LAN Interfaces

Teldat Dm709-I

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I Related Documents

Teldat Dm702-I TCP-IP Configuration

Teldat Dm750-I Ethernet Subinterface

Teldat Dm751-I VLAN

Teldat Dm772-I Common Configuration Interfaces

Teldat Dm776-I Power Over Ethernet

Teldat Dm783-I 802.1X Authentication

Teldat Dm795-I Policy Map-Class Map

Teldat Dm813-I LLDP Protocol

Chapter 1 Configuring Token Ring Interfaces

1.1 Introduction

This chapter describes the Token Ring interface configuration. It includes the following sections:

- Accessing the Token Ring Configuration.
- Token Ring Configuration Commands.

1.2 Accessing the Token Ring Configuration

To access the Token Ring configuration:

(1) Enter **list devices** at the *Config>* prompt to display the list of interfaces and their interface number.

(2) Enter **network**, followed by the Token Ring interface name.

Example:

```
*config
Config>list devices
Interface            Connector     Type of interface
ethernet0/0          LAN1          Fast Ethernet interface
serial0/0            SERIAL0/WAN1  X25
serial0/1            SERIAL1/WAN2  X25
serial0/2            SERIAL2/WAN3  X25
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
token-ring3/0        SLOT3         Token Ring
Config>network token-ring3/0

-- Token Ring User Configuration --
token-ring3/0 config>
```

1.3 Token Ring Configuration Commands

Certain commands are common to all device interfaces. These commands are described in *Teldat Dm772-I Common Configuration Interfaces.*

The following table summarizes the Token Ring configuration commands, further explained below. Enter said commands from the Token Ring configuration menu.

Command	Function
? (HELP)	Displays available commands or their options.
LIST	Displays the selected Token Ring interface configuration.
LLC	Accesses LLC configuration.
MAC-ADDRESS	Configures the interface's physical address (MAC).
NO	Configures default values for the configuration parameters.
PACKET-SIZE	Modifies packet-size for all Token Ring networks.
RIF-TIMER	Configures the Routing Information Field (RIF) timer.
SOURCE-ROUTING	Enables or disables source-routing on the interface.
SPEED	Sets the interface speed in Mbps.
EXIT	Exits Token Ring configuration.

1.3.1 ? (HELP)

Displays the available commands and their options.

Syntax:

```
token-ringX/X config>?
```

Example:

```
token-ring3/0 config>?
  list              List configuration
  llc               Enter the LLC configuration menu
  mac-address       Configure the interface physical address
  no                Negate a command or set its defaults
  packet-size       Change packet size for all Token Ring networks
  rif-timer         Configure the RIF timer
  source-routing    Enable or disable end station source routing
  speed             Modify the data transmission speed
  exit
token-ring3/0 config>
```

1.3.2 LIST

Displays the current configuration for the Token Ring interface.

Syntax:

```
token-ringX/X config>list
```

Example:

```
token-ring3/0 config>list
Packet size :   2052
Speed:          16 Mbps
RIF aging:      120
Source Routing: Enabled
MAC address:    00:00:00:00:00:00

token-ring3/0 config>
```

1.3.3 LLC

Accesses the LLC configuration. This configuration is mandatory to forward packets over the SNA network. See the *LLC Configuration Commands* section for a description of the available commands and their use.

Syntax:

```
token-ringX/X config>llc
```

Example:

```
token-ring3/0 config>llc
-- LLC User Configuration --
token-ring3/0 LLC config>
```

1.3.4 MAC ADDRESS

Configures the physical address of the interface (MAC). The interface can adopt locally administered addresses, or those given by the device manufacturer (universal administration). Through this command, only locally administrated addresses are deemed valid. Entering *00:00:00:00:00:00* (default value) forces the router to use the address given by the manufacturer for the interface. This last MAC address is used by default.

Example:

```
token-ring3/0 config>mac-address 50:84:c0:4c:84:4e
token-ring3/0 config>
```

1.3.5 NO

Sets the different parameters to their default values.

Syntax:

```
token-ringX/X config>no ?
  mac-address    Restore universal administration MAC
  packet-size    Set default packet size (2052 bytes)
```

```
  rif-timer      Set default RIF timer (2m)
  speed          Set default speed (16Mbps)
token-ringX/X config>
```

The default values are as follows:

Command	Default Value
MAC-ADDRESS	00:00:00:00:00:00
PACKET-SIZE	2052 bytes.
RIF-TIMER	120 seconds.
SPEED	16 Mbps.

1.3.6 PACKET-SIZE

Changes the packet size of all Token Ring networks. Changing the *packet-size* value can greatly increase buffer memory requirements.

The following table shows valid packet sizes for 4 Mbps and 16 Mbps networks.

Speed	Values (# of bytes).
4 Mbps	1470, 2052, 4399
16 Mbps	1470, 2052, 4399, 8130, 11407, 17749

Syntax:

```
token-ringX/X config>packet-size <packet size>
```

Example:

```
token-ring3/0 config>packet-size ?
  1470
  2052
  4399
  8130
  11407
  17749
token-ring3/0 config>packet-size 17749
token-ring3/0 config>
```

If you enter an incorrect value, an error message is displayed:

token-ring3/0 config>speed 4

```
token-ring3/0 config>packet-size 17749
CLI Error: Valid packet-size for 4 Mbps: 1470,2052,4399
CLI Error: Command error
token-ring3/0 config>
```

1.3.7 RIF-TIMER

Configures the *Routing Information Field* (RIF) timer, which measures (in seconds) the amount of time the router keeps RIF information before it is refreshed. Default is 120 seconds.

Syntax:

```
token-ringX/X config>rif-timer <value>
```

Example:

```
token-ring3/0 config>rif-timer ?
  <0s..1h>    RIF aging (Time value)
token-ring3/0 config>rif-timer 40
token-ring3/0 config>
```

1.3.8 SOURCE-ROUTING

Enables or disables end station *source routing*. Through this process, end stations can determine the route to other network devices over bridges implementing source routing. This allows the IP protocol to reach nodes located on the other side of the bridge in source routing mode. This option does not depend on whether the interface supports source routing in packet transmission and reception for this type or not. Default is enabled.

Syntax:

```
token-ringX/X config>source-routing ?
  disabled    Disable end station source routing
  enabled     Enable end station source routing
token-ringX/X config>
```

Example:

```
token-ring3/0 config>source-routing disabled
token-ring3/0 config>
```

1.3.9 SPEED

Modifies the data transmission speed. The options are 4 or 16 Mbps. Default is 16.

Syntax:

```
token-ringX/X config>speed <speed>
```

Example:

```
token-ring3/0 config>speed ?
  4
  16
token-ring3/0 config>speed 16
token-ring3/0 config>
```

1.3.10 EXIT

Returns to the general configuration menu (*Config>)*.

Syntax:

```
token-ringX/X config>exit
```

Example:

```
token-ring3/0 config>exit
Config>
```

Chapter 2 Monitoring Token Ring Interfaces

2.1 Introduction

This chapter describes the monitoring of Token Ring interfaces and includes the following sections:

- Accessing Token Ring Monitoring.
- Token Ring Monitoring Commands.
- Token Ring Interfaces and the Monitoring Interface Command.

2.2 Accessing Token Ring Monitoring

To access Token Ring Monitoring:

(1) Enter **device** at the monitoring menu (+) to display the list of interfaces configured in the router.

(2) Enter **network**, followed by the Token Ring interface name, at the monitoring menu (+).

Example:

```
*monitor
Console Operator
+device
                                    Auto-test   Auto-test     Maintenance
Interface            CSR    Vect      valids    failures        failures
ethernet0/0     FA200e00      27           0        2687               0
serial0/0       FA200a00      5e           1           0               0
serial0/1       FA200a20      5d           0       36796               0
serial0/2       FA200a60      5b           0       36796               0
bri0/0          FA200a40      5c           1           0               0
x25-node               0       0           1           0               0
token-ring3/0   E0000000      24           1           0               0
+network token-ring3/0

-- Token Ring Console --
token-ring3/0 TKR+
```

2.3 Token Ring Monitoring Commands

The following table summarizes the Token Ring monitoring commands, further explained in the subsequent sections. Enter these commands from the Token Ring monitoring menu.

Command	Function
? (HELP)	Shows the available commands and their options.
LLC	Accesses the LLC monitoring menu.
RIF-DUMP	Displays an RIF cache dump.
EXIT	Exits the Token Ring monitoring menu.

2.3.1 ? (HELP)

Shows the available commands and their options.

Syntax:

```
token-ringX/X TKR+?
```

Example:

```
token-ring3/0 TKR+?
LLC             Access to the LLC monitoring prompt
RIF-DUMP        Dumps RIF information
EXIT
token-ring3/0 TKR+
```

2.3.2 LLC

Accesses the LLC monitoring menu and allows the user to enter the LLC monitoring commands. Please see the *LLC monitoring commands* section for a description on these commands.

Syntax:

```
token-ringX/X TKR+LLC
```

Example:

```
token-ring3/0 TKR+LLC
LLC user Monitoring
token-ring3/0 LLC+
```

2.3.3 RIF-DUMP

When *source routing* is enabled on the Token Ring interface (see the section on Token Ring configuration commands), **rif-dump** displays the content of the RIF cache. The **rif-dump** command only applies to protocols, it does not apply to DLSw or bridging.

Syntax:

```
token-ringX/X TKR+RIF-DUMP
```

Example:

```
token-ring3/0 TKR+RIF-DUMP

 MAC Address           RIF
=================   ===============
00:00:C9:1E:ED:5C   0620 0011 0020

token-ring3/0 TKR+
```

The meaning of each field is as follows:

MAC Address	Token Ring interface MAC address in non-canonical format.
RIF	Displays a code that indicates the RIF in hexadecimal format.

2.3.4 EXIT

Returns to the (+) general monitoring menu.

Syntax:

```
token-ringX/X TKR+EXIT
```

Example:

```
token-ring3/0 TKR+EXIT
+
```

2.4 Token Ring Interfaces and the Interface Monitoring Command

The router displays statistics for network interfaces when you enter **device** at the monitoring menu prompt (+).

2.4.1 DEVICE

At the monitoring menu prompt (+), enter **device** and the name of the interface. The following statistics are then displayed for the Token Ring interface chosen.

Syntax:

```
+DEVICE <TKR interface name>
```

Example:

```
+DEVICE TOKEN-RING3/0
```

```
                                  Auto-test   Auto-test     Maintenance
Interface            CSR    Vect      valids    failures        failures
token-ring3/0   e0000000      24           1           0               0

Physical Address: 00:05:64:02:D0:25
PROM Address:     00:05:64:02:D0:25
Speed:            16 Mbps

Max. packet size:     4399
Handler state:        Available ring
Ring status:          OK

  Number of Signal lost           0  'beacon' packets              0
  Fatal errors                    0  Lobe errors                   0
  'auto-remove' errors            0  'Removes' packets             0
  Ring recovery                   0

  Line errors                     0  'burst' errors                0
  ARI/FCI errors                  0  Input drops                   0
  Frame copy errors               0  'token' errors                0
  Lost frames                     0  Too big frames                0
MAC code version: EMAC 2.28 512K
+
```

The meaning of each field is:

Interface	Interface name.
CSR	Control/status/data Register Address.
Vect	Interrupt vector associated to the interface, written in hexadecimal.
Auto-test Valids	Number of successful auto-tests.
Auto-test Failures	Number of unsuccessful auto-tests.
Maintenance Failures	Number of maintenance failures.
Physical Address	Token Ring interface MAC address in NON-canonical format. This is the address currently used by the interface. This can be a locally administrated address or a universal address.
PROM Address	MAC address provided by the manufacturer for the Ethernet interface. This is a universal address.
Speed	Transmission speed, in Mbps, of the Token Ring network connected to the interface.
Max. packet size	Maximum size of the data field, in bytes, configured for this interface.
Handler state	Current state of the Token Ring interface. This is the state of the interface after executing the auto-test.
Ring status	Information indicating the current status of the ring where the interface is found. The values displayed are: OK ok ARMV Auto removal SIGERR Signal loss RXRMV Remove received HERR Hard error COVF Counter overflow SERR Soft error SGST Single station TXBCM Transmit beacon RNGREC Ring recovery LWFAULT Lobe wire fault
Number of Signal lost	Counter for the number of frames the router has not been able to transmit due to loss of signal in the line interface.
Fatal errors	Interface transmits or receives *beacon* frames from the network.
'*Auto-remove*' *errors*	Due to the beacon auto-removal process, the interface fails the lobe wrap test and removes itself from the ring.
Ring recovery	Interface detects token request MAC frames.
'*Beacon*' *packets*	Number of beacon frames transmitted by the interface.
Lobe errors	Network detects an open circuit or a short circuit in the cable linking the interface to the MAU (Multistation Access Unit).

'*Removes' packets*	Number of MAC *remove from the ring* frames received by the interface. On receiving these, the interface removes itself from the ring.
Line errors	Increases when a frame is repeated or copied, the Error Detected Indicator (EDI) bit is 0 for the incoming frame and one of the following conditions is met: a) A Token has a code violation. b) A frame has a code violation between the start and end delimiters. c) A Frame Check Sequence (FCS) error occurs.
ARI/FCI errors	The ARI/FCI (Address Recognized Indicator/Frame Copied Indicator) Errors counter increases if the interface receives either of the following: a) An Active Monitor Present (AMP) MAC frame with the ARI/FCI bits equal to 0 and a Standby Monitor Present (SMP) MAC frame with the ARI/FCI bits equal to 0. b) More than one SMP MAC frame with the ARI/FCI bits equal to 0, without an intervening AMP MAC frame. This condition indicates the upstream neighbor (from where frames are received) is unable to activate the ARI/FCI bits.
Frame copy errors	The interface, in *receive/copy* mode, recognizes a frame addressed to its specific address but finds the Address Recognize Indicator (ARI) bits is not equal to 0. This error indicates a possible line hit or duplicate address.
Lost frames	The interface is in *transmit* mode and fails to receive the end of a transmitted frame.
'*Burst*' *errors*	The interface detects the absence of transitions for *five half-bits* times between the start delimiter (SDEL) and the end delimiter (EDEL), or between the EDEL and the SDEL.
Input drops	The interface, in *repeat* mode, recognizes a frame addressed to it but has no available space to copy the frame.
'*Token*' *errors*	Increases when the active monitor detects a token protocol with any of the following errors: a) The token MONITOR_COUNT bit with nonzero priority equals one. b) The frame MONITOR_COUNT bit equals one. c) No token or frame is received within a 10ms window. d) The starting delimiter/token sequence has a code violation in an area where code violations cannot exist.
Too big frames	Number of received frames with a bigger data field than the one supported by the interface.
Mac Code Version	Mac code version running in the Token Ring communications processor.

Chapter 3 Configuring Ethernet Interfaces

3.1 Introduction

This chapter describes how to configure Ethernet interfaces. It includes the following sections:

- Accessing the Ethernet Configuration Menu.
- Ethernet Configuration Commands.

3.2 Accessing the Ethernet Configuration Menu

Follow these steps to access the Ethernet configuration menu:

(1) Enter **list devices** at the *Config>* prompt to display a list of all the interfaces.

(2) Enter **network,** followed by the name of the Ethernet interface.

Example:

```
*config
Config>list devices
Interface            Connector     Type of interface
ethernet0/0          GE0/FE0/LAN1  Fast Ethernet interface
ethernet0/1          GE1/FE1/LAN2  Fast Ethernet interface
serial0/0            SERIAL0/WAN1  Auto Install Interface
serial0/1            SERIAL1/WAN2  X25
serial0/2            SERIAL2/WAN3  X25
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
token-ring3/0        SLOT3         Token Ring
Config>network ethernet0/0

-- Ethernet Interface User Configuration --
ethernet0/0 config>
```

3.3 Ethernet Configuration Commands

Certain commands are common to all device interfaces. These commands are described in *Teldat Dm772-I Common Configuration Interfaces*.

This section summarizes and then explains the Ethernet configuration commands. Enter these commands from the ETH configuration menu.

Note

Not all commands specified in this section are available for all Ethernet interfaces. Depending on the device, or on the interface configured, some commands may not appear.

Command	Function
? (HELP)	Shows the available commands or their options.
AUTO-NEGOTIATION	Enables auto-negotiation.
CDP	Configures the CDP protocol in the interface.
DOT1Q	Configures the VLAN tag Ethertype field.
DOT1X	Accesses authentication 802.1X configuration.
DUPLEX	Sets the mode: half-duplex or full-duplex.
FLOW-CONTROL	Configures FLOW-CONTROL mode.
INPUT-BUFFERS	Configures the number of buffers used at reception.
IP-ENCAPSULATION	Sets IP encapsulation as Ethernet type 8137 or Ethernet 802.3.
LIST	Displays the interface configuration.
LLC	Displays the LLC configuration prompt (*LLC config>*).
LLDP	Configures LLDP in the interface.

MAC-ADDRESS	Sets the MAC address used by the interface.
MEDIA-TYPE	Specifies the physical connection on the interface.
NO	Removes previously configured parameters.
OAM	Accesses the Ethernet OAM configuration menu.
PHY-SHUTDOWN	Disables the Ethernet interface at the physical layer.
PROMISCUOUS-MODE	Enables promiscuous mode.
REPEATER-SWITCH	Accesses the Ethernet switch configuration menu.
SPEED	Configures the interface speed (10 Mbps or 100 Mbps).
EXIT	Exits the Ethernet configuration menu.

3.3.1 ? (HELP)

Shows the available commands and their options.

Syntax:

```
ethernetX/X config>?
```

Example:

```
ethernet0/0 config>ip-encapsulation ?
  ethernet      Ethernet type 8137
  ieee-802.3    Ethernet 802.3 raw without 802.2
ethernet0/0 config>
```

Command history:

Release	Modification
11.00.07, 11.01.02	The "promiscuous-mode" command was introduced.
11.01.05	The "flow-control" command was introduced as of version 11.01.05.

3.3.2 AUTO-NEGOTIATION

Configures the Ethernet interface so that it operates in auto-negotiation mode. Here, the duplex mode is set and the interface's speed is configured in accordance with the characteristics of the rest of the devices connected to the Ethernet. The device with the worst characteristics limits the rest of devices connected to the Ethernet. If, for example, several devices can operate at 100 Mbps and one can only operate at 10 Mbps, auto-negotiation configures the interface to 10 Mbps.

Syntax:

```
ethernetX/X config>auto-negotiation
```

Example:

```
ethernet0/0 config>auto-negotiation
ethernet0/0 config>
```

Note

If devices connected with set speeds connect to an Ethernet interface where auto-negotiation is configured, problems may arise. The auto-negotiation mode with set speeds will be unable to detect the duplex mode of the other end. Thus, it will configure in half-duplex mode. Auto-negotiation is mandatory for Gigabit connections. If the speed is set to 1000 Mbps, the device will internally switch to auto-negotiation mode.

3.3.2.1 AUTO-NEGOTIATION ADVERTISE

Configures the characteristics advertised in auto-negotiation. To disable the advertising of characteristics, use the **auto-negotiation no advertise** option. The following characteristics can be configured:

- **flow-control**: advertises all flow control options available (symmetric or both symmetric and asymmetric).
- **flow-control asymmetric**: advertises asymmetric flow control (does not advertise symmetric flow control).
- **flow-control symmetric**: advertises symmetric flow control (does not advertise asymmetric flow control).

Syntax:

```
ethernetX/X config>auto-negotiation advertise
```

Example:

```
ethernet0/0 config>auto-negotiation
     advertise    Autonegotiation advertisement configuration
        flow-control    Flow control capability
           asymmetric    Asymmetric PAUSE toward link partner
           symmetric     Symmetric PAUSE
           <cr>
        no              Disable capability advertisement
           flow-control    Flow control capability
```

Command history:

Release	Modification
11.01.05	The "*auto-negotiation advertise*" command was introduced as of version 11.01.05.

3.3.3 CDP

Configures the CDP protocol in the interface.

3.3.4 DOT1Q

Configures the Ethertype field for the tags used when encapsulation is executed at the MAC level that corresponds to the IEEE 802.1Q standard in Ethernet subinterfaces. For further information on the encapsulation of Ethernet subinterfaces, please see manual *Teldat Dm750-I Ethernet Subinterface.* The default value for this field is 0x8100.

Syntax:

```
ethernetX/X config>dot1q tunneling ethertype <ethertype>
ethernetX/X config>dot1q tunneling ethertype ?
  0x88A8    dot1q tunneling etype 0x88A8
  0x9100    dot1q tunneling etype 0x9100
  0x9200    dot1q tunneling etype 0x9200
```

Example:

```
ethernet0/0 config>dot1q tunneling ethertype 0x88A8
ethernet0/0 config>
```

Note

Encapsulation increases the Ethernet frame and can cause MTU/fragmentation problems in some devices. To solve this, limit the subinterface IP MTU using the **IP MTU** command described in manual *Teldat Dm702-I TCP-IP Configuration* .

3.3.5 DOT1X

Accesses the 802.1X authentication configuration. For further information on 802.1X authentication, please see manual *Teldat Dm783-I 802.1X Authentication.*

Note

The **dot1x** command is not available when the Ethernet interface is internally connected to a switch.

Syntax:

```
ethernetX/X config>dot1x
```

Example:

```
ethernet0/0 config>dot1x
-- 802.1X User Config --
ethernet0/0 dot1X config>
```

3.3.6 DUPLEX

Configures the device duplex mode: half duplex or full duplex. If the device is configured with auto-negotiation, the duplex mode configuration is ignored. The interface is configured in accordance with the characteristics of the devices connected to the Ethernet.

Syntax:

```
ethernetX/X config>duplex <duplex mode>
```

Example 1:

```
ethernet0/0 config>duplex ?
  full    forces full duplex operation mode
  half    forces half duplex operation mode
ethernet0/0 config>
```

Example 2:

```
ethernet0/0 config>duplex full
ethernet0/0 config>
```

3.3.7 FLOW-CONTROL

Configures the flow control mode when the port is configured in fixed mode (i.e. with auto-negotiation disabled).

Syntax:

```
ethernetX/X config>flow-control
     disabled    Disable flow control
     enabled     Enable flow control
      rx-only    Enable asymmetric PAUSE toward local device
      tx-only    Enable asymmetric PAUSE toward link partner
```

Note

Flow control is not available in all switches.

Note

Asymmetric flow control is not available in all switches.

Command history:

Release	Modification
11.01.05	The "*flow-control*" command was introduced as of version 11.01.05.

3.3.8 INPUT-BUFFERS

Configures the number of buffers used at reception. The default value depends on the type of driver. Please, do not to modify this unless our technical personnel says otherwise.

Syntax:

```
ethernetX/X config>input-buffers <number of buffers>
```

Example:

```
ethernet0/0 config>input-buffers 50
ethernet0/0 config>
```

3.3.9 IP-ENCAPSULATION

Selects the IP transport mode in the Ethernet frame data field. Possible formats are: Ethernet (Ethernet type 8137) or IEEE-802.3 (Ethernet 802.3 *raw* without 802.2). Default encapsulation is ETHERNET.

Syntax:

```
ethernetX/X config>ip-encapsulation <encapsulation type>
ethernetX/X config>ip-encapsulation ?
  ethernet      Ethernet type 8137
  ieee-802.3    Ethernet 802.3 raw without 802.2
ethernetX/X config>
```

Example:

```
ethernet0/0 config>ip-encapsulation ieee-802.3
ethernet0/0 config>
```

3.3.10 LIST

Displays the Ethernet interface's current configuration. This includes the MAC address used by the interface, the speed, the duplex mode and the IP encapsulation. Whenever the interface is configured using auto-negotiation, the speed and the duplex mode are not displayed (as these are obtained from the characteristics of the devices connected to the Ethernet).

Syntax:

```
ethernetX/X config>list
```

Example 1:

```
ethernet0/0 config>list
MAC address: 000000000000
Speed: Auto-negotiation
IP encapsulation:   ETHER
ethernet0/0 config>
```

Example 2:

```
ethernet0/0 config>list
MAC address: 000000000000
Speed: 100Mbps
Duplex mode : Half duplex
IP encapsulation:   ETHER
ethernet0/0 config>
```

3.3.11 LLC

Accesses the LLC configuration. LLC configuration is mandatory to pass frames over the SNA network. See the *LLC Configuration Commands* section for a description of the available commands and their use.

Syntax:

```
ethernetX/X config>llc
```

Example:

```
ethernet0/0 config>llc
-- LLC User Configuration --
ethernet0/0 LLC config>
```

3.3.12 LLDP

Configures the LLDP options in the interface. For further information on the *Link Layer Discovery Protocol* , please see manual *Teldat Dm813-I LLDP Protocol.*

3.3.13 MAC-ADDRESS

The interface can adopt locally-administered addresses or those provided by the device manufacturer. Only locally-administrated addresses are provided through this command. Entering *00-00-00-00-00-00* (default value) causes the router to use the default factory station address. This last MAC address is used by default.

