Media Redundancy Protocol (MRP)

Feature Overview and Configuration Guide

Introduction

This guide describes Media Redundancy Protocol (MRP) and how to configure it.

Media Redundancy Protocol (MRP) is a protocol for providing redundancy in Ethernet networks via a ring.

Contents

Products and software version that apply to this guide

This guide applies to AlliedWare Plus™ products that support MRP, running version **5.5.0-2.1** or later.

To see whether your product supports MRP, see the following documents:

- The product's Datasheet

- The product's Command Reference

These documents are available from the above links on our website at alliedtelesis.com.

Most features described in this document are supported from AlliedWare Plus **5.5.0-2.1** or later. The following features are available in later releases:

- Version **5.5.1-1.1** and later support MRP in Virtual Chassis Stacking (VCStack) environments.

For more information on VCStack, see the Virtual Chassis Stacking (VCStack) Feature Overview and Configuration Guide.

Related documents

The following documents give more information about MRP features on AlliedWare Plus products:

- The product's Command Reference

Licensing

An MRP license is required to use this feature. From AlliedWare Plus version 5.5.2-0.1 onwards, an MRP license is required on the device that is an MRP manager. In earlier software versions, an MRP license is required to run either MRP client or MRP manager.

To obtain a license, contact your authorized Allied Telesis representative.

Media Redundancy Protocol Overview

What is it?

Media redundancy is primarily used to avoid single points of failure in industrial communication networks. If a failure occurs on a redundant structure, the network falls back to a secondary state in which communication is still viable, and repair can be made to restore the system to the previous fault-free state.

Ethernet technology does not allow physical loops, as they cause packets to circulate endlessly and overload the network. This means providing media redundancy within an Ethernet network requires the use of a protocol that is able to monitor and resolve the physical loops introduced by redundant pathways. This protocol must ensure that, even with multiple physical pathways to any device, only one is activated at any one time and the remaining are in standby mode. This is achieved by:

- monitoring links,

- detecting interruptions, and

- switching to an alternative path in the event of failure as soon as possible.

Media Redundancy Protocol (MRP) is a protocol for providing redundancy in Ethernet networks via a ring. MRP is specified for ring networks with up to 50 devices. It guarantees fully predictable switch-over behavior. Allied Telesis switches support worst-case switch-over times of 200 or 500ms.

Important concepts

- **MRP node**: A switch contained within a ring network monitored by MRP.

- **Redundancy Domain**: A ring controlled by MRP.

- **Media Redundancy Manager (MRM)**: A single MRP node that monitors and controls the ring network and reacts to any failure.

- **Media Redundancy Client (MRC)**: Any node within the ring that is not an MRM.

- **Ring port**: The two designated ports on each MRP node that are physically connected to the ring topology.

How it works

Ring ports can be in one of three states:

- **disabled**: all packets received by the port are dropped.

- **blocking**: all packets received by the port are dropped, with the exception of MRP protocol packets.

- **forwarding**: all packets received by the port are forwarded.

The ring itself can be in one of three states:

- **closed**: both ports on all nodes are linked up, one port on the MRM is **blocking**, all others are **forwarding**.

- **open**: both ports on the MRM are **forwarding**, either because one of the MRCs has signalled a port down, or the MRM failed to receive its own test frames.

- **undefined**: this is set before the actual state of the ring is known.

MRM port blocking

During normal operation, one of the MRM's ring ports is **blocking**, while the other is **forwarding**. This puts the network in a **closed** state, where the physical ring topology is in a ring structure, and at the logical level is in a linear structure. The MRM sends MRP_Test frames (at a predetermined interval) out both its ring ports. These will be forwarded around the ring by the MRCs until they again reach the MRM.

In the case of a transmission failure (for example, a ring port becomes disabled), the MRM will fail to receive its test frames. After a predefined number of test packets are lost, it will set its **blocking** ring port to **forwarding**. This enables the secondary network path, and puts the network in an **open** state where both MRM ring ports are forwarding.

MRC port blocking

MRP rings support two profiles for recovery time, 200ms or 500ms. This is set with the **profile (mrp-ring)** command.

If the MRP ring is set to the 200ms profile, it also uses port blocking on the MRCs. When an MRC detects a link down on one of its ports, it puts the port in a **blocking** state. This is to prevent a loop if and when the port comes back up again, since the MRM has unblocked its secondary port. When the port comes back up, the MRC signals the MRM with an MRP_Link_Up frame. This contains the MRP_LNKupT interval that tells the MRM when the MRC is going to unblock its port. The MRM then blocks its secondary port after the same interval. Both nodes doing this at the same time minimizes any interruption, while still preventing loops.

