monitor the ring status, MRM regularly sends test frames on both ring ports.
- When MRM detects failure or recovery, it sends TopoChange frames on both ring ports.
- When MRC detects failure or recovery on a local port, it sends LinkChange subtype frames, Linkdown and Linkup, to the MRM.

Media Redundancy Automanager (MRA)



Note MRA can be activated through the CLI or through PROFINET.

If configured to start as a Media Redundancy Automanager (MRA), the node or nodes select an MRM using a voting protocol and configured priority value. The remaining MRAs transition to the MRC role. All nodes must be configured as MRA or MRC. A manually configured MRM and MRA in the same ring is not supported.

The MRA role is not an operational MRP role like MRM or MRC. It is only an administrative, temporary role at device startup, and a node must transition to the MRM role or the MRC role after startup and the MRM is selected through the manager voting process.

MRA functions as follows:

1. At power on, all MRAs begin the manager voting process. Each MRA begins to send MRP_Test frames on both ring ports. The MRP_Test frame contains the MRA's priority value. The remote manager's priority value contained in the received MRP_Test frames are compared with the MRA's own priority. If its own priority is higher than the received priority, the MRA sends a negative test manager acknowledgement (MRP_TestMgrNAck) frame, along with the remote manager's MAC address.
2. If the receiving MRA receives an MRP_TestMgrNAck with its own MAC address, the receiving MRA initiates the transition into the client (MRC) role.
3. The MRP_TestPropagate frame informs other MRA devices in the client role about the role change and the new higher priority manager. The clients receiving this frame update their higher priority manager information accordingly. This ensures that clients remain in the client role if the monitored higher priority manager role changes.

License Levels



Note Information about the MRP feature license described below applies only to Cisco IOS XE releases earlier than 17.7.1. Use of MRP in Cisco IOS XE 17.7.1 and later does not require a feature license, only the Network Essentials Base license. Information below about Base Licenses and Add-On Licenses applies to all Cisco IOS XE releases.

In Cisco IOS XE releases prior to 17.7.1, use of the MRP feature requires a feature license. The feature license is enforced and must be authorized by Cisco before the feature can be enabled. To use the MRP feature, you buy an MRP feature license and Cisco installs an authorization code on your device at the time the device is purchased, or you can install the authorization code on your device using the **license smart authorization request add <feature-name> local** command.

In online mode, the device requests the license from the Cisco Smart Software Manager (CSSM) directly or through the Cisco Smart Licensing Utility (CSLU). The CSSM returns a smart license authorization code (SLAC) to the Product Instance (PI) directly or through the CSLU. If a device receives the authorization code, the smart agent on the device stores this authorization code in the tamper-proof trusted store and you can enable the feature. If you install the authorization code and do not enable the feature, when you boot the device the smart agent on the device will honor the auth-code that was stored in trusted store. The device does not need to request the authorization code from the CSSM again and you can enable the feature.

The software features available on Cisco Catalyst IE3x00 Rugged and IE3400H switches fall under these base or add-on license levels.

Base Licenses

- Network Essentials
- Network Advantage—Includes features available with the Network Essentials license and more.

Add-On Licenses

Add-On Licenses require a Network Essentials or Network Advantage as a pre-requisite. The features available with add-on license levels provide Cisco innovations on the switch, as well as on the Cisco Digital Network Architecture Center (Cisco DNA Center).

- DNA Essentials
- DNA Advantage— Includes features available with the DNA Essentials license and more.

To find information about platform support and to know which license levels a feature is available with, use Cisco Feature Navigator. To access Cisco Feature Navigator, go to <https://www.cisco.com/go/cfn>. An account on cisco.com is not required.

Feature Licenses

Feature Licenses are bound to a specific feature or set of features. Feature licenses can be enabled regardless of Base License (Network Advantage or Network Essential). Feature licenses are Smart Licenses as well and require a Smart Account to be activated.



Note The MRP feature license requirement is removed in Cisco IOS XE 17.7.1 and later. The MRP feature is available as a part of Network Essentials Licensing. In releases prior to Cisco IOS XE 17.7.1, use of MRP requires a feature license and the following information applies only to those earlier releases.

There are 2 MRP licenses available for IE3x00:

- LIC-MRP-MGR-XE= MRP Ring Manager license.
- LIC-MRP-CLIENT-XE= MRP Ring Client license.

See [Activating the MRP License, on page 9](#) for procedures to activate the MRP license.

For more information about Smart Licensing, see [Smart Licensing Using Policy for Cisco Enterprise Routing Platforms](#).

Multiple MRP Rings

In an Industrial Ethernet network, an MRP ring in a cell/area is a sub-ring of the access layer. You can connect multiple MRP rings, which you can then aggregate into the distribution layer.



Note The MRP feature license requirement is removed in Cisco IOS XE 17.7.1 and later.

You can configure up to three rings, and you can configure the switch as either automanager or client.

MRP-STP Interoperability

MRP works with Spanning Tree Protocol (STP) to prevent unwanted broadcast loops in the event that a user accidentally connects a device that does not participate in the MRP ring. In a network operating with MRP and STP, spanning tree BPDUs are not sent on MRP-enabled ports. If ports are unconfigured from an MRP ring, then the ports are added to the spanning tree.

MRP-STP interoperability is supported for both PROFINET MRP mode and MRP CLI mode, and functions without additional CLI configuration.

Prerequisites

- Before configuring a ring, in Cisco IOS XE releases 17.6.x and earlier, ensure that you have enabled MRP Manager/Client licenses. These can be obtained from Smart licensing account, and by following the SL or SLR process to activate the feature licenses.
- Use of MRP in Cisco IOS XE 17.7.1 and later is available with the Networking Essentials license.
- Because MRP is deployed in a physical Ring topology, before configuring or unconfiguring the MRP feature, it is advised to leave one physical connection between two nodes in each ring open by either issuing a **shut** command on the connecting interfaces or physically removing the cable to avoid any

network storms. After you have properly configured all MRCs and MRMs, issue a **no shut** command on the port or re-connect the cable between the nodes.

- In Cisco IOS XE releases 17.6.x and earlier, activate the MRP License before you configure the MRP protocol.
- Determine the MRP configuration on the switch: MRA, or MRC.
- When the network is managed by SIMATIC TIA or STEP7, ensure that the basic PROFINET connection is on.
- The MRP default VLAN is 1. To use a non-default VLAN, you must configure the PROFINET VLAN ID before assigning it to the MRP configuration.

Guidelines and Limitations

- MRP is supported on Cisco Catalyst IE3x00 and IE3100 Rugged Series and IE3400 Heavy Duty Series Switches. MRP is not supported on ESS3300 Switches.
- In Cisco IOS XE 17.7.1 and later, the MRP feature is available as a part of Network Essentials Licensing. In releases prior to Cisco IOS XE 17.7.1, use of MRP requires a feature license that must be activated using the Cisco switch CLI.
- By default, Profinet MRP mode is enabled on Cisco Catalyst IE3x00 switches. You can configure MRP, including the MRP role, using the Cisco switch CLI only after you disable the PROFINET MRP function using the Cisco switch CLI.



Note Profinet MRP mode is not supported by default on Cisco Catalyst IE3x00 switches. You must use the Cisco switch CLI for configuration.

When PROFINET MRP is enabled, use STEP7 and TIA to configure MRP, including the MRP role.

- To avoid Smart License registration failure, ensure that the NTP configuration and the device clock are in sync.
- With the MRP manager license (Cisco IOS XE 17.6.x and earlier), you can configure up to three rings on a device (each MRP instance can be manager or client), with a manager instance for each ring.
- Support for multiple MRP rings is available only through the CLI or WebUI.
- The switch supports up to 50 MRCs per ring.
- MRP cannot run on the same interface (port) as Resilient Ethernet Protocol (REP), Spanning Tree Protocol (STP), Flex Links, macsec, or Dot1x.
- STP does not run on MRP segments. MRP interfaces drop all STP BPDUs.
- For access ports, you must specifically configure **switchport mode access** and **switchport access vlan x** commands in the MRP interface.
- MRP interfaces come up in a forwarding state and remain in a forwarding state until notified that it is safe to block. The MRP ring state changes to Ring-Closed.

- MRP ports cannot be configured as any of these port types: SPAN destination port, Private VLAN port, or Tunnel port. Additionally, when operating in PROFINET mode, you cannot configure MRP ports as Trunk ports.
- MRP is not supported on EtherChannels or on an individual port that belongs to an EtherChannel.
- Each MRP ring can have one MRP VLAN. The VLAN must be different for each ring in a device to avoid traffic flooding.