Syntax:

```
ethernetX/X config>mac-address <MAC address>
```

Example:

```
ethernet0/0 config>mac-address 0a-21-03-32-21-72
ethernet0/0 config>
```

3.3.14 MEDIA-TYPE

Specifies the physical connection preference on the interface. For interfaces supporting RJ–45 (copper) and SFP (fiber), several options can be available depending on the operating hardware:

- `auto-select`: select whichever connector is attached
- `prefer rj45`: choose RJ-45 over SFP
- `prefer sfp`: choose SFP over RJ-45
- `rj45`: enable RJ-45 only (disable SFP)
- `sfp`: enable SFP only (disable RJ-45)

Syntax:

```
ethernetX/X config>media-type {auto-select | prefer rj45 | prefer sfp | rj45 | sfp}
```

Example:

```
ethernet0/1 config>media-type prefer sfp
ethernet0/1 config>
```

Note

Some devices fail to connect via an SFP interface in `auto-select` mode due to hardware limitations. If this is the case, please select the `sfp` mode instead. This limitation is present in RS123 devices.

3.3.15 NO

Sets the different parameters to their default values, disables options or deletes previously added configuration elements.

Syntax:

```
ethernetX/X config>no <option>
```

Example:

```
ethernet0/0 config>no ?
  auto-negotiation    Operates in auto-negotiation mode
  dot1q               dot1q interface configuration commands
  input-buffers       Number of rx buffers
  phy-shutdown        Shutdown interface at physical level
  promiscuous-mode    Enables promiscuous mode
ethernet0/0 config>
```

3.3.15.1 NO AUTO-NEGOTIATION

Disables auto-negotiation in the Ethernet interface so the interface is forced to operate at the configured speed and duplex mode.

Example:

```
ethernet0/0 config>no auto-negotiation
ethernet0/0 config>
```

Note

If devices with set speeds connect to an Ethernet interface where auto-negotiation is configured, problems may arise. The auto-negotiation mode with set speeds will be unable to detect the duplex mode of the other end. Thus, it will configure in half-duplex mode. Auto-negotiation is mandatory for Gigabit connections. If the speed is set to 1000 Mbps, the device will internally switch to auto-negotiation mode.

3.3.15.2 NO DOT1Q

Uses the Ethertype field default value in the Ethernet subinterfaces encapsulation (i.e. 0x8100).

Example:

```
ethernet0/0 config>no dot1q tunneling ethertype
ethernet0/0 config>
```

3.3.15.3 NO FLOW-CONTROL

Disables flow-control.

Example:

```
ethernet0/0 config>no flow-control
ethernet0/0 config>
```

Command history:

Release	Modification
11.01.07	The "*no flow-control*" command was introduced as of version 11.01.07.

3.3.15.4 NO INPUT-BUFFERS

Uses the default value for the number of buffers used in reception. Default depends on the type of driver.

Example:

```
ethernet0/0 config>no input-buffers
ethernet0/0 config>
```

3.3.15.5 NO MEDIA-TYPE

Uses the default value for the media type. Default depends on the type of driver.

Example:

```
ethernet0/0 config>no media-type
ethernet0/0 config>
```

3.3.15.6 NO PHY-SHUTDOWN

Enables an Ethernet interface at the physical layer.

Example:

```
ethernet0/0 config>no phy-shutdown
ethernet0/0 config>
```

3.3.15.7 NO PROMISCUOUS-MODE

Disables the promiscuous-mode.

Example:

```
ethernet0/0 config>no promiscuous-mode
ethernet0/0 config>
```

Command history:

Release	Modification
11.00.07	This command was introduced as of version 11.00.07.
11.01.02	This command was introduced as of version 11.01.02.

3.3.16 OAM

Allows a user to access the configuration menu for the interface's Ethernet OAM feature. For further information, please see the *Configuring Ethernet OAM* chapter.

Syntax:

```
ethernetX/X config>oam
```

Example:

```
ethernet3/0 config>oam
-- Ethernet OAM interface configuration --
ethernet3/0 OAM config>
```

3.3.17 PHY-SHUTDOWN

Disables an Ethernet interface at the physical layer. This command is only available in Ethernet interfaces that aren't internally connected to a switch.

Example:

```
ethernet0/0 config>phy-shutdown
```

3.3.18 PROMISCUOUS-MODE

Enables promiscuous mode. In this mode, the Ethernet interface accepts all packets/frames transmitted on the media. However, when the promiscuous mode is disabled, the interface only accepts packets/frames addressed to it.

Syntax:

```
ethernetx/x config>promiscuous-mode
```

Default is disabled.

Example:

```
ethernet0/0 config>promiscuous-mode
ethernet0/0 config>
```

Command history:

Release	Modification
11.00.07	The "*promiscuous-mode*" command was introduced as of version 11.00.07.
11.01.02	The "*promiscuous-mode*" command was introduced as of version 11.01.02.

3.3.19 REPEATER-SWITCH

In Ethernet interfaces internally connected to a switch, this command grants access to the switch configuration menu. You can configure the operating mode of each external port that belongs to the switch in this menu. For a more in-depth explanation of the commands available, please see the *Switch Configuration Commands* section.

Syntax:

```
ethernetX/X config>repeater-switch
```

Example:

```
ethernet3/0 config>repeater-switch
-- Switch User Config --
ethernet0/0 switch config>
```

3.3.20 SPEED

Configures the interface speed: 10 Mbps, 100 Mbps or 1000Mbps (when supported by the device). If the device is configured using auto-negotiation, the speed configuration is ignored. The interface is configured in accordance with the characteristics of the devices connected to the Ethernet.

Syntax:

```
ethernetX/X config>speed <speed>
ethernetX/X config>speed ?
  1000mbps    forces 1000Mbps
  100mbps     forces 100Mbps
  10mbps      forces 10Mbps
```

```
ethernetX/X config>
```

Example:

```
ethernet0/0 config>speed 100mbps
ethernet0/0 config>list
MAC address: 000000000000
Speed: 100 Mbps
Duplex mode : Half duplex
IP encapsulation:   ETHER
ethernet0/0 config>speed 10mbps
ethernet0/0 config>list
MAC address: 000000000000
Speed: 10 Mbps
Duplex mode : Half duplex
IP encapsulation:   ETHER
ethernet0/0 config>
```

3.3.21 EXIT

Exits the Ethernet configuration menu and returns to the general configuration menu (*Config*>).

Syntax:

```
ethernetX/X config>exit
```

Example:

```
ethernet0/0 config>exit
Config>
```

Chapter 4 Monitoring Ethernet Interfaces

4.1 Introduction

This chapter describes the commands used to monitor Ethernet interfaces. It includes the following sections:

- Accessing the Ethernet Monitoring Menu.
- Ethernet Monitoring Commands.
- Ethernet Interfaces and the Interface Monitoring Command.

4.2 Accessing the Ethernet Monitoring Menu

To access the Ethernet monitoring menu:

(1) Enter **device** at the monitoring (+) prompt to display a list of the interfaces configured on the router.

(2) Enter **network,** followed by the Ethernet interface identifier, at the monitoring (+) prompt.

Example:

```
*monitor
Console Operator
+device

                                  Auto-test   Auto-test     Maintenance
Interface            CSR    Vect     valids    failures        failures
ethernet0/0     FA200E00      27          1           0               0
serial0/0       FA200A00      5e          0        2596               0
serial0/1       FA200A20      5d          0        2596               0
serial0/2       FA200A60      5b          0        2596               0
bri0/0          FA200A40      5c          1           0               0
x25-node               0       0          1           0               0
ethernet3/0     F2000000      22          1           1               0
+network ethernet0/0

--  Ethernet Console  --
ethernet0/0 ETH+
```

4.3 Ethernet Monitoring Commands

The following table summarizes the Ethernet monitoring commands that are available, further explained in the sections below. Enter commands from the Ethernet monitoring menu.

Note

Not all commands specified in this section are available for all Ethernet interfaces. Depending on the device, or on the monitoring interface, some commands may not appear.

Command	Function
? (HELP)	Displays available commands and their options.
BITRATE	Measures the real transmission and reception rate in Ethernet.
COLLISION	Displays collision statistics for a specified Ethernet interface.
COUNTERS	Displays different statistics for an interface.
DOT1X	Accesses the authentication 802.1X monitoring menu.
LASER	Displays information on the laser used.
LLC	Accesses the LLC monitoring menu.
OAM	Accesses the OAM protocol monitoring menu.
POWER-SOURCING-EQUIPMENT	Accesses the Power Over Ethernet monitoring menu.
REGISTERS	Displays the content of the controller registers.

REPEATER-SWITCH	Accesses the switch monitoring menu.
STATUS	Displays the status of the Ethernet interface.
SUBIFCS	Displays information on the Ethernet subinterfaces configured over the Ethernet interface.
EXIT	Exits the Ethernet monitoring menu.

4.3.1 ? (HELP)

Shows the available commands and their options.

Syntax:

```
ethernetX/X ETH>?
```

Example:

```
ethernet0/0 ETH+?
  bitrate                    Bit rate monitor
  collision                  List collisions statistics
  counters                   List device counters
  dot1x                      Access to 802.1X monitoring
  laser                      List laser parameters
  llc                        Access to llc monitoring
  oam                        Ethernet OAM monitoring
  power-sourcing-equipment   Access to power source engine monitoring
  registers                  List device registers
  repeater-switch            Access to switch monitoring
  status                     List interface status
  subifcs                    List ethernet subinterfaces info
  exit
ethernet0/0 ETH+
```

Command history:

Release	Modification
11.01.03	The "*Subifcs*" command was introduced as of version 11.01.03.

4.3.2 BITRATE

Measures the real transmission and reception rate in the Ethernet line. The rate is measured in intervals of 1 second for bits per second (bps) and for packets per second (pps). A new line is created every time the rate exceeds a maximum historic value at the point where the command was executed. Press any key to finalize rate monitoring.

Syntax:

```
ethernetX/X ETH+bitrate
```

Example:

```
ethernet0/0 ETH+bitrate

             Interface ethernet0/0
 Trx rate (bps/pps)  Rcv rate (bps/pps)
 ------------------------------------
          0/    0        2000/    3
          0/    0        8000/    5
          0/    0        8000/   13
          0/    0        4000/    5
ethernet0/0 ETH+
```

4.3.3 COLLISION

Displays the counters for frames that suffered from collisions before being successfully transmitted. The counters tally the number of frames that were successfully sent after a specified number of collisions (ranging from 1 to 16). An increase in the number of frames transmitted with collisions and in the number of collisions per frame indicates a busy Ethernet line.

Enter **clear statistics** at the monitoring menu prompt (+) to clear these counters.

Syntax:

```
ethernetX/X ETH+collision
```

Example:

```
ethernet0/0 ETH+collision
Transmitted with  1 collisions:        341
Transmitted with  2 collisions:        281
Transmitted with  3 collisions:         94
Transmitted with  4 collisions:         26
Transmitted with  5 collisions:          5
Transmitted with  6 collisions:          4
Transmitted with  7 collisions:          4
Transmitted with  8 collisions:          4
Transmitted with  9 collisions:          2
Transmitted with 10 collisions:          2
Transmitted with 11 collisions:          0
Transmitted with 12 collisions:          0
Transmitted with 13 collisions:          0
Transmitted with 14 collisions:          0
Transmitted with 15 collisions:          0
Transmitted with 16 collisions:          0
ethernet0/0 ETH+
```

4.3.4 COUNTERS

Displays the different interface statistics. These depend on the type of Ethernet interface you access.

Syntax:

```
ethernetX/X ETH+counters
```

Example:

```
ethernet3/0 ETH+counters
rx-dropped-by-kernel           =          0
rx-large-frame-errors          =          0
rx-short-frame-errors          =          0
rx-non-octet-errors            =          0
rx-crc-errors                  =          0
rx-overrun-errors              =          0
rx-busy-errors                 =          0
rx-babbling-errors             =          0
rx-truncated-frames            =          0
ethernet-bus-error             =          0
tx-babbling-errors             =          0
tx-underrun-errors             =          0
rx-skb-missing-errors          =          0
tx-timeout-errors              =          0
tx-rx-64-frames                =          0
tx-rx-65-127-frames            =          0
tx-rx-128-255-frames           =          0
tx-rx-256-511-frames           =          0
tx-rx-512-1023-frames          =          0
tx-rx-1024-1518-frames         =          0
tx-rx-1519-1522-good-vlan      =          0
rx-bytes                       =          0
rx-packets                     =          0
rx-fcs-errors                  =          0
receive-multicast-packet       =          0
receive-broadcast-packet       =          0
rx-control-frame-packets       =          0
rx-pause-frame-packets         =          0
rx-unknown-op-code             =          0
rx-alignment-error             =          0
rx-frame-length-error          =          0
```

```
rx-code-error                  =          0
rx-carrier-sense-error         =          0
rx-undersize-packets           =          0
rx-oversize-packets            =          0
rx-fragmented-frames           =          0
rx-jabber-frames               =          0
rx-dropped-frames              =          0
tx-byte-counter                =          0
tx-packets                     =          0
tx-multicast-packets           =          0
tx-broadcast-packets           =          0
tx-pause-control-frames        =          0
tx-deferral-packets            =          0
tx-excessive-deferral-packets  =          0
tx-single-collision-packets    =          0
tx-multiple-collision-packets  =          0
tx-late-collision-packets      =          0
tx-excessive-collision-packets =          0
tx-total-collision             =          0
reserved                       =          0
tx-dropped-frames              =          0
tx-jabber-frames               =          0
tx-fcs-errors                  =          0
tx-control-frames              =          0
tx-oversize-frames             =          0
tx-undersize-frames            =          0
tx-fragmented-frames           =          0
ethernet3/0 ETH+
```

4.3.5 DOT1X

Accesses the 802.1X authentication monitoring menu. For further information on 802.1X authentication, please see manual *Teldat Dm783-I 802.1X Authentication.*

Note

The **dot1x** command is not available if the Ethernet interface is internally connected to a switch.

Syntax:

```
ethernetX/X ETH+dot1x
```

Example:

```
ethernet0/0 ETH+dot1x
--  802.1X Console  --
ethernet0/0 DOT1X+
```

4.3.6 LASER

In the case of Ethernet interfaces over optic fiber, this command displays information on the laser used.

Note

Diagnostic information matching the SFF-8472 specification is only shown when available.

Syntax:

```
ethernetX/X ETH+laser
```

Example:

```
ethernet3/0 ETH+laser

Laser Information:
Transceiver type . SFP
Connector ........ LC Optical Connector
```

```
Gbit Compliant ... 1000BASE-SX
Vendor ........... OEM              OUI : 000000
Part number ...... SFP-1G1302K-I
Revision ......... 1.0
Serial number .... GS1311220307
Date code ........ 131121   (yymmddll)
Specific .........
Encoding ......... 8B10B
Wavelength ....... 1310 nm
BR Nominal........ 1.3 Gb/s
9u  Distance ..... 0 m
50u Distance ..... 2000 m
62.5u Distance ... 2000 m

Digital Diagnostics:
Diagnostic type:
Version .......... SFF-8472 Rev 9.3
Diagnostic type .. Internally Calibrated (68)
Temperature ...... 39.44 degC
Voltage .......... 3.318 V
Current .......... 17.658 mA
TX-Power ......... 0.6278 mW (-2.02 dBm)
RX-Power ......... 0.1040 mW (-9.83 dBm)

DDM Thresholds:
                  Low Alarm    Low Warning   High Warning     High Alarm
-----------    ------------   ------------   ------------   ------------
Temp.(Celsius)        -88.00         -98.00         +93.00        +110.00
Voltage(Volts)         2.700          2.900          3.700          3.900
Current(mA)            2.000          4.000         70.000         80.000
TxPower(dBm)           -9.11          -7.02           3.61           5.62
RxPower(dBm)          -18.01         -13.87           5.23           6.93

Raw data:

Device ID:0xa0 128 bytes

0x00 .. 03 04 07 00 00 00 01 00 00 00 00 01 0d 00 00 00
0x10 .. c8 c8 00 00 4f 45 4d 20 20 20 20 20 20 20 20 20
0x20 .. 20 20 20 20 00 00 00 00 53 46 50 2d 31 47 31 33
0x30 .. 30 32 4b 2d 49 20 20 20 31 2e 30 20 05 1e 00 75
0x40 .. 00 1a 00 00 47 53 31 33 31 31 32 32 30 33 30 37
0x50 .. 20 20 20 20 31 33 31 31 32 31 20 20 68 f0 01 ea
0x60 .. 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x70 .. 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00


Device ID:0xa2 128 bytes

0x00 .. 64 00 ce 00 5f 00 d3 00 90 88 71 48 8c 9f 75 30
0x10 .. 7e f4 13 88 75 30 17 70 31 2d 01 f5 27 10 02 77
0x20 .. 31 2d 00 14 27 10 00 19 00 00 00 00 00 00 00 00
0x30 .. 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40 .. 00 00 00 00 3f 80 00 00 00 00 00 00 01 00 00 00
0x50 .. 01 00 00 00 01 00 00 00 01 00 00 00 00 00 00 c7
0x60 .. 27 71 81 9c 22 7d 18 86 04 10 00 00 00 00 00 00
0x70 .. 00 00 00 00 00 00 00 00 00 4d ff ff ff ff ff ff
```

The information displayed is shown in accordance with MSA SFF-8472:

Laser Information	Data information provided by the manufacturer (including model, serial number, OID, device type, connector, etc.).
Digital Diagnostics	Real time diagnostics measured by the device. Values shown: • Internally measured transceiver temperature. • Internally measured transceiver supply voltage. • Measured TX bias current in mA.

	• Measured TX output power in mW and dBm. • Measured RX received optical power in mW and dBm
DDM Thresholds	High alarm, low alarm, high warning and low warning threshold for each digital diagnostic measure.
RAW data	Data information (0xA0) and Diagnostic data (0xA2) memory content in RAW mode.

Command history:

Release	Modification
11.01.04	Digital diagnostic information is shown if available as of version 11.01.04.
11.01.05	Information on DDM Thresholds is shown under the digital diagnostic section as of version 11.01.05.

4.3.7 LLC

Accesses the LLC monitoring menu. The LLC monitoring commands must be entered here. For a detailed description of these commands, please see the *LLC Monitoring Commands* section.

Syntax:

```
ethernetX/X ETH+llc
```

Example:

```
ethernet0/0 ETH+llc
LLC user Monitoring
ethernet0/0 LLC+
```

4.3.8 OAM

Accesses the monitoring menu for the interface's Ethernet OAM protocol. For further information on the available commands, please see the *Monitoring the Ethernet OAM protocol* chapter.

Syntax:

```
ethernetX/X ETH+oam
```

Example:

```
ethernet0/0 ETH+oam
-- Ethernet OAM interface monitor --
ethernet0/1 OAM monitor+
```

4.3.9 POWER-SOURCING-EQUIPMENT

Accesses the Power Over Ethernet monitoring menu. For a more detailed explanation on the commands available in this menu, please see manual *Teldat Dm776-I Power Over Ethernet.*

Syntax:

```
ethernetX/X ETH+power-sourcing-equipment
```

Example:

```
ethernet0/0 ETH+power-sourcing-equipment
-- Power Sourcing Equipment Monitoring Console --
ethernet0/0 PSE+
```

4.3.10 REGISTERS

Displays or modifies the content of controller registers.

Syntax:

```
ethernetX/X ETH+registers
  get     Get device register
  list    List device registers
```

```
  set     Set device register
```

Note

If no options are available, command **registers** will display all controller registers.

4.3.10.1 REGISTERS GET

Displays the value of a given register.

Syntax:

```
ethernetX/X ETH+registers get
```

Example:

Read register at address 0x0.

```
ethernet2/0 ETH+registers get
Hex Register: [0]? 0
Value read: 0x08101a41
```

Command history:

Release	Modification
11.00.06	The "*Registers Get*" command was introduced as of version 11.00.06.
11.01.02	The "*Registers Get*" command was introduced as of version 11.01.02.

4.3.10.2 REGISTERS LIST

Displays all registers.

Syntax:

```
ethernetX/X ETH+registers list
```

Example:

```
ethernetX/X ETH+registers list
-General Command and Status Registers
        TSEC_ID,Controller ID        0x01240000
        TSEC_ID2,Controller ID       0x00300000
        IEVENT,Interrupt Event       0x02000700
        IMASK,Interrupt Mask         0x00000000
        EDIS,Error Disabled          0x00000000
        ECNTRL,Ethernet Control      0x00003000
        PTV,Pause Time Value         0x00000000
        DMACTRL,DMA Control          0x00000018
        TBIPA,TBI Physical Address   0x00000001

-FIFO Control and Status Registers
        FIFO_RX_PAUSE,FIFO Receive Pause Start Threshold        0x00000080
        FIFO_RX_PAUSE_SH,FIFO Receive Pause Shut-off Threshold  0x000000c0
        FIFO_RX_ALARM,FIFO Receive Alarm Start Threshold        0x00000040
        FIFO_RX_ALARM_SH,FIFO Receive Alarm Shut-off Threshold  0x00000080
        FIFO_TX_THR,FIFO Transmit Threshold                     0x00000080
        FIFO_TX_STRV,FIFO Transmit Starve                       0x00000040
        FIFO_TX_STRV_SH,FIFO Transmit Starve Shutoff            0x00000080

more? n

ethernet0/0 ETH+
```

Command history:

Release	Modification
11.00.06	The "*Registers List*" command was introduced as of version 11.00.06.
11.01.02	The "*Registers List*" command was introduced as of version 11.01.02.

4.3.10.3 REGISTERS SET

Modifies a given register.

Syntax:

```
ethernetX/X ETH+registers set
```

Example:

Set register at address 0x5b8c with value 0x20.

```
ethernet2/0 ETH+registers set
Hex Register: [0]? 0x5b8c
Hex Value: [0]? 0x20
Value read: 0x00000020
ethernet2/0 ETH+
```

Command history:

Release	Modification
11.00.06	The "*Registers Set*" command was introduced as of version 11.00.06.
11.01.02	The "*Registers Set*" command was introduced as of version 11.01.02.

4.3.11 REPEATER-SWITCH

In Ethernet interfaces internally connected to a switch, this command allows you to access the switch monitoring menu. For a more in-depth explanation of the commands available in this menu, please see *Switch Monitoring Commands* on page 64.

Syntax:

```
ethernetX/X ETH+repeater-switch
```

Example:

```
ethernet0/0 ETH+repeater-switch
-- Switch Monitoring Console --
ethernet0/0 Switch+
```

4.3.12 STATUS

Displays information on the Ethernet interface: phyter model used, link status, auto-negotiation status and the speed and duplex mode the interface operates at.

Syntax:

```
ethernetX/X ETH+status
```

Example:

```
ethernet0/1 ETH+status
Supported .......... 0x1626f
                     10baseT_Half
                     10baseT_Full
                     100baseT_Half
                     100baseT_Full
                     1000baseT_Full
                     1000baseX_Full
                     Pause
                     Asymmetric Pause
Advertising ........ 0x1626f
                     10baseT_Half
                     10baseT_Full
                     100baseT_Half
                     100baseT_Full
                     1000baseT_Full
                     1000baseX_Full
                     Pause
```

```
                    Asymmetric Pause
Port ............... SFP
Autonegotiation .... True
Link ............... True
Speed .............. 1000 Mbps
Duplex ............. Full
Flow control ....... enabled (rx & tx)
ethernet0/1 ETH+
```

When the link is copper (Port RJ45) and the speed is forced to 1000Mbps, an '*' appears next to Autonegotiation parameter with the following message below the list "(*) Interface speed has been configured to 1000 Mbps and Auto-Negotiation is mandatory." to indicate that the standard is obeyed.

Command history:

Release	Modification
11.01.05	The status information shows supported, advertising, port and flow control data as of version 11.01.05..

4.3.13 SUBIFCS

Displays information on subinterfaces configured over the Ethernet interface.

Syntax:

```
ethernetX/X ETH+subifcs
```

Example:

```
ethernet0/0 ETH+subifcs
Subinterface ethernet0/0.20:
  Encapsulation IEEE 802.1Q:
     VLAN ID: 20
  Port-tag:      Not assigned
  Excluded port: None

Subinterface ethernet0/0.30:
  Encapsulation IEEE 802.1Q in Q:
     SP VLAN ID: 30  CE VLAN ID: 300
  Port-tag:      Not assigned
  Excluded port: None

Subinterface ethernet0/0.40:
  Encapsulation ARPA
  Port-tag:      Not assigned
  Excluded port: None

Subinterface ethernet0/0.255:
  Encapsulation IEEE 802.1Q (RA Auto):
     VLAN ID: 10
  Port-tag:      Not assigned
  Excluded port: None

ethernet0/0 ETH+
```

Command history:

Release	Modification
11.01.03	The "*Subifcs*" command was introduced as of version 11.01.03.

4.3.14 EXIT

Returns to the general monitoring menu (+).

Syntax:

```
ethernetX/X ETH+exit
```

Example:

```
ethernet0/0 ETH+exit
+
```

4.4 Ethernet Interfaces and the Interface Monitoring Command

The router displays statistics for network interfaces when you enter **device** at the monitoring (+) prompt.

4.4.1 DEVICE

On entering **device,** followed by the Ethernet interface, the router displays a series of statistics associated to it.

