Configuration Note

Multi-Service Business Routers Product Series

Mediant MSBR

Layer-2 Bridging

Version 7.2

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Document Revision Record

LTRT	Description
31672	Added Q-in-Q section.
31674	Updated to Version 7.2
31675	Document template update
31676	Example updated in Trunk section; Trunk Bridging section added
31677	Typo
31678	QinQ for Mediant 500Li/800Ci

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1 Introduction

This document describes Layer-2 Bridging configuration through CLI on the MSBR device.

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2 Layer-2 Switching Interfaces

In the MSBR, Layer-2 switching is hardware-based and uses the host's Media Access Control (MAC) address from the host's network interface cards (NICs) to decide where to forward frames. The MAC addresses that the MSBR acquires are used to build a MAC Address table, also known as a 'CAM Table'. Layer-2 switching interfaces also support high speed, low latency, and wire speed.

2.1 Commands

The table below describes Layer-2 switching Interface commands.

Table 2-1: Layer-2 Switching Interfaces

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# interface <physical_interface> [slot/port.vlanID]`	Allows you to enter a specific interface configuration mode. ▪ <physical_interface> - selects the type of interface. ▪ [slot/port.vlanID] – slot and port number is taken from the device panel. **Note:** The interface configuration mode changes after the command is entered.
`(conf-if-GE SlotNum/PortNum)# desc [WORD]`	Defines a description. It is recommended to write a useful and informative interface description.
`(conf-if-GE SlotNum/PortNum)# duplex [Auto/Half/Full]`	Configures negotiation duplex on the interface: • Auto (default) • Half • Full
`(conf-if-GE SlotNum/PortNum)# speed[10/100/Auto]`	Configures speed negotiation on the interface: • 10 • 100 • Auto (default)
`(conf-if-GE SlotNum/PortNum)# shutdown`	Disables the interface.
`(conf-if-GE SlotNum/PortNum)# spanning-tree [cost/edge/point-to-point/priority]`	Relates to the spanning-tree protocol (STP) issues on the interface. • edge – this type of port mode will not participate on spanning-tree converge and acts as a port fast port according to STP. • cost – sets a cost value for the interface to be used in calculations of the cost to the root bridge in STP. • point-to-point – enables link type point-

Command	Description
	to-point to make the link become designated port. • priority – local priority number on interface configuration mode. **Note:** This is not applicable to Mediant 500Li MSBR.
MSBR# sh data interface <physical_interface> [slot/port.vlanID]	Displays interface statistics, port mode, speed, duplex and PoE information.

2.2 Example

This example shows how to configure an interface to access mode and auto-negotiation 100BaseT full permanent:

```
#interface configured as access mode
MSBR(config-data)# interface gigabitethernet 4/1
MSBR(conf-if-GE 4/1)# duplex full
MSBR(conf-if-GE 4/1)# speed 100
MSBR(conf-if-GE 4/1)# switchport mode access
MSBR(conf-if-GE 4/1)# spanning-tree edge enabled
MSBR(conf-if-GE 4/1)# exit
MSBR(config-data)# interface vlan 200
MSBR(config-data)# interface vlan 300

#interface configured as Trunk mode
MSBR(config-data)# interface gigabitethernet 4/2
MSBR(conf-if-GE 4/2)# switchport mode trunk
MSBR(conf-if-GE 4/2)# switchport native vlan 200 [ All Untagged
packets send to vlan 200]
MSBR(config-data)# interface gigabitethernet 4/3
MSBR(conf-if-GE 4/3)# switchport mode trunk
MSBR(conf-if-GE 4/3)# switchport native vlan 300[ All Untagged
packets send to vlan 300]
```

3 VLANs

A VLAN is a broadcast domain created by switches. Typically, it's the router that connects between the switches that broadcast to the VLAN domain.

The VLAN represents a group of hosts with a common set of requirements, independent of physical location. VLANs have the same attributes as a physical LAN, but allow you to group end stations even if they are not located physically on the same LAN segment.

VLANs are usually associated with IP sub-networks. For example, all the end stations in a particular IP subnet belong to the same VLAN. Traffic between VLANs must be routed. LAN port VLAN membership is assigned manually on a port-by-port basis.

While configuring switch ports in a VLAN other than 1 (the default VLAN), all ports in a single VLAN reside in the same broadcast domain.

VLANs are broadcast domains defined within switches to allow control of broadcast, multicast, unicast, and unknown unicast within a Layer-2 device.

3.1 Commands

The table below shows how to assign an interface to a specific VLAN.

Table 3-1: VLAN Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# interface <physical_interface> [slot/port.vlanID]`	Allows you to enter a specific interface configuration mode. • <physical_interface> - selects the type of interface. • [slot/port.vlanID] – slot and port number is taken from the device panel. **Note**: The interface configuration mode changes after the command is entered.
`(conf-if-GE SlotNum/PortNum)# Switchport mode access`	Sets the port into access mode.
`(conf-if-GE SlotNum/PortNum)# switchport access vlan [Vlan_ID]`	Changes the VLAN membership of the port from default to the VLAN ID it will use.