PROFINET MRP Mode Only

- PROFINET MRP mode is supported on IE3x00 Series Switches; it is not supported on IE3100 Rugged Series Switches.
- Ensure that you configure the correct ring ID on client and manager. Ring ID configuration is not automatically validated by the switch.
- You can configure only one MRP ring in PROFINET MRP mode.



Note The number of MRP rings displayed in the **show profinet status** command output indicates the maximum number of rings allowed for configuration through the CLI and not through PROFINET.

- In PROFINET MRP, which is managed by STEP7 and TIA, only Layer 2 access ports are supported because PROFINET does not have the concept of VLAN tagging.
- The 10 ms profile is not supported.
- When using PROFINET MRP mode, we recommend setting the LLDP timer to 5 ms or 10 ms to ensure PROFINET can see neighbor devices and to avoid a Siemens PLC timeout.
- When a new pluggable module GSD file is installed in TIA/ STEP7, you must recreate the project in TIA/Step7. The existing project, which was created using the old GSD file, will display an error when you attempt to select the new GSD file for the same device. This occurs because the combo ports in the pluggable module SKUs were previously defined as fixed ports.
- You cannot change the role of any node from MRA to MRC after all nodes come up in MRA mode, either by breaking the ring (by shutting the port or physically removing the cable) or manually configuring the role change. If you want an MRP ring configuration with MRA and MRCs, you need to initially configure only one node as MRA and the rest as MRCs.

MRP CLI Mode Only

- After using the CLI to configure the MRP ring, you must attach the MRP ring to a pair of ports that support MRP.
- Both MRP ports must have the same interface mode (access or trunk).
- To change an existing MRP ring's configuration (mode), or to change the interface mode of the ring ports between access and trunk, you must first delete the ring and then recreate it with the new configuration.
- When both MRP ports are in access mode, the access VLANs should match. If the configured MRP VLAN does not match the ports' access VLAN, the MRP VLAN is automatically changed to the MRP ports' access VLAN.

- In an MRP ring with two access ports, if the ports do not belong to the same access VLAN when you create the MRP ring or you change the access VLAN for only one of the ports after the MRP ring is created, the MRP ring operation is suspended and a message similar to the following is displayed:

```
ERROR% The ring 1 ports don't belong to the same access VLAN. The MRP ring will not function until the issue has been fixed
```

Resolve the issue by configuring the access VLAN to be the same for the two ring ports.

- The 200 ms standard profile, 500 ms profile, and 30 ms profile are supported. The 10 ms profile is not supported.
- MRA can be activated through CLI and PROFINET.

Default Settings

- In Cisco IOS XE 17.6.x and earlier, MRM and MRC licenses are not installed by default. Starting with 17.7.1 a feature license is no longer required for MRP.
- (Cisco IOS XE 17.6.x and earlier) PROFINET MRP mode is enabled by default when MRM or MRC licenses are enabled.
- MRP is disabled by default.
- The default VLAN is 1.
- Create the non-default VLAN before you assign it to MRP ring 1.

Activating the MRP License



Note Activating the MRP license applies to Cisco IOS XE 17.6.x and earlier. The MRP feature license requirement is removed in Cisco IOS XE 17.7.1 and later.

The procedure to activate the MRP license depends on whether you are using Smart Licensing in online mode or offline mode. Each mode has two scenarios:

- Online mode:
 - The device is connected directly to the Cisco Smart Software Manager (CSSM).
 - The device is connected to the CSSM through the CSLU.
- Offline mode:
 - The device is not connected to the CSSM or the CSLU.
 - The device is in CSLU mode and not connected to the CSSM.

Perform one of the following procedures to activate the MRP license, based on your Smart Licensing mode.



Note The following procedures show examples of activating both the MRP Manager and Client licenses. When activating the MRP license on your switch, enter the commands for your license type: mrp-manager or mrp-client.

Device Directly Connected to CSSM

To activate the MRP license when the device is directly connected to the CSSM, follow these steps.

Step 1 Enter configuration mode:

configure terminal

Step 2 Configure the transport mode:

license smart transport smart

license smart url smart <url>

Example:

```
conf t
(config)#license smart transport smart
(config)# license smart url smart https://smartreceiver.cisco.com/licservice/license
(config)#end
wr
```

Step 3 Check the transport mode configuration:

show license all

Example:

```
Switch#show license all
Transport:
  Type: Smart
  URL: license smart url smart https://smartreceiver.cisco.com/licservice/license
```

Step 4 Establish trust with the CSSM:

license smart trust idtoken <idtoken> local force

A syslog message indicates if trust is established.

Step 5 Verify that trust got established:

show license tech sup | i INSTALL

Example:

```
Switch#show licence tech sup | i INSTALL
  Reservation status: NOT INSTALLED
Local Device: P:IE-3300-8T2X,S:FCW24160H8C, state[2], Trust Data INSTALLED
Overall Trust: INSTALLED (2)
Switch#
```

Step 6 Request and install the Smart License Authorization Code (SLAC) to allow usage of MRP licenses:

license smart authorization request add mrp_manager local

or

license smart authorization request add mrp_client local

Example:

```
Switch#license smart authorization request add mrp_manager local
Switch#license smart authorization request add mrp_client local
Switch#show licence summary
```

License Usage:

License	Entitlement tag	Count	Status
network-advantage	(IE3400H_Network_Advantage)	1	IN USE
dna-essentials	(IE3400H_DNA_Essentials)	1	IN USE
MRP ring manager lic...	(IE3x00_LIC_MRP_Manager)	0	NOT IN USE
MRP ring client lice...	(IE3x00_LIC_MRP_Client)	0	NOT IN USE

Switch #

Step 7

Enable the MRP feature:

platform license feature mrp-manager

or

platform license feature mrp-client

Example:

```
Switch(config)#platform license feature mrp-manager
Switch(config)#platform license feature mrp-client
Switch#show licence summary
```

License Usage:

License	Entitlement tag	Count	Status
network-advantage	(IE3400H_Network_Advantage)	1	IN USE
dna-essentials	(IE3400H_DNA_Essentials)	1	IN USE
mrp_manager	(IE3x00_LIC_MRP_Manager)	1	IN USE
mrp_client	(IE3x00_LIC_MRP_Client)	1	IN USE

Device Connected to CSSM through CSLU

To activate the MRP license when the device is connected to the CSSM through the CLSU, follow these steps.

Step 1

Enter configuration mode:

configure terminal

Step 2

Configure the transport mode:

license smart transport cslu

```
license smart url cslu http://<ip-of-windows-machine>:8182/cslu/v1/pi
```

Example:

```
Switch#conf t
Switch(config)#license smart transport cslu
Switch(config)#license smart url cslu http://10.65.77.61:8182/cslu/v1/pi

Switch(config)#end
```

wr

Step 3 Check the transport mode configuration:

```
show license all
```

Example:

```
Switch#show license all
Transport:
  Type: cslu
  Cslu address: http://10.65.77.61:8182/cslu/v1/pi
```

Step 4 In the CSLU, enter the required information such as the CSSM URL, Smart Account, and Virtual Account, as shown below, and log in to the CSSM.

Step 5 Request and install the Smart License Authorization Code (SLAC) to allow usage of MRP licenses:

```
license smart authorization request add mrp_manager local
```

or

```
license smart authorization request add mrp_client local
```

Example:

```
Switch#license smart authorization request add mrp_manager local
Switch#license smart authorization request add mrp_client local
```

```
Switch#show licence summary
```

```
License Usage:
```

License	Entitlement tag	Count	Status
network-advantage	(IE3400H_Network_Advantage)	1	IN USE
dna-essentials	(IE3400H_DNA_Essentials)	1	IN USE
MRP ring manager lic...	(IE3x00_LIC_MRP_Manager)	0	NOT IN USE
MRP ring client lice...	(IE3x00_LIC_MRP_Client)	0	NOT IN USE

```
Switch #
```

Step 6

Enable the MRP feature:

```
platform license feature mrp-manager
```

or

```
platform license feature mrp-client
```

Example:

```
Switch(config)#platform license feature mrp-manager
```

```
Switch(config)#platform license feature mrp-client
```

```
Switch#show license summary
```

```
License Usage:
```

License	Entitlement tag	Count	Status
network-advantage	(IE3400H_Network_Advantage)	1	IN USE
dna-essentials	(IE3400H_DNA_Essentials)	1	IN USE
mrp_manager	(IE3x00_LIC_MRP_Manager)	1	IN USE
mrp_client	(IE3x00_LIC_MRP_Client)	1	IN USE

Device Not Connected to CSSM or CSLU

To activate the MRP license when the device is not connected to the CSSM or the CSLU, follow these steps.