Syntax:

```
+device <ETH interface name>
```

Example:

```
+device ethernet0/0
                                  Auto-test   Auto-test     Maintenance
Interface            CSR    Vect      valids    failures        failures
ethernet0/0     FA200E00      27           1           0               0

Physical address:  00A026700000
PROM address:      00A026700000
Speed:             10 Mbps

 Input statistics:
  failed, frame too long             0  failed, FCS error                 1
  failed, alignment error            0  failed, FIFO overrun              1
  internal MAC rcv error             1  packets missed                    1
Output statistics:
  deferred transmission              0  single collision                  0
  multiple collisions                0  total collisions                  0
  failed, excess collisions          0  failed, FIFO underrun             0
  failed, carrier sense err          0  SQE test error                   0
  late collision                     0  internal MAC trans errors         0
  Ethernet MAC code release 1
+
```

The meaning of each field is as follows:

Interface	Interface name.
CSR	Control/status and physical interface data register address.
Vect	Interrupt vector associated to the interface, written in hexadecimal format.
Auto-test valids	Number of successful auto-tests.
Auto-test failures	Number of unsuccessful auto-tests.
Maintenance failures	Number of maintenance failures.
Physical address	MAC address used in the Ethernet interface in canonical format.
PROM address	MAC address for the Ethernet interface provided by the manufacturer.
Speed	Speed (in Mbps) at which the Ethernet interface operates. It can range from 10 to 100.

Input statistics:

failed, frame too long	The interface received a frame exceeding the maximum size of 1,518 bytes for an Ethernet frame. This data is exported via SNMP as the dot3StatsFrameTooLong counter.
failed, FCS error	The interface received a packet with a CRC error. This data is exported via SNMP as the dot3StatsFCSErrors counter.
failed, alignment error	The interface received a frame whose size in bits is not a multiple of eight.
failed, FIFO overrun	The Ethernet chipset is unable to store bytes in the local packet buffer as fast as they come off the cable.
packets missed	The interface tries to receive a packet but the local packet buffer is full. This indicates that traffic in the network surpasses what the interface can handle.

internal MAC rcv error	Received errors not due to excessive collisions or to carrier detection. This data is exported via SNMP as the dot3StatsInternalMacReceiveErrors counter.

Output statistics:

deferred transmission	The carrier detection mechanism detects activity on the line that causes the interface to defer transmission. This data is exported via SNMP as the dot3StatsDeferredTransmission counter.
single collision	Increases when a frame collides on the first transmission attempt but is then successfully sent on the second. This data is exported via SNMP as the dot3StatsSingleCollisionFrames counter.
multiple collisions	Increases when a frame has multiple collisions before being successfully transmitted. This data is exported via SNMP as the dot3StatsMultipleCollisionFrames counter.
total collisions	Total number of collisions.
failed, excess collisions	Increases when a frame transmission fails due to 16 or more successive collisions. This error indicates a high volume of network traffic or hardware problems with the network. This data is exported via SNMP as the dot3StatsExcessiveCollisions counter.
failed, FIFO underrun	Increases when packet transmission fails due to the inability of the interface to retrieve packets from the local packet buffer fast enough to transmit them onto the network.
failed, carrier sense err	Increases when a frame collides because the carrier detector is disabled. This error indicates a problem between the interface and its Ethernet transceiver. This data is exported via SNMP as the dot3StatsCarrierSenseErrors counter.
SQE test error	Increases when the interface sends a frame but detects that the transceiver has no heartbeat. The packet is treated as successfully transmitted because some transceivers do not generate heartbeats. This data is exported via SNMP as the dot3StatsSQETTestErrors counter.
late collision	Increases when a frame collides after transmitting at least 512 bits. This error indicates that an interface on the network failed to defer, or that the network has too many stations. This data is exported via SNMP as the dot3StatsLateCollisions counter.
internal MAC trans errors	Transmits errors that are not late, excessive, or carrier-sense collisions. This data is exported via SNMP as the dot3StatsInternalMacTransmit Errors counter.
Ethernet MAC code release	Microcode release running over the Ethernet communications processor.

Chapter 5 LLC Configuration

5.1 Introduction

This chapter describes the LLC configuration and includes the following sections:

- Accessing the LLC configuration.
- LLC configuration commands.

5.2 Accessing the LLC Configuration

Access LLC configuration from a LAN interface, be it Token Ring or Ethernet, through the **LLC** command.

Example:

```
*config
Config>network ethernet0/0
-- Ethernet Interface User Configuration --
ethernet0/0 config>llc
-- LLC User Configuration --
ethernet0/0 LLC config>
```

5.3 LLC Configuration Commands

LLC configuration is mandatory to pass packets over an SNA network.

The following table summarizes the LLC commands. This section includes a more detailed explanation further on.

Command	Function
? (HELP)	Displays all LLC commands and their options.
LIST	Displays LLC configuration.
N2-MAX-RETRY	Modifies N2.
N3-FRAMES_RCVD-BEFORE-ACK	Modifies N3.
NO	Sets the parameters to their default values.
NW-ACKS-TO-INC-WW	Configures NW.
RW-RECEIVE-WINDOW	Configures RW: size of the receive window.
T1-REPLY-TIMER	Configures T1.
T2-RECEIVE-ACK-TIMER	Configures T2.
TI-INACTIVITY-TIMER	Configures TI.
TW-TRANSMIT-WINDOW	Configures TW: size of the transmit window.
EXIT	Exits the LLC configuration menu and returns to the LAN interface configuration menu.

Warning

Modifying the default values for LLC parameters may affect protocol performance.

5.3.1 ? (HELP)

Displays all available commands and their options.

Syntax:

```
ethernetX/X LLC config>?
```

Example:

```
ethernet0/0 LLC config>?
  list                        List configuration
```

```
  n2-max-retry                Max retry value
  n3-frames_rcvd-before-ack   Rcvd I-frames before ack
  no                          Negates a command or sets its defaults
  nw-acks-to-inc-ww           Acks needed to increment Ww
  rw-receive-window           Receive window
  t1-reply-timer              Reply timer
  t2-receive-ack-timer        Receive Ack timer (in 100 millisec.)
  ti-inactivity-timer         Inactivity timer
  tw-transmit-window          Transmit window
  exit
ethernet0/0 LLC config>
```

5.3.2 LIST

Displays the current LLC configuration.

Syntax:

```
ethernetX/X LLC config>list
```

Example:

```
ethernet0/0 LLC config>list
No LLC configuration record found for this interface.
Default values are used.
  Reply Timer(T1):                1 seconds
  Receive ACK Timer(T2):          1 100miliseconds
  Inactivity Timer(Ti):           30 seconds
  Max Retry value(N2):            8
  Rcvd I-frames before Ack(N3):   1
  Transmit Window(Tw):            2
  Receive Window(Rw):             2
  Acks needed to increment Ww(Nw): 1
ethernet0/0 LLC config>
```

5.3.3 N2-MAX-RETRY

Maximum number of times LLC transmits an RR without receiving an acknowledgment when the inactivity timer times out. Values can range from 1 to 255. Default is 8.

Syntax:

```
ethernetX/X LLC config>n2-max-retry <valor>
```

Example:

```
ethernet0/0 LLC config>n2-max-retry 8
ethernet0/0 LLC config>
```

5.3.4 N3-FRAMES_RCVD-BEFORE-ACK

This counter works with the T2 timer to reduce acknowledgment traffic for I-frames received. Each time the router receives an I-frame, this value decreases by one. When this counter reaches 0, or when the T2 timer times out, the router sends an acknowledgement. Values range from 1 to 255. Default is 1.

Syntax:

```
ethernetX/X LLC config>n3-frames_rcvd-before-ack <valor>
```

Example:

```
ethernet0/0 LLC config>n3-frames_rcvd-before-ack 1
ethernet0/0 LLC config>
```

5.3.5 NO

Sets the different parameters to their default values.

Syntax:

```
<interface name> LLC config>no ?
  n2-max-retry                Max retry value
  n3-frames_rcvd-before-ack   Rcvd I-frames before ack
  nw-acks-to-inc-ww           Acks needed to increment Ww
  rw-receive-window           Receive window
  t1-reply-timer              Reply timer
  t2-receive-ack-timer        Receive Ack timer (in 100 millisec.)
  ti-inactivity-timer         Inactivity timer
  tw-transmit-window          Transmit window
<interface name> LLC config>
```

The default values are as follows:

Command	**Default value**
N2-MAX-RETRY	8
N3-FRAMES_RCVD-BEFORE-ACK	1
NW-ACKS-TO-INC-WW	1
RW-RECEIVE-WINDOW	2
T1-REPLY-TIMER	1 second.
T2-RECEIVE-ACK-TIMER	1 (100 ms.)
TI-INACTIVITY-TIMER	30 seconds.
TW-TRANSMIT-WINDOW	2

5.3.6 NW-ACKS-TO-INC-WW

When sending I-frames is not enabled, LLC goes into a mode where the working window (Ww) is set back to 1 before slowly reaching its normal size (Tw). This is known as the dynamic window algorithm. This value is the number of I-frames LLC must receive before incrementing Ww by 1. Values range from 1 to 127. Default is 1.

Syntax:

```
ethernetX/X LLC config>nw-acks-to-inc-ww <value>
```

Example:

```
ethernet0/0 LLC config>nw-acks-to-inc-ww 1
ethernet0/0 LLC config>
```

5.3.7 RW-RECEIVE-WINDOW

Maximum number of unacknowledged sequentially numbered I-frames that LLC can receive from a remote LLC peer. This value must be equal to, or lower than, 127. Default is 2.

Syntax:

```
ethernetX/X LLC config>rw-receive-window <value>
```

Example:

```
ethernet0/0 LLC config>rw-receive-window 2
ethernet0/0 LLC config>
```

5.3.8 T1-REPLY-TIMER

Times out when LLC fails to respond on receiving a required acknowledgment or a response from another LLC station. When this timer times out, an RR is sent with the poll bit set and T1 is re-started. If LLC receives no response after the maximum number of retries configured has timed out (N2), the lower link is declared inoperative. Values range from 1s to 4m16s. Default is 1 second.

Syntax:

```
ethernetX/X LLC config>t1-reply-timer <value>
```

Example:

```
ethernet0/0 LLC config>t1-reply-timer 1
```

```
ethernet0/0 LLC config>
```

5.3.9 T2-RECEIVE-ACK-TIMER

Delays acknowledging I-format frames. This timer starts when the router receives an I-frame and stops when the router sends an acknowledgment. If this timer times out, LLC2 sends an acknowledgment as soon as possible. T2 must be set to a value that is lower than T1 to ensure the remote LLC2 peer receives the delayed acknowledgment before the T1 timer expires. Values range from 1 to 2560. Default is 1 (100 ms), which disables the timer.

Syntax:

```
ethernetX/X LLC config>t2-receive-ack-timer <value>
```

Example:

```
ethernet0/0 LLC config>t2-receive-ack-timer 1
ethernet0/0 LLC config>
```

5.3.10 TI-INACTIVITY-TIMER

This timer times out when LLC does not receive a frame during a specified time period. When this occurs, the LLC transmits an RR until the other LLC station responds or the N2 retry count is exceeded. Values range from 1s to 4m16s. Default is 30 seconds.

Syntax:

```
<interface name> LLC config>ti-inactivity-timer <value>
```

Example:

```
ethernet0/0 LLC config>ti-inactivity-timer 30
ethernet0/0 LLC config>
```

5.3.11 TW-TRANSMIT-WINDOW

Maximum number of I-frames that can be sent before receiving an RR. Assuming the other end of the LLC session can actually receive this many consecutive I-frames, and the router has enough heap memory to keep copies of these frames until an acknowledgment is received, increasing this value may increase the performance. Values range from 1 to 127. Default is 2.

Syntax:

```
ethernetX/X LLC config>tw-transmit-window <value>
```

Example:

```
ethernet0/0 LLC config>tw-transmit-window 2
ethernet0/0 LLC config>
```

5.3.12 EXIT

Returns to the LAN interface (Ethernet, Token Ring or Ethernet subinterface) configuration menu.

Syntax:

```
ethernetX/X LLC config>exit
```

Example:

```
ethernet0/0 LLC config>exit
ethernet0/0 config>
```

Chapter 6 LLC Monitoring

6.1 Introduction

This chapter describes LLC monitoring and includes the following sections:

- Accessing LLC monitoring.
- LLC monitoring commands.

6.2 Accessing the LLC Monitoring

Access LLC monitoring from a LAN interface, be it Token Ring or Ethernet, by entering **llc.**

Example:

```
*monitor
Console Operator
+network ethernet0/0
--  Ethernet Console  --
ethernet0/0 ETH+llc
LLC user Monitoring
ethernet0/0 LLC+
```

6.3 LLC Monitoring Commands

The following table summarizes the LLC monitoring commands, which are further explained later on.

Command	**Function**
? (HELP)	Displays the LLC command and its options.
CLEAR-COUNTERS	Clears all statistics counters.
LIST	Displays the interface, SAP, and session information.
SET	Dynamically configures LLC parameters, valid for the session lifetime.
EXIT	Exits the specific LLC monitoring menu.

6.3.1 ? (HELP)

Displays the available commands and their options.

Syntax:

```
<interface name> LLC+?
```

Example:

```
ethernet0/0 LLC+?
  clear-counters    Clears statistical counters
  list              Displays LLC information
  set               Dynamically configures LLC parameters
  exit
ethernet0/0 LLC+
```

6.3.2 CLEAR-COUNTERS

Clears all LLC information counters.

Syntax:

```
<interface name> LLC+clear-counters
```

Example:

```
ethernet0/0 LLC+clear-counters
```

```
ethernet0/0 LLC+
```

6.3.3 LIST

Displays information on the interface, the service access point (SAP) and the session.

Syntax:

```
<interface name> LLC+list ?
  interface    Displays all SAPs opened on the interface
  sap          Displays detailed information on a SAP
  session      Displays detailed information on a LLC session
<interface name> LLC+
```

6.3.3.1 LIST INTERFACE

Displays all SAPs opened on this interface.

Syntax:

```
<interface name> LLC+list interface
```

Example:

```
ethernet0/0 LLC+list interface
SAP       Number of Sessions
0         0
4         1
8         0
c         0
f0        0
ethernet0/0 LLC+
```

6.3.3.2 LIST SAP

Displays information on the interface's specified SAP.

Syntax:

```
<interface name> LLC+list sap <SAP number>
```

Example:

```
ethernet0/0 LLC+list sap 4
Interface:                      6,TKR/0
Reply Timer(T1):                1 sec
Receive ACK Timer(T2):          1 100milisec (note: not used when N3=1)
Inactivity Timer(Ti):           30 sec
MAX Retry Value(N2):            8
MAX I-Field Size(N1):           0
Rcvd I-frames before Ack(N3):   1
Transmit Window Size(Tw):       2
Acks Needed to Inc Ww(Nw):      1

Frame Type          Xmt      Rcvd
UI-frames:            0         0
TEST-frames:          0        24
XID-frames:           0        58
I-frames:            16        17
RR-frames:          687       677
RNR-frames:           2         0
REJ-frames:           0         0
SABME-frames:         0         2
UA-frames:            2         1
DISC-frames:          1         0
DM-frames:            0         0
FRMR-frames:          0         0
I-frames Discarded by LLC:      0
I-frames Refused by LLC user:   0
```

```
Cumulative number of sessions:  13
Number of active sessions:      1
Session ID                                          Remote
(int-sap-id)  Local MAC          Remote MAC         SAP     State
00-04-000c    00:05:24:a7:a3:99  00:05:24:3e:d7:28  04      LINK_OPENED
ethernet0/0 LLC+
```

The meaning of each field is:

SAP value in hex(0-FE)	SAP value for the session (hexadecimal value).
Interface	Number and type of interface the session is running over.
Reply Timer(T1)	Time it takes for this timer to time out when LLC fails to receive an acknowledgment or response from the other LLC station.
Receive ACK Timer(T2)	Time delay LLC uses before sending an *ACK* for a received I-frame.
Inactivity Timer(Ti)	Time the LLC waits during inactivity before issuing an RR.
MAX Retry Value(N2)	Maximum number of retries by the LLC protocol.
MAX I-Field Size(N1)	Data (in bytes) allowed in the I-field for an LLC2 frame.
Rcvd I-frames before Ack(N3)	Value used with T2 timer to reduce acknowledgment traffic for received I-frames.
Transmit Window Size(Tw)	I-frames that can be sent before receiving an RR.
Acks Needed to Inc Ww(Nw)	I-frames the LLC must receive before incrementing Ww by 1.
Frame Type (Xmt, Rcvd)	Frame types transmitted (Xmt) and received (Rcvd).
I-frames Discarded by LLC	I-frames discarded by the LLC, usually because the sequence number is out of sequence.
I-frames Refused by LLC user	I-frames discarded by the software above the LLC. For example: LNM (LAN Network Manager) and DLSw (Data Link Switching).
Cumulative number of sessions	Sessions opened over this session SAP.
Number of active sessions	Currently active sessions running over the interface.
Session ID (int-sap-id)	Session ID for the interface.
Local MAC	Router's LLC MAC address.
Remote MAC	Remote router's LLC MAC address.
Remote SAP	Remote router's SAP address for the LLC connection.

Remote State

Defined state(s) that result from the interaction of LLC peers. There are 21 states, described below:

LINK_CLOSED	The remote LLC peer is not known to the local LLC peer and is considered nonexistent.
DISCONNECTED	The local LLC peer is known to the other peer. This LLC peer can send and receive **xid, test sabme** and **disc** commands and XID TEST, UA, and DM responses.
LINK_OPENING	State of the local LLC peer after sending an SABME or UA in response to a received SABME.
DISCONNECTING	State of the local LLC after sending a **disc** command to the remote LLC peer.
FRMR_SENT	Local LLC peer has entered the frame reject exception state and has sent an FRMR response across the link.
LINK_OPENED	Local LLC peer is in a data transfer phase.
LOCAL_BUSY	Local LLC peer is unable to receive additional I-frames.
REJECTION	Local LLC peer has received one or more out-of-sequence I-frames.
CHECKPOINTING	The local LLC peer has sent a poll to the remote LLC peer and is waiting for an appropriate response.
CKPT_LB	Combination of checkpointing and local busy states.
CKPT_REJ	Combination of checkpointing and rejection states.
RESETTING	Local LLC peer has received an SABME and is reestablishing the link.
REMOTE_BUSY	Resulting state when an RNR is received from the remote LLC peer.
LB_RB	Combination of Local_Busy and Remote_Busy states.
REJ_LB	Combination of rejection and Local_Busy states.
REJ_RB	Combination of rejection and Remote_Busy states.
CKPT_REJ_LB	Combination of checkpointing, rejection, and Local_Busy states.

CKPT_CLR	Combination state resulting from the termination of a Local-Busy condition while the LLC peer is CKPT_LB.
CKPT_REJ_CLR	Combination state resulting from the transfer of an unconfirmed Local_Busy clear while the link station is in the CKPT_REJ_LB state.
REJ_LB_RB	Combination of the rejection, Local_Busy, and Remote_Busy states.
FRMR_RECEIVED	Local LLC peer has received an FRMR response from the remote LLC peer.

6.3.3.3 LIST SESSION

Displays information on a specific LLC session that is open on the interface.

Syntax:

```
<interface name> LC+list session <session identifier>
```

Example:

```
ethernet0/0 LC+list session 07-04-000c
Session ID:                     07-04-000c
Interface:                      07,BDG/0
Remote MAC addr:                00:05:24:3e:d7:28
Source MAC addr:                00:05:24:a7:a3:99
Remote SAP:                     04
Local SAP:                      04
RIF:                            None
Access Priority:                0
State:                          LINK_OPENED
Reply Timer(T1):                1 sec
Receive ACK Timer(T2):          1 100milisec (note: not used when N3=1)
Inactivity Timer(Ti):           30 sec
MAX I-Field Size(N1):           0
MAX Retry Value(N2):            8
Rcvd I-frames before Ack(N3):   1
Transmit Window Size(Tw):       4
Working Transmit Size(Ww):      4
Acks Needed to Inc Ww(Nw):      1
Current Send Seq (Vs):          7
Current Rcv Seq (Vr):           7
Last ACK'd sent frame(Va):      7
No. of frames in ACK pend q:    0
No. of frames in Tx pend q:     0
Local Busy:                     NO
Remote Busy:                    NO
Poll Retry count:               8
Appl output flow stopped:       NO
Send process running:           YES

Frame Type          Xmt      Rcvd
I-frames:             7         7
RR-frames:           19        15
RNR-frames:           1         0
REJ-frames:           0         0
I-frames Discarded by LLC:      0
I-frames Refused by LLC user:   0
ethernet0/0 LLC+
```

The meaning of each field is as follows:

Session ID	Session ID number.
Interface	Interface over which the session is running.
Remote MAC addr	Remote LLC peer MAC address.
Source MAC addr	Local LLC MAC address.
Remote SAP	Remote router's SAP address for the LLC.
Local SAP	Router's local SAP for LLC connection.
RIF	Frame RIF.
Access Priority	Packet priority. 0-7 for upper layer control.
State	Defined state(s) resulting from the interaction between the LLC peers. For further

	information, see the **list sap** command (previously described in this chapter).
Reply Timer(T1)	Time-out duration period of the timer when the LLC is unable to receive an acknowledgement or response from the other LLC station.
Receive ACK Timer(T2)	Time delay LLC uses before sending an acknowledgment for a received I-frame.
Inactivity Timer(Ti)	Time delay the LLC waits during inactivity before issuing an RR.
MAX I-Field Size(N1)	Maximum size of a frame data field (in bytes). Default is the interface size.
MAX Retry Value(N2)	Number of times LLC transmits an RR without receiving an acknowledgment.
Rcvd I-frames before Ack (N3)	Value used by the T2 timer to reduce acknowledgement traffic for received I-frames.
Transmit Window Size (Tw)	Number of I-frames that can be sent before receiving an RR.
Working Transmit Size (Ww)	Number of I-frames sent before receiving an RR. This can be lower than Tw during the dynamic window algorithm.
Acks Needed to Inc Ww (Nw)	Number of I-frames the LLC must receive before incrementing Ww by 1.
Current Send Seq (Vs)	Send state variable (Ns value for the next I-frame to be transferred).
Current Rcv Seq (Vr)	Receive state variable (next in-sequence Ns to be accepted).
Last ACK'd sent frame(Va)	Acknowledged state variable (last valid Nr received).
No. of frames in ACK pend q	Transmitted I-frames awaiting acknowledgment.
No. of frames in Tx pend q	Number of frames awaiting transmission.
Local Busy	LLC router's local connection is sending RNRs.
Remote Busy	Remote LLC is receiving RNRs.
Poll Retry count	Normal value of the counter retry in the LLC protocol.
Appl output flow stopped	LLC has ordered the application to stop sending outgoing data frames.
Send process running	This process runs at the same time as other frame actions and takes I-frames in the transmit queue and forwards them.
Frame Type (Xmt, Rcvd)	Displays the total number of frame types transmitted (Xmt) and received (Rcvd).
I-frames Discarded by LLC	I-frames discarded by the LLC, usually because the sequence number is wrong.
I-frames Refused by LLC user	I-frames discarded by the LLC software. For example, LNM (LAN Network Manager) and DLSw (Data Link Switching).

6.3.4 SET

Dynamically configures LLC parameters on an open LLC session. Modifications made to the parameters are effective for the session's lifetime. These parameters are the same as those described in chapter *LLC Configuration* on page 30.

Warning

Modifying the default values of LLC parameters may affect protocol performance.

Syntax:

```
<interface name> LLC+set ?
  n2-max-retry                Max retry value
  n3-frames_rcvd-before-ack   Rcvd I-frames before ack
  nw-acks-to-inc-ww           Acks needed to increment Ww
  t1-reply-timer              Reply timer
  t2-receive-ack-timer        Receive Ack timer (in 100 millisec.)
  ti-inactivity-timer         Inactivity timer
  tw-transmit-window          Transmit window
<interface name> LLC+
```

6.3.4.1 SET N2-MAX-RETRY

Maximum number of times the LLC protocol transmits an RR without receiving an acknowledgment when the inactivity timer times out. Values range from 1 to 225. Default is 8.

Syntax:

```
<interface name> LLC+set n2-max-retry <session ID> {<value>|default}
```

Example:

```
ethernet0/0 LLC+set n2-max-retry 07-04-000c 8
ethernet0/0 LLC+
```

6.3.4.2 SET N3-FRAMES_RCVD-BEFORE-ACK

Value used with the T2 timer to reduce acknowledgment traffic for I-frames received. Each time an I-frame is received, this value diminishes and a counter, which started out with the value configured for this command, decreases. When this counter reaches 0, or the T2 timer times out, an acknowledgment is sent. Values range from 1 to 255. Default is 1.

Syntax:

```
<interface name> LLC+set n3-frames_rcvd-before-ack <session ID> {<value>|default}
```

Example:

```
ethernet0/0 LLC+set n3-frames_rcvd-before-ack 07-04-011f 1
ethernet0/0 LLC+
```

6.3.4.3 SET NW-ACKS-TO-INC-WW

When sending I-frames is not possible, the LLC protocol enters into a mode where the working window (Ww) is set back to 1 and is then slowly increased back to its normal size (Tw). This is known as the dynamic window algorithm. This value is the number of I-frames the LLC must receive before incrementing Ww by 1. Values range from 1 to 127. Default is 1.