The table below shows how to configure a VLAN on Layer 3:

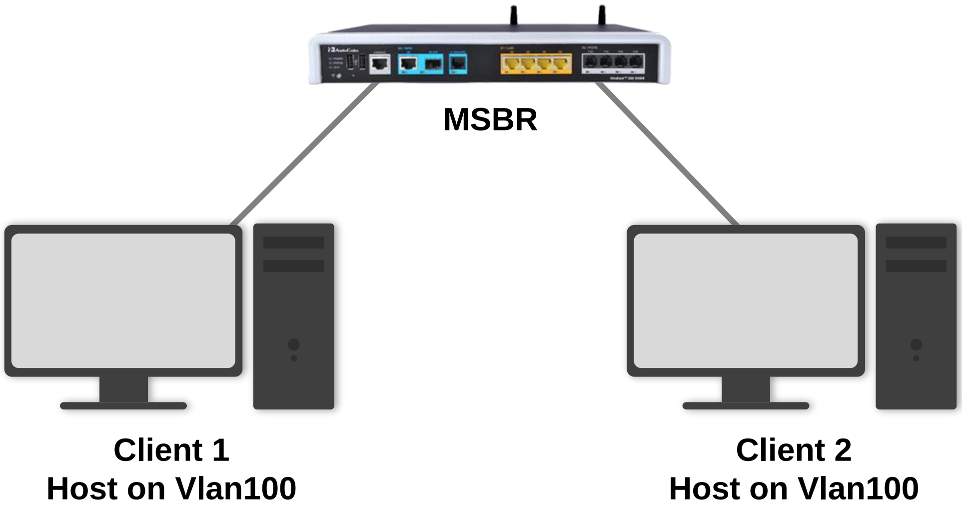
Table 3-2: VLAN on Layer 3 Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# interface vlan [Vlan-ID]`	Allows you to enter a specific interface VLAN mode. Vlan-ID – actual VLAN number.
`(conf-if-GE SlotNum/PortNum)# ip address [A.B.C.D] [Subnet_Mask]`	Assigns an IP address to the VLAN interface.

3.2 Example

In this example, two interfaces have been assigned to the same VLAN. The interface VLAN layer 3 has also been configured.

Figure 3-1: VLAN



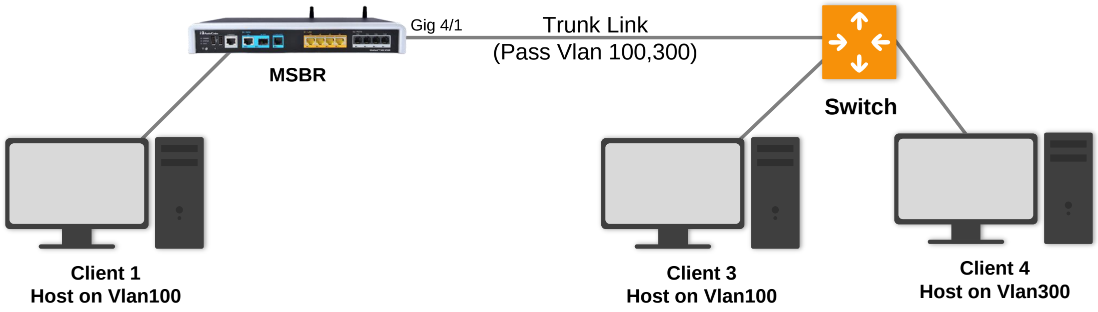
The above example is implemented using the following commands:

```
MSBR(config-data)# interface gigabitethernet 4/1
MSBR(conf-if-GE 4/1)# switchport mode access
MSBR(conf-if-GE 4/1)# switchport access vlan 100
MSBR(conf-if-GE 4/1)# exit
MSBR(config-data)# interface gigabitethernet 4/2
MSBR(conf-if-GE 4/2)# switchport mode access
MSBR(conf-if-GE 4/2)# switchport access vlan 100
MSBR(conf-if-GE 4/2)# exit
MSBR(config-data)# interface vlan 100
MSBR(conf-if-VLAN 100)# ip address 192.168.100.1 255.255.255.0
```

An advanced example shows when the MSBR can recognize LAN ports as Trunk mode:

- VLAN 100 is configured on both the MSBR1 and switch devices.
- On the switch, VLAN 100 and VLAN 300 is configured with clients.
- On MSBR1, only enable VLAN 300 with access to the private network.

Figure 3-2: Trunk



The above example is implemented using the following commands:

```
MSBR(config-data)# interface gigabitethernet 4/1
MSBR(conf-if-GE 4/1)# switchport mode trunk
MSBR(conf-if-GE 4/1)# switchport trunk allowed vlan add 100,300
MSBR(conf-if-GE 4/1)# exit
MSBR(config-data)# interface gigabitethernet 4/2
MSBR(conf-if-GE 4/2)# switchport mode access
MSBR(conf-if-GE 4/2)# switchport access vlan 100
MSBR(conf-if-GE 4/2)# exit
```

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4 Trunk

Ethernet interfaces can be configured either as an access port or as trunk ports. Trunks carry the traffic of multiple VLANs over a single link. A trunk port can have two or more VLANs configured on the interface and can carry traffic for several VLANs simultaneously.

To correctly deliver traffic on a trunk port with several VLANs, the device uses the IEEE 802.1Q encapsulation (tagging) method that uses a tag inserted into the frame header. The tag carries information about the specific VLAN to which the frame and packet belong. This method allows packets that are encapsulated for several different VLANs to traverse the same port and maintain traffic separation between the VLANs. The encapsulated VLAN tag also allows the trunk to move traffic end-to-end through the network on the same VLAN.

4.1 Commands

The table below explains the trunk bridging commands.