Step 1

Configure the transport mode:

```
license smart transport off
```

Example:

```
conf t
```

```
(config)#license smart transport off
```

Step 2

Check the transport mode configuration:

```
show license all
```

Example:

```
Switch#show license all
```

```
Transport:
```

Type: Transport Off

Step 3 To download the Authorization code, go to CSSM > Product Instances, click on **Authorize License-Enforced Features**, and follow the steps.

a) Enter the device identifiers:

Authorize License-Enforced Features ✕

STEP 1 **Enter Request Code** | STEP 2 Select Licenses | STEP 3 Review and confirm | STEP 4 Authorization Code

Choose Devices

Some advanced or export-controlled features must be licensed in advance, before they can be enabled on the device. After the licenses are reserved, an authorization code is uploaded to the device to enable the features. [Learn More](#)

Generating an authorization code here is only required for devices that do not connect to the Smart Software Manager directly, or through the Cisco Licensing Manager, to report the features they need.

Single Device

Enter the identifiers for the device to be licensed.

Display Name:

UUID:

Serial Number:

PID:

Version ID:

Host ID:

MAC Address:

Virtual ID(SUVI):

b) Enter the required number of MRP licenses:

Authorize License-Enforced Features ✕

STEP 1 Enter Request Code | **STEP 2 Select Licenses** | STEP 3 Review and confirm | STEP 4 Authorization Code

Product Instance Details

UDI PID: IE-3300-8T2X

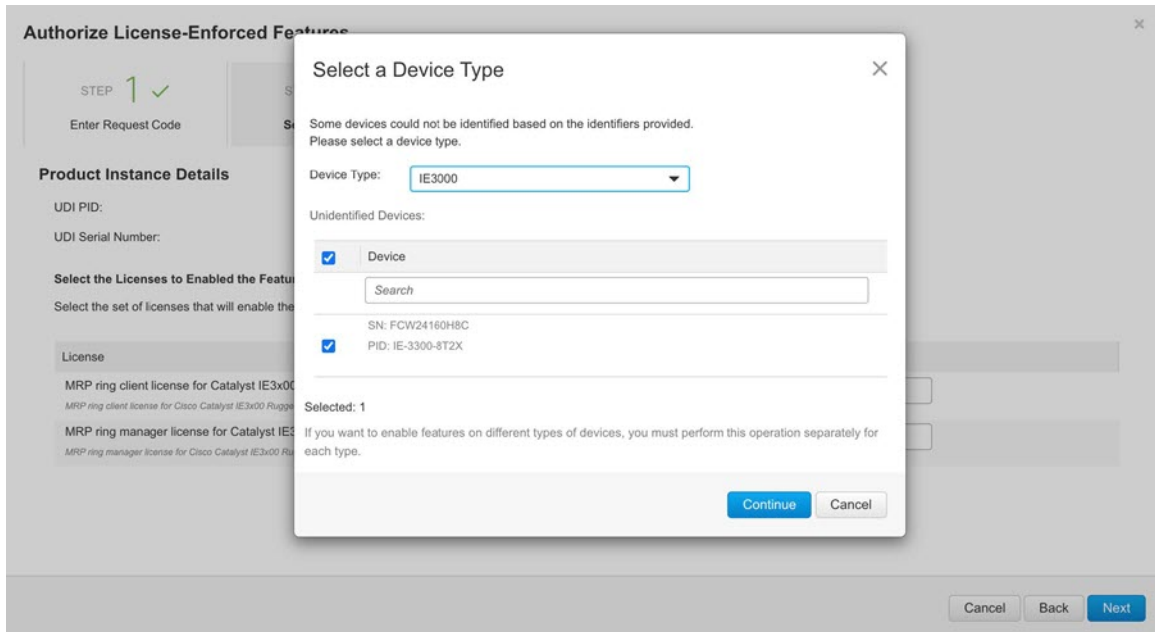
UDI Serial Number: FCW24160H8C

Select the Licenses to Enabled the Features

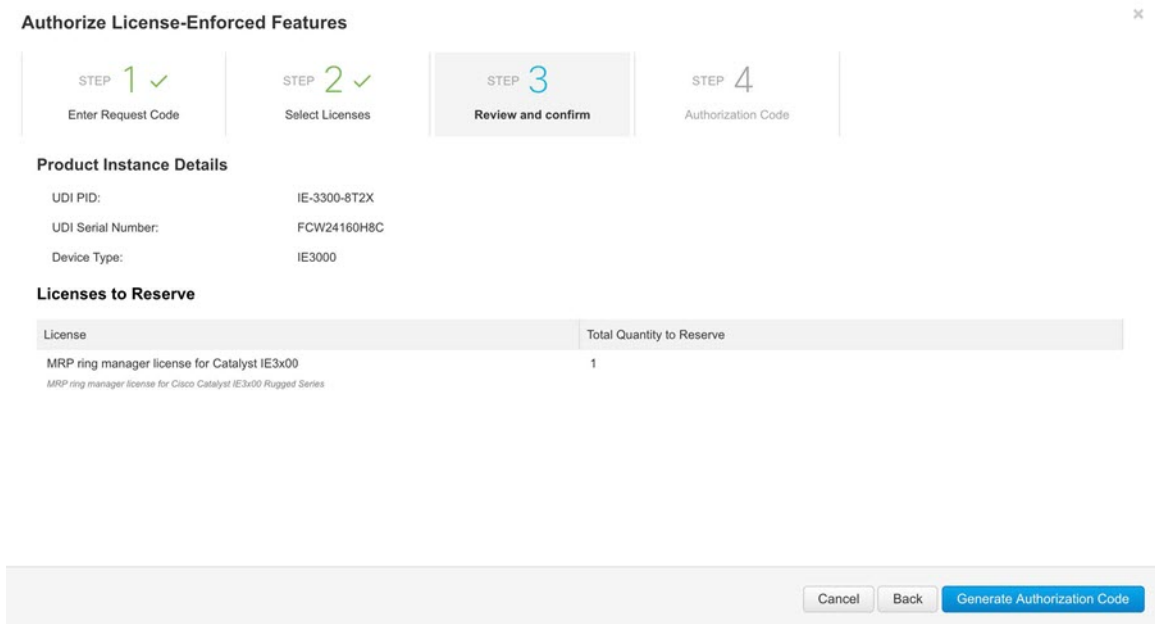
Select the set of licenses that will enable the desired features. The licenses will be reserved on the devices

License	Purchased	Available	Reserve
MRP ring client license for Catalyst IE3x00 <small>MRP ring client license for Cisco Catalyst IE3x00 Rugged Series</small>	70	49	<input type="text" value="0"/>
MRP ring manager license for Catalyst IE3x00 <small>MRP ring manager license for Cisco Catalyst IE3x00 Rugged Series</small>	110	56	<input type="text" value="1"/>

c) Select the device type:



d) Verify device and licenses:



e) Click **Download as File** or **Copy to Clipboard** to obtain the Authorization Code:

Authorize License-Enforced Features

STEP 1 ✓ Enter Request Code

STEP 2 ✓ Select Licenses

STEP 3 ✓ Review and confirm

STEP 4 Authorization Code

✓ The Reservation Authorization Code below has been generated for this product instance.
Enter this code into the Smart Licensing settings for the product, to enable the licensed features.