Syntax:

```
<interface name> LLC+set nw-acks-to-inc-ww <session ID> {<value>|default}
```

Example:

```
ethernet0/0 LLC+set nw-acks-to-inc-ww 07-04-00ac 2
ethernet0/0 LLC+
```

6.3.4.4 SET T1-REPLY-TIMER

Times out when the LLC fails to receive a required acknowledgment or response from the other LLC station. When this timer times out, an RR is sent with the poll bit set and T1 is restarted. If the LLC receives no response after the configured maximum number of retries has been reached (N2), the lower link is declared inoperative. Values range from 1 to 256. Default is 1 second. The **disable** option deactivates the timer.

Syntax:

```
<interface name> LLC+set t1-reply-timer <session ID> {<value>|default|disable}
```

Example:

```
ethernet0/0 LLC+set t1-reply-timer 07-04-000c 1
ethernet0/0 LLC+
```

6.3.4.5 SET T2-RECEIVE-ACK-TIMER

Timer used to delay the sending of an acknowledgment when an I-frame is received. The timer starts when an I-frame is received, and resets when an acknowledgment is sent. If it times out, LLC2 sends an acknowledgment as soon as possible. This value must be set to a lower value than T1, ensuring the remote LLC2 peer receives the delayed acknowledgment before the T1 timer expires. Values range from 1 to 2560. Default is 1 (100 ms), which deactivates the timer. The **disable** option also deactivates the timer.

Syntax:

```
<interface name> LLC+set t2-receive-ack-timer <session ID> {<value>|default|disable}
```

Example:

```
ethernet0/0 LLC+set t2-receive-ack-timer 07-04-000c disable
ethernet0/0 LLC+
```

Note

If this timer is set to 1 (default), it will not run (e.g., N3-FRAMES_RCVD-BEFORE-ACK=1).

6.3.4.6 SET TI-INACTIVITY-TIMER

Expires when LLC does not receive a frame for a specified time period. When it times out, LLC transmits an RR until the other LLC station responds or the N2 timer expires. Default is 30 seconds, but options range from 1 to 256. The **disable** option deactivates the timer.

Syntax:

```
<interface name> LLC+set ti-inactivity-timer <session ID> {<value>|default|disable}
```

Example:

```
ethernet0/0 LLC+set ti-inactivity-timer 07-04-000c default
Inactivity Timer(Ti) in sec.[30]?
ethernet0/0 LLC+
```

6.3.4.7 SET TW-TRANSMIT-WINDOW

Sets the maximum number of I-frames that can be sent before receiving an RR. Assuming that the other end of the LLC session can actually receive this many consecutive I-frames, and the router has enough memory to keep copies of these frames until an acknowledgment is received, increasing this value may increase the throughput. Values range from 1 to 127. Default is 2. The **disable** option deactivates the timer.

Syntax:

```
<interface name> LLC+set tw-transmit-window <session ID> {<value>|default|disable}
```

Example:

```
ethernet0/0 LLC+set tw-transmit-window 07-04-000c 10
ethernet0/0 LLC+
```

6.3.5 EXIT

Returns to the LAN monitoring menu (Ethernet or Token Ring*)*.

Syntax:

```
<interface name> LLC+exit
```

Example:

```
ethernet0/0 LLC+exit
ethernet0/0 ETH+
```

Chapter 7 Switch Configuration

7.1 Introduction

Some of our routers have an internally-connected switch to an Ethernet interface.

A switch enables traffic separation through the creation of independent segments. To do this, the switch has several ports (each one corresponding to a segment). The switch learns the MAC addresses in each segment and only allows traffic to pass from one segment to another when the destination address is proven to belong to another segment or is a group address (multicast or broadcast).

7.2 Traffic Storm Control

A switch transmits the broadcast and multicast traffic received through a port to the remaining ports. Similarly, if a destination MAC address for a unicast packet isn't known to the switch, the packet is sent through all ports. If high volumes of this type of traffic are generated (traffic storms) in a segment, they are sent to all segments. Traffic storms usually stem from network configuration errors and can saturate the network.

Using the traffic storm control frame throughput at the switch port can be limited.

Traffic control is configured by entering **storm-control**. Traffic control is a characteristic of the switch being used (i.e. it's a hardware characteristic, not software-related), meaning its configuration varies depending on the switch being used in the device.

The configurable parameters are as follows:

- Bandwidth, which triggers the traffic control mechanism. If the number of frames of a certain type received by a port surpasses the bandwidth configured for said port, the switch stops sending these frames to the other ports.
- The type of frames to take into account when the traffic control mechanism begins to operate: all frames, broadcast frames, multicast frames or flooded-unicast (unicast frames sent by all the switch ports when the destination address cannot be found in the switch's MAC addressing table).
- Traffic control mechanism, enabled or disabled in the switch port.

Depending on the type of switch, the first two parameters can be configured globally or per port. The types of frames that can be taken into account for traffic control also vary according to the type of switch used.

If you enable traffic control in a port, the switch calculates, in time intervals, the number of frames received for the configured types. If the number of frames surpasses the configured bandwidth, the frame reception process is stopped in said port until the next time interval for calculation begins. The frame counter restarts when a new calculation period begins.

When configuring traffic control, please remember hardware limitations may be set in the bandwidth values of the switch (i.e., little resolution in the internal registers used). This means that, in some switches, the real value of the bandwidth used is different from the value configured. You can view the real value in the switch by entering **list storm-control** (a monitoring command).

7.3 Spanning Tree Protocol

Switch ports can be configured to execute the Spanning Tree protocol. Ports can be divided in different Spanning Tree instances.

Note

Throughout this manual, the ports grouped in a Spanning Tree instance are sometimes referred to as *bridge*.

When enabling Spanning Tree in a switch port, take the following considerations into account:

- The switch stops forwarding BPDU frames, regardless of whether the frame is received through a port where Spanning Tree is running or not.
- You cannot configure *bridge* in a switch where a port is running Spanning Tree.
- You cannot configure a port as a *WAN port* if a Spanning Tree is running. For further information on *WAN ports*, please see manual *Teldat Dm750-I Ethernet Subinterface* .

- In the case of Kendin switches, there are restrictions when configuring the VLANs. Please see manual *Teldat Dm751-I VLAN*

Use the following commands to configure Spanning Tree in a switch:

- **port <port-id> stp enable instance <id>** to enable Spanning Tree in a port and to associate it to a certain Spanning Tree instance.
- **port <port-id> stp <parameters>** to configure the different Spanning Tree protocol parameters associated to a given port.
- **stp <instance> <parameters>** to configure the different Spanning Tree protocol parameters associated to a certain instance.

Per Vlan Spanning Tree (PVST) can also be used for the selected ports.

This means that each VLAN on a network can build its own Spanning Tree. All switch ports used in this instance must be a member of the requested VLAN.

- **stp <instance> vlan <vlan-id>** to enable Spanning Tree using PVST.
- *Feature vlan* **vlan <vlan-id> ethernet0/0 port x** to enable vlan on switch port x.

7.4 Quality of Service

This feature is available in some switches and allows:

(1) To configure a limit on the output rate in a given switch port.

(2) To assign the default COS values to traffic from a port and execute re-tagging for some, or all, COS values.

(3) To configure different priorities, depending on the COS or DSCP values, and assign them to different output queues (up to a total of four) in each port.

(4) To alter the output queue discipline, either globally or per port.

(5) To configure which input packet parameter in a port (COS or DSCP) is used for priority.

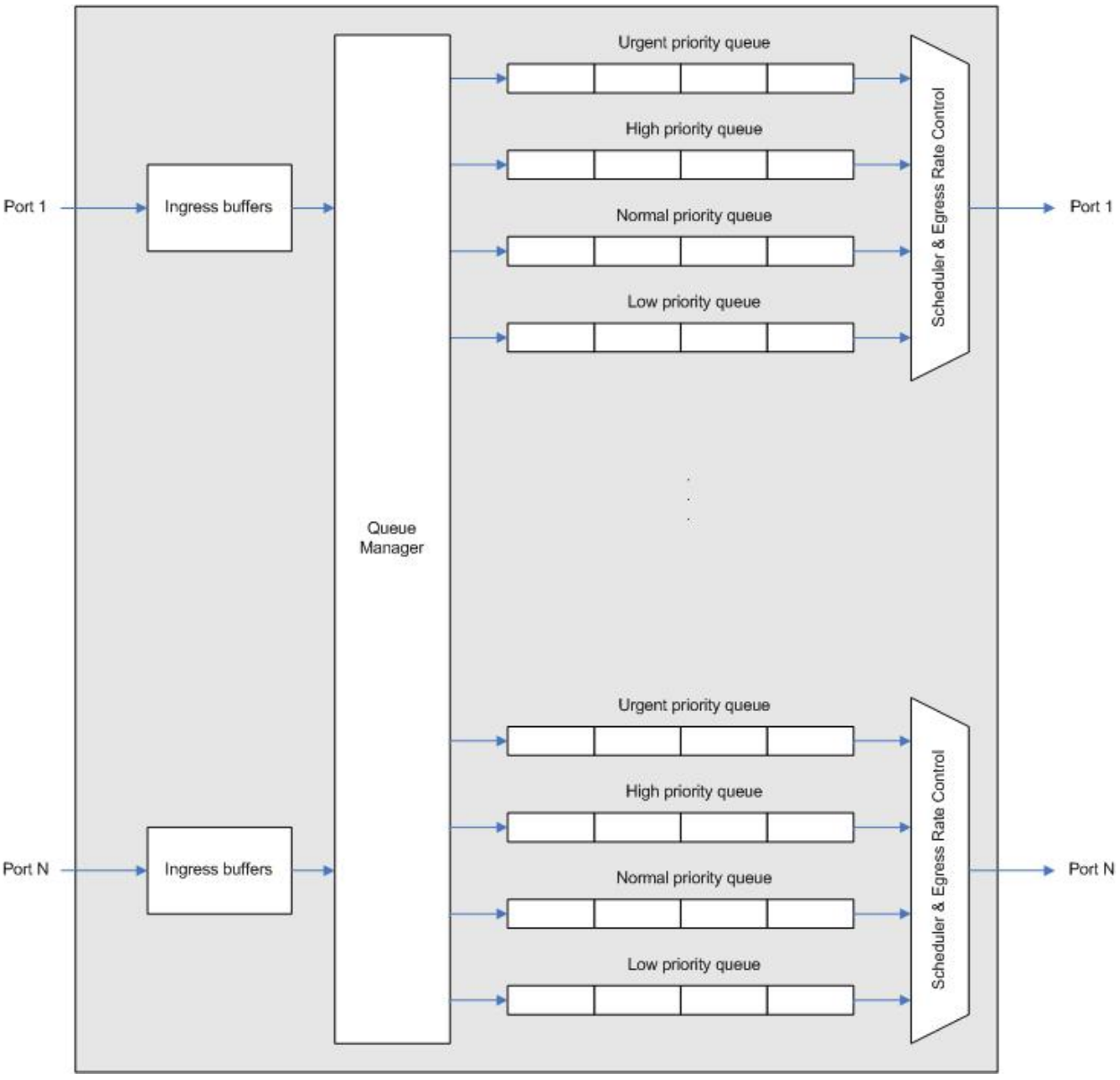

Fig. 1: **Switch queue structure**

The switch queue structure is based on a queue manager, four output queues per port, a scheduler and an output rate manager.

The queue manager receives the packets from each port and, depending on the configured criteria (COS in 802.1Q, DSCP, COS by default) and the output port, selects where to queue the packet. The scheduler organizes the four queues for each port and decides what queue is served at what time, depending on the programmable service discipline (Strict Priority or Weight Round Robin).

The output rate manager limits the volume of data transmitted to the configured value.

7.5 Accessing the Switch Configuration

To access the switch configuration, enter **repeat-switch** in the configuration menu of the Ethernet interface.

Example 1:

```
Config>list devices
Interface            Connector     Type of interface
ethernet0/0          LAN1          Fast Ethernet interface
serial0/0            SERIAL0/WAN1  X25
serial0/1            SERIAL1/WAN2  X25
serial0/2            SERIAL2/WAN3  X25
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
ethernet3/0          SLOT3         KS8995M Switch PCI
Config>network ethernet3/0
```

```
-- Ethernet Interface User Configuration --
ethernet3/0 config>repeater-switch

-- Switch User Config --
ethernet0/0 switch config>
```

Example 2:

```
Config>list devices
Interface            Connector     Type of interface

               ethernet0/0 LAN1 Marvell Fast Ethernet Switch
atm0/0               DSL1          Generic ATM
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
Config>network ethernet0/0

-- Ethernet Interface User Configuration --
ethernet0/0 config>repeater-switch

-- Switch User Config --
ethernet0/0 switch config>
```

7.6 Switch Configuration Commands

The following table summarizes all switch configuration commands. These commands are further explained in the following paragraphs.

Command	Function
? (HELP)	Displays all switch configuration commands or their options.
ACCESS-CONTROL	Configures access control parameters.
AGING-TIME	Configures aging time for the switch MAC addresses.
CPU	CPU port configuration
DOWN-BY-DEFAULT	Interface status is down if there is nothing connected to it.
LIST	Displays switch configuration.
NO	Configures parameters with their default values.
PORT	Configures specific parameters for a switch port.
QOS	Configures quality of service parameters.
STORM-CONTROL	Configures traffic storm control global parameters.
STP	Configures global parameters for the Spanning Tree protocol function in the switch.
EXIT	Exits the switch configuration menu.

7.6.1 ? (HELP)

Displays the available commands and their options.

Syntax:

```
ethernetX/X switch config>?
```

Example:

```
ethernet3/0 switch config>?
  access-control   Access Control Configuration
  aging-time       Configures Aging time for MAC address table entries
  cpu              CPU port configuration
  down-by-default  Interface status is down if there is nothing connected to it
  list             List Configuration
  no               Negate a command or set its defaults
  port             Port Configuration
  qos              Configures quality of service
  storm-control    Configures storm control
  stp              Configures spanning tree protocol
```

```
  exit
ethernet3/0 switch config>
```

Command history:

Release	Modification
11.01.04	The "*down-by-default*" command was introduced as of version 11.01.04.
11.01.05	The "*CPU*" command was introduced as of version 11.01.05.

7.6.2 ACCESS-CONTROL

Accesses the submenu to configure the blocked entries list, applied to all switch ports for access control. The entries list is configured as a *class-map*.

Syntax:

```
ethernetX/X switch config>access-control
--Access Control User Config --
Access Control Config>?
  block                   Configures a block list to access control
  no                      Negate a command or set its defaults
  refresh-mac-interval    Configures MAC addresses refresh interval
  exit
```

Note

You can only configure blocked entry lists. If you try to configure a permitted entry list, an error message appears.

7.6.2.1 block class-map <class-name>

Configures the name of the *class-map* that contains the list of blocked entries. To configure the *class-map*, please see manual *Teldat Dm795-I_ Policy_Map-Class_Map:*

```
ethernetX/X switch config>access-control
--Access Control User Config --
Access Control Config>block class-map list_deny

Access Control Config>exit

ethernet0/0 switch config>show config
; Showing Menu and Submenus Configuration for access-level 15 ...
; Default Router 0 0 Version 10.8.13-Alfa
         access-control
; --Access Control User Config --
         block class-map list_deny
;
         exit
;
```

Note

The class-map must exist before it can be assigned as an access control list. Otherwise, an error message appears.

7.6.2.2 refresh-mac-interval

Configures the refresh time for MAC entries learned by the switch. In some devices, the MAC control allowed forces the *software* to maintain a list of MACs learned by the switch. To do this, you need to periodically check the table that internally manages the switch and update it.

This parameter is only valid if it is applied to the access control of a switch port.

Syntax:

```
Access Control Config> refresh-mac-interval ?
  <1..65535>    Value in the specified range
```

Example:

Configuring 600 seconds as a refresh interval.

```
Access Control Config> refresh-mac-interval 600
```

7.6.3 AGING-TIME

Configures the aging time for MAC addresses learned by the switch.

Syntax:

```
ethernetX/X switch config>aging-time <value>
```

<value> Value between 1 and 3600 seconds.

Example:

```
ethernet1/0 switch config>aging-time 60
```

NO configures the aging default value (300 seconds).

7.6.4 CPU

Configures CPU port options.

Syntax:

```
ethernetX/X switch config>cpu
 flow-control Configures flow control mode
  disabled    Disables flow control mode
  enabled     Enables flow control mode
   rx-only    Enable asymmetric PAUSE toward local device
   tx-only    Enable asymmetric PAUSE toward link partner
```

Note

This command is not available on all platforms.

Command history:

Release	Modification
11.01.05	The "*cpu*" command was introduced as of version 11.01.05.

7.6.5 DOWN-BY-DEFAULT

When configuring the down-by-default command, the interface status will be down if there is nothing connected to it. Otherwise, the interface base will always be up.

It is important to keep in mind that raising an interface could take a while.

Example:

```
ethernet0/0 switch config>down-by-default
```

Command history:

Release	Modification
11.01.04	The "*down-by-default*" command was introduced as of version 11.01.04.

7.6.6 LIST

Displays the switch configuration.

Syntax:

```
ethernetX/X switch config>list ?
  configuration    Lists ports configuration
  stp              Lists the Spanning Tree Protocol configuration
```

7.6.6.1 LIST CONFIGURATION

Displays the configuration of the various switch ports.

Syntax:

```
ethernetX/X switch config>list configuration
```

Example:

```
ethernet3/0 switch config>list configuration
                                  Auto-negotiation Advertise       Storm Control
Port  Ena  Aneg  Speed  Duplex  FC  100FD 100HD 10FD 10HD FlowC     Packets     Lvl
----  ---  ----  -----  ------ ---- ---------------------------- --------------- ---
  1    Y    Y     100    Half   N     Y     Y     Y    Y    Y             Bcst  15
  2    Y    Y     100    Half   N     Y     Y     Y    Y    Y         Disabled  15
  3    Y    Y     100    Half   N     Y     Y     Y    Y    Y         Disabled  15
  4    Y    Y     100    Half   N     Y     Y     Y    Y    Y         Disabled  15
ethernet3/0 switch config>
```

The meaning of the columns is as follows:

Port: Switch port identifier.

Ena (Enable): Indicates whether the port is enabled or not. If the port is disabled, data is not transmitted or received through it.

Aneg (Auto-negotiation): Indicates if auto-negotiation is enabled or not. Whenever it is enabled, the rate and duplex mode for the port are set (based on the characteristics of the devices connected to the network segment where the port is connected).

Speed: Speed in Mbps configured for the port. This is only valid when auto-negotiation is disabled.

Duplex: Duplex mode configured for the port. This is only valid when auto-negotiation is disabled.

FC: Flow control (Pause) configured for the port. This value is only used if auto-negotiation is disabled.

Auto-negotiation Advertise: Indicates the characteristics the port advertises to other devices connected to the same segment during auto-negotiation. The configurable characteristics are as follows:

- 100FD: the device is capable of operating at 100Mbps, Full-Duplex.
- 100HD: the device is capable of operating at 100Mbps, Half-Duplex.
- 10FD: the device is capable of operating at 10Mbps, Full-Duplex.
- 10HD: the device is capable of operating at 10Mbps, Half-Duplex.
- FlowC: the device understands flow control commands.

Storm control: traffic storm control configuration per port. The configurable characteristics are as follows:

- Packets: type of packets calculated when determining if the traffic control should be activated in a port.
- Lvl (Level): percentage of bandwidth that must be surpassed for traffic control to activate.

7.6.6.2 LIST STP

Displays the global configuration for a Spanning Tree protocol instance.

Syntax:

```
ethernetX/X switch config>list stp <instance>
```

<instance> Spanning Tree instance identifier. You can configure up to 16 Spanning Tree instances in a switch.

Example:

```
ethernet1/0 switch config>list stp 1
STP instance  1
---------------
```

```
Address:        00-a0-26-21-22-41
Priority:       32768
Protocol:       normal operation
ForwardDelay:   15
MaxAge:         20
TxHoldCount:    6
Vlan-Id:        100
Tagged:         yes
Vlan-Id:        20
Ports:
        Port: 1
                PathCost:       0
                Priority:       128
                Admin:          No
                Auto:           Mo
                PointToPoint:   Auto
                BPDU Filter:    Default
                BPDU Filter:    Default

        Port: 2
                PathCost:       0
                Priority:       128
                Admin:          No
                Auto:           Mo
                PointToPoint:   Auto
                BPDU Filter:    Default
                BPDU Filter:    Default

        Port: 4
                PathCost:       0
                Priority:       128
                Admin:          No
                Auto:           Mo
                PointToPoint:   Auto
                BPDU Filter:    Default
                BPDU Filter:    Default

ethernet1/0 switch config>
```

7.6.7 NO

Configures parameters with their default values or deletes the configuration.

Syntax:

```
ethernetX/X switch config>no ?
  aging-time         Configures Aging time for MAC address table entries
  cpu                CPU port configuration
  down-by-default    Interface status is down if there is nothing connected to it
  qos                Configures quality of service
  storm-control      Configures storm control
  stp                Configures spanning tree protocol
```

7.6.8 PORT

Configures a switch port.

Syntax:

```
ethernetX/X switch config>port <port identifier>
  access-control     Configures port access control
  autonegotiation    Autonegotiation Configuration
  dot1X              Accesses the 802.1X configuration menu
  duplex             configures duplex mode
  enable             Enables rx and tx on port
  disable            Disables rx and tx on port
  flow-control       Configures flow control mode
```

```
  label              Configures label to port
  no                 Negates a command or sets its defaults
  qos                Configures quality of service
  stp                Configures spanning tree protocol
  speed              configures port speed
  storm-control      Configures storm control
```

7.6.8.1 access-control

Configures a port's access control. This accesses the configuration submenu for the entries allowed in an access control list used in a port.

Syntax:

```
ethernetX/X switch config>port <1…n> access-control
-- Port Access Control User Config --
Port Access Control Config>?
  class-map    Configures a class-map to access control
  maximum      Configures the maximum number of MAC addresses to learn
  no           Negate a command or set its defaults
  exit
```

7.6.8.1.1 class-map <class-name>

Configures a list of entries allowed to gain port access control. The list is configured as a *class-map* (please see manual *Teldat Dm795-I Policy Map-Class Map).*

7.6.8.1.2 maximum <1-255>

Configures a limit for the MAC addresses you want the port to learn.

This limit doesn't affect the entries allowed on the access control list, as these always have access.

Example:

Configuring a permitted entries access control list in port 6 and a limit (value to 5) of learned MAC addresses. The *class-map* must exist before it can be assigned as an access control list:

```
ethernet0/0 switch config>port 6 access-control

-- Port Access Control User Config --
Port Access Control Config>class-map RPD
ethernet0/0 switch config>sho conf
; Showing Menu and Submenus Configuration for access-level 15 ...
; Default Router 0 0 Version 10.8.13-Alfa

         port 6 access-control
; -- Port Access Control User Config --
            class-map RPD
;
            maximum 5
;
         exit
;
```

Note

You can only configure lists of permitted entries in the ports. If you try to configure a list of blocked entries, an error message appears.

7.6.8.2 autonegotiation

Enables auto-negotiation. The link's physical characteristics are negotiated with the other devices connected to the LAN.

Syntax:

```
ethernetX/X switch config>port <identificador de puerto> autonegotiation
     advertise    Autonegotiation advertisement configuration
```

```
      10BaseT-half-duplex     advertises 10BaseT half duplex capability
      10BaseT-full-duplex     advertises 10BaseT full duplex capability
      100BaseT-half-duplex    advertises 100BaseT half duplex capability
      100BaseT-full-duplex    advertises 100BaseT full duplex capability
      flow-control            advertises flow control capability
   <cr>          Enables Autonegotiation
   no            Negates a command or sets its defaults
      advertise    Autonegotiation advertisement configuration
         10BaseT-half-duplex     advertises 10BaseT half duplex capability
         10BaseT-full-duplex     advertises 10BaseT full duplex capability
         100BaseT-half-duplex    advertises 100BaseT half duplex capability
         100BaseT-full-duplex    advertises 100BaseT full duplex capability
         1000BaseT-half-duplex   advertises 100BaseT half duplex capability
         1000BaseT-full-duplex   advertises 100BaseT full duplex capability
         flow-control            advertises flow control capability
```

Note

If devices connected with set speeds connect to an Ethernet interface where auto-negotiation is configured, problems may arise.

The auto-negotiation mode with set speeds will be unable to detect the duplex mode of the other end. Thus, it will configure in half-duplex mode.

Auto-negotiation is mandatory for Gigabit connections. If the speed is set to 1000 Mbps, the device will internally switch to auto-negotiation mode.