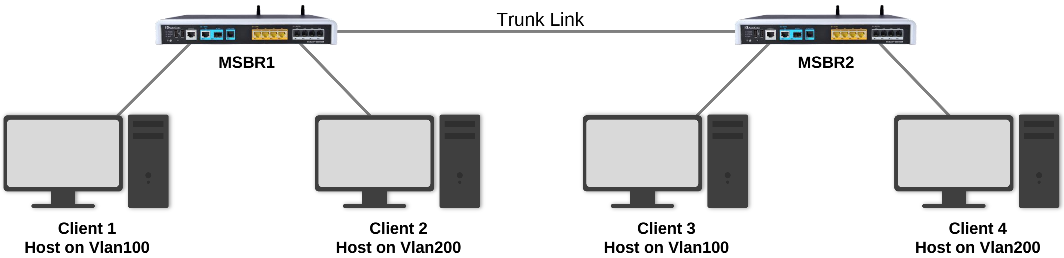
Table 4-1: Trunk Bridging Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# interface <physical_interface> [slot/port.vlanID]`	Allows you to enter a specific interface configuration mode. • <physical_interface> - selects the type of interface. • [slot/port.vlanID] – slot and port number is taken from the device panel. **Note:** The interface configuration mode changes after the command is entered.
`(conf-if-GE SlotNum/PortNum)# Switchport mode trunk`	Switches the port to trunk mode.
`(conf-if-GE SlotNum/PortNum)# switchport trunk allowed vlan [add/remove]`	Takes control of specific VLANs that will be transmitted on the trunk interface. Any VLAN that is not configured won't be allowed to transmit data on this trunk interface.
`(conf-if-GE SlotNum/PortNum)# switchport trunk native vlan [Native_VlanID]`	Configures the native VLAN for this trunk interface. Any packet on this interface without a tag is tagged to the native VLAN number.

4.2 Example

This example shows two different VLANs configured on each switch port with a connecting trunk that allows the transmission of data from VLAN 100 and VLAN 200. The example shows how the same VLAN can be configured on different switch ports and at the same time be connected to other hosts on the same VLAN via the Trunk.

Figure 4-1: Trunk Bridging



The above example is implemented using the following commands:

- **MSBR1:**

```
MSBR1(config-data)# interface gigabitethernet 4/1
MSBR1(conf-if-GE 4/1)# switchport mode trunk
MSBR1(conf-if-GE 4/1)# switchport trunk allowed vlan add
100,200
MSBR1(conf-if-GE 4/1)# switchport trunk native vlan 1
```

- **MSBR2:**

```
MSBR2(config-data)# interface gigabitethernet 4/1
MSBR2(conf-if-GE 4/1)# switchport mode trunk
MSBR2(conf-if-GE 4/1)# switchport trunk allowed vlan add
100,200
MSBR2(conf-if-GE 4/1)# switchport trunk native vlan 1
```

5 Trunk Bridging

Trunk bridging lets you connect a client that works with tagging and forwards the traffic through the WAN without configuring the VLANs on the switch side. This mean that all VLANs are passed from the LAN to the WAN.

5.1 Commands

The table below explains the trunk bridging commands.

Table 5-1: Trunk Bridging Commands

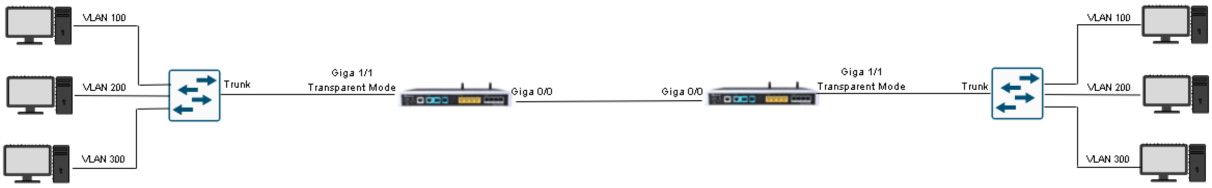
Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`MSBR(config-data)# interface bvi <bridge_Number>`	Enters a specific interface BVI configuration mode. <bridge_Number> - enter a number between 1 and 255 that represents the new bridge interface.
`(config-data)# interface vlan [Vlan-ID]`	Allows you to enter a specific interface VLAN mode. Vlan-ID – actual VLAN number.
`MSBR(conf-if-VLAN [Vlan-ID])# bridge-group [Bridge Number] trunk pvid 1 vlans [Range / all]`	Configure the LAN interface to work as a trunk bridging.
`MSBR(conf-if-GE SlotNum/PortNum)# switchport mode transparent`	Switches the port to transparent mode.
`(conf-if-GE SlotNum/PortNum)# switchport trunk native vlan [Native_VlanID]`	Configures the native VLAN for this trunk interface. Any packet on this interface without a tag is tagged to the native VLAN number.
`MSBR(conf-if-GE SlotNum/PortNum)# bridge-group [Bridge Number] trunk pvid 1 vlans [Range / all]`	Configure the WAN interface to work as a trunk bridging.

5.2 Example

This example shows clients that connects with VLAN tagging to the MSBR switch and wants to communicate with a remote clients that works with the same VLAN tagging, but without adding this VLAN to the MSBR switch.

In trunk bridging, the LAN ports are configured to work in transparent mode and forwards all the VLANs from the LAN to the WAN that works as a trunk.