Product Instance Details

UDI PID: IE-3300-8T2X
UDI Serial Number: FCW24160H8C

Authorization Code:

```
<smartLicenseAuthorization><udi>P:IE-3300-8T2X,S:FCW24160H8C</udi><authorizationCode><customerInfo><smartAccount>BU Production Test</smartAccount><virtualAccount>Petra-Helicat
Testing</virtualAccount></customerInfo><flag>A</flag><version>C</version><pid>7f850c96-bfce-48d6-a872-2bfd44fa02b</pid><dateStamp>2020-11-20T05:23:58</dateStamp><entitlements>
<entitlement><tag>regid.2019-02.com.cisco.IE3x00_LIC_MRP_Manager,1.0_af7ba576-36e3-49a6-ac8b-ddc51e3591fa</tag><count>1</count><startDate></startDate></endDate></endDate>
<licenseType>PERPETUAL</licenseType><displayName>MRP ring manager license for Catalyst IE3x00</displayName><tagDescription>MRP ring manager license for Cisco Catalyst IE3x00
Rugged Series</tagDescription><tagType>PERPETUAL</tagType></entitlement></entitlements></authorizationCode>
<signature>MEUCiCvGAh+HMfs1ihwivSi0MxmbZ22+6zDnLDBeDoRHFpxPAiEAgVol/+kmYig4comxY36V+2s/UBE0M7UlrJwKmBQIvJw=</signature></smartLicenseAuthorization>
```

To learn how to enter this code, see the configuration guide for the product being licensed

Download as File

Copy to Clipboard

Close

Step 4 Install the Authorization Code obtained in the previous step in the device:

```
license smart import <AuthorizationCode.txt>
```

Example:

```
Switch#license smart import AuthorizationCode.txt
Import Data Successful
Last Confirmation code UDI: PID:IE-3400H-24T,SN:FCW23200H5S
Confirmation code: 8c55e536
Switch#
```

Step 5 Enable the MRP feature:

```
platform license feature mrp-manager
```

or

```
platform license feature mrp-client
```

Example:

```
Switch(config)#platform license feature mrp-manager
Switch(config)#platform license feature mrp-client
Switch#show license summary
License Usage:
License                               Entitlement tag                               Count Status
-----
network-advantage                     (IE3400H_Network_Advantage)                 1 IN USE
dna-essentials                         (IE3400H_DNA_Essentials)                    1 IN USE
mrp_manager                            (IE3x00_LIC_MRP_Manager)                    1 IN USE
mrp_client                             (IE3x00_LIC_MRP_Client)                     1 IN USE
```


Device in CSLU Mode and Not Connected to CSSM

To activate the MRP license when the device is in CLSU mode and not connected to the CSSM, follow these steps.

Step 1 Enter configuration mode:

configure terminal

Step 2 Configure the transport mode:

license smart transport cslu

license smart url cslu http://<ip-of-windows-machine>:8182/cslu/v1/pi

Example:

```
Switch#conf t
Switch(config)#license smart transport cslu
Switch(config)#license smart url cslu http://10.65.77.61:8182/cslu/v1/pi
```

```
Switch(config)#end
```

wr

Step 3 Check the transport mode configuration:

show license all

Example:

```
Switch#show license all
Transport:
  Type: cslu
  Cslu address: http://10.65.77.61:8182/cslu/v1/pi
```

Step 4 Send the authorization request from the device to the CSLU.

Export the request to a file on the CSLU, upload the file in CSSM, and get the authorization code from the CSSM.

Step 5 Import the authorization code on the CSLU.

The device will get the authorization code on the next communication with the CSLU and install it.

Step 6 Enable the MRP feature:

platform license feature mrp-manager

or

platform license feature mrp-client

Example:

```
Switch(config)#platform license feature mrp-manager
Switch(config)#platform license feature mrp-client
Switch#show license summary
```

```
License Usage:
  License                               Entitlement tag                Count Status
  -----
  network-advantage                    (IE3400H_Network_Advantage)    1 IN USE
  dna-essentials                        (IE3400H_DNA_Essentials)       1 IN USE
```

mrp_manager	(IE3x00_LIC_MRP_Manager)	1 IN USE
mrp_client	(IE3x00_LIC_MRP_Client)	1 IN USE

Configuring PROFINET MRP Mode Using TIA 15 or STEP7

After activating the license (Cisco IOS XE 17.6.x and earlier), you can push PROFINET MRP configuration to the Cisco switch using Siemens TIA or STEP7. With IOS XE versions 17.6.x and earlier, the MRP feature license must be installed prior to PROFINET configuring MRP. Starting with IOS XE 17.7.1, MRP can be configured by PROFINET without a feature license.



Note Do not use the CLI to configure or modify the switch configuration when PROFINET and TIA are in use. This includes setting the MRC or MRM role. MRP CLI mode and PROFINET MRP modes are mutually exclusive.



Note If the Cisco switch is connected to the PROFINET PLC, the output of **show profinet status | include Connected** is **Yes**. If the output of **show profinet status | include Connected** is **No**, then the switch is not connected to the PROFINET PLC.

Installing the PROFINET GSD File

The PROFINET MRP GSD file is bundled with the Cisco IOS XE software release. After the IE3x00 boots at least one time, the GSD files for the IE3x00 are located in a directory called "ProfinetGSD". In this directory, there is a zip file containing all the GSDs for all IE3x00 SKUs. The file is called "CISCO_Petra_3400.zip". Cisco recommends using the GSD file bundled with the release and included in the ProfinetGSD directory.



Caution If you have a GSD XML file installed in TIA 15 or STEP 7 that is older than the version bundled with the Cisco IOS software, we recommend that you remove the older file to prevent any possible incompatibilities.

Bringing Up PROFINET MRP

Prerequisites

We recommend allowing a MRP Ethernet port, disconnected from the ring (open ring), to discover all the neighbor devices using the LLDP protocol, before pushing the PROFINET MRP to the network. This approach avoids any unnecessary flooding should there be any issues.

SUMMARY STEPS

1. (Optional) Verify that the LLDP protocol discovers all neighbors correctly by entering **show lldp neighbor**.
2. (Cisco IOS XE 17.6 and earlier) Verify that all of the MRP licenses are active on the switch.
3. Ensure PROFINET status shows as connected.

4. Inspect the output of **profinet mrp ring 1** to confirm that the MRP ports connected correctly and report:

DETAILED STEPS

Step 1 (Optional) Verify that the LLDP protocol discovers all neighbors correctly by entering **show lldp neighbor**.

Step 2 (Cisco IOS XE 17.6 and earlier) Verify that all of the MRP licenses are active on the switch.

Step 3 Ensure PROFINET status shows as connected.

Step 4 Inspect the output of **profinet mrp ring 1** to confirm that the MRP ports connected correctly and report:

- One MRM port in blocked mode
- All other (balance of) MRM ports in forwarding mode

Note Before making a MRP device role change (such as MRP client to MRP manager or MRP manager to MRP client), make sure that the MRP ring is OPEN.

Managing PROFINET Using Simatic Step 7 or TIA 15 Portal

This section provides an overview of key screens within the TIA portal. It does not provide any configuration details. For details on using the TIA portal, refer to the Siemens Simatic STEP7 user documentation.



Note MRP automanager in PROFINET mode is supported only in TIA V15.