7.6.8.3 autonegotiation advertise

Configures the characteristics advertised in auto-negotiation. To disable advertising for a characteristic, use the **auto-negotiation no advertise** option. The following characteristics can be configured:

- Speed 1Gbps, full duplex mode.
- Speed 1 Gbps, half duplex mode.
- Speed 100Mbps, full duplex mode.
- Speed 100Mbps, half duplex mode.
- Speed 10Mbps, full duplex mode.
- Speed 10Mbps, half duplex mode.
- Flow control: advertise all available flow control options (symmetric or both symmetric and asymmetric).
- Flow control asymmetric: advertise asymmetric flow control (do not advertise symmetric flow control).
- Flow control symmetric: advertise symmetric flow control (do not advertise asymmetric flow control).

Example:

Configuring port 1 to negotiate duplex mode (half or full), forcing the speed to 10Mbps.

```
ethernet1/0 switch config>port 1 autonegotiation no advertise 100BaseT-full-duplex
ethernet1/0 switch config>port 1 autonegotiation no advertise 100BaseT-half-duplex
ethernet1/0 switch config>list configuration
                              Auto-negotiation Advertise       Storm Control
Port  Ena  Aneg  Speed  Duplex  100FD 100HD 10FD 10HD FlowC     Packets     Lvl
----  ---  ----  -----  ------  ---------------------------- --------------- ---
  1    Y    Y     100    Half     -     -     Y    Y    Y          Disabled   0
  2    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  3    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  4    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
ethernet1/0 switch config>
```

Command history:

Release	Modification
11.01.05	Symmetric and asymmetric flow control options have been introduced as of version 11.01.05.

7.6.8.4 dot1x

Accesses the 802.1X authentication configuration menu for the switch port. For further information, please see manual *Teldat Dm783-I 802.1X Authentication.*

7.6.8.5 duplex

Configures the duplex mode in half duplex or full duplex.

Syntax:

```
ethernetX/X switch config>port <identificador de puerto>
  duplex            configures duplex mode
    half    forces half duplex operation mode
    full    forces full duplex operation mode
```

Note

If you configure flow control, speed or duplex mode in a port, auto-negotiation in said port is automatically disabled.

7.6.8.6 flow-control

Configures the flow control mode when the port is configured in fixed mode (i.e. with auto-negotiation disabled).

Syntax:

```
ethernetX/X switch config>port <identificador de puerto>
 flow-control Configures flow control mode
  disabled    Disables flow control mode
  enabled     Enables flow control mode
   rx-only    Enable asymmetric PAUSE toward local device
   tx-only    Enable asymmetric PAUSE toward link partner
```

Note

Flow control is not available in all switches.

Note

Asymmetric flow control is not available in all switches.

Note

If you configure flow control, speed or duplex mode in a port, auto-negotiation in said port is automatically disabled.

Command history:

Release	Modification
11.01.05	The "*rx-only*" and "*tx-only*" options have been introduced as of version 11.01.05.

7.6.8.7 enable

Enables port transmission and reception.

7.6.8.8 disable

Disables transmission and reception in the port.

Example:

Port 3 is disabled; nothing can be sent or received through it.

```
ethernet3/0 switch config>port 3 disable
ethernet3/0 switch config>list
                                        Auto-negotiation Advertise
Port  Ena  Autoneg  Speed  Duplex  100FD  100HD  10FD  10HD  Flow Control
----  ---  -------  -----  ------  ------------------------------------
  1    Y      Y      100    Half     -      -      Y     Y       Y
  2    Y      N      100    Full     Y      Y      Y     Y       Y
  3    N      Y      100    Half     Y      Y      Y     Y       Y
  4    Y      Y      100    Half     Y      Y      Y     Y       Y
ethernet3/0 switch config>
```

7.6.8.9 label

Configures a label in a port to classify the traffic, depending on the port said traffic has entered through.

Syntax:

```
ethernetX/X switch config>port <1…n> label <1…99>
```

Example:

```
ethernet0/0 switch config>port 6 label 60
```

7.6.8.10 no autonegotiation

Disables auto-negotiation. As a result, the speed and duplex modes have to match the values configured for the port.

Note

If devices connected with set speeds connect to an Ethernet interface where auto-negotiation is configured, problems may arise.

The auto-negotiation mode with set speeds will be unable to detect the duplex mode of the other end. Thus, it will configure in half-duplex mode.

7.6.8.11 no autonegotiation advertise

Sets the characteristics advertised during auto-negotiation to their default values.

7.6.8.12 qos

Configures the quality of service parameters in a switch port.

Syntax:

```
ethernetX/X switch config>port <port-number> qos
    default-cos     Default CoS value for untagged frames
      <0..7>        cos value
    rate-limit      Configures a limit for the egress rate
      <1..1000>      rate value (Mbps)
    map             Set a priority map
      cos           Configures a cos matching criteria
        <0..7>      cos value
          to        Configures target for a map
             cos    Set the output cos
               <0..7>  cos value
    override-cos    Fixed CoS value for all frames
      <0..7>        cos value
    priority        Scheduling discipline for the port egress queues
      strict        Strict discipline for all queues
      urgent-strict Strict discipline for urgent queue and weighted round robin for all other
      wrr           Weighed round robin discipline for all queues (default 8-4-2-1)
    trust           Set what priority indicator should be used in this port
      none          Use CoS defaults in this port
      cos           Use CoS values for 802.1Q tagged frames in this port, if not tagged use DSCP
      dscp          Use DSCP values in this port, regardless if frames are 802.1Q tagged or not
```

default-cos Establishes the COS default value for untagged packets entering this port.

rate-limit	Establishes the egress rate limit in the port. The value is set in Mbps.
map	Configures the translation table for some COS values. The **map** command establishes which packets, with certain COS values, are re-tagged and transmitted by the switch with a different COS value. Re-tagging is executed at entry, so the command must specify which port the packets you want re-tagged must enter through. So that the packets being transmitted are re-tagged, configure the tag-insertion option in the *feature vlan* menu for all ports where the re-tagged packets are transmitted.
override-cos	Establishes the COS value that all packets received through this port are going to be transmitted with. So that packets being transmitted are re-tagged, configure the tag-insertion option in the *feature vlan* menu for all the ports where re-tagged packets are transmitted.
priority	Establishes the egress queues service discipline for said port. The values allowed are as follows: *strict*: Queues are served with strict discipline. This means packets from a queue are not transmitted if there are packets awaiting transmission in higher-priority queues. E.g. packets in the low queue are not transmitted while there are packets to be transmitted in any of the other three queues. This discipline requires careful configuration, as it can lead to situations where some queues are never served. *urgent-strict*: The urgent queue takes strict priority while the other three are served in accordance with the Weighted Round Robin system. This means that packets from the other queues are not transmitted if there are packets in the urgent queue. This discipline also requires caution as it can lead to situations where only urgent queue packets are served. *wrr*: All the queues are served in accordance with the Weighted Round Robin system. A weighted table determines how many times the scheduler has polled every queue in each cycle and packets are sent accordingly. This is the switch default operating mode.
trust	Establishes which field is used to prioritize the packets in a port. Allowable values are as follows: *none*: Prioritizes depending on the port's default COS value. *cos*: Prioritizes depending on the value of the packet 802.1Q tag COS field. Default is COS. *dscp*: Prioritizes depending on the IP packet DSCP value.

Note

Some switches may vary from others, depending on the trust option. When the packet does not have COS, some switches use the DSCP value to prioritize and others do not prioritize said packet. In the same way, if you select the **dscp trust** option and the packet does not have DSCP, some switches use COS to prioritize packets and others don't.

The priority option is not available in all switches. For some, priority is globally configured.

Example 1:

Setting switch port 3 output rate to 20 Mbps.

```
ethernet0/0 switch config>port 3 qos rate-limit 20
```

Example 2:

Configuring COS re-tagging in two different ways in two switch ports:

(1) All packets in port 14 are re-tagged by default to COS 5, regardless of the COS value they had on arrival.

(2) All packets entering port 15 with a COS 6 value are re-tagged to COS 5.

```
ethernet0/0 switch config>port 14 qos override-cos 5
ethernet0/0 switch config>port 15 map cos 6 to cos 5
ethernet0/0 switch config>exit
ethernet0/0 config>>exit
Config>feature vlan
VLAN config>enable
```

```
VLAN config>vlan 20 ethernet0/0 port 14
VLAN config>vlan 20 ethernet0/0 port 15
VLAN config>vlan 20 ethernet0/0 port 16
VLAN config>tag-insertion ethernet0/0 port 16
```

Example 3:

Configuring the mode for port 7 output queues service discipline to *strict*.

```
ethernet0/0 switch config>port 7 qos priority strict
ethernet0/0 switch config>
```

Example 4:

Configuring port 3 to use the DSCP field value in input IP packets for prioritization purposes.

```
ethernet0/0 switch config>port 3 qos trust dscp
ethernet0/0 switch config>
```

7.6.8.13 stp

Configures the parameters associated to the Spanning Tree protocol in a switch port. You can configure different Spanning Tree instances in the switch so they operate independently. This is useful when executing Spanning Tree through VLAN. There is an example of this under *Examples*.

Note

If, in the dynamic configuration, the Spanning Tree is enabled or disabled in a port, the Spanning Tree sets machine reboots in all ports concerned.

Syntax:

```
ethernetX/X switch config>port <port-number> stp
  <1..16>      spanning-tree instance
 edge-port  Edge Port configuration
       admin   Configures the port as an edge port
       auto    Configures auto edge port detection
  link-type  Link Type Configuration
       point-to-point       Configures the port as connected to a point-to-point LAN
       point-to-multipoint Configures the port as not connected to a point-to-point LAN
       autodetect           Automatic detection of a point-to-point LAN
  path-cost  Port Path Cost
             <0..200000000>   Port Path-cost
       priority   Port Priority for this stp instance
             <0..255>         Port Priority
  bpdu-filter  don't send or receive BPDUs for this port
       enable     Enables BPDU filtering on this port
       disable    Disables BPDU filtering on this port
  bpdu-guard   don't accept BPDUs on this port
       enable     Enables BPDU guard on this port
       disable    Disables BPDU guard on this port
  edge-port    Edge Port configuration
        admin    Configures the port as an edge port
        auto     Configures auto edge port detection
  enable         enables spanning-tree on this port
       instance    spanning-tree instance
                <1..16>         spanning-tree instance
  disable        disables spanning-tree on this port
  link-type      Link Type Configuration
       point-to-point           Configures the port as connected to a point-to-point LAN
       point-to-multipoint        Configures the port as not connected to a point-to-point LAN
       autodetect               Automatic detection of a point-to-point LAN
  path-cost    Port Path Cost
       <0..200000000>    Port Path-cost
  priority     Port Priority
       <0..255>    Port Priority
```

Note

Spanning Tree parameters can be configured globally or through the spanning tree instance. If you configure the value through instance, this value takes priority over a global value for said parameter. If the instance is left blank, the global value configured is used.

Bpdu-filter	Enables (**bpud-filter enable**) or disables *(* **bpdu-filter disable** *)* BPDUs filtering in the port.
Bpdu-guard	Enables (**bpdu-guard enable**) or disables (**bpdu-guard disable**) BPDUs guard in the port.
Edge port	Configures the parameters for the RSTP bridges detection states machine function. If a port is established as directly connected to a station (*EdgePort*), the Spanning Tree protocol convergence in the port is faster. The **edge-port admin** option configures the port as *EdgePort* by default. However, the states machine can change the port to *Non EdgePort* when BPDUs are received through it. If you select the **edge-port auto** option, the Spanning Tree protocol decides if a port is directly connected to a station or not. Both options are not exclusive. By default, the port is not detected as *EdgePort* and auto-detection is disabled.
enable	Enables Spanning Tree protocol in a given switch port.
instance	Spanning Tree instance to which the port is associated.
disable	Disables Spanning Tree protocol in a certain switch port.
Link type	Configures the type of link for the port: connected to a point to point link (**link-type point-to-point** option), connected to a point-to-multipoint link (**link-type point-to-multipoint** option), or detected by the Spanning Tree protocol (**link-type autodetect** option). The latter is the default option.
Path Cost	Cost associated to the port, used in the Spanning Tree protocol, to calculate the cost of the path to the root bridge. Ranges from 1 to 65535. A 0 value is used to indicate the default cost. A cost is automatically assigned, depending on the type of interface the port refers to.
Port Priority	Port priority. Ranges from 0 to 255. The 4 least significant bits for the priority must be 0. If they aren't, the device rounds them up to the nearest valid priority. Default for a port priority is 128.

Example 1:

Two Spanning Tree instances are used: one for ports 1 and 3 and the other for switch ports 3, 5, 6, and 7.

```
ethernet0/0 switch config>port 1 stp enable instance 1
ethernet0/0 switch config>port 3 stp enable instance 1
ethernet0/0 switch config>port 3 stp enable instance 2
ethernet0/0 switch config>port 5 stp enable instance 2
ethernet0/0 switch config>port 6 stp enable instance 2
ethernet0/0 switch config>port 7 stp enable instance 2
```

Example 2:

Configuring the global priority associated to port 3.

```
ethernet0/0 switch config>port 3 stp priority 56
value rounded to 48
ethernet0/0 switch config>
```

Example 3:

Configuring the priority associated to port 3 for Spanning Tree instance 1.

```
ethernet0/0 switch config> port 3 stp 1 priority 64
ethernet0/0 switch config>
```

Example 4:

Configuring port 1 as a port directly connected to a station (link not shared with more bridges).

```
ethernet0/0 switch config>port 1 stp edge-port admin
ethernet0/0 switch config>
```

Example 5:

Configuring the link port 2 is connected to as point-to-point (port directly connected to another bridge).

```
ethernet0/0 switch config>port 2 stp link-type point-to-point
ethernet0/0 switch config>
```

Example 6:

Configuring BPDUs filtering in port 6.

```
ethernet0/0 switch config>port 6 stp bpdu-filter enable
ethernet0/0 switch config>
```

7.6.8.14 speed

Configures the speed: 10 Mbps, 100 Mbps or 1 Gbps (when supported by the device) .

Syntax:

```
ethernetX/X switch config>port <port identifier>
    10Mbps      Forces 10Mbps
    100Mbps     Forces 100Mbps
    1Gbps       Forces 1Gbps
```

Note

If you configure flow control, speed or duplex mode in a port, auto-negotiation for said port is automatically disabled.

Auto-negotiation is mandatory for Gigabit connections. If the speed is set to 1000 Mbps, the device will internally switch to auto-negotiation mode.

Configuration for port 2 at 100Mbps and full duplex.

```
ethernet3/0 switch config>port 2 speed 100Mbps
ethernet3/0 switch config>port 2 duplex full
ethernet3/0 switch config>list
                                      Auto-negotiation Advertise
Port  Ena  Autoneg  Speed  Duplex  100FD  100HD  10FD  10HD  Flow Control
----  ---  -------  -----  ------  ------------------------------------
  1    Y      Y      100    Half     -      -      Y     Y       Y
  2    Y      N      100    Full     Y      Y      Y     Y       Y
  3    Y      Y      100    Half     Y      Y      Y     Y       Y
  4    Y      Y      100    Half     Y      Y      Y     Y       Y
ethernet3/0 switch config>
```

7.6.8.15 storm-control

Configures the traffic storm control in a port. You can enable/disable and configure the type of frames calculated and bandwidth occupation to trigger traffic control.

Syntax:

```
ethernetX/X switch config>port <identificador de puerto>
  storm-control      Configures storm control
    enable       Enables storm control on a given port
    disable      Disables storm control on a given port
    all          All frames storm control
       level <level>   Incoming traffic bandwidth to start storm protection
    broadcast    Broadcast address storm control
       level <level>   Incoming traffic bandwidth to start storm protection
       include multicast      Multicast address storm control
           level <level>
           include flooded-unicast    Flooded unicast storm control
               level <level>
```

Note

In some switches, traffic control parameters are globally configured for all switch ports. Similarly, the type of configurable frames varies from switch to switch.

Example 1:

Switch with control type and traffic level per port.

Traffic storm control, configured in port 2, is associated to unicast and multicast frames with a 10 % bandwidth.

In this kind of switches, the type of traffic control and the level can be configured independently for each port.

```
ethernet0/0 switch config>port 2 storm-control broadcast include multicast
level 10
ethernet0/0 switch config>list conf
                              Auto-negotiation Advertise       Storm Control
Port  Ena  Aneg  Speed  Duplex  100FD 100HD 10FD 10HD FlowC     Packets     Lvl
----  ---  ----  -----  ------  ------------------------- --------------- ---
  1    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  2    Y    Y     100    Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
  3    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  4    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  5    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  6    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  7    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  8    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  9    Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  10   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  11   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  12   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  13   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  14   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  15   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
  16   Y    Y     100    Half     Y     Y     Y    Y    Y          Disabled   0
ethernet0/0 switch config>
```

Example 2:

Switch with global control and traffic level per port.

Traffic storm control, configured in ports 2 and 4, is associated to unicast and multicast frames with a 10% bandwidth.

In this kind of switches, the type of traffic control is common to all switch ports. However, the level is programmable per port.

```
ethernet0/0 switch config> storm-control broadcast include multicast
ethernet0/0 switch config> port 2 storm-cntrol level 10
ethernet0/0 switch config>list
                              Auto-negotiation Advertise       Storm Control
Port  Ena  Aneg  Speed  Duplex  100FD 100HD 10FD 10HD FlowC     Packets     Lvl
----  ---  ----  -----  ------  ------------------------- --------------- ---
  1    Y    Y     1000   Half     Y     Y     Y    Y    Y          Disabled   0
  2    Y    Y     1000   Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
  3    Y    Y     1000   Half     Y     Y     Y    Y    Y          Disabled   0
  4    Y    Y     1000   Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
ethernet0/0 switch config>
```

Example 3:

Switch with global traffic control and level.

Traffic storm control, configured in port 2, is associated to unicast and multicast frames with a 10% bandwidth.

In this kind of switches, the type of traffic control and the level are common to all ports.

```
ethernet0/0 switch config> storm-control broadcast include multicast level 10
ethernet0/0 switch config>list
                              Auto-negotiation Advertise       Storm Control
Port  Ena  Aneg  Speed  Duplex  100FD 100HD 10FD 10HD FlowC     Packets     Lvl
----  ---  ----  -----  ------  ------------------------- --------------- ---
  1    Y    Y     1000   Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
  2    Y    Y     1000   Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
  3    Y    Y     1000   Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
  4    Y    Y     1000   Half     Y     Y     Y    Y    Y         Bcst-Mcst  10
```

```
ethernet0/0 switch config>
```

7.6.9 QOS

Configures the global quality of service parameters. These parameters affect all ports in the switch.

Syntax:

```
ethernetX/X switch config>qos ?
  map    Set a priority map
  set    Set a priority queue param
```

7.6.9.1 MAP

Configures the COS or DSCP values in assignment maps to the output port queues.

Syntax:

```
ethernetX/X switch config>qos map {cos| dscp | default} [ <value> to queue <queue> ]
  cos        Configures a cos matching criteria
    <0..7>    cos value
      to queue
         urgent    Urgent Priority Queue
         high      High Priority Queue
         normal    Normal Priority Queue
         low       Low Priority Queue
  dscp       Configures a dscp matching criteria
    <0..63>    dscp value
      to queue
         urgent    Urgent Priority Queue
         high      High Priority Queue
         normal    Normal Priority Queue
         low       Low Priority Queue
  default    Restore the default cos/dscp priority map
```

Example 1:

Packets with COS equal to 1 are queued in the **urgent** priority queue.

```
ethernet0/0 switch config>qos map cos 1 to queue urgent
ethernet0/0 switch config>
```

Example 2:

Packets with DSCP equal to 32 are queued in the **normal** priority queue.

```
ethernet0/0 switch config>qos map dscp 32 to queue normal
ethernet0/0 switch config>
```

Example 3:

Restore the COS and DSCP default assignments for the output queues.

```
ethernet0/0 switch config>qos map default
ethernet0/0 switch config>
```

Default allocation for COS is:

COS	Queue
0	Low
1	Low
2	Normal
3	Normal
4	High
5	High
6	Urgent
7	Urgent

For DSCP, all values are assigned to the *normal* queue, with *normal* priority, by default.

7.6.9.2 SET

Configures the Quality of Service global parameters.

Syntax:

```
ethernetX/X switch config>qos set
  queue       Priority queue
  priority    Scheduling discipline for the switch egress queues
```

7.6.9.2.1 SET QUEUE

Configures the weighted table the scheduler is going to use in each output queue for a port, when said port is configured in Weighted Round Robin mode.

The weighted tables define the relative priority of one queue compared to another. The weight assigned to each queue establishes how many times the scheduler checks for the presence of packets in said queue, for each of the scheduler's cycles.

In each check, if a packet is found in the queue, it is transmitted (provided the output rate control allows this). In practice, when faced with congestion, the scheduler assumes the output rate is shared in the following proportions: 53% (8/15), 27% (4/15), 13% (2/15), 7% (1/15).

Syntax:

```
ethernetX/X switch config>qos set queue <queue> weight <value>
```

queue:	Queue you want to configure. Possible values are: *urgent*, *high*, *normal* and *low*.
value:	Weight value to assign to the queue. This ranges from <1..100> or <1..49> depending on the switch. The sum of the weights can be below or above the 100 value, as the relative weight for each queue is equal to the value configured, divided by the sum of the weights for the four queues.

Example:

Sets a weighted table for the 60-30-9-1 **Urgent-High-Normal-Low** queues.

```
ethernet0/0 switch config>qos set queue low weight 1
ethernet0/0 switch config>qos set queue normal weight 9
ethernet0/0 switch config>qos set queue high weight 30
ethernet0/0 switch config>qos set queue urgent weight 60
ethernet0/0 switch config>
```

7.6.9.2.2 SET PRIORITY

Sets service priorities for outgoing switch queues.

Syntax:

```
ethernetX/X switch config>qos set priority <strict|urgent-strict|wrr>
```

- Priority can take the following values:
- *strict*: The queues are served with strict priority. This means that packets are not transmitted when there are packets in higher priority queues awaiting transmission (i.e., packets in the *low* queue are not transmitted if packets in the other three queues are awaiting transmission). One needs to be careful with this priority, as it can lead to some queues never transmitting anything.
- *urgent-strict*: The *urgent* queue transmits with a strict priority and the other three queues with Weighted Round Robin priority. This means that packets from the other queues are not transmitted if there are packets in the urgent queue. This priority must also be used carefully, as it can lead to situations where only packets from the urgent queue are transmitted.
- *wrr*: All queues are transmitted in accordance with the Weighted Round Robin system. This means they are transmitted in a cycle, according to a weighted table that determines how many times polling is planned for each queue in each cycle. This is the default mode for the switch feature.

7.6.10 STORM-CONTROL

Configures the global parameters for traffic storm control.

Note

This command does not appear in switches where traffic control configuration is carried out per port.

Syntax:

```
ethernetX/X switch config>storm-control <type-of-packets> level <level>
```

type-of-packet: Types of packets to consider for traffic storm control. These can be *broadcast* or *broadcast* and *multicast*.

Example:

Traffic storm control configuration to calculate broadcast frames and to limit the frames to 15 percent of the bandwidth.

```
ethernet2/0 switch config>storm-control broadcast include multicast level 15
```

7.6.11 STP

Configures the global parameters associated to a Spanning Tree protocol instance.

Syntax:

```
ethernetX/X switch config>stp ?
  <1..16>    Spanning Tree Protocol instance
        bpdu-filter         Configures BPDU filter globally
        bpdu-guard          Configures BPDU guard globally
        bridge-address      Configures Bridge Address
               <mac-address>
        vlan                Configures Bridge VLAN STP Id
               <vlan-id>      1..4094

        bridge-priority     Configures Bridge Priority
        forward-delay       Configures Bridge Forward Delay
        max-age             Configures Bridge Max Age
        protocol-version    Configures Spanning-Tree Protocol Version
        tx-hold-count       Configures Transmit Hold Count
```

7.6.11.1 BPDU-FILTER DEFAULT

Enables BPDU filtering by default in all ports in *Edge Port* mode. To disable the default BPDU filtering, enter **no**.

7.6.11.2 BPDU-GUARD DEFAULT

Enables BPDU guard by default in all ports in *Edge Port* mode. To disable the default BPDU guard, enter **no**.

7.6.11.3 BRIDGE-ADDRESS

Configures the bridge MAC address.

Example:

```
ethernet0/0 switch config>stp 1 bridge-address 00-a0-24-31-11-23
ethernet0/0 switch config>
```

Note

Each bridge in the network must have a unique MAC address for the Spanning Tree protocol to operate correctly.

The configured address is used in the 6 octets that belong to a lower order from the bridge identifier. If a MAC address isn't configured in the bridge, the device uses the one associated to the switch (where possible).

7.6.11.4 VLAN

Configures the Bridge VLAN ID used in PVST+ (Per VLAN Spanning Tree) environment. All ports assigned to this bridge instance must be members of the VLAN used. The VLAN is in the 1..4094 range. VLAN 1 is used to build a spanning tree common to all VLANs. Unlike what happens with other manufacturers, here you need to explicitly create the instance associated to VLAN 1. Please see the chapter on *Examples* for a configuration example.