Figure 5-1: Trunk Bridging



The above example is implemented using the following commands:

- **MSBR1:**

```
MSBR1# configure data
MSBR1(config-data)# interface bvi 100
MSBR1(conf-if-BVI 100)# no shutdown
MSBR1(config-data)# interface vlan 100
MSBR1(conf-if-VLAN 100)# bridge-group 100 trunk pvid 1 vlans all
MSBR1(conf-if-VLAN 100)# no shutdown
MSBR1(config-data)# interface gigabitethernet 1/1
MSBR1(conf-if-GE 1/1)# switchport mode transparent
MSBR1(conf-if-GE 1/1)# switchport trunk native vlan 100
MSBR1(conf-if-GE 1/1)# no shutdown
MSBR1(config-data)# interface gigabitethernet 0/0
MSBR1(conf-if-GE 0/0)# bridge-group 100 trunk pvid 1 vlans all
MSBR1(conf-if-GE 0/0)# no shutdown
MSBR1(conf-if-GE 0/0)# exit
```

- **MSBR2:**

```
MSBR1# configure data
MSBR1(config-data)# interface bvi 100
MSBR1(conf-if-BVI 100)# no shutdown
MSBR1(config-data)# interface vlan 100
MSBR1(conf-if-VLAN 100)# bridge-group 100 trunk pvid 1 vlans all
MSBR1(conf-if-VLAN 100)# no shutdown
MSBR1(config-data)# interface gigabitethernet 1/1
MSBR1(conf-if-GE 1/1)# switchport mode transparent
MSBR1(conf-if-GE 1/1)# switchport trunk native vlan 100
MSBR1(conf-if-GE 1/1)# no shutdown
MSBR1(config-data)# interface gigabitethernet 0/0
MSBR1(conf-if-GE 0/0)# bridge-group 100 trunk pvid 1 vlans all
MSBR1(conf-if-GE 0/0)# no shutdown
MSBR1(conf-if-GE 0/0)# exit
```

6 Port-Monitoring

Also known as 'mirroring', Port Monitoring is used on a network switch to send a copy of network packets seen on one switch port (or an entire VLAN) to a network monitoring connection on another switch port. Port mirroring is configured by assigning a port from which to copy all packets, and another port to which those packets will be sent. Usually a protocol analyzer such as Wireshark is run on the port receiving the mirrored data to monitor each segment separately. The analyzer, sometimes called a sniffer or packet sniffer, captures and evaluates the data without affecting the client on the original port. Port mirroring can also be used as a diagnostic or debugging tool.

6.1 Commands

The table below explains the port mirroring commands.

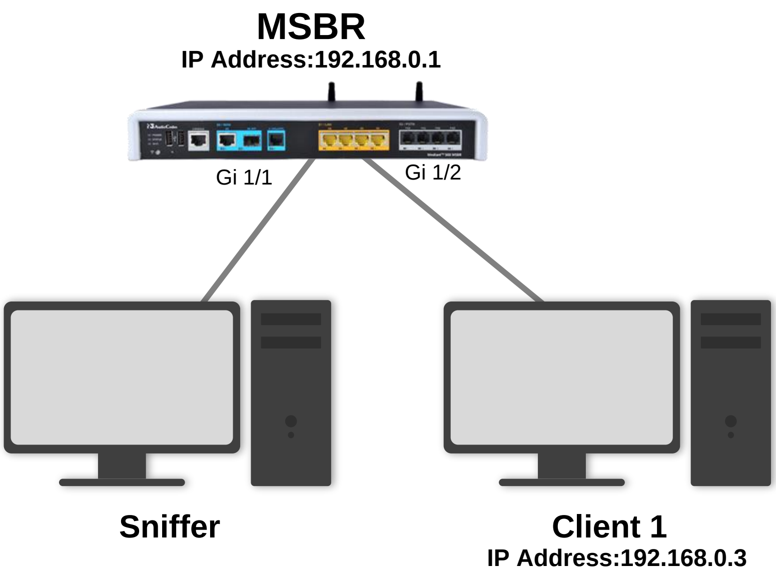
Table 6-1: Port Monitoring Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# interface <physical_interface> [slot/port.vlanID]`	Accesses a specific interface configuration mode. • <physical_interface> - selects the type of interface. • [slot/port.vlanID] – slot and port number is taken from the device panel. **Note**: The interface configuration mode changes after the command is entered.
`(conf-if-GE SlotNum/PortNum)# port-monitor gigabitethernet [slot/port.vlanID] [both-direction|ingress|egress]`	Allows this port to monitor the traffic on another port: • both-direction – monitors all incoming and outgoing packets for this port. • ingress – monitors all incoming packets for this port. • egress – monitors all outgoing packets for this port.

6.2 Example

In this example, a sniffer is connected to one of the switch ports on the MSBR and a client connected to another switch port. The figure below shows how the sniffer listens to all transport that passes through from the Gigabit Ethernet interface 1/2.