If the MRP ring is set to the 500ms profile, port blocking is not used.

All nodes in an MRP ring must be set with the same profile.

Virtual chassis stacking

Virtual Chassis Stacking—VCStack™—is the name given to two or more Allied Telesis switches that are configured to operate as a single switch. From a configuration and management point of view, it is as though the switches are just one device with a seamless transition from the ports of one stack member to the ports of the next. VCStack provides a highly available system where network resources are spread out across stacked units, reducing the impact if one of the units fails. Aggregating switch ports on different units across the stack provides excellent network resiliency.

For more information on VCStack, see the Virtual Chassis Stacking (VCStack) Feature Overview and Configuration Guide.

Configuration examples

The switchports in an MRP ring can be configured in either **access** or **trunk** mode. All nodes in the ring must be configured in the same mode. We recommend configuring in access mode, unless you have a setup that requires trunk mode (for example, if you need to send tagged Ethernet frames for any other device or switch on a port).

Each node in the ring must be configured with the same domain-id UUID. By default, this is set based on the ring ID, using the value:

(FFFFFFFF-FFFF-FFFF-FFFF-FFFFFFFFFFFF) - (ring ID + 1)

You can check the UUID by using the **show mrp ring** command, and set it using the **domain-id** command.

From AlliedWare Plus version 5.5.2-0.1 onwards, an MRP license is required on the device that is an MRP manager. In earlier software versions, an MRP license is required to run either MRP client or MRP manager.

Switchport mode access

The following examples show how to configure an MRP ring with the switchports in **access** mode.

Media redundancy manager (MRM) configuration

Step 1: **Start the MRP service**

```
awplus#configure terminal
awplus(config)#service mrp
```

The MRP service needs to be started before any other MRP configuration.

Step 2: **Create the MRP ring**

```
awplus(config)#mrp ring 1
```

This command creates an MRP ring with the ring ID 1, and enters MRP Configuration mode.

Step 3: **Set the role to manager**

```
awplus(config-mrp-ring)#role manager
```

This command sets the role of this node to manager for your MRP ring, and enters MRP Ring Manager Configuration mode.

Step 4: **Select the ring ports**

```
awplus(config-mrp-ring-manager)#end
awplus#configure terminal
awplus(config)#interface port1.0.25,port1.0.29
```

Return to Global Configuration mode, then select the ring ports to configure. In this example, we are configuring port1.0.25 and port1.0.29.

Step 5: Configure the ring ports

```
awplus(config-if)#switchport mode access
awplus(config-if)#mrp ring 1
```

These commands set the switchport mode to access, and attach MRP ring 1 to port1.0.25 and port1.0.29. When the ports are set to access mode, the MRP ring will use the VLAN of the ports.

This is an example of the configuration for an MRM in an access mode MRP ring.

```
!
service mrp
!
mrp ring 1
 role manager
!
interface port1.0.25,port1.0.29
 switchport
 switchport mode access
 mrp ring 1
!
```

Media redundancy client (MRC) configuration on every other switch in the ring

Step 1: Start the MRP service

```
awplus#configure terminal
awplus(config)#service mrp
```

The MRP service needs to be started before any other MRP configuration.

Step 2: Create the MRP ring

```
awplus(config)#mrp ring 1
```

This command creates an MRP ring with the ring ID 1, and enters MRP Configuration mode.

Step 3: Select the ring ports

```
awplus(config-mrp-ring)#end
awplus#configure terminal
awplus(config)#interface port1.0.25,port1.0.29
```

Return to Global Configuration mode, then select the ring ports to configure. In this example, we are configuring port1.0.25 and port1.0.29.

Step 4: Configure the ring ports

```
awplus(config-if)#switchport mode access
awplus(config-if)#mrp ring 1
```

These commands set the switchport mode to access, and attach MRP ring 1 to port1.0.25 and port1.0.29. When the ports are set to access mode, the MRP ring will use the VLAN of the ports.

This is an example of the configuration for an MRC in an access mode MRP ring.

```
!
service mrp
!
mrp ring 1
!
interface port1.0.25,port1.0.29
 switchport
 switchport mode access
 mrp ring 1
!
```

Switchport mode trunk

The following examples show how to configure an MRP ring with the switchports in **trunk** mode.

Media redundancy manager (MRM) configuration

Step 1: Create the VLAN

awplus#configure terminal

awplus(config)#vlan database

awplus(config-vlan)#vlan 10

awplus(config-vlan)#end

These commands create a VLAN named 10.