Figure 2: PROFINET Device Discovery (DCP) Window Before Configuring MRP

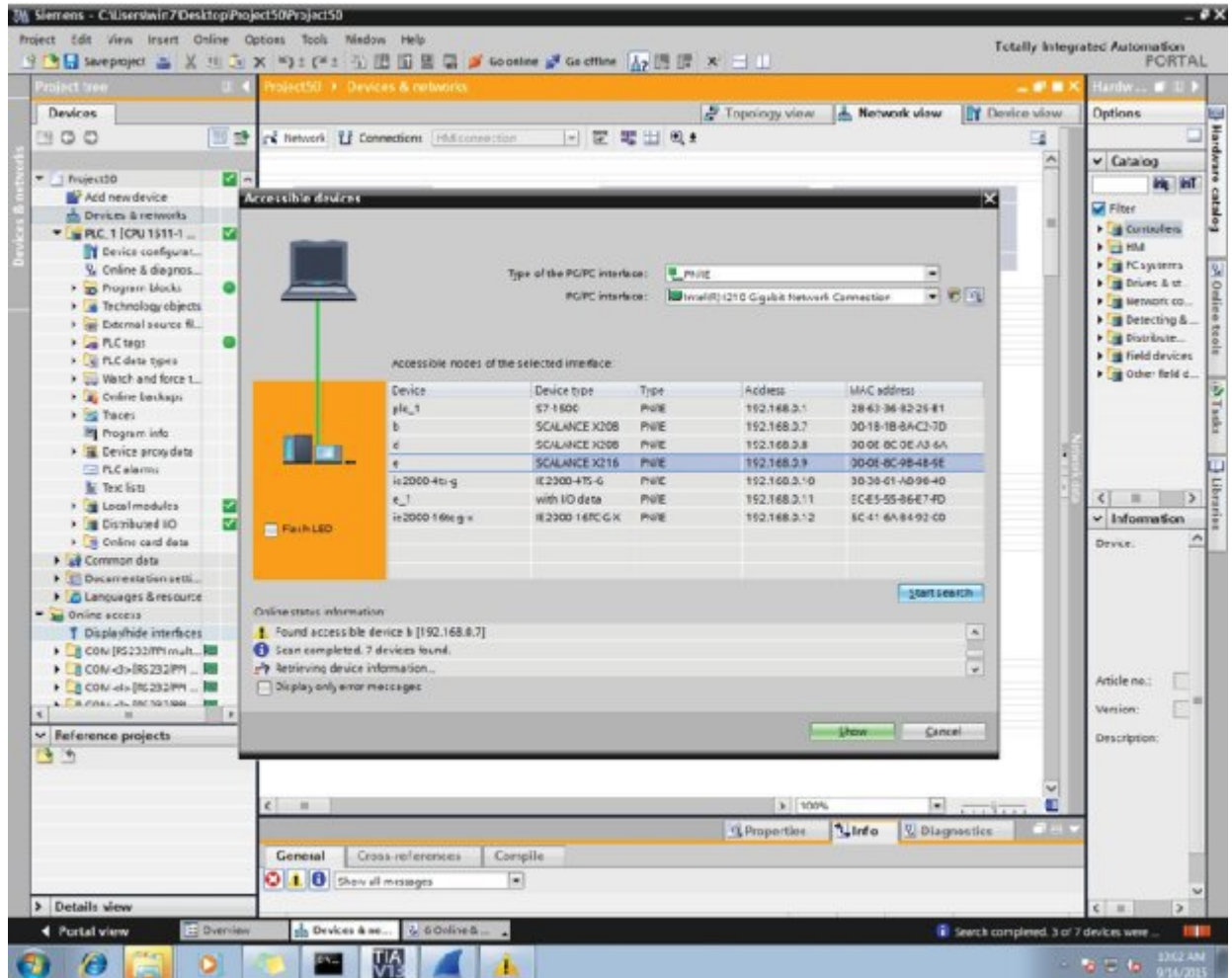


Figure 3: Define PROFINET MRP Manager and MRP domain

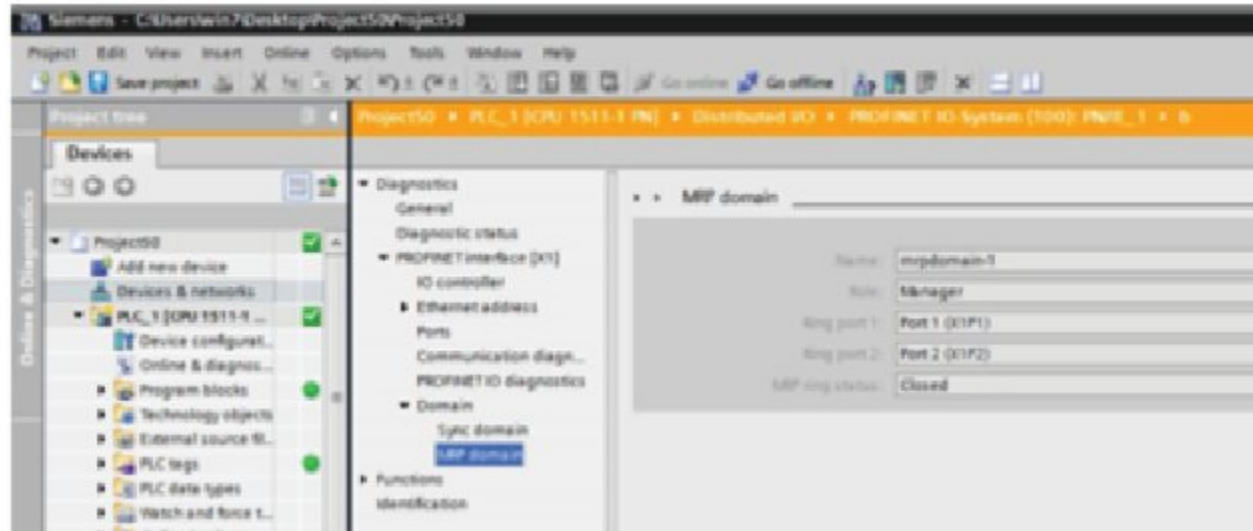


Figure 4: Define PROFINET MRP Client and MRP Domain

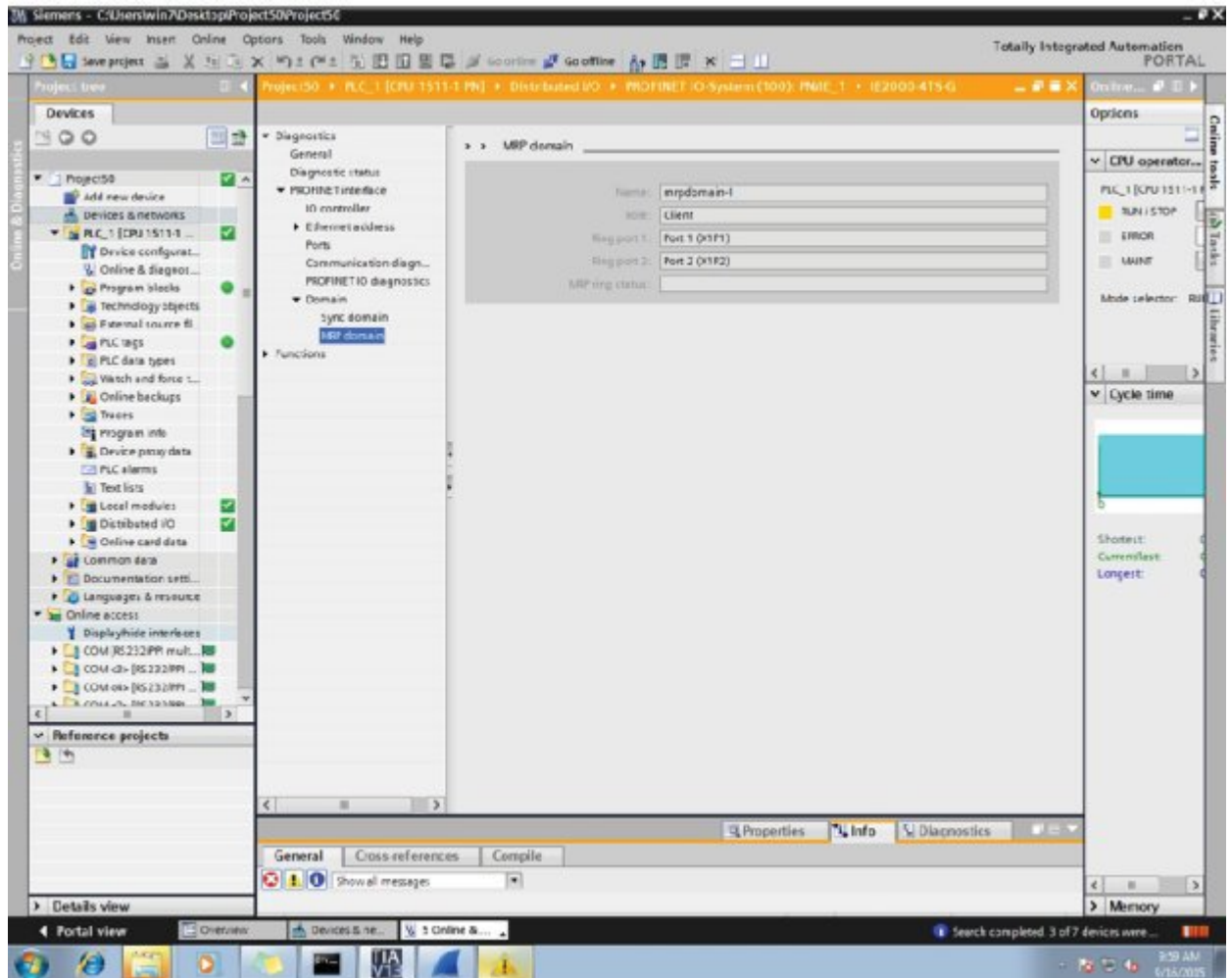


Figure 5: Define PROFINET MRP Interfaces

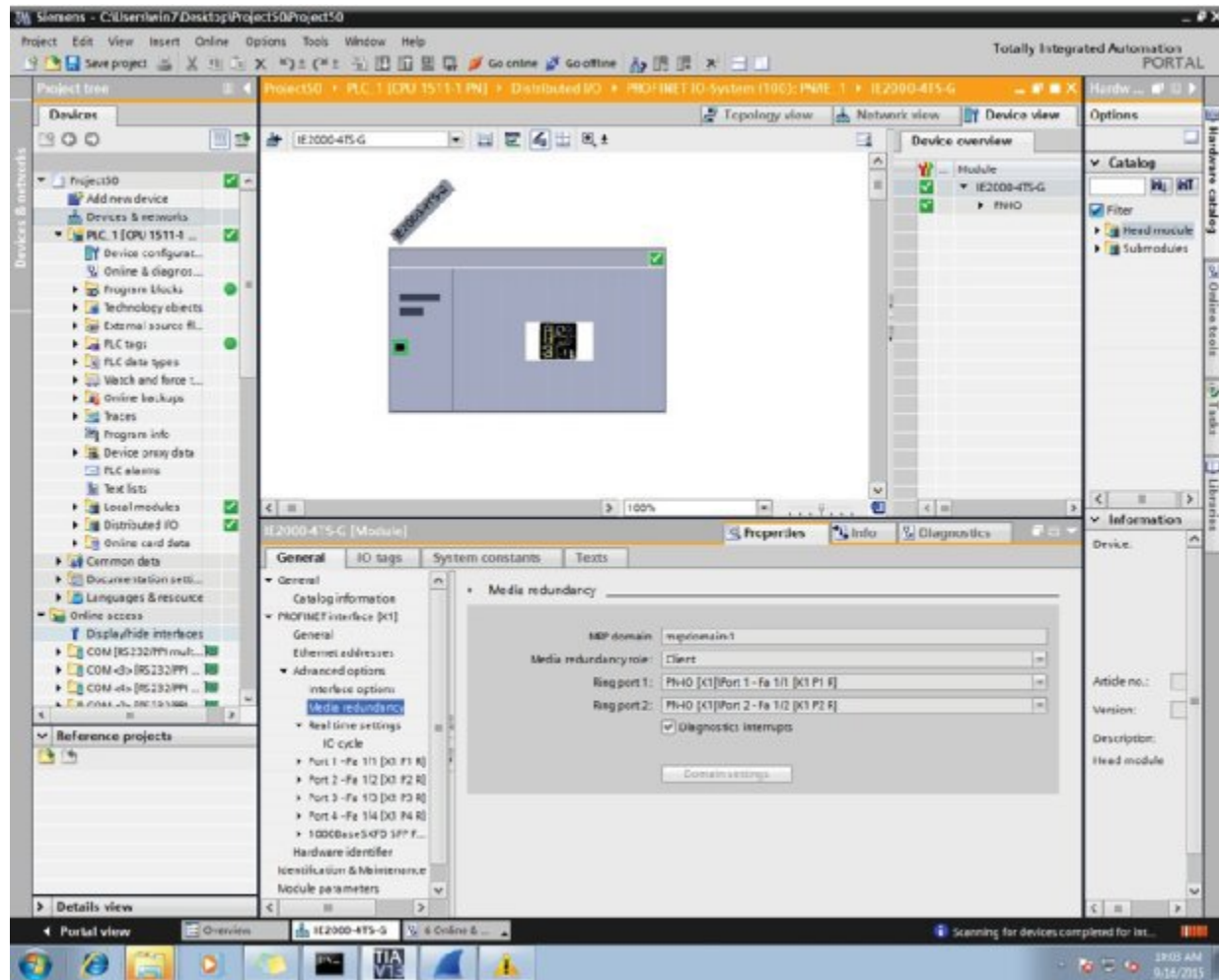
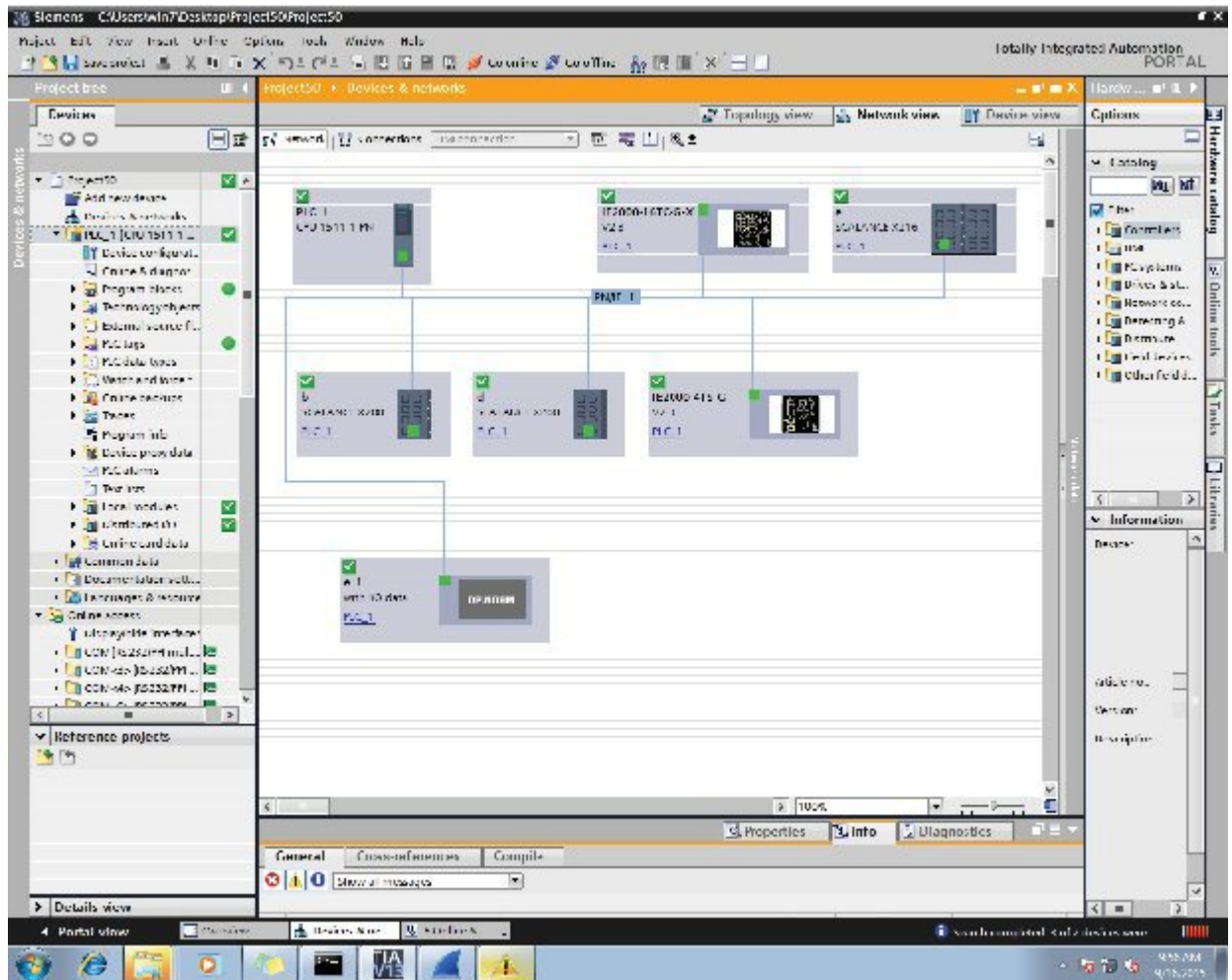


Figure 6: PROFINET MRP Network Configuration Diagram



Configuring MRP CLI Mode

To configure MRP, configure the node as MRA or MRC, and specify the two MRP ports. With the mrp-manager license, you can configure up to three rings on the device (the device can be manager or client) with a manager instance for each ring and one manager per device. Each ring with a single MRM can support up to 50 MRCs.



Note The MRP feature license (mrp-manager or mrp-client) applies only to Cisco IOS XE releases earlier than 17.7.1. Use of MRP in Cisco IOS XE 17.7.1 and later does not require a feature license, only the Network Essentials Base license.

The following MRP configuration parameters are optional except for domain-id, which is required for multiple MRP rings, and priority:

- domain-id—A unique ID that represents the MRP ring.

- domain-name—Logical name of the configured MRP domain-ID.
- profile—200 ms (the default)
- vlan-id—VLAN for sending MRP frames.
- default—In global MRP configuration, sets the mode to client.

Configuring MRP Manager

Follow this procedure to configure the switch as MRA in MRP CLI Mode.