Figure 6-1: Port-Monitor



The above example is implemented using the following commands:

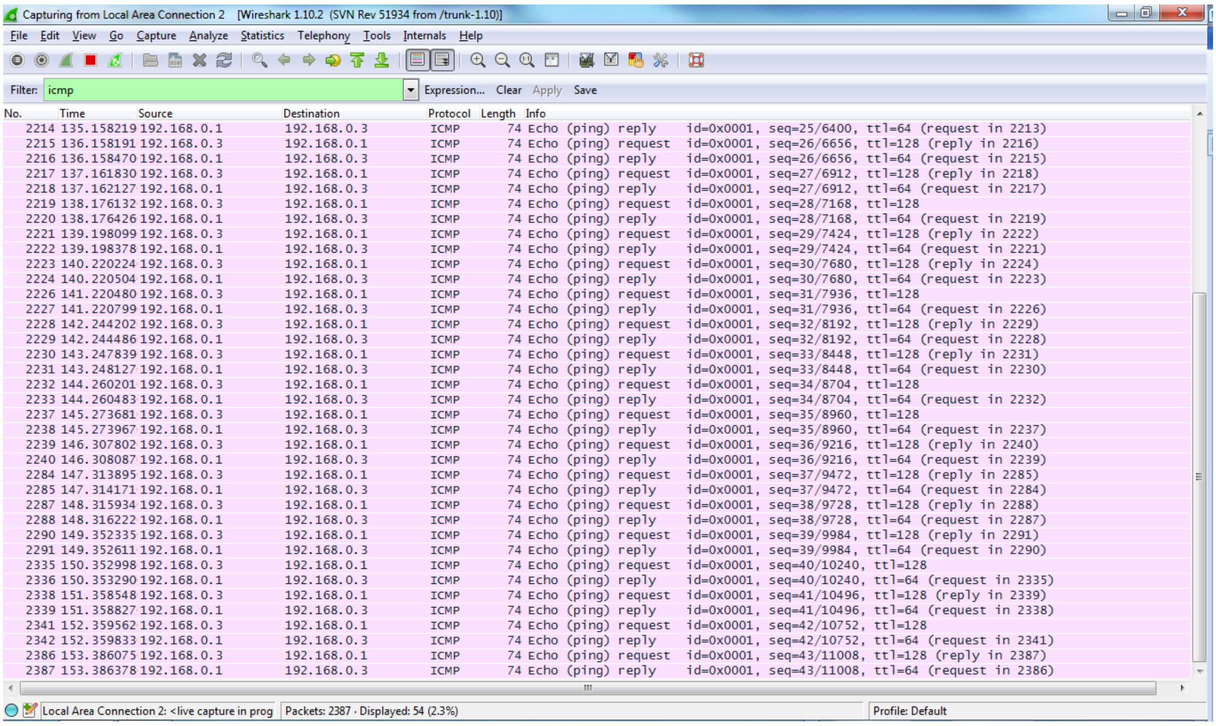
```
MSBR# configure data
MSBR (config-data)# interface vlan 1
MSBR (conf-if-VLAN 1)# ip address 192.168.0.1
MSBR (config-data)# interface gigabitethernet 1/1
MSBR (conf-if-GE 1/1)# port-monitor gigabitethernet 1/2 both-
direction
```

➢ **To view packets for the gigabitethernet 1/1 interface:**

1. Connect a network sniffer such as Wireshark (free download on the internet).
2. After downloading the software, activate the packet filter on a specific Ethernet NIC.
3. Ping from the client to the MSBR with a repeat of 1000 packets, and then **Get Next Result**.

A screen similar to the following is displayed:

Figure 6-2: ICMP Filter



Note: You can apply a filter that displays only ICMP packets sent. Every packet contains data and information.

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7 Bridge Group Virtual Interface (BVI) Interfaces

A BVI (Bridge Group Virtual Interface) is a routed interface that represents a set of interfaces that are bridged. Using a BVI, you can convert multiple Router Ethernet WAN interfaces as members of a common Ethernet broadcast domain.

A BVI interface allows you to combine multiple ports on the router to the group functioning as a flat Layer-2 bridge. A BVI interface can be associated with many different Layer 3 interfaces such as fiber, DSL, copper and even wireless. All packets have to bypass the BVI and accelerate processing time.

7.1 Commands

The table below explains the BVI Interface commands.

Table 7-1: BVI Interface Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`MSBR(config-data)# interface bvi <bridge_Number>`	Enters a specific interface BVI configuration mode. • <bridge_Number> - enter a number between 1 and 255 that represents the new bridge interface.
`MSBR(conf-if- BVI Num_BVI)# ip address [A.B.C.D]  [SubnetMask]`	Allows the assignment of an IP address to a BVI interface.

The table below explains the physical interface commands.

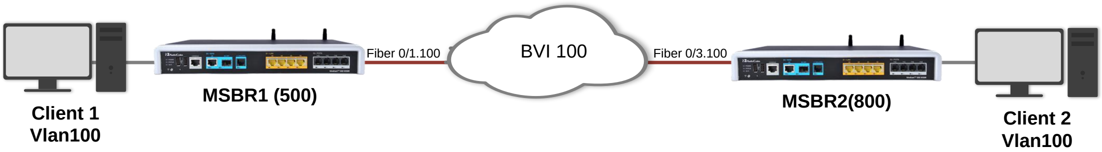
Table 7-2: Physical Interface Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`MSBR(config-data)# interface <physical_interface> [slot/port.vlanID]`	Accesses a specific interface configuration mode. • <physical_interface> - selects the type of interface. • [slot/port.vlanID] – slot and port number is taken from the device panel. **Note**: The interface configuration mode changes after the command is entered.
`MSBR(conf-if-GE SlotNum/PortNum)#bridge-group [Bridge Group ID]`	The Bridge Group ID must be configured with the same value as the BVI interface ID number, i.e., the Bridge ID value must be identical to the ID of the interface to which you want to associate with this bridge.

7.2 Example

This example shows how to configure BVI as an interface and how to connect VLAN 100 to the bridge group. Note that VLAN 100 configured on MSBR1 is unrelated to the VLAN 100 configured on MSBR2.