Syntax:

```
ethernet0/0 switch config>stp <instance> vlan <vlan-id>
```

Note

If you do not assign a VLAN identifier to the Spanning Tree instance, make sure all ports assigned to this Spanning Tree instance are not assigned to other Spanning Tree instances. To configure PVST+, ensure you create an instance associated to VLAN 1.

Example 1:

Configuration for PVST+ instances associated to VLANs 21, 22 and 30. Port 4 uses VLAN 30 as native VLAN.

```
ethernet0/0 switch config>port 1 stp enable instance 2
ethernet0/0 switch config>port 1 stp enable instance 3
ethernet0/0 switch config>port 2 stp enable instance 2
ethernet0/0 switch config>port 2 stp enable instance 4
ethernet0/0 switch config>port 3 stp enable instance 3
ethernet0/0 switch config>port 4 stp enable instance 4
ethernet0/0 switch config>stp 2 vlan 21
ethernet0/0 switch config>stp 3 vlan 22
ethernet0/0 switch config>stp 4 vlan 30
ethernet0/0 switch config>exit
ethernet0/0 config>exit
Config>feature vlan
VLAN config>enable
VLAN config>vlan 20 ethernet0/0 port 1
VLAN config>vlan 20 ethernet0/0 port 2
VLAN config>vlan 21 ethernet0/0 port 2
VLAN config>vlan 21 ethernet0/0 port 3
VLAN config>vlan 30 ethernet0/0 port 2
VLAN config>vlan 30 ethernet0/0 port 4
VLAN config>tag-default ethernet0/0 port 4 30
VLAN config>tag-removal ethernet0/0 port 4 30
VLAN config> exit
```

Example 2:

Configuration for a common instance associated to VLAN 1.

```
ethernet0/0 switch config>port 3 stp enable instance 1
ethernet0/0 switch config>port 4 stp enable instance 1
ethernet0/0 switch config>stp 1 vlan 1
ethernet0/0 switch config>exit
ethernet0/0 config>exit
```

7.6.11.5 BRIDGE-PRIORITY

Configures the priority assigned to the bridge used to form, together with the bridge MAC address, the bridge identifier. The value must be between 0 and 65535. The 12 least significant bits for the priority must be 0. If they aren't, the device rounds them up to the nearest valid priority. Default priority for a port is 32768.

Example:

```
ethernet0/0 switch config>stp 2 bridge-priority 32120
value rounded to 28672
ethernet0/0 switch config>
```

7.6.11.6 FORWARD-DELAY

Configures the time interval that goes by before there is a change in the state of a port (where the bridge has been selected as the Spanning Tree root bridge). Admissible values range from 4 to 30 seconds. Default is 15 seconds.

Example:

```
ethernet0/0 switch config>stp 1 forward-delay 30
ethernet0/0 switch config>
```

Note

When configuring this parameter, ensure the following condition is fulfilled:

2 * (Bridge Forward Delay - 1 second) > Bridge Maximum Age

Configures the maximum time period during which the information received in the Spanning Tree protocol is valid. Admissible values range from 6 to 40 seconds. Default is 20 seconds.

Example:

```
ethernet0/0 switch config>stp 2 max-age 13
ethernet0/0 switch config>
```

Note

When configuring this parameter, ensure the following conditions are fulfilled:

2 * (Bridge Forward Delay - 1 second) > Bridge Maximum Age

Bridge Maximum Age > 2 * (Bridge Hello Time + 1 second)

The Bridge Hello Time value is not configurable. It is set to 2 seconds.

7.6.11.7 PROTOCOL-VERSION

Configures the Spanning Tree protocol version running in the device.

Syntax:

```
ethernetX/X switch config>stp <instance> protocol-version
  stp-compatibility        STP Compatibility Mode
  rstp-normal-operation    RSTP Normal Operation
```

stp-compatibility	Device executes the old Spanning Tree protocol defined in the 802.1D-1998 standard. Spanning Tree BPDUs are used and RSTP (Rapid Spanning Tree Protocol) frames are not sent.
rstp-normal-operation	Device executes the Rapid Spanning Tree protocol. This protocol is an upgrade of the quicker convergence Spanning Tree. This is done by default.

Example:

```
ethernet0/0 switch config>stp 1 protocol-version stp-compatibility
ethernet0/0 switch config>
```

7.6.11.8 TX-HOLD-COUNT

Maximum number of BPDUs sent through a port in one second. Admissible values range from 1 to 10. Default is 6 BPDUs.

Example:

```
ethernet0/0 switch config>stp 2 tx-hold-count 4
ethernet0/0 switch config>
```

7.6.12 EXIT

Exits the switch configuration menu.

Syntax:

```
ethernetX/X switch config>exit
```

Example:

```
ethernet3/0 switch config>exit
ethernet3/0 config>
```

Chapter 8 Switch Monitoring

8.1 Introduction

This chapter describes the switch monitoring commands and includes the following sections:

- Accessing switch monitoring.
- Switch monitoring commands.

8.2 Accessing Switch Monitoring

Some of our devices have a switch that is internally connected to an Ethernet interface. To access switch monitoring, enter **repeat-switch** at the monitoring menu prompt for said Ethernet interface.

Example 1:

```
+configuration
7 interfaces:
Connector     Interface            MAC/Data-Link        Status
LAN1          ethernet0/0          Ethernet/IEEE 802.3  Down
SERIAL0/WAN1  serial0/0            Auto Install         Down
SERIAL1/WAN2  serial0/1            X25                  Down
SERIAL2/WAN3  serial0/2            X25                  Down
BRI/ISDN1     bri0/0               BRI Net              Up
---           x25-node             internal             Up
               SLOT3 ethernet3/0 Ethernet/IEEE 802.3 Up

+network ethernet3/0
--  Ethernet Console  --
ethernet3/0 ETH+repeater-switch
-- Switch Monitoring Console --
ethernet3/0 Switch+
```

Example 2:

```
+configuration
4 interfaces:
Connector     Interface            MAC/Data-Link        Status
LAN1          ethernet0/0          Ethernet/IEEE 802.3  Up
DSL1          atm0/0               ATM                  Down
BRI/ISDN1     bri0/0               BRI Net              Up
---           x25-node             internal             Up
+network ethernet0/0
--  Ethernet Console  --
ethernet0/0 ETH+repeater-switch
-- Switch Monitoring Console --
ethernet0/0 Switch+
```

8.3 Switch Monitoring Commands

The following table summarizes the switch monitoring commands.

Note

Not all commands specified in this section are available for all Ethernet interfaces. Depending on the device, or on the interface you are monitoring, some commands may not appear.

Similarly, the information displayed on executing a command can vary from one interface to another.

Command	Function
? (HELP)	Displays the switch commands or their options.
CLEAR	Deletes information stored in the switch.
DOT1X	Accesses the 802.1X monitoring menu for a switch port.

LIST	Displays different switch operating parameters.
NO	Deactivates previously configured parameters.
PORT-MONITOR	Configures port monitoring.
SNIFF	Configures the type of packets for a port, which must be reflected in the listening port.
SNIFFER-PORT	Configures a port as listening.
SPANNING-TREE	Configures Spanning Tree Protocol parameters.
EXIT	Exits the switch monitoring menu.

8.3.1 ? (HELP)

Displays the available commands and their options.

Syntax:

```
ethernetX/X Switch+?
```

Example:

```
ethernet3/0 Switch+?
  clear            Clear switch options
  dot1x            Access to 802.1X monitoring
  list             Display switch information
  no               Disable sniffer options
  sniff            Select port to sniff
  sniffer-port     Select sniffer port
  spanning-tree    Spanning Tree Protocol
  exit
ethernet3/0 Switch+
```

8.3.2 CLEAR

Deletes information stored in the switch.

Syntax:

```
ethernetX/X Switch+clear ?
  dynamic-mac-table    Dynamic MAC addresses table
  mac-address          MAC into address dynamic table
        <mac>    MAC format
  stats                Port statistics
        <port>               Port number
        cpu-port             CPU connection port
        connection-ports     Device connection ports
        <cr>
  stp                  Spanning Tree Protocol status
        <1..16>              Spanning Tree Protocol instance
               counters      Clears Spanning Tree protocol counters
ethernetX/X Switch+
```

8.3.2.1 CLEAR STATS

Deletes statistics for all switch ports.

Syntax:

```
ethernetX/X Switch+clear stats
```

8.3.2.2 CLEAR STATS CPU-PORT

Deletes statistics for the connection between the switch and the internal port.

Syntax:

```
ethernetX/X Switch+clear stats cpu-port
```

8.3.2.3 CLEAR STATS CONNECTION-PORTS

Deletes statistics for the connection between devices that make up the switch. This is only valid for switches with more than 8 ports.

Syntax:

```
ethernetX/X Switch+clear stats connection-ports
```

8.3.2.4 CLEAR STATS <PORT>

Deletes statistics for a port in the switch.

Syntax:

```
ethernetX/X Switch+clear stats <port identifier>
```

Example:

```
ethernet0/0 Switch+clear stats 1
ethernet0z/0 Switch+
```

Deletes statistics associated to port 1:

8.3.2.5 CLEAR DYNAMIC-MAC-TABLE

Deletes the dynamic table for MAC addresses: deletes the MAC addresses learned by the switch.

Syntax:

```
ethernetX/X Switch+clear dynamic-mac-table
```

8.3.2.6 CLEAR MAC-ADDRESS

Deletes a MAC address from the address table learned by the switch. Deleting a MAC address here may cause issues if access control is enabled in the switch.

Syntax:

```
ethernetX/X Switch+clear mac-address <MAC address>
```

Example:

Deletes MAC address 00-00-E8-3D-26-97 from the address table learned by the switch.

```
ethernet0/0 Switch+clear mac-address 00-00-e8-3d-26-97
Warning!!!
Deleting an entry may result in improper behavior of the access control functionality
Continue (Yes/No)? y
Address 0000E83D2697 deleted
ethernet0/0 Switch+
```

Command history:

Release	Modification
11.00.04	A warning appears when deleting a MAC address as of version 11.00.04.

8.3.2.7 CLEAR STP <instance> COUNTERS

Clears the counters associated to a Spanning Tree protocol instance.

8.3.3 DOT1X

Accesses the 802.1X monitoring menu for a switch port. For further information on 802.1X authentication, please see manual *Teldat Dm783-I 802.1X Authentication* .

Syntax:

```
ethernetX/X Switch+dot1x <port identifier>
```

Example:

Accesses the 802.1X authentication monitoring menu for port 3:

```
ethernet0/0 Switch+dot1x 3
--  802.1X Console  --
ethernet0/0 (port 3) DOT1X+
```

8.3.4 LIST

Displays information on the switch.

Syntax:

```
ethernetX/X Switch+list ?
  access-control       Access Control tables used
  configuration        Ports configuration
        stp                   Spanning Tree Protocol
        vlan                  VLAN
  counters             Internal switch counters
  dynamic-mac-table    Dynamic MAC addresses table
        <port>                Port number
        cpu-port              CPU connection port
        connection-ports      Device connection ports
        <cr>
  mac-table            MAC addresses table
        <port>                Port number
        cpu-port              CPU connection port
        <cr>
  mac-address          Find a MAC into address dynamic table
        <mac>    MAC format
  registers            Display register information
        global                Global switch registers
        physical              Physical switch registers
        port                  Port switch registers
  remote-status        Remote end information
  sniffer              Sniffer status
  static-mac-table     Static MAC addresses table
  stats                Ports statistics
  status               Ports status
  storm-control        Storm control status
  stp                  Spanning Tree Protocol status
  vlan-table           VLAN table
ethernet3/0 Switch+
```

8.3.4.1 LIST ACCESS-CONTROL

Displays information on the entries the software uses for access control in the switch ports.

Syntax:

```
ethernetX/X Switch+list access-control
```

Example:

```
ethernet0/0 Switch+li access-control
Port: CPU
-------
Port: 1
-------
Discarded packets MAC out of limits 0
Learned addresses 0
Port: 2
-------
Discarded packets MAC out of limits 64
Learned addresses 2
Address: 00-a0-26-a6-20-16 VID 1
Address: 00-a0-26-32-00-02 VID 1
Port: 3
```

```
-------
Discarded packets MAC out of limits 0
Learned addresses 0
Port: 4
-------
Discarded packets MAC out of limits 0
Learned addresses 0
Ethernet0/0 Switch+
```

Discarded packets MAC out of limits: Number of discarded packets in a switch port from a MAC that hasn't been learned (i.e., the maximum value specified in the configuration has been reached).

Learned addresses: number of entries learned in the port. Entries that are not in the permitted list are the only ones counted. Using this option only makes sense when the port has a maximum of learned entries configured. It also displays the entry MACs learned.

8.3.4.2 LIST CONFIGURATION STP

Displays the ports configuration on the Spanning Tree protocol.

Syntax:

```
ethernetX/X Switch+list configuration stp
```

Example:

```
ethernet1/0 Switch+list configuration stp

Port   Tx    Rx   Learning
----  ----  ----  --------
 1     Yes   Yes    Yes
 2     Yes   Yes    Yes
 3     Yes   Yes    Yes
 4     Yes   Yes    Yes
 5     Yes   Yes    Yes
ethernet1/0 Switch+
```

The following is listed for each switch port: if transmission is permitted, if reception is permitted and if MAC address learning is permitted.

8.3.4.3 LIST CONFIGURATION VLAN

Displays the configuration for VLANs in the switch ports.

Syntax:

```
ethernetX/X Switch+list configuration vlan
```

Example:

```
ethernet1/0 Switch+list configuration vlan
802.1Q VLAN:                    Disabled
Special TPID:                   Disabled

        Tag        Tag
Port  Insertion  Removal  Membership  PVID  Ingress Filter  Discard Non PVID
----  ---------  -------  ----------  ----  --------------  ----------------
 1        No        No       0x1f     1           No               No
 2        No        No       0x1f     1           No               No
 3        No        No       0x1f     1           No               No
 4        No        No       0x1f     1           No               No
 5        No        No       0x1f     1           No               No
ethernet1/0 Switch+
```

The following fields are displayed:

802.1Q VLAN	Indicates whether the treatment of VLANs is enabled in the switch.
Special TPID	Indicates whether the special tag is enabled in the switch (characteristic used for the Spanning Tree to work).
Tag insertion	Indicates whether the frames are tagged when they exit through the port.

Tag removal	Indicates whether the tags are removed from the frames when they exit through the port.
Membership	VLAN Port mapping. Indicates the ones a certain port can communicate with.
PVID	Default VLAN tag for the port.
Ingress Filter	Indicates whether the frames with a VLAN that isn't a member of the port are dropped.
Discard Non PVID	Indicates whether the frames with a VLAN tag that is different from the one configured by default at the port must be dropped at entry.

8.3.4.4 LIST COUNTERS

Displays the frames sent and received by each switch port. The frames are classified as *unicast*, *multicast* and *broadcast*.

Syntax:

```
ethernetX/X Switch+list counters
```

Example 1:

```
ethernet0/0 Switch+list counters

PORT     *************** IN *****************  *************** OUT *****************
NUMBER      Unicast    Broadcast    Multicast      Unicast    Broadcast    Multicast
 01           43995         4715          665           10            0            0
 02               0            0            0            0            0            0
 03               0            0            0            0            0            0
 04               0            0            0            0            0            0
 05               0            0            0            0            0            0
 06               0            0            0            0            0            0
 07               0            0            0            0            0            0
 08               0            0            0            0            0            0
 09               0            0            0            0            0            0
 10               0            0            0            0            0            0
 11               0            0            0            0            0            0
 12               0            0            0            0            0            0
 13               0            0            0            0            0            0
 14               0            0            0            0            0            0
 15               0            0            0            0            0            0
 16               0            0            0            0            0            0
INT              10            0            0        15058         4715          665
ethernet0/0 Switch+
```

The meaning of the fields is as follows:

Port Number:	Switch port identifier. The INT identifier refers to the internal port (port internally connected to the device).
IN Unicast:	Unicast frames received by a port.
IN Multicast:	Multicast frames received by a port.
IN Broadcast:	Broadcast frames received by a port.
OUT Unicast:	Unicast frames transmitted by a port.
OUT Multicast:	Multicast frames transmitted by a port.
OUT Broadcast:	Broadcast frames transmitted by a port.

Note

Some devices do not support an atomic reading of all counters. If any counters are updated during the reading, an asterisk is shown next to the value of the counter to warn about possible inaccuracies.

Example 2:

```
ethernet0/0 Switch+list counters

PORT     *************** IN *****************  *************** OUT *****************
NUMBER      Unicast    Broadcast    Multicast      Unicast    Broadcast    Multicast
 01             172          798         1104            0            0            0
 02               0            0            0            0            0            0
```

```
 03              0           0           0           0           0           0
 04              0           0           0           0           0           0
 05        5473899*          1*          0     1488147           0           0
CPU        1488371           0           0     5474121*        798*        1104

* Inaccurate value because of counter update during read

ethernet0/0 Switch+
```

Command history:

Release	Modification
11.01.05	An inaccuracy notification has been introduced as of version 11.01.05.

8.3.4.5 LIST DYNAMIC-MAC-TABLE

Displays the table of MAC addresses learned by the switch.

Syntax:

```
ethernetX/X Switch+list dynamic-mac-table
```

Example 1:

```
ethernet3/0 Switch+list dynamic-mac-table
Number of valid entries:   11
Entry  Time stamp  Data ready  Source port  FilterID   MAC ADD
-------------------------------------------------------------------
   1         2          0            4           0     00000C07CCCC
   2         2          0            4           0     0000E28B0336
   3         2          0            4           0     0000E83DA504
   4         2          0            4           0     000102211C46
   5         2          0            4           0     00010233FFFF
   6         1          0            4           0     000102AEA6E6
   7         2          0            4           0     000102DCC74C
   8         2          0            4           0     000102DCCAA5
   9         2          0            4           0     000102DCCAAB
  10         1          0            4           0     000102DCCAE3
  11         2          0            4           0     000102DCCB65
ethernet3/0 Switch+
```

The meaning of the fields is as follows:

Entry:	Entry identifier in the MAC table.
Time stamp:	Internal counter to consider an entry as valid.
Data ready:	Indicates whether the entry is valid (1) or not (0).
Source port:	Switch port through which the MAC address has been learned.
Filter ID:	Identifier used to discriminate between the 16 VLANs that can be defined in the switch.
MAC ADD:	MAC address learned.

Example 2:

```
ethernet0/0 Switch+list dynamic-mac-table
DBNum  Entry  Dev  Prio  PortMap  Port  State  MAC Address
-----------------------------------------------------------
0      1      1    0     0x0001      1  0x1    00005E000103
0      2      1    0     0x0001      1  0x1    000C76CCC47E
0      3      1    0     0x0001      1  0x1    0016E6D3FFF1
0      4      1    0     0x0001      1  0x1    001A4D6B6AB1
0      5      1    0     0x0001      1  0x1    001CF0ECBF0E
0      6      1    0     0x0001      1  0x1    00235431A647
0      7      1    0     0x0001      1  0x1    0023546B5D91
0      8      1    0     0x0001      1  0x1    00A02600AA30
0      9      1    0     0x0001      1  0x1    00A026220601
0      10     1    0     0x0001      1  0x1    00A0262822AA
0      11     1    0     0x0001      1  0x1    00A026329080
0      12     1    0     0x0001      1  0x1    00A02632C568
```

```
0      13     1    0     0x0001      1  0x1    00A02632C578
0      14     1    0     0x0001      1  0x1    00A02632FAA8
0      15     1    0     0x0001      1  0x1    00A0264E004C
0      16     1    0     0x0001      1  0x1    020001110005
0      17     1    0     0x0001      1  0x1    020001110007
0      18     1    0     0x0001      1  0x1    90E6BADF9B88

ethernet0/0 Switch+
```

The meaning of the fields is as follows:

DBNum:	Internal database identifier where the MAC address is located. For VLANs, each VLAN handles a different internal database.
Entry:	Entry identifier in the MAC table.
Dev:	In switches made up of various modules, module identifier.
Prio:	Priority associated to the MAC entry.
PortMap:	Port map for those sending frames with the specified MAC. For dynamic addresses, this corresponds to the port the MAC has been learned through.
Port:	Switch port through which the MAC address has been learned. With static addresses, this field is not active whenever a packet can be transmitted through various ports.
State:	State of the MAC entry.

This value depends on the type of MAC address installed in the table. This can take the following values:

State	**MAC Type**
0x0	Invalid entry.
0x1	Unicast dynamic.
0x8, 0x9, 0xA, 0xB, 0xC,0xD, 0xE, 0xF	Static Unicast.
0x4, 0x5, 0x6, 0x7, 0xC, 0xD, 0xE, 0xF	Static Multicast.
MAC ADD	Learned MAC address.

8.3.4.6 LIST MAC-TABLE

Displays all the MAC addresses learned by the switch.

Syntax:

```
ethernetX/X Switch+list mac-table
```

Example 1:

```
ethernet0/0 Switch+list mac-table

 Entry  Type    FID  PortId        MAC Address  Age Timer
-------------------------------------------------------
    1     D      0       1  00-0c-29-60-1b-ee        220
    2     D      0       1  40-61-86-f7-18-07        300
    3     D      0       1  00-16-e6-38-eb-da        220
    4     D      0       1  3c-d9-2b-56-16-24        180
    5     D      0       1  f0-1f-af-ec-a6-f1        300
```

The meaning of the fields is as follows:

Entry:	Entry identifier in the MAC table.
Type :	Indicates if the entry is static or dynamic address.
FID:	Identifier used to discriminate between the 16 VLANs that can be defined in the switch.
PortId:	Switch port the MAC address has been learned through.
MAC ADD:	Learned MAC address.
Age Timer:	Aging time for MAC address table entries. Ranges from 1 to 3600 seconds.

8.3.4.7 LIST MAC-ADDRESS

Displays the contents of the MAC addresses table associated to a specific MAC address.

Syntax:

```
ethernetX/X Switch+list mac-address <mac>
```

Example:

```
ethernet0/0 Switch+list mac-address 00A0267C0043
DBNum  Entry  Dev  Prio  PortMap  Port  State  MAC Address
------------------------------------------------------------
0      1      1    0     0x0001      1  0x1    00A0267C0043
ethernet0/0 Switch+
```

8.3.4.8 LIST REGISTERS

Displays the content of the switch's internal registers.

Syntax:

```
ethernetX/X Switch+ list registers ?
  global      Global switch registers
  physical    Physical switch registers
  port        Port switch registers
```

global	Switch global registers.
physical	Registers associated to the PHYTER for a switch port.
port	Registers associated to a switch port.

Example:

```
ethernet0/0 Switch+list registers global
Print Global (Set-1) registers device 1
 0 ... e804  0000  0000  0000  440a  1000  0000  0000
 8 ... 0000  0000  0161  4000  0807  00a0  267c  0043
10 ... 0000  0000  5555  5555  aaaa  aaaa  ffff  ffff
18 ... fa50  0000  ffaf  00f4  2001  4c12  0003  fc0d
Print Global (Set-2) registers device 1
 0 ... 0000  0000  ffff  0008  0258  04ff  0208  07ff
 8 ... 0000  3707  0000  1000  07ff  0000  000c  0000
10 ... 0000  0000  0000  0000  0000  0000  0000  0000
18 ... 18e1  78ed  0000  f869  0000  07ff  0000  0000
Print Global (Set-1) registers device 2
 0 ... e854  0000  0000  0000  440a  1000  0000  0000
 8 ... 0000  0000  0161  4000  1007  00a0  267c  0043
10 ... 0000  0000  5555  5555  aaaa  aaaa  ffff  ffff
18 ... fa50  0000  ff8f  00f8  2002  4c12  0000  0000
Print Global (Set-2) registers device 2
 0 ... 0000  0000  ffff  0008  0258  04ff  0000  07ff
 8 ... 0000  3f01  0004  1000  07ff  0000  000c  0000
10 ... 0000  0000  0000  0000  0000  0000  0000  0000
18 ... 1801  78c9  0000  f869  0000  07ff  0000  0000
ethernet0/0 Switch+list registers physical 1
Print PHY registers port 1 (hwport 7)
 0 ... 3100  78ed  0141  0c89  05e1  45e1  0007  2801
 8 ... 0000  0000  0000  0000  0000  0000  0000  0000
10 ... 4130  7c00  6c01  0000  0000  0000  4a34  03fc
18 ... 42bf  0000  0000  0000  0002  0000  0000  0000
ethernet0/0 Switch+list registers port 1
Print PORT registers port 1 (hwport 7, devnum 1)
 0 ... fd06  0003  9f00  0992  007f  0000  077f  0001
 8 ... 0080  0001  8000  0080  0000  0000  0000  9100
10 ... 0000  0000  0000  0000  0000  0000  0000  000f
18 ... 3210  7654  610c  0024  0000  0c84  0022  4444
ethernet0/0 Switch+
```

8.3.4.9 LIST REMOTE-STATUS

Displays information on the status of the remote end connected to each switch port.