Because PROFINET MRP is the default mode of the switch, you will need to disable that mode to allow operation in MRP CLI mode in Step 1 below.



Note If the device is connected to a PLC module, please make sure “no device in the ring” is selected for MRP.

SUMMARY STEPS

1. Enter configuration mode:
2. Enable MRP:
3. Configure MRP manager mode on the switch:
4. (Optional for single MRP ring) Configure the domain ID:
5. (Optional for single MRP ring) Configure the domain name:
6. (Optional) Configure the VLAN ID:
7. (Optional) Configure the recovery profile:
8. Configure the MRA priority:
9. Configure the interval:
10. Specify the ID of the port that serves as the first ring port:
11. Configure the interface mode:
12. Associate the interface to the MRP ring:
13. Return to global configuration mode:
14. Specify the ID of the port that serves as second ring port:
15. Configure the interface mode:
16. Associate the interface to the MRP ring:
17. Return to privileged EXEC mode:
18. (For multiple rings) Repeat step 2 through 15 for each additional ring:

DETAILED STEPS

Step 1 Enter configuration mode:
configure terminal
no profinet mrp

Step 2 Enable MRP:

mrp ring 1

Step 3 Configure MRP manager mode on the switch:

mode auto-manager

Step 4 (Optional for single MRP ring) Configure the domain ID:

domain-id *value*

value —UUID string of 32 hexadecimal digits in five groups separated by hyphens

Example: 550e8400-e29b-41d4-a716-446655440000

The default domain ID for ring 1 is FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFFE.