Figure 7-1: BVI



The above example is implemented using the following commands:

- **MSBR2:**

```
MSBR2(config-data)# interface bvi 100
MSBR2(conf-if-BVI 100)# no shutdown
MSBR2(conf-if-BVI 100)# exit
MSBR2(config-data)# interface vlan 100
MSBR2(conf-if-VLAN 100)# bridge-group 100
MSBR2(conf-if-VLAN 100)# exit
MSBR2(config-data)# interface fiber 0/3.100
MSBR2(conf-if-FIBER 0/3.100)# bridge-group 100
```

- **MSBR1:**

```
MSBR1(config-data)# interface bvi 100
MSBR1(conf-if-BVI 100)# no shutdown
MSBR1(conf-if-BVI 100)# exit
MSBR1(config-data)# interface vlan 100
MSBR1(conf-if-VLAN 100)# bridge-group 100
MSBR1(conf-if-VLAN 100)# exit
MSBR1(config-data)# interface fiber 0/1.100
MSBR1(conf-if-FIBER 0/1.100)# bridge-group 100
```

The following show output is displayed after connecting a host on VLAN 100:

```
MSBR# show data interfaces bvi 100

BVI 100 is Connected.
  Description: Bridge
  Hardware address is 00:90:8f:4f:5a:87
  State Time:   2:20:10
  Time since creation:   2:22:16
  Time since last counters clear :   2:20:10
  mtu auto
  DNS is configured static
  DNS primary IP address is 0.0.0.0
  DNS secondary IP address is 0.0.0.0

  rx_packets 12159            rx_bytes 1498976          rx_dropped
0                 rx_errors 0
  tx_packets 5498             tx_bytes 459573           tx_dropped
0                 tx_errors 0
  5-minute input rate:   621 bits/sec, 0 packets/sec
  5-minute output rate:  43 bits/sec, 0 packets/sec
  15-second input rate:  883 bits/sec, 2 packets/sec
  15-second output rate: 806 bits/sec, 2 packets/sec
```

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8 802.1p Priority/Layer-2 QoS

Layer-2 QoS is lightweight, easily implemented and independent of Layer 3. Due to its independence, it can also be applied to non-IP networks where QoS provisioning is impossible or very difficult.

Layer-2 Ethernet switches rely on the 802.1p standard to provide QoS. The IEEE 802.1p standard is a method for assigning priority for network packet transmission. This priority works with the MAC header at the data link layer (Layer-2 in the OSI reference model).

It uses tagged frames inserted in Ethernet frames after the source address field. One of the tag fields, Tag Control Information, is used by 802.1p to differentiate between the classes of service (CoS).

The 802.1p sets a 3-bit CoS value in the MAC header (when 802.1Q VLAN tagging is present) to indicate prioritization. This 3-bit value provides priority levels ranging from 0 to 7, with level 7 representing the highest priority. This allows packets to cluster and form different traffic classes, so that when network congestion occurs, those packets that are assigned higher priority receive preference, while lower priority packets are queued.

When the priority command is used in MSBR interface, all incoming packets will be marked with the VLAN priority bit.

Note: CoS only operates on 802.1Q VLAN Ethernet at the data link layer (Layer-2), while other QoS mechanisms (such as DSCP) operate at the IP network layer (layer 3-ToS).

8.1 Commands

The table below explains the 802.1p priority commands.

Table 8-1: 802.1p Priority Commands

Command	Description
MSBR# configure data	Enter the data configuration menu.
(config-data)# interface <physical_interface> [slot/port.vlanID]	Accesses a specific interface configuration mode. • <physical_interface> - selects the type of interface. • [slot/port.vlanID] – slot and port number is taken from the device panel. **Note**: The interface configuration mode changes after the command is entered.
(conf-if-GE SlotNum/PortNum)# Priority [Number: 0-7]	Configures the priority interface traffic. • 0 – Low Priority • 7 – High Priority

8.2 Example

This example shows how to change priority for a specific physical interface.

```
MSBR(config-data)# interface fiber 0/3
MSBR(conf-if-GE 0/0)# priority 7
```