Syntax:

```
ethernetX/X Switch+list remote-status
```

Example 1:

```
ethernet3/0 Switch+list remote-status
                Autoneg        Auto-negotiation Advertise
Port  Lnk  MDIX  complete  1000FD  1000HD  100FD  100HD  10FD  10HD  Flow Control
----  ---  ----  --------   ------------------------------------------------------
 1     N     Y      N         -       -       -      -      -     -       -
 2     Y     N      Y         -       -       Y      Y      Y     Y       Y
 3     N     Y      N         -       -       -      -      -     -       -
 4     Y     N      Y         -       -       -      -      -     -       -
 5     Y     N      Y         -       -       -      Y      Y     Y       -
ethernet3/0 Switch+
```

Example 2:

```
ethernet0/0 Switch+list remote-status
                Autoneg                 Auto-negotiation Advertise
Port  Lnk  MDIX  complete  1000FD  1000HD  100FD  100HD  10FD  10HD  Pause  Asym
----  ---  ----  --------  ------------------------------------------------------
  1    Y     N      Y         -       -      Y      Y      Y     Y     Y      -
  2    N     -      N         -       -      -      -      -     -     -      -
  3    N     -      N         -       -      -      -      -     -     -      -
  4    N     -      N         -       -      -      -      -     -     -      -
  5    Y     N      Y         Y       -      Y      Y      Y     Y     -      Y
ethernet0/0 Switch+
```

The meaning of the fields is as follows:

Port: Switch port identifier.

Lnk (Link): Link status, established (Y) or not (N).

MDIX: Indicates if the link uses a crossover cable (Y) or not (N).

Autoneg complete: Indicates if auto-negotiation has completed or not.

Auto-negotiation advertise: Where auto-negotiation has completed, this indicates the capacities advertised by the remote end:

- 1000FD: Remote end advertises it supports links at 1Gbp in Full Duplex mode.
- 1000HD: Remote end advertises it supports links at 1Gbp in Half Duplex mode.
- 100FD: Remote end advertises it supports links at 100Mbp in Full Duplex mode.
- 100HD: Remote end advertises it supports links at 100Mbp in Half Duplex mode.
- 10FD: Remote end advertises it supports links at 10Mbp in Full Duplex mode.
- 10HD: Remote end advertises it supports links at 10Mbp in Half Duplex mode.
- Flow Control: Remote end advertises it supports flow control.
- Pause: Remote end advertises it supports symmetric flow control.
- Asym: Remote end advertises it supports asymmetric flow control.

Command history:

Release	Modification
11.01.05	The "*Pause*" and "*Asym*" options have been introduced as of version 11.01.05.

8.3.4.10 LIST SNIFFER

Displays information on port monitoring configured through **sniffer-port** and **sniff.**

Syntax:

```
ethernetX/X Switch+list sniffer
```

Example:

```
ethernet3/0 Switch+list sniffer
Port  Sniffer Port  Tx Sniff  Rx Sniff
----  ------------  --------  --------
```

```
 1          N           N          Y
 2          N           N          Y
 3          Y           N          N
 4          N           Y          N
 5          N           N          N
ethernet3/0 Switch+
```

The following information is displayed for each port:

Port:	Switch port identifier.
Sniffer Port:	Indicates whether the port is configured as a listening port or not. Only one port can be configured as listening.
Tx Sniff:	Indicates whether the packets transmitted through a port are reflected in the listening port or not.
Rx Sniff:	Indicates whether the packets received through a port are reflected in the listening port or not.

8.3.4.11 LIST STATIC-MAC-TABLE

Displays the MAC addresses table statically configured in the switch.

Syntax:

```
ethernetX/X Switch+list static-mac-table
```

Example:

```
ethernet1/0 Switch+list static-mac-table

Entry  FilterID  Use FID  Override   Forwarding ports       MAC Addr
-----  --------- -------- ---------- ------------------ -----------------
  1        0        No      Yes        5               01-80-c2-00-00-00
ethernet1/0 Switch+
```

The meaning of the fields is as follows:

Entry	Entry identifier in the MAC table.
FilterID	Identifier used to discriminate between the 16 VLANs that can be defined in the switch.
UseFID	Indicates whether or not FilterID should be used when searching for a MAC address in the table.
Override	Indicates whether the Spanning Tree state should be ignored in the ports (transmission enabled or not, reception enabled or not) when dealing with this MAC address.
Forwarding ports	Ports to which frames with this destination MAC are sent.
MAC Addr	Configured MAC address.

In the previous example, the destination address for the BPDUs used in the Spanning Tree protocol had been configured. Said BPDUs are consequently sent to the internal port, which connects to the CPU (regardless of the ports through which BPDUs are received).

8.3.4.12 LIST STATUS

Displays information on the status of each switch port.

Syntax:

```
ethernetX/X Switch+list status
```

Example 1:

```
ethernet3/0 Switch+list status
Switch Status: Operational
Number of resets: 1
                Autoneg                      Auto-negotiation Advertise
Port  Lnk  MDIX  complete  Speed  Duplex  1000FD  1000HD  100FD  100HD  10FD  10HD  Flow Control
----  ---  ----  -------   -----  ------  ------------------------------------------------------
1     N     N      N        -      -      Y       Y       Y       Y      Y     Y        Y
2     N     N      N        -      -      Y       Y       Y       Y      Y     Y        Y
```

```
3     N     N      N        -       -      Y       Y      Y       Y     Y     Y        Y
4     Y     N      Y       10    Half     Y       Y      Y       Y     Y     Y        Y
5     Y     N      Y      100    Half     Y       Y      Y       Y     Y     Y        Y
ethernet3/0 Switch+
```

Example 2:

```
ethernet0/0 Switch+list status
                Autoneg                                    Auto-negotiation Advertise
Port  Lnk  MDIX  complete  Speed  Duplex   FC   1000FD  1000HD  100FD  100HD  10FD  10HD  Pause  Asym
----  ---  ----  --------  -----  ------  ----  ------------------------------------------------------
  1    Y     Y      Y*      1000   Full    N       Y       -      -      -     -     -      Y      -
  2    N     -      N         -      -     -       Y       Y      Y      Y     Y     Y      Y      -
  3    N     -      N         -      -     -       Y       Y      Y      Y     Y     Y      Y      -
  4    N     -      N         -      -     -       Y       Y      Y      Y     Y     Y      Y      -

(*) Port speed has been configured to 1000 Mbps and Auto-Negotiation is mandatory.
ethernet0/0 Switch+
```

The meaning of the fields is as follows:

Switch Status: Switch status, operating or not.

Number of resets: Number of internal switch resets.

Port: Switch port identifier.

Lnk (Link): Link status, established (Y) or not (N).

MDIX:

Indicates whether the switch port is exchanging (Y) the Tx and Rx pairs or not (N).

If the link isn't established, then this value isn't valid.

If the remote end doesn't have an MDI/MDIX feature and the cable is pin to pin, the port exchanges Tx and Rx pairs so a crossover cable is not required.

If the remote end doesn't have the MDI/MDIX feature, then it uses a crossover cable and consequently does not exchange the pairs.

If the remote end has the MDI/MDIX feature (with a crossover cable or not) the result is undetermined. Either one of the ends can be crossed.

Autoneg complete: Indicates if the auto-negotiation has completed or not. Whenever auto-negotiation is disabled, this is indicated with a hyphen (' - '). When the speed is forced to 1000Mbps, an '*' appears with the following message below the table "(*) Port speed has been configured to 1000 Mbps and Auto-Negotiation is mandatory." to indicate that the standard is obeyed.

Speed: Whenever auto-negotiation has completed or is disabled, this option indicates the link speed in Mbps.

Duplex: Whenever auto-negotiation has completed or is disabled, this option indicates the link duplex mode.

FC:

Whenever auto-negotiation has completed or is disabled, this indicates the flow control mode.

- N: no flow control.
- Rx: asymmetric flow control on incoming path. Pause frames are received and dispatched, thus enabling or disabling transmission accordingly. No Pause frames are transmitted.
- Tx: asymmetric flow control on outgoing path. Pause frames are transmitted on congestion. Received Pause frames are ignored.
- Y: symmetric flow control, on both incoming and outgoing paths.

Auto-negotiation advertise: Indicates the capacities advertised by the switch:

- 1000FD: switch advertises it supports links at 1Gbps in Full Duplex mode.
- 1000HD: switch advertises it supports links at 1Gbps in Half Duplex mode.
- 100FD: switch advertises it supports links at 100Mbps in Full Duplex mode.
- 100HD: switch advertises it supports links at 100Mbps in Half Duplex mode.
- 10FD: switch advertises it supports links at 10Mbps in Full Duplex mode.
- 10HD: switch advertises it supports links at 10Mbps in Half Duplex mode.

- Flow Control: switch advertises it supports flow control.
- Pause: switch advertises it supports symmetric flow control.
- Asym: switch advertises it supports asymmetric flow control.

Command history:

Release	Modification
11.01.05	The "*FC*", "*Pause*" and "*Asym*" options have been introduced as of version 11.01.05.

8.3.4.13 LIST STATS

Displays statistics on a switch port.

Syntax:

```
ethernetX/X Switch+list stats <port identifier>
```

Example 1:

```
ethernet3/0 Switch+list stats 4
Port: 4
-------
rx_lo_priority_byte ..... 229330857
rx_hi_priority_byte ..... 0
rx_undersize_pkt ..... 0
rx_fragments ..... 0
rx_oversize ..... 0
rx_jabbers ..... 0
rx_symbol_error ..... 0
rx_crc_error ..... 1
rx_alignment_error ..... 0
rx_control_8808_pkts ..... 0
rx_pause_pkts ..... 0
rx_broadcast ..... 205113
rx_multicast ..... 1134065
rx_unicast ..... 409052
rx_64_octets ..... 180378
rx_65_to_127_octets ..... 1448751
rx_128_to_255_octets ..... 10724
rx_256_to_511_octets ..... 13615
rx_512_to_1023_octets ..... 4718
rx_1024_to_1522_octets ..... 90348
tx_lo_priority_byte ..... 65313
tx_hi_priority_byte ..... 0
tx_late_collision ..... 0
tx_pause_pkts ..... 0
tx_broadcast ..... 84
tx_multicast ..... 569
tx_unicast ..... 251
tx_deferred ..... 7
tx_total_collision ..... 10261
tx_excessive_collision ..... 629
tx_single_collision ..... 150
tx_multiple_collision ..... 12
tx_drop_packets ..... 0
rx_drop_packets ..... 0
Info_last_change ..... 1175
ethernet3/0 Switch+
```

The meaning of the fields is as follows:

rx_lo_priority_byte:	Bytes received with low priority, including packets with errors.
rx_hi_priority_byte:	Bytes received with high priority, including packets with errors.
rx_undersize_pkt:	Undersized packets received with correct CRC.
rx_fragments:	Fragments received with CRC, alignment or symbol errors.
rx_oversize:	Oversized packets received with correct CRC.
rx_jabbers:	Oversized packets received with CRC, alignment or symbol errors.

rx_symbol_error:	Packets received with symbol error and admitted size.
rx_crc_error:	Packets received with CRC error.
rx_alignment_error:	Packets received with alignment error.
rx_control_8808_pkts:	Control packets received (EtherType=0x8808).
rx_pause_pkts:	PAUSE packets received.
rx_broadcast:	Correct broadcast packets received.
rx_multicast:	Correct multicast packets received.
rx_unicast:	Correct unicast packets received.
rx_64_octets:	Total packets received with length equal to 64 octets.
rx_65_to_127_octets:	Total packets received with lengths between 65 and 127 octets.
rx_128_to_255_octets:	Total packets received with lengths between 128 and 255 octets.
rx_256_to_511_octets:	Total packets received with lengths between 256 and 511 octets.
rx_512_to_1023_octets:	Total packets received with lengths between 512 and 1023 octets.
rx_1024_to_1522_octets:	Total packets received with lengths between 1024 and 1522 octets.
tx_lo_priority_byte:	Bytes transmitted with low priory, including packets with errors.
tx_hi_priority_byte:	Bytes transmitted with high priory, including packets with errors.
tx_late_collision:	Packets transmitted where a collision has been detected after sending 512 bits.
tx_pause_pkts:	PAUSE packets transmitted.
tx_broadcast:	Broadcast packets transmitted.
tx_multicast:	Multicast packets transmitted.
tx_unicast:	Unicast packets transmitted.
tx_deferred:	Packets transmitted after deferring transmission due to the media being busy at the time of transmission.
tx_total_collision:	Total number of detected collisions. Only valid in half duplex mode.
tx_excessive_collision:	Packets not transmitted due to excessive collisions.
tx_single_collision:	Packets transmitted after a single collision.
tx_multiple_collision:	Packets transmitted after multiple collisions.
tx_drop_packets:	Packets not transmitted due to lack of resources.
rx_drop_packets:	Packets not received due to lack of resources.
Info_last_reset:	Seconds elapsed since the last switch reset.

Example 2:

```
ethernet0/0 Switch+list stats 1
Port:    1
----------
INPUT COUNTERS
InUnicasts             85632   InBroadcasts            8490
InPause                    0   InMulticasts            1922
InFCSErr                   0   AlignErr                   0
InGoodOctets        78807398   InBadOctets              421
Undersize                  0   Fragments                 31
In64Octets             32794   In127Octets             4790
In255Octets              580   In511Octets              410
In1023Octets           11720   InMaxOctets            45750
Jabber                     0   Oversize                   0
InDiscards                 0   Filtered               73468
OUTPUT COUNTERS
OutUnicasts                2   OutBroadcasts              0
OutPause                   0   OutMulticasts              0
OutFCSErr                  0   OutGoodOctets            174
Out64Octets                1   Out127Octets               1
Out255Octets               0   Out511Octets               0
Out1023Octets              0   OutMaxOctets               0
Collisions                 0   Late                       0
Excessive                  0   Multiple                   0
Single                     0   Deferred                   0
OutFiltered                0
ethernet0/0 Switch+
```

The meaning of the fields is as follows:

InUnicasts:	Unicast packets received.
InBroadcasts:	Broadcast packets received.
InPause:	Pause packets received.
InMulticasts:	Multicast packets received.
InFCSErr:	Packets received with CRC error.
AlignErr:	Packets received with alignment errors.
InGoodOctets:	Bytes received without errors.
InBadOctets:	Bytes received with errors.
Undersize:	Undersized packets received with correct CRC.
Fragments:	Fragments received with CRC, alignment or symbol errors.
In64Octets:	Total packets received with a length equal to 64 octets.
In127Octets:	Total packets received with lengths between 65 and 127 octets.
In255Octets:	Total packets received with lengths between 128 and 255 octets.
In511Octets:	Total packets received with lengths between 256 and 511 octets.
In1023Octets:	Total packets received with lengths between 512 and 1023 octets.
InMaxOctets:	Total packets received with lengths between 1024 octets and the maximum permitted frame.
Jabber:	Oversized packets with CRC, alignment or symbol errors.
Oversize:	Oversized packets received with correct CRC.
InDiscards:	Packets discarded due to lack of resources at the switch.
Filtered:	If VLAN is not enabled in the port, this indicates the number of packets received that were not forwarded to another port. If VLAN is enabled in the port, this indicates the number of packets that have been dropped due to an unknown VLAN identifier.
OutUnicasts:	Unicast packets transmitted.
OutBroadcasts:	Broadcast packets transmitted.
OutPause:	Pause packets transmitted.
OutMulticasts:	Multicast packets transmitted.
OutFCSErr:	Packets transmitted with CRC error.
OutGoodOctets:	Bytes transmitted.
Out64Octets:	Packets transmitted with a 64 byte length.
Out127Octets:	Packets transmitted with a length between 65 and 127 bytes.
Out255Octets:	Packets transmitted with a length between 128 and 255 bytes.
Out511Octets:	Packets transmitted with a length between 256 and 511 bytes.
Out1023Octets:	Packets transmitted with a length between 512 and 1023 bytes.
OutMaxOctets:	Packets transmitted with a length between 1024 and 1522 bytes.
Collisions:	Total number of detected collisions. Only logical in half duplex mode.
Late:	Number of late detected collisions.
Excessive:	Packets not transmitted due to excessive collisions.
Multiple:	Packets transmitted after multiple collisions.
Single:	Packets transmitted after a single collision.
Deferred:	Packets transmitted after deferring transmission due to the media being busy at the time of transmission.
OutFiltered:	Packets filtered at the output.

Note

Some devices do not support an atomic reading of all counters. If any counters are updated during the reading, an asterisk is shown next to the value of the counter to warn about possible inaccuracies.

8.3.4.14 LIST STATS CPU-PORT

Displays the statistics for the switch port connected to the CPU.

Syntax:

```
ethernetX/X Switch+list stats cpu-port
```

Example 1:

```
ethernet0/2 Switch+list stats cpu-port
Port:  CPU
----------
InGoodOctetsHi             0    InGoodOctetsLo             0
InBadOctets                0    OutFCSErr                  0
InUnicasts                 0    Deferred                   0
InBroadcasts               0    InMulticasts               0
64Octets                 297    127Octets                629
255Octets                 66    511Octets                 17
1023Octets              8746    MaxOctets                  0
OutOctetsHi                0    OutOctetsLo          4962585
OutUnicasts             9184    Excessive                  0
OutMulticasts             62    OutBroadcasts            509
Single                     0    OutPause                   0
InPause                    0    Multiple                   0
Undersize                  0    Fragments                  0
Oversize                   0    Jabber                     0
InMACRcvErr                0    InFCSErr                   0
Collisions                 0    Late                       0
```

The values listed have the same meaning as those displayed through **list stats**.

8.3.4.15 LIST STATS CONNECTION-PORTS

Displays the statistics for the ports that interconnect with the different chips that make up the switch. This only appears when the switch has more than 8 ports.

Syntax:

```
ethernetX/X Switch+list stats connection-ports
```

Example 1:

```
ethernet0/2 Switch+list stats connection-ports
Port: Nxt1
----------
InGoodOctetsHi             0    InGoodOctetsLo             0
InBadOctets                0    OutFCSErr                  0
InUnicasts                 0    Deferred                   0
InBroadcasts               0    InMulticasts               0
64Octets                2181    127Octets                2239
255Octets                487    511Octets                 107
1023Octets             20058    MaxOctets                  0
OutOctetsHi                0    OutOctetsLo         11626563
OutUnicasts            21048    Excessive                  0
OutMulticasts            455    OutBroadcasts           3569
Single                     0    OutPause                   0
InPause                    0    Multiple                   0
Undersize                  0    Fragments                  0
Oversize                   0    Jabber                     0
InMACRcvErr                0    InFCSErr                   0
Collisions                 0    Late                       0

Port: Prv2
----------
InGoodOctetsHi             0    InGoodOctetsLo      11627084
InBadOctets                0    OutFCSErr                  0
InUnicasts             21048    Deferred                   0
InBroadcasts            3573    InMulticasts             455
64Octets                2181    127Octets                2242
255Octets                488    511Octets                 107
1023Octets             20058    MaxOctets                  0
OutOctetsHi                0    OutOctetsLo                0
OutUnicasts                0    Excessive                  0
```

```
OutMulticasts              0    OutBroadcasts              0
Single                     0    OutPause                   0
InPause                    0    Multiple                   0
Undersize                  0    Fragments                  0
Oversize                   0    Jabber                     0
InMACRcvErr                0    InFCSErr                   0
Collisions                 0    Late                       0
```

The values listed have the same meaning as those displayed through **list stats.**

The first group represents the statistics for chip controlling ports 1-8. The second refers to ports 9-16.

Note

Some devices do not support an atomic reading of all counters. If any counters are updated during the reading, an asterisk is shown next to the value of the counter to warn about possible inaccuracies.

8.3.4.16 LIST STORM-CONTROL

Displays the traffic storm control configuration. The value of the bandwidth displayed is the real value used in the switch. In some cases, due to hardware limitations, this value can be different to the one configured.

Syntax:

```
ethernetX/X Switch+list storm-control
```

Example 1:

```
ethernet0/0 Switch+list storm-control
Port       Packets          Level
----   ---------------   ----------
  1               Bcst   0 Kbps
  2               Bcst   32000 Kbps
  3                All   0 Kbps
  4                All   0 Kbps
  5                All   0 Kbps
  6                All   0 Kbps
  7                All   0 Kbps
  8                All   0 Kbps
  9                All   0 Kbps
 10                All   0 Kbps
 11                All   0 Kbps
 12                All   0 Kbps
 13                All   0 Kbps
 14                All   0 Kbps
 15                All   0 Kbps
 16                All   0 Kbps
ethernet0/0 Switch+
```

Example 2:

```
ethernet2/0 Switch+list storm-control
Port       Packets          Level
----   ---------------   ---------
  1           Disabled       0.00%
  2           Disabled       0.00%
  3           Disabled       0.00%
  4           Disabled       0.00%
ethernet2/0 Switch+
```

8.3.4.17 LIST STP

Displays information from the Spanning Tree protocol.

Syntax:

```
ethernetX/X Switch+list stp <instance>
  configuration    Lists configuration information about the Spanning Tree
                   protocol
```

```
  counters          Lists counters related to the Spanning Tree protocol
  state             Lists the state of the Spanning Tree protocol
  tree              Lists current information about the Spanning Tree protocol
  detail            Lists detailed information about operation of the Spanning
                    Tree protocol
```

8.3.4.18 LIST STP CONFIGURATION

Displays information on the Spanning Tree protocol.

Example:

```
ethernet0/0 Switch+list stp 1 configuration
Bridge ID (prio/add):  28672/00-a0-26-44-03-38
Vlan:                  100
Maximum age:           20.000 seconds
Hello time:            2.000 seconds
Forward delay:         15.000 seconds
Transmit Hold Count:   6
Migrate Time:          3 seconds

Port  Interface      Priority          Cost      State
   1  ethernet0/0         128       2000000      Enabled
   2  ethernet0/0         128        200000      Enabled
ethernet0/0 Switch+
```

Bridge ID (prio/add)	Bridge identifier. Bridge priority and MAC address are displayed.
VlanID	Parameter value for the bridge Vlan ID if PVST is configured for this instance.
Maximum age	Parameter value for the maximum age used by the Spanning Tree protocol. This indicates the maximum time the information received in a BPDU is valid.
Hello Time	Parameter value for the *Hello Time* used by the Spanning Tree protocol. Indicates how often the Hello BPDUs are sent.
Forward Delay	Parameter value for the *Forward Delay* used by the Spanning Tree protocol. Indicates the wait time in the *Learning* state before passing to a *Forwarding* state.
Transmit Hold Count	Parameter value for the *Transmit Hold Count* used by the Spanning Tree protocol. Indicates the maximum number of BPDUs that can be sent by a port in one second.
Migrate Time	Parameter value for the *Migrate Time* used by the Spanning Tree protocol. This parameter is used to initiate the counters that control whether Rapid Spanning Tree BPDUs or Spanning Tree should be used, and if a port can be considered as a port directly connected to a station (*edge-port*).
Port	Port identifier.
Interface	Interface associated to the port.
Priority	Port priority.
Cost	Cost associated to the port in the Spanning Tree.
State	Port state: active or not.

8.3.4.19 LIST STP COUNTERS

Displays the counters associated to the Spanning Tree protocol.

Example:

```
ethernet0/0 Switch+list stp 1 counters
BPDUs received:                         0
        Dropped:                        0
        Errs:                           0
        Config:                         0
        TCN:                            0
        RST:                            0
BPDUs sent:                            30
        Dropped:                        0
        Errs:                           0
        Config:                         0
        TCN:                            0
```

```
       RST:                              30

Port  Interface                          BPDUs rcv
----  ----------------  ------------------------------------------------------
                           Total     Drop      Err       TCN     Conf      RST
   1  ethernet0/0               0        0        0         0        0        0
   2  ethernet0/0               0        0        0         0        0        0

Port  Interface                          BPDUs xmt
----  ----------------  ------------------------------------------------------
                           Total        Err        TCN        Conf        RST
   1  ethernet0/0              15          0          0          0         15
   2  ethernet0/0              15          0          0          0         15

Port  Interface         Forward transitions
----  ----------------  -------------------
   1  ethernet0/0       1
   2  ethernet0/0       1
ethernet0/0 Switch+
```

BPDUs received	Number of protocol frames received. The total number of BPDUs is displayed, both globally and per interface. In addition, a breakdown of these is shown: BPDUs dropped (*Dropped*), received with errors (*Errs*), configuration BPDUs (*Config*), topology change notification BPDUs (*TCN*) and the Rapid Spanning Tree protocol BPDUs (*RST*).
BPDUs sent	Number of protocol frames sent. The total number of BPDUs is displayed, both globally and per interface. In addition, a breakdown of these is shown: BPDUs transmitted with errors (*Errs*), configuration BPDUs (*Config*), topology change notification BPDUs (*TCN*) and the Rapid Spanning Tree protocol BPDUs (*RST*).
Forward transitions	Number of times the port has switched to a *Forwarding* state.

8.3.4.20 LIST STP DETAIL

Displays detailed information on the Spanning Tree protocol function. This command displays the state of all internal variables used while the Spanning Tree protocol is running.

Syntax:

```
ethernet0/0 Switch+list stp 1 detail ?
  bridge    Lists information about Spanning Tree protocol related to the bridge
  port      Lists information about Spanning Tree protocol related to a specific port
  all       Lists all the information about the Spanning Tree protocol
```

bridge	Displays information on the Spanning Tree that is globally relevant for the bridge (Spanning Tree instance).
port	Displays information on the Spanning Tree relative to a specific port.
all	Displays all information on the Spanning Tree.