Note Only change the domain-ID from the default when required.

Step 5 (Optional for single MRP ring) Configure the domain name:

domain-name *name*

name —String of up to 32 characters

Step 6 (Optional) Configure the VLAN ID:

vlan-id *vlan*

Step 7 (Optional) Configure the recovery profile:

profile {**30** | **200** | **500**}

- 30—Maximum recovery time 30 milliseconds
- 200—Maximum recovery time 200 milliseconds
- 500—Maximum recovery time 500 milliseconds

Step 8 Configure the MRA priority:

priority *value*

value —Range: <36864 – 61440>, lowest: 65535.

The default priority is 40960.

Step 9 Configure the interval:

interval *interval*

- 3—3 milliseconds MRP_Test default interval for 30 ms profile
- 20—20 milliseconds MRP_Test default interval for 200 ms profile
- 50—50 milliseconds MRP_Test default interval for 500 ms profile
- <3-10>—Optional faster MRP_Test interval in milliseconds

Note The optional faster MRP_Test interval can be configured only when the ring is formed with IE3x00 devices.

Step 10 Specify the ID of the port that serves as the first ring port:

interface *port*

Step 11 Configure the interface mode:

switchport mode { **access** | **trunk** }

Note You must specify **switchport mode access** when configuring MRP in access mode.

Step 12 Associate the interface to the MRP ring:

mrp ring 1

Step 13 Return to global configuration mode:

exit

Step 14 Specify the ID of the port that serves as second ring port:

interface *port*

Step 15 Configure the interface mode:

switchport mode { **access** | **trunk** }

Note You must specify **switchport mode access** at this step when configuring MRP in access mode.

Step 16 Associate the interface to the MRP ring:

mrp ring 1

Step 17 Return to privileged EXEC mode:

end

Step 18 (For multiple rings) Repeat step 2 through 15 for each additional ring:

- Assign ring number 2 for the second ring.
- Assign a unique domain ID for Ring 2. The default domain ID for ring 2 is FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFD.
- Assign ring number 3 for the third ring.
- Assign a unique domain ID for Ring 3. The default domain ID for ring 3 is FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFC.

Note Each ring should have its own domain ID. No two rings share the same domain ID.

Example

The following example shows configuring MRP automanager:

```
Switch#configure terminal
Switch# no profinet mrp
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#mrp ring 1
Switch(config-mrp)#mode manager
Switch(config-mrp-manager)#domain-id FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFF
```

```

Switch(config-mrp-manager)#priority 40960
Switch(config-mrp-manager)#end
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#GigabitEthernet1/2
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
WARNING% Enabling MRP automatically set STP FORWARDING. It is recommended to shutdown all
interfaces which are not currently in use to prevent potential bridging loops.
Switch(config-if)#exit
Switch(config)#GigabitEthernet1/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
WARNING% Enabling MRP automatically set STP FORWARDING. It is recommended to shutdown all
interfaces which are not currently in use to prevent potential bridging loops.
Switch(config-if)#exit
Switch(config-if)#end

Switch# show mrp ring 1
MRP ring 1

Profile : 200 ms
Mode : Auto-Manager
Priority : 40960
Operational Mode: Client
From : CLI
License : Active
Best Manager :
MAC Address : 00:78:88:5E:03:81
Priority : 36864

Network Topology: Ring
Network Status : OPEN
Port1: Port2:
MAC Address :84:B8:02:ED:E8:02 MAC Address :84:B8:02:ED:E8:01
Interface :GigabitEthernet1/2 Interface :GigabitEthernet1/1
Status :Forwarding Status :Forwarding

VLAN ID : 1
Domain Name : Cisco MRP Ring 1
Domain ID : FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFFFF

Topology Change Request Interval : 10ms
Topology Change Repeat Count : 3
Short Test Frame Interval : 10ms
Default Test Frame Interval : 20ms
Test Monitoring Interval Count : 3
Test Monitoring Extended Interval Count : N/A
Switch#show mrp ports

Ring ID : 1
PortName                Status
-----
GigabitEthernet1/2      Forwarding
GigabitEthernet1/1      Forwarding

```



Note The `show mrp ring` output shows "License: Not Applicable" in CLI and Profinet mode in Cisco IOS XE release 17.7.1 and later.

Configuring MRP Client

Follow this procedure to configure the switch as an MRP Client.

SUMMARY STEPS

1. Enter configuration mode:
2. Enable MRP:
3. Configure MRP client mode (if you do not specify the mode, client mode is the default):
4. (Optional) Configure the domain ID matching the one configured for this ring on MRM:
5. Return to privileged EXEC mode:
6. Enter configuration mode:
7. Specify the ID of the port that serves as the first ring port:
8. Configure the interface mode:
9. Associate the interface to the MRP ring:
10. Return to global configuration mode:
11. Specify the ID of the port that serves as second ring port:
12. Configure the interface mode:
13. Associate the interface to the MRP ring:
14. Return to privileged EXEC mode:

DETAILED STEPS

-
- Step 1** Enter configuration mode:
configure terminal
- Step 2** Enable MRP:
mrp ring 1
- Step 3** Configure MRP client mode (if you do not specify the mode, client mode is the default):
mode client
- Step 4** (Optional) Configure the domain ID matching the one configured for this ring on MRM:
domain-id *value*
value —UUID string of 32 hexadecimal digits in five groups separated by hyphens
Example: 550e8400-e29b-41d4-a716-446655440000
The default domain ID for ring 1 is FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFFE.
- Step 5** Return to privileged EXEC mode:
end
- Step 6** Enter configuration mode:
configure terminal
- Step 7** Specify the ID of the port that serves as the first ring port:

interface *port*

Step 8 Configure the interface mode:

switchport mode { **access** | **trunk** }

Note You must specify **switchport mode access** when configuring MRP in access mode.

Step 9 Associate the interface to the MRP ring:

mrp ring 1

Step 10 Return to global configuration mode:

exit

Step 11 Specify the ID of the port that serves as second ring port:

interface *port*

Step 12 Configure the interface mode:

switchport mode { **access** | **trunk** }

Note You must specify **switchport mode access** when configuring MRP in access mode.

Step 13 Associate the interface to the MRP ring:

mrp ring 1

Step 14 Return to privileged EXEC mode:

end

Example

The following example shows configuring MRP client:

```
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#mrp ring 1
Switch(config-mrp)#mode client
Switch(config-mrp-client)#end
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#interface gi1/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
Switch(config-if)#exit
Switch(config)#interface gi1/2
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
Switch(config-if)#end

Switch#show mrp ring
MRP ring 1

Mode : Client
From : CLI
```

```

License : Active
Best Manager :
MAC Address : Unknown
Priority : Unknown

Network Topology: Ring
Network Status : Unknown
Port1: Port2:
MAC Address :30:F7:0D:68:07:81 MAC Address :30:F7:0D:68:07:82
Interface :GigabitEthernet1/1 Interface :GigabitEthernet1/2
Status :Forwarding Status :Forwarding

VLAN ID : 1
Domain Name : Cisco MRP Ring 1
Domain ID : FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFFFF

Link Down Timer Interval : 20 ms
Link Up Timer Interval : 20 ms
Link Change (Up or Down) count : 4 ms
MRP ring 2 not configured
MRP ring 3 not configured

```



Note The **show mrp ring** output shows "License: Not Applicable" in CLI and Profinet mode in Cisco IOS XE release 17.7.1 and later.

Re-enabling PROFINET MRP

PROFINET MRP is enabled by default. Follow these steps only if your switch is currently operating in MRP CLI mode and you wish to change the operating mode back to PROFINET MRP.



Note Do not configure **switchport mode trunk on** the interfaces that you want to configure for PROFINET MRP. You can have default vlan mode/no configuration or **switchport access vlan 1** CLI configuration on the PROFINET MRP interfaces.

SUMMARY STEPS

1. Enter configuration mode:
2. Enable PROFINET MRP:
3. Configure PROFINET MRP Client or PROFINET MRP Manager using the TIA portal.