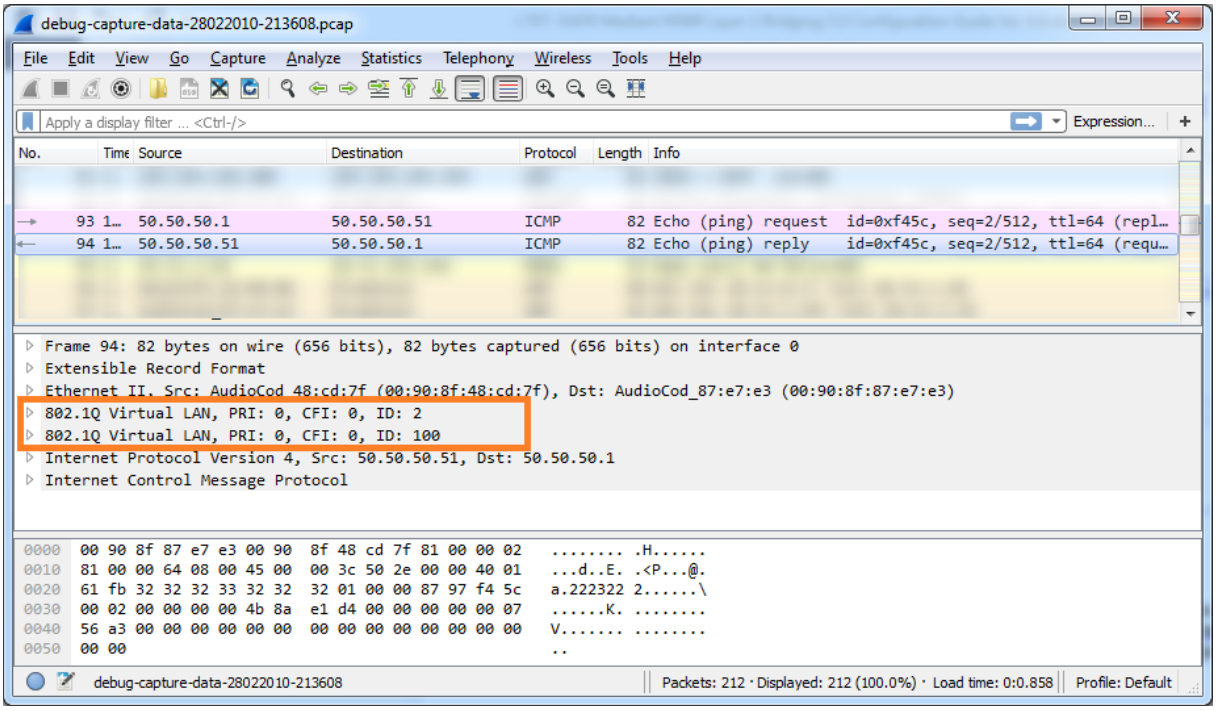
9 QinQ

MSBR supports encapsulating 802.1Q tags within 802.1Q tags. This feature links several VLANs into a single VLAN. An IP address can be configured on the tagged interface.

> **Note:** For Mediant 500Li and Mediant 800Ci, QinQ is supported only on the WAN interface (not LAN).

The figure below shows a packet captured by a sniffer with QinQ configured. The QinQ encapsulated 802.1Q tags are highlighted.

Figure 9-1: Packet Capture



9.1 Commands

Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# interface <physical_interface> [slot/port.vlanID]`	Accesses a specific interface configuration mode. • <physical_interface> - selects the type of interface. • [slot/port.vlanID] – slot and port number is taken from the device panel. vlanID – encapsulating dot1q. **Note**: The interface configuration mode changes after the command is entered.
`(conf-if-GE SlotNum/PortNum)# exit`	Back up one level

Command	Description
(config-data)# interface <physical_interface> [slot/port.vlanID.vlanID]	Configure encapsulated VLAN ID. The first VLAN ID is the encapsulating VLAN ID, the second is the encapsulated VLAN ID.
Mediant 500Li and Mediant 800Ci Only	
MSBR# configure network	Enter the network configuration menu.
(config-network)# network-settings (network-settings)# wan-copper-fiber-mode {single-copper|single-fiber|use-all}	Configure the WAN interface on which to apply QinQ. You must select one WAN interface - single-copper or single-fiber. To disable QinQ, configure the command to use-all.

9.2 Example

This example shows the configuration of QinQ on gigabitethernet 0/0.

```
interface GigabitEthernet 0/0.2
 no ip address
 mtu auto
 desc "WAN Copper.2"
 no ipv6 enable
 no service dhcp
 ip dns server auto
 no shutdown
exit
interface GigabitEthernet 0/0.2.100
 ip address 50.50.50.1 255.255.255.0
 mtu auto
 desc "WAN Copper.2.100"
 no ipv6 enable
 no service dhcp
 ip dns server static
 napt
 firewall enable
 no shutdown
exit
```

10 Pseudo Wires

Pseudo wires is a mechanism that emulates the essential features of a native service while transporting over a Packet Switched Network (PSN), where the mechanism tunnels traffic through a PSN.

Services emulated can include T1, E1 leased line, frame relay, Ethernet, ATM, TDM, or SONET/SDH.

The Pseudo Wires mechanism:

- Provides a true end-to-end solution for operators
- Transforms the access network by tightly integrating it with the core
- Provides a platform for new services (such as Virtual Private LAN Service) and not just for the transport of legacy services

10.1 Connectivity Fault Management (CFM)

IEEE 802.1ag Connectivity Fault Management (CFM) refers to the capability of a network to monitor the health of a service delivered to customers as opposed to just links or individual bridges.

CFM protocol provides pseudo wires capability – simulating cross network connectivity. If one end point is down, the other end point reflects this failure as well.

The IEEE 802.1ag CFM standard specifies protocols, procedures, and managed objects to support transport fault management. This allows for the discovery and verification of the path, through bridges and LANs, taken by frames addressed to and from specified network users and the detection, and isolation of a connectivity fault to a specific bridge or LAN.

Ethernet CFM defines proactive and diagnostic fault localization procedures for point-to-point and multipoint Ethernet Virtual Connections that span one or more links. It operates end-to-end within an Ethernet network. CFM provides the capability for detecting, verifying and isolating connectivity failures in such networks.