Step 2: Start the MRP service

awplus#configure terminal

awplus(config)#service mrp

The MRP service needs to be started before any other MRP configuration.

Step 3: Create the MRP ring

awplus(config)#mrp ring 1

This command creates an MRP ring with the ring ID 1, and enters MRP Configuration mode.

Step 4: Set the role to manager

awplus(config-mrp-ring)#role manager

This command sets the role of this node to manager for your MRP ring, and enters MRP Ring Manager Configuration mode. This command requires an MRP license on this device.

Step 5: Assign the VLAN

awplus(config-mrp-ring)#vlan-id 10

This command assigns the VLAN 10 to the MRP ring. When the ports are set to trunked mode, then the VLAN must be assigned to the MRP ring using the **vlan-id** command.

Step 6: **Select the ring ports**

```
awplus(config-mrp-ring-manager)#end
awplus#configure terminal
awplus(config)#interface port1.0.25,port1.0.29
```

Return to Global Configuration mode, then select the ring ports to configure. In this example, we are configuring port1.0.25 and port1.0.29.

Step 7: **Configure the ring ports**

```
awplus(config-if)#switchport mode trunk
awplus(config-if)#switchport trunk allowed vlan add 10
awplus(config-if)#mrp ring 1
```

These commands set the switchport mode to trunk, set VLAN 10 to be trunked, and attach MRP ring 1 to port1.0.25 and port1.0.29.

This is an example of the configuration for an MRM in a trunk mode MRP ring.

```
!
service mrp
!
mrp ring 1
 vlan-id 10
 role manager
!
vlan database
 vlan 10 state enable
!
interface port1.0.25,port1.0.29
 switchport
 switchport mode trunk
 switchport trunk allowed vlan add 10
 mrp ring 1
!
```

Media redundancy client (MRC) configuration on every other switch in the ring

Step 1: **Create the VLAN**

```
awplus#configure terminal
awplus(config)#vlan database
awplus(config-vlan)#vlan 10
awplus(config-vlan)#end
```

These commands create a VLAN named 10.

Step 2: **Start the MRP service**

```
awplus#configure terminal
awplus(config)#service mrp
```

The MRP service needs to be started before any other MRP configuration.

Step 3: **Create the MRP ring**

```
awplus(config)#mrp ring 1
```

This command creates an MRP ring with the ring ID 1, and enters MRP Configuration mode.

Step 4: Assign the VLAN

```
awplus(config-mrp-ring)#vlan-id 10
```

This command assigns the VLAN 10 to the MRP ring. When the ports are set to trunked mode, then the VLAN must be assigned to the MRP ring using the **vlan-id** command.

Step 5: Select the ring ports

```
awplus(config-mrp-ring)#end
awplus#configure terminal
awplus(config)#interface port1.0.25,port1.0.29
```

Return to Global Configuration mode, then select the ring ports to configure. In this example, we are configuring port1.0.25 and port1.0.29.

Step 6: Configure the ring ports

```
awplus(config-if)#switchport mode trunk
awplus(config-if)#switchport trunk allowed vlan add 10
awplus(config-if)#mrp ring 1
```

These commands set the switchport mode to trunk, and attach MRP ring 1 to port1.0.25 and port1.0.29.

This is an example of the configuration for an MRC in a trunk mode MRP ring.

```
!
service mrp
!
mrp ring 1
 vlan-id 10
!
vlan database
 vlan 10 state enable
!
interface port1.0.25,port1.0.29
 switchport
 switchport mode trunk
 switchport trunk allowed vlan add 10
 mrp ring 1
!
```

Show commands

Example output from the **show mrp ring** command:

```
awplus#show mrp ring
Media Redundancy Protocol - Ring Information
MRP Ring 1
 Domain ID:                         ffffffff-ffff-ffff-ffff-ffffffffffff
 Domain Name:
 Ring Status:              Enabled
 Operating Mode:           CLI
 Role:                     Manager
 Network Status:           Open
 Port1:                    port1.0.25
  Status:                  Forwarding
 Port2:                    port1.0.29
  Status:                  Forwarding

Vlan ID:
 React on Link Change:     No
 Profile:                  200ms
  Topology Change Interval:        10ms
  Topology Change Count:           3
  Short Test Frame Interval:       10ms
  Default Test Frame Interval:     20ms
  Test Monitoring Interval Count:  3
  Test Monitoring Ext Interval Count: 0
  Non-blocking MRC Supported:      No
```