DETAILED STEPS

Step 1 Enter configuration mode:
configure terminal

Step 2 Enable PROFINET MRP:
profinet mrp

Step 3 Configure PROFINET MRP Client or PROFINET MRP Manager using the TIA portal.

The following example shows how to enable PROFINET MRP and check the status:

Example

```
switch#configure terminal
switch(config)# profinet mrp
switch(config)# end
switch#show profinet status
Profinet : Enabled
Connection Status : Connected
Vlan : 50
Profinet ID : ie2kml
GSD version : Match
Reduct Ratio : 128
MRP : Enabled
MRP License Status : Active
MRP Max Rings Allowed : 3
MRC2# sh profinet mrp ring 1
MRP ring 1
Profile      : 200 ms
Mode        : Client
From        : Profinet
Network Topology: Ring
PNPORT 1:(0/32769)   PNPORT 2:(0/32770)
MAC Address   :78:DA:6E:57:9C:83           MAC Address
:78:DA:6E:57:9C:84
Interface     :gigabitEthernet1/1           Interface     :gigabitEthernet1/2
Status       :Forwarding                    Status       :Forwarding
VLAN ID      : 1
Domain Name  : mrpdomain-1
Domain ID    : C3D687FE789E3A1ACDBE5BFCBBC27B6
Topology Change Request Interval      : 10ms
Topology Change Repeat Count          : 3
Short Test Frame Interval              : 10ms
Default Test Frame Interval            : 20ms
Test Monitoring Interval Count         : 3
Test Monitoring Extended Interval Count : N/A
```

Verifying Configuration

Command	Description
show mrp ring {1 - 3}	Display details about the MRP ring configuration.
show mrp ports	Display details about the MRP port states. If MRP is not configured on any ports, display shows N/A.
show mrp ring {1 - 3} statistics [all event hardware packet platform]	Display details about the MRP ring operation.

Command	Description
debug mrp [alarm cli client license manager packet platform]	Trace MRP events. Note manager is available only when the switch is configured as manager or automanager. license is available only in Cisco IOS XE 17.6.x and earlier.
show profinet status	Display details about PROFINET.
show profinet mrp ring <i>ring id</i>	Display details about the PROFINET MRP ring configuration.
show tech-support profinet	Display all Profinet details.

Command	Description
show mrp ring {1 - 3}	Display details about the MRP ring configuration.
show mrp ports	Display details about the MRP port states. If MRP is not configured on any ports, display shows N/A.
show mrp ring {1 - 3} statistics [all event hardware packet platform]	Display details about the MRP ring operation.
debug mrp-ring [alarm cli client license manager packet platform]	Trace MRP events. Note manager is available only when the switch is configured as manager or automanager. license is available only in Cisco IOS XE 17.6.x and earlier.
show profinet status	Display details about PROFINET.
show profinet mrp ring <i>ring id</i>	Display details about the PROFINET MRP ring configuration.
show tech-support profinet	Display all Profinet details.

Configuration Example

The following example shows the MRP switch configured as manager:

```
Switch#configure terminal
Switch# no profinet mrp
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#mrp ring 1
Switch(config-mrp)#mode manager
Switch(config-mrp-manager)#end
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#interface gi1/8
```

```

Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
WARNING% Enabling MRP automatically set STP FORWARDING. It is recommended to shutdown all
interfaces which are not currently in use to prevent potential bridging loops.
Switch(config-if)#exit
Switch(config)#interface gil/7
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
WARNING% Enabling MRP automatically set STP FORWARDING. It is recommended to shutdown all
interfaces which are not currently in use to prevent potential bridging loops.
Switch(config-if)#end

Switch#show mrp ring
MRP ring 1

Profile      : 200 ms
Mode        : Master
From        : CLI

Network Topology: Ring
Port1:
MAC Address  :2C:54:2D:2C:3E:0A
Interface    :gigabitEthernet1/8
Status       :Forwarding
Port2:
MAC Address  :2C:54:2D:2C:3E:09
Interface    :gigabitEthernet1/7
Status       :Forwarding

VLAN ID     : 1
Domain Name : Cisco MRP
Domain ID   : FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFFFF

Topology Change Request Interval      : 10ms
Topology Change Repeat Count         : 3
Short Test Frame Interval             : 10ms
Default Test Frame Interval           : 20ms
Test Monitoring Interval Count        : 3
Test Monitoring Extended Interval Count : N/A
Switch#show mrp ports

Ring ID : 1
PortName          Status
-----
gigabitEthernet1/7 Forwarding
gigabitEthernet1/8 Forwarding

```

The following example shows the MRP switch configured as automanager:

```

Switch#configure terminal
Switch# no profinet mrp
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#mrp ring 1
Switch(config-mrp)#mode auto-manager
Switch(config-mrp-auto-manager)#priority 36864
Switch(config-mrp-auto-manager)#end
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#interface gil/2
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
WARNING% Enabling MRP automatically set STP FORWARDING. It is recommended to shutdown all
interfaces which are not currently in use to prevent potential bridging loops.
Switch(config-if)#exit
Switch(config)#interface gil/1
Switch(config-if)#switchport mode trunk

```

```

Switch(config-if)#mrp ring 1
WARNING% Enabling MRP automatically set STP FORWARDING. It is recommended to shutdown all
interfaces which are not currently in use to prevent potential bridging loops.
Switch(config-if)#end

Switch#show mrp ring
MRP ring 1

Profile      : 200 ms
Mode         : Auto-Manager
Priority      : 36864
Operational Mode: Manager
From         : CLI
License      : Active
Best Manager MAC Address      :84:B8:02:ED:E8:01      priority 36864

Network Topology: Ring
Network Status  : OPEN
Port1:
  MAC Address   :84:B8:02:ED:E8:02
  Interface     :GigabitEthernet1/2
  Status        :Forwarding
Port2:
  MAC Address   :84:B8:02:ED:E8:01
  Interface     :GigabitEthernet1/1
  Status        :Forwarding

VLAN ID       : 1
Domain Name   : Cisco MRP Ring 1
Domain ID     : FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFF

Topology Change Request Interval      : 10ms
Topology Change Repeat Count         : 3
Short Test Frame Interval             : 10ms
Default Test Frame Interval          : 20ms
Test Monitoring Interval Count        : 3
Test Monitoring Extended Interval Count : N/A

Topology Change Request Interval      : 10ms
Topology Change Repeat Count         : 3
Short Test Frame Interval             : 10ms
Default Test Frame Interval          : 20ms
Test Monitoring Interval Count        : 3
Test Monitoring Extended Interval Count : N/A

```

The following example shows the MRP switch configured as client:

```

Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#mrp ring 1
Switch(config-mrp)#mode client
Switch(config-mrp-client)#end
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#interface gil/3
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
Switch(config-if)#exit
Switch(config)#interface gil/4
Switch(config-if)#switchport mode trunk
Switch(config-if)#mrp ring 1
Switch(config-if)#end

```

Feature History

The following table shows the Cisco IOS release in which the feature is first supported on each of the IE switch platforms that support MRP.

Switch Platform	Feature	Initial Release
Cisco Catalyst IE3x00 Rugged Series and Cisco Catalyst IE3400 Heavy-Duty Series Switches	MRP Support	Cisco IOS XE Gibraltar 16.12.1
Cisco Catalyst IE3x00 Rugged Series and Cisco Catalyst IE3400 Heavy-Duty Series Switches	MRP-PROFINET	Cisco IOS XE Amsterdam 17.1.1
Cisco Catalyst IE3x00 Rugged Series and Cisco Catalyst IE3400 Heavy-Duty Series Switches	MRP 500ms Profile Support	Cisco IOS XE Amsterdam 17.3.1
Cisco Catalyst IE3x00 Rugged Series and Cisco Catalyst IE3400 Heavy-Duty Series Switches	MRP Support on Trunk Links	Cisco IOS XE Bengaluru 17.4.1
Cisco Catalyst IE3x00 Rugged Series and Cisco Catalyst IE3400 Heavy-Duty Series Switches	MRP License removal	Cisco IOS XE Cupertino 17.7.1
Cisco Catalyst IE3x00 Rugged Series and Cisco Catalyst IE3400 Heavy-Duty Series Switches	MRP: 30ms Profile Support	Cisco IOS XE Cupertino 17.9.1
Cisco Catalyst IE3100 Rugged Series Switches	<ul style="list-style-type: none"> • MRP: 30ms Profile Support • MRP 200ms Profile Support • MRP 500ms Profile Support • MRP CLI support by default 	Cisco IOS XE Dublin 17.11.1