CFM:

- Monitors the health of links (because providers and customers might not have access to the management layer)
- Checks connectivity of ports
- Detects frame structure failures
- Avoids security breaches

10.2 Commands

The table below explains the Ethernet CFM commands:

Table 10-1: Ethernet CFM Commands

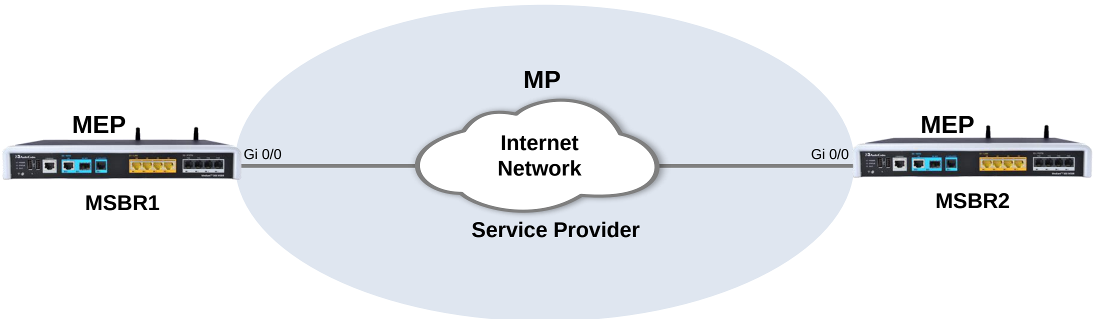
Command	Description
`MSBR# configure data`	Enter the data configuration menu.
`(config-data)# ethernet cfm aging-time [1-9999]`	Configures the remote MEP aging time. Maintenance End Point (MEP) is located at the edge of the domain. It defines the boundary for the domain. A MEP sends and receives CFM frames through the relay function, drops all CFM frames of its level or lower that arrive from the wire side.
`(config-data)# ethernet cfm`	Debounce is the number of port-down

Command	Description
debounce [1-500]	packets to receive before blocking ports.
(config-data)# ethernet mep domain [DOMAIN_NAME] mpid [MEP_identifier_Num]	Configures the MEP on the MSBR and enters the MEP to Configuration mode.
(conf-mep)# continuity-check interval [100ms,10m,10ms,10s,1m,1s,3ms]	The Continuity Check Message (CCM) provides a way to detect connectivity failures. CCMs are multicast messages. CCMs are confined to a domain. These messages are unidirectional and do not solicit a response.
(conf-mep)# level [0-7]	Configures the domain level. The larger the domain, the higher the level. For example, a service-provider domain would be larger than an operator domain and might have a maintenance level of 6, while the operator domain maintenance level would be 3 or 4.
(conf-mep)# interface [Any-Physcal_interface] [slot/port or number]	Enables and transfers CFM messages through the insert interface.
(conf-mep)# link-state reflect	Reflects LAN link state.
(conf-mep)# service [number|string|vid]	Set one of these options to Maintenance association.

10.3 Example

This example shows how to configure the MSBR to serve as a Maintenance End Point (MEP) to monitor other nodes in the network such as another MSBR on the other side of the network.

Figure 10-1: CFM



The above example is implemented using the following commands:

- **MSBR1:**

```
MSBR1(config-data)# ethernet cfm aging-time 0
MSBR1(config-data)# ethernet cfm debounce 5
MSBR1(config-data)# ethernet cfm mep domain TEST mpid 10
MSBR1(conf-mep)# level 6
MSBR1(conf-mep)# domain-name-format none
MSBR1(conf-mep)# service number 1
MSBR1(conf-mep)# link-state reflect
```

```
MSBR1(conf-mep)# vlan 1
MSBR1(conf-mep)# interface GigabitEthernet 0/0
MSBR1(conf-mep)# continuity-check interval 1s
MSBR1(conf-mep)# exit
MSBR1(conf-if-VLAN 1)# interface VLAN 1
MSBR1(conf-if-VLAN 1)# link-state monitor
MSBR1(conf-if-VLAN 1)# no shutdown
MSBR1(conf-if-VLAN 1)# exit
```

- **MSBR2:**

```
MSBR2(config-data)# ethernet cfm aging-time 0
MSBR2(config-data)# ethernet cfm debounce 5
MSBR2(config-data)# ethernet cfm mep domain TEST mpid 10
MSBR2(conf-mep)# level 6
MSBR2(conf-mep)# domain-name-format none
MSBR2(conf-mep)# service number 1
MSBR2(conf-mep)# link-state reflect
MSBR2(conf-mep)# vlan 1
MSBR2(conf-mep)# interface GigabitEthernet 0/0
MSBR2(conf-mep)# continuity-check interval 1s
MSBR2(conf-mep)# exit
MSBR2(conf-if-VLAN 1)# interface VLAN 1
MSBR2(conf-if-VLAN 1)# link-state monitor
MSBR2(conf-if-VLAN 1)# no shutdown
MSBR2(conf-if-VLAN 1)# exit
```

The following command shows the MEP status:

```
MSBR# show data ethernet cfm

Local MEPs:
MPID  VLAN   RmtRDI MAC    Remote XCON
----------------------------------------
   10 OK     OK     OK     OK     OK

Remote MEPs:
MPID  Stat DomainName       MAC                 Age    Intf Port
-----------------------------------------------------------------
   10 UP   TEST             00:90:8f:4a:23:44    0s     Up   Up

#show command after disconnect cable:

Local MEPs:
MPID  VLAN   RmtRDI MAC    Remote XCON
----------------------------------------
   10 OK     OK     OK     Error  OK

Remote MEPs:
MPID  Stat DomainName        MAC                Age    Intf Port
-----------------------------------------------------------------
```

International Headquarters
1 Hayarden Street,
Airport City
Lod 7019900, Israel
Tel: +972-3-976-4000
Fax: +972-3-976-4040

AudioCodes Inc.
80 Kingsbridge Rd
Piscataway, NJ 08854, USA
Tel: +1-732-469-0880
Fax: +1-732-469-2298

Contact us: https://www.audiocodes.com/corporate/offices-worldwide
Website: https://www.audiocodes.com

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