Example:

```
ethernet0/0 Switch+list stp 1 detail all
               ----------------
               Brige Parameters
               ----------------
Bridge Id ....................... 32768/00-a0-26-44-03-38
rstpBEGIN ....................... FALSE
rstp_sched ...................... FALSE
Bridge Message Age .............. 0.000
Bridge Max Age .................. 20.000
Bridge Hello Time ............... 2.000
Bridge Forward Delay ............ 15.000
Transmit Hold Count ............. 6
Force Protocol Version .......... 2 (RSTP Normal Operation)
BPDU filtering .................. enabled by default
BPDU guard ...................... enabled by default
Root priority vector:
       RootBridgeID ............. 32768/00-a0-26-44-03-38
```

```
        RootPathCost ............ 0
        DesignatedBridgeId ...... 32768/00-a0-26-44-03-38
        DesignatedPortID ........ 0 (0/0)
        BridgePortID ............ 0 (0/0)
Root times:
        Message Age ............. 0.000
        Max Age ................. 20.000
        Hello Time .............. 2.000
        Forward Delay ........... 15.000
State Machines:
        Bridge role selection ... ROLE_SELECTION
more ? y
                ---------------
                Port Parameters
                ---------------
Port 1
        Port priority ..................... 128
        MAC Operational ................... Yes
        Administrative state .............. Enabled
        AuthControlledPortStatus .......... Authorized
        Operational Point To Point MAC .... Not Point To Point
        Admin Point To Point MAC .......... Auto
        Port enabled ...................... Yes
        BPDU filtering .................... enabled
        BPDU guard ........................ disabled (by default)
        Port path cost .................... 2000000
        Oper Edge ......................... Non Edge
        Rcv BPDU .......................... No
        Rcv RSTP .......................... No
        Rcv STP ........................... Yes
        Rcv msg ........................... No
        Send RSTP ......................... No
        Rcv info .......................... No
        mcheck ............................ No
        newInfo ........................... No
        Tx Count .......................... 0
        role .............................. Designated
        selectedRole ...................... Designated
        infoIs ............................ Mine
        learn ............................. Yes
        learning .......................... Yes
        forward ........................... Yes
        forwarding ........................ Yes
        sync .............................. No
        synced ............................ No
        proposing ......................... No
        proposed .......................... No
        agree ............................. No
        agreed ............................ No
        disputed .......................... No
        reselect .......................... No
        selected .......................... Yes
        updtInfo .......................... No
        reRoot ............................ No
        fdbFlush .......................... No
        tcAck ............................. No
        rcvdTc ............................ No
        rcvdTcn ........................... No
        rcvdTcAck ......................... No
        tcProp ............................ No
        AdminEdge ......................... No
        AutoEdge .......................... No
        Ageing Time ....................... 320
        rapid Ageing ...................... No
        Port priority vector:
                RootBridgeID .............. 32768/00-a0-26-44-03-38
                RootPathCost .............. 0
```

```
                DesignatedBridgeId ........ 32768/00-a0-26-44-03-38
                DesignatedPortID .......... 32769 (128/1)
                BridgePortID .............. 32769 (128/1)
        Port times:
                Message Age ............... 0.000
                Max Age ................... 20.000
                Hello Time ................ 2.000
                Forward Delay ............. 15.000
        Designated priority vector:
                RootBridgeID .............. 32768/00-a0-26-44-03-38
                RootPathCost .............. 0
                DesignatedBridgeId ........ 32768/00-a0-26-44-03-38
                DesignatedPortID .......... 32769 (128/1)
                BridgePortID .............. 0 (0/0)
        Designated times:
                Message Age ............... 0.000
                Max Age ................... 20.000
                Hello Time ................ 2.000
                Forward Delay ............. 15.000
        Message priority vector:
                RootBridgeID .............. 32768/00-17-0e-82-e6-c2
                RootPathCost .............. 0
                DesignatedBridgeId ........ 32768/00-17-0e-82-e6-c2
                DesignatedPortID .......... 32769 (128/1)
                BridgePortID .............. 32769 (128/1)
        Message times:
                Message Age ............... 0.000
                Max Age ................... 20.000
                Hello Time ................ 2.000
                Forward Delay ............. 15.000
        Timers:
                edgeDelayWhile ............ 0
                fdWhile ................... 0
                helloWhen ................. 1
                mdelayWhile ............... 0
                rbWhile ................... 0
                rcvdInfoWhile ............. 0
                rrWhile ................... 0
                tcWhile ................... 0
        Machine State Status:
                Receive State Machine ..... RECEIVE
                Receive State Machine ..... RECEIVE
                Transmit State Machine ..... IDLE
                Protocol Migration State Machine ... SENSING
                Bridge Detection State Machine ..... NOT_EDGE
                Port Information State Machine ..... CURRENT
                Role Transitions State Machine ..... DESIGNATED_PORT
                State Transition State Machine ..... FORWARDING
                Topology Change State Machine ...... ACTIVE
more ? n

ethernet0/0 Switch+
```

8.3.4.21 LIST STP STATE

Displays information on the current state of the Spanning Tree protocol.

Example:

```
ethernet0/0 Switch+list stp 1 state
Designated root (prio/add):    32768/00-a0-26-44-03-38
Vlan:                          100
Root cost:                     0
Root port:                     1 (ethernet0/0)
Current (root) Maximum Age:    20.000 seconds
Current (root) Hello Time:     2.000 seconds
Current (root) Forward Delay:  15.000 seconds
```

```
Port      Interface         State         Role
   1      ethernet0/0       Forwarding    Designated
   2      ethernet0/0       Forwarding    Designated
ethernet0/0 Switch+
```

Designated root	Identifier for the bridge selected as root bridge by the Spanning Tree protocol.
VlanID	Vlan ID for the bridge if PVST is used for this instance.
Root cost	Cost associated to the path to the root bridge.
Root port	Identifier for the port selected as root port in this bridge. When the bridge has been selected as root bridge, *Self* is displayed to indicate there is no root port.
Current maximum age	Value of the *Max Age* parameter shown by the root bridge.
Current hello time	Value of the *Hello Time* parameter shown by the root bridge.
Current Forward Delay	Value of the *Forward Delay* parameter shown by the root bridge.
Port	Port identifier.
Interface	Interface associated to the port.
State	State of the port when it comes to the Spanning Tree protocol: *Discarding*, if it drops received packets; *Learning*, if it doesn't process the received packets but does use them to learn MAC addresses; *Forwarding* , if it processes the received packets; and *Undefined*, if it doesn't do any of the previous actions.
Role	Role the port plays in the Spanning Tree protocol. It can be *Disabled*, when the port is disabled, *Designated*, for a designated port, *Root*, for a root port, *Alternate*, for an alternate port, *Backup*, for a backup port.

8.3.4.22 LIST STP TREE

Displays the current information on the Spanning Tree, including information on the port, the interface and the cost.

Example:

```
ethernet0/0 Switch+list stp 1 tree
Port                              Designated  Desig.             Designated Des.
 N. Interface                           Root   Cost                  Bridge Port
 1 ethernet0/0      32768/00-a0-26-40-0c-e4      0 32768/00-a0-26-40-0c-e4 80-01
 2 ethernet0/0      32768/00-a0-26-40-0c-e4      0 32768/00-a0-26-40-0c-e4 80-02
ethernet0/0 Switch+
```

Port	Port identifier.
Interface	Interface associated to the port.
Designated root	Designated root bridge identifier for the LAN to which the port is connected.
Designated cost	Cost associated to the path to the root bridge for the LAN to which the port is connected.
Designated Bridge	Designated bridge identifier for the LAN to which the port is connected.
Designated Port	Designated port identifier for the LAN to which the port is connected.

8.3.4.23 LIST VLAN-TABLE

Displays the VLAN table.

Syntax:

```
ethernetX/X Switch+list vlan-table
```

Example 1:

```
ethernet3/0 Switch+list vlan-table
Entry  Membership  FilterID  VlanID
-----------------------------------
   1      0x1F         0        1
   2      0x1F         0        1
   3      0x1F         0        1
   4      0x1F         0        1
   5      0x1F         0        1
   6      0x1F         0        1
   7      0x1F         0        1
   8      0x1F         0        1
```

```
   9      0x1F         0        1
  10      0x1F         0        1
  11      0x1F         0        1
  12      0x1F         0        1
  13      0x1F         0        1
  14      0x1F         0        1
  15      0x1F         0        1
  16      0x1F         0        1
ethernet3/0 Switch+
```

The meaning of the fields is as follows:

Entry:	Entry identifier in the MAC table.
Membership:	Bits map indicating what ports are associated to the VLAN.
Filter ID:	Identifier used to discriminate between the 16 VLANs. It can be defined in the switch.
VLAN ID:	VLAN identifier.

Example 2:

```
ethernet0/0 Switch+list vlan-table

VID:   1 SID:   5 Members: Internal, 1, 2, 3, 4,
VID:  20 SID:   2 Members: Internal, 2, 4,
VID:  21 SID:   3 Members: Internal, 2, 4,
VID:  30 SID:   4 Members: Internal, 2, 4,

ethernet0/0 Switch+
```

The VLANs, configured in the switch, are displayed together with information on the ports.

8.3.5 NO

Resets parameters that had been previously configured.

Syntax:

```
ethernetX/X Switch+no ?
  sniff           Sniffed port
  sniffer-port    Sniffer port
ethernetX/X Switch+
```

8.3.5.1 NO SNIFFER-PORT

Disables the monitoring functionality for the ports enabled through **sniffer-port.**

Syntax:

```
ethernetX/X Switch+no sniffer-port
```

Example:

```
ethernet3/0 Switch+no sniffer-port
ethernet3/0 Switch+
```

8.3.5.2 NO SNIFF

Disables, in a switch port, the reflection of packets received or transmitted in the port configured as the listening port.

Syntax:

```
ethernetX/X Switch+no sniff <option> <port identifier>
  receive     Reception
  transmit    Transmission
ethernetX/X Switch+
```

To stop packets received by a port from being mirrored in the listening port, enter **no sniff receive.**

To stop packets transmitted by a port from being mirrored in the listening port, enter **no sniff transmit.**

Example:

Removes port 2 transmission and reception monitoring.

```
ethernet3/0 Switch+no sniff receive 2
ethernet3/0 Switch+no sniff transmit 2
ethernet3/0 Switch+
```

8.3.6 PORT-MONITOR

Configures monitoring for a switch port.

Syntax:

```
ethernetX/X Switch+port-monitor ?
  disable    Disable port monitor
  enable     Enable port monitor
ethernetX/X Switch+
```

8.3.6.1 PORT-MONITOR DISABLE

Disables the monitoring function for ports enabled with **port-monitor enable**. This command disables monitoring in all switch ports.

Syntax:

```
ethernetX/X Switch+port-monitor disable
```

Example:

```
ethernet0/0 Switch+port-monitor disable
Port Monitoring disabled on all ports
ethernet0/0 Switch+
```

8.3.6.2 PORT-MONITOR ENABLE

Configures the ports monitoring function. You need to specify a monitored port and a monitoring port so that everything the monitored port sends and receives is reflected in the monitoring port.

Syntax:

```
ethernetX/X Switch+port-monitor enable <monitored port><monitoring port>
```

Example:

The switch is configured so that the traffic from the internal port (port 0) is reflected in port 5.

```
ethernet0/0 Switch+port-monitor enable 0 5
Port Monitoring enabled
ethernet0/0 Switch+
```

8.3.7 SNIFF

Configures the type of packet for a port that must be reflected in the listening port. The listening port is configured by entering **sniffer-port**.

Syntax:

```
ethernetX/X Switch+sniff <option> <port identifier>
  receive     Reception
  transmit    Transmission
ethernetX/X Switch+
```

To enable the reflection of packets received by a port in the listening port, enter **sniff receive.**

To enable the reflection of packets transmitted by a port in the listening port, enter **sniff transmit**.

Example:

You want to monitor the traffic port 3 sends and receives. To do this, use port 2 as the listening port.

```
ethernet3/0 Switch+sniffer-port 2
```

```
ethernet3/0 Switch+sniff receive 3
ethernet3/0 Switch+sniff transmit 3
ethernet3/0 Switch+list sniffer
Port  Sniffer Port  Tx Sniff  Rx Sniff
----  ------------  --------  --------
 1         N           N         N
 2         Y           N         N
 3         N           Y         Y
 4         N           N         N
 5         N           N         N
ethernet3/0 Switch+
```

8.3.8 SNIFFER-PORT

Configures a port as a listening port. Through **sniff,** indicate what type of packets you wish to reflect in the port configured as the listening port. This can prove useful to analyze traffic leaving through a certain port.

Syntax:

```
ethernetX/X Switch+sniffer-port <port identifier>
```

Example:

You want to monitor traffic sent and received through port 2 and traffic sent through port 4. To do so, use port 1 as the listening port.

```
ethernet3/0 Switch+sniffer-port 1
ethernet3/0 Switch+sniff receive 2
ethernet3/0 Switch+sniff transmit 2
ethernet3/0 Switch+sniff transmit 4
ethernet3/0 Switch+list sniffer
Port  Sniffer Port  Tx Sniff  Rx Sniff
----  ------------  --------  --------
 1         Y           N         N
 2         N           Y         Y
 3         N           N         N
 4         N           Y         N
 5         N           N         N
ethernet3/0 Switch+
```

8.3.9 SPANNING TREE

Options associated to the Spanning Tree protocol.

Syntax:

```
ethernet0/0 Switch+spanning-tree
  force-bpdu-migration-check    Forces BPDU migration check
```

8.3.9.1 SPANNING-TREE FORCE-BPDU-MIGRATION-CHECK

Forces *RSTP BPUD* frames to be sent in the port specified during the migration time. Consequently, a check is carried out to make sure there are no STP bridges in the LAN and that RSTP BPDU frames can be sent through said port.

Syntax:

```
ethernet0/0 Switch+spanning-tree force-bpdu-migration-check <port-number>
```

Example:

```
ASRT Main Bridge+spanning-tree force-bpdu-migration-check 1
```

8.3.10 EXIT

Exits the switch monitoring menu.

Syntax:

```
ethernetX/X Switch+exit
```

Example:

```
ethernet3/0 Switch+exit
ethernet3/0 ETH+
```

Chapter 9 Ethernet OAM Configuration

9.1 Introduction

Ethernet OAM (Operations, Administration and Maintenance, IEEE 802.3 ah EFM) is a layer 2 protocol (designed as a sublayer in the link layer, in accordance with the OSI model) that provides performance monitoring, remote failure indication and loopback testing in an Ethernet link. It is meant to operate in full-duplex point-to-point Ethernet links in EFM (Ethernet in the First Mile) environments.

9.1.1 Ethernet OAM: Main operating points

The Ethernet OAM protocol doesn't generate a significant traffic load in Ethernet interfaces, as it requires little bandwidth to operate (it's known as a slow protocol).

The protocol starts with a discovery phase where a local station transmits OAM information packets (OAMPDUs), describing the functionalities and the configuration of the local OAMs. At the same time, it detects the presence of a remote OAM station by receiving OAMPDUs from the other end of the link. This phase provides the opportunity for both stations to accept or reject the OAM configuration available at the remote station.

Amongst the information exchanged during the discovery phase, the following is worth noting:

- Operating mode: active or passive.
- Available operations: link and remote loopback monitoring, etc.
- Maximum size allowed for an OAMPDU.
- Platform identification.

Once the OAM session is established, both stations must send information OAMPDUs to maintain the session. If OAMPDUs are not received after a certain time, an OAM station restarts the OAM session and returns to the discovery phase.

An OAM station can operate in two modes: active and passive. Only an active station can start the discovery phase by sending an information OAMPDU. Therefore, a station configured as passive must wait to receive an information OAMPDU to start transmitting OAMPDUs with local information. An OAM session is also possible with both link stations in active mode.

An OAM station in passive mode must fulfill certain rules. The following should be noted:

- It must wait for the remote station to start the discovery phase (as already commented).
- Control commands in loopback mode cannot be sent from the remote station.
- It cannot send MIB variable petitions.

One of the main points of Ethernet OAM is *link monitoring*. This feature is implemented through the sending of event notification OAMPDUs, which contain information on the traffic-related error statistics received in the interface. These statistics often contain the received frame and symbol errors. Likewise, there are flags reserved in an OAMPDU used to advise the remote station on critical events in the link. The definition of the events activating these flags is not specified in the IEEE norm and falls under the implementer's responsibility.

To round off, we are going to describe the Ethernet OAM loopback operation. An OAM station, configured in active mode, can send an order to the remote station to set it in loopback mode (provided said station allows this operation). Loopback control commands are transmitted through a specific type of OAMPDUs. When an OAM station is in loopback mode, any packet received by the interface that is not OAMPDU is returned unaltered. Loopback was developed to be used when installing a link or to resolve problems in the link.

9.2 Accessing the Ethernet OAM Configuration menu

Accesses OAM configuration from an Ethernet interface through the **oam** command. The configuration can be activated from both the *Config* process (static configuration, active after restarting the device) and the *running-config* process (dynamic configuration).

Example:

```
*config
Config>network ethernet0/1
-- Ethernet Interface User Configuration --
ethernet0/1 config>oam
```

```
-- Ethernet OAM interface configuration --
ethernet0/1 OAM config>
```

9.3 Ethernet OAM Configuration Commands

This section enumerates and describes the various OAM feature configuration commands.

Command	Function
? (HELP)	Displays the available commands and their options.
LINK-MONITOR	Configures parameters relative to the link events notification.
NO	Deletes previously configured parameters.
OAM	Configures global parameters for the Ethernet OAM.
REMOTE-FAILURE	Configures the actions to be taken whenever critical events occur.
REMOTE-LOOPBACK	Configures parameters associated to the test loopback.
EXIT	Exits the Ethernet OAM configuration menu.

9.3.1 ? (HELP)

Displays all the available commands and their options.

Syntax:

```
ethernet0/1 OAM config>?
```

Example:

```
ethernet0/1 OAM config>oam ?
  enable      Enable Ethernet OAM functionality
  max-rate    Set the maximum rate for OAMPDUs transmitted
  min-rate    Set the minimum rate for OAMPDUs transmitted
  mode        Set the OAM Client mode
  timeout     Set the OAM Discovery FSM timeout
ethernet0/1 OAM config>
```

9.3.2 LINK-MONITOR

Enables link events monitoring (statistics for errors in traffic received in the interface), in addition to configuring various parameters that control the operating mode of said functionality. The following options (among others) are available:

```
ethernet0/1 OAM config>link-monitor ?
  crc-errors              CRC error configuration
  enable                  Enable Link Monitoring functionality
  frame                   Frame TLV configuration
  frame-period            Frame-period TLV configuration
  frame-seconds           Frame-seconds TLV configuration
  high-threshold-action   Set high-threshold action
  symbol-period           Symbol-period TLV configuration
```

Subsequent sections describe the configurable parameters.

9.3.2.1 LINK-MONITOR CRC-ERRORS

Configures the time window, and the high and low thresholds, used while monitoring CRC errors when frames are received through the corresponding Ethernet interface. Thresholds are specified in number of frames and the time window in multiples of 100 ms.

The time window specifies the time interval where CRC errors produced at reception are counted. If the number of CRC errors in said interval exceeds the low threshold configured, a trace is displayed on the console to indicate the event. When the high threshold is surpassed, and if an action has been configured through **high-threshold-action**, said action is executed.

Syntax:

```
ethernet0/1 OAM config>link-monitor crc-errors ?
  high-threshold    Set high-threshold value
```

```
  low-threshold     Set low-threshold value
  window            Set window value
ethernet0/1 OAM config>link-monitor crc-errors high-threshold ?
  <1..900>    Set high-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor crc-errors low-threshold ?
  <1..900>    Set low-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor crc-errors window ?
  <10..1800>  Set window value (multiples of 100ms)
```

Example:

```
ethernet0/1 OAM config>link-monitor crc-errors window 200
ethernet0/1 OAM config>
```

9.3.2.2 LINK-MONITOR ENABLE

Enables the OAM functionality to monitor the link events. When an OAM session is established (i.e., the discovery phase ends), some of the reception error statistics in the Ethernet interface are periodically monitored. Examples of error statistics are: the number of erroneous symbols, the number of alignment errors or the number of CRC errors. If some of the configured thresholds are surpassed, event notification OAMPDU packets are sent to the remote OAM client. This functionality is enabled by default.

Syntax:

```
ethernet0/1 OAM config>link-monitor enable ?
  <cr>
```

Example:

```
ethernet0/1 OAM config>link-monitor enable
ethernet0/1 OAM config>
```

9.3.2.3 LINK-MONITOR FRAME

Configures the time window, and the high and low thresholds, used to monitor frame errors when these are received through the corresponding Ethernet interface. The time window is specified in multiples of 100 ms and the thresholds in number of frames.

The time window specifies the time interval where the frame errors produced at reception are counted. If the number of errors surpasses the low threshold configured, a link event notification OAMPDU packet is sent together with a *frame-period event* TLV. If an action has been configured through **high-threshold-action** and the high threshold is surpassed, said action is executed.

Syntax:

```
ethernet0/1 OAM config>link-monitor frame ?
  high-threshold    Set high-threshold value
  low-threshold     Set low-threshold value
  window            Set window value
ethernet0/1 OAM config>link-monitor frame high-threshold ?
  <1..65535>    Set high-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor frame low-threshold ?
  <1..65535>    Set low-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor frame window ?
  <10..600>     Set window value (multiples of 100ms)
```

Example:

```
ethernet0/1 OAM config>link-monitor frame high-threshold 5
ethernet0/1 OAM config>
```

9.3.2.4 LINK-MONITOR FRAME-PERIOD

Configures the time window, and the high and low thresholds, used to monitor frame errors received through the corresponding Ethernet interface. The time window is specified in multiples of 10000 frames (internally, this is translated from a number of frames to time units, depending on the interface's active speed) and the thresholds in number of frames.

The time window specifies the time interval where the frame errors produced at reception are counted. If the number of errors exceeds the low threshold configured, a link event notification OAMPDU packet is sent, together with a *frame-period event* TLV. If an action has been configured through **high-threshold-action** and the high threshold is

surpassed, said action is executed.

Syntax:

```
ethernet0/1 OAM config>link-monitor frame-period ?
  high-threshold    Set high-threshold value
  low-threshold     Set low-threshold value
  window            Set window value
ethernet0/1 OAM config>link-monitor frame-period high-threshold ?
  <1..65535>    Set high-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor frame-period low-threshold ?
  <1..65535>    Set low-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor frame-period window ?
  <2000..65535> Set window value (multiples of 10000 frames)
```

Example:

```
ethernet0/1 OAM config>link-monitor frame-period window 5000
ethernet0/1 OAM config>
```

9.3.2.5 LINK-MONITOR FRAME-SECONDS

Configures the time window and the high and low thresholds used to monitor frame errors received through the corresponding Ethernet interface. Both the time window and the high and low thresholds are specified in seconds.

The time window specifies the time interval where the second errors produced at reception are counted. A second error is a period of time (1 sec.) during which at least one frame error has been received through the Ethernet interface. If the number of second errors surpasses the low threshold configured, a link event notification OAMPDU packet is sent including a *frame-seconds event* TLV. If an action has been configured through **high-threshold-action** and the high threshold is surpassed, said action is executed.

Syntax:

```
ethernet0/1 OAM config>link-monitor frame-seconds ?
  high-threshold    Set high-threshold value
  low-threshold     Set low-threshold value
  window            Set window value
ethernet0/1 OAM config>link-monitor frame-seconds high-threshold ?
  <1..900>    Set high-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor frame-seconds low-threshold ?
  <1..900>    Set low-threshold value (number of frames)
ethernet0/1 OAM config>link-monitor frame-seconds window ?
  <100..9000> Set window value (multiples of 100ms)
```

Example:

```
ethernet0/1 OAM config>link-monitor frame-seconds window 500
ethernet0/1 OAM config>
```

9.3.2.6 LINK-MONITOR HIGH-THRESHOLD-ACTION

Configures what action to execute if a link monitoring statistic exceeds the high threshold established during a time window. Currently, it's only possible to configure one action: disable the interface. No action is configured by default.

Syntax:

```
ethernet0/1 OAM config>link-monitor high-threshold-action ?
  shutdown    Disable the interface on event
```

Example:

```
ethernet0/1 OAM config>link-monitor high-threshold-action shutdown
ethernet0/1 OAM config>
```

9.3.2.7 LINK-MONITOR SYMBOL-PERIOD

Configures the time window and the high and low thresholds used to monitor symbol errors when frames are received through the interface. The time window is specified in multiples of millions of symbols and the thresholds in number of symbols.

The time window specifies the time interval (internally this is translated from number of symbols to time units, depending on the interface's active speed) where the symbol errors generated at reception are counted. If the number

of errors exceeds the low threshold configured, a link event notification OAMPDU packet is sent together with a *symbol-period event* TLV. If an action has been configured through **high-threshold-action** and the high threshold is surpassed, said action is