Table 1: Parameters in the output from the **show mrp ring** command

PARAMETER	DESCRIPTION
Domain ID	The UUID that identifies the ring. The Domain ID is used in MRP PDU packets.
Domain Name	Description of the ring that can be set by the user.
Ring Status	Whether the ring is Enabled or Disabled.
Operating Mode	CLI - the MRP ring is configured and controlled from the command line.
Role	Whether the node is a Manager (MRM) or Client (MRC).
Network Status	Whether the MRP ring is Open or Closed (MRM only).
Port Status	The state of the port: Disabled - all packets received by the port are dropped. Blocking - all packets received by the port are dropped, with the exception of MRP protocol packets. Forwarding - all packets received by the port are forwarded.
Vlan ID	If the MRP ring is configured with a trunked VLAN, this shows the configured VLAN ID.
Profile	Whether it is configured for 200ms or 500ms.

Example output from the **show mrp ports** command:

```
awplus#show mrp ports
Media Redundancy Protocol - Port Information

Connection          Port        State
-------------------------------------------
Ring 1              port1.0.25  Forwarding
Ring 1              port1.0.29  Blocking

awplus#
awplus#show mrp ports
Media Redundancy Protocol - Port Information

Connection          Port        State
-------------------------------------------
Ring 1              port2.0.25  Forwarding
Ring 1              port2.0.29  Forwarding
```

Table 2: Parameters in the output from the **show mrp ports** command

PARAMETER	DESCRIPTION
Connection	The name of the MRP ring.
Port	The ID of the port.
State	The state of the port: Disabled - all packets received by the port are dropped. Blocking - all packets received by the port are dropped, with the exception of MRP protocol packets. Forwarding - all packets received by the port are forwarded.

Example output from the **show counter mrp** command:

```
awplus#show counter mrp
Media Redundancy Protocol Global Counters

MRP Started             ....... 1
MRP Dispatcher          ....... 16574983
MRP Timer Tick          ....... 16446942
MRP Packet RX           ....... 128041
MRP Packet RX Error     ....... 0
MRP Packet TX           ....... 1642783
MRP Packet TX Error     ....... 0

Media Redundancy Protocol Ring 1 Counters

Port 1 PDUs Received
MRP_Test                ......... 64013
MRP_TopologyChange      ......... 0
MRP_LinkUp              ......... 0
MRP_LinkDown            ......... 0

Port 1 PDUs Transferred
MRP_Test                ......... 821366
MRP_TopologyChange      ......... 26
MRP_LinkUp              ......... 0
MRP_LinkDown            ......... 0

Port 2 PDUs Received
MRP_Test                ......... 64013
MRP_TopologyChange      ......... 0
MRP_LinkUp              ......... 15
MRP_LinkDown            ......... 0

Port 2 PDUs Transferred
MRP_Test                ......... 821366
MRP_TopologyChange      ......... 26
MRP_LinkUp              ......... 0
MRP_LinkDown            ......... 0

Other Counters
State Changes           ......... 11
Port Blocked Set        ......... 6
Port Forwarding Set     ......... 5
Multiple Manager        ......... 0
```

Table 3: Parameters in the output from the **show counter mrp** command

PARAMETER	DESCRIPTION
MRP Started	The number of times the MRP service has been started with the **service mrp** command. This counter increases each time it is stopped and started.
MRP Dispatcher MRP Timer Tick	Internal timer tick that provides timing for the protocol and the dispatcher. This is called to process timing events, packet reception, and state changes.
MRP Packet RX	The number of MRP protocol packets received.
MRP Packet RX Error	The number of failures when receiving a packet.
MRP Packet TX	The number of MRP protocol packets sent.
MRP Packet TX Error	The number of failures when sending a packet.

PARAMETER	DESCRIPTION
MRP_Test	The number of test frames sent and received by the Media Redundancy Manager (MRM) to test if the ring is open or closed.
MRP_TopologyChange	The number of topology change frames sent from the MRM to indicate ring topology changes to Media Redundancy Clients (MRC).
MRP_LinkUp MRP_LinkDown	The number of Link Up/Down frames sent from MRC to indicate a link state change on one of its ring ports.
State Changes	The number of changes in the protocol state. These are triggered by test packets detecting the ring opening or closing, and MRP ring port link changes.
Port Blocked Set	The number of times a ring port has been set to blocking.
Port Forwarding Set	The number of times a ring port has been set to forwarding.
Multiple Manager	A misconfiguration detected by the MRM that another manager is on the ring. This is detected from information in the MRP PDU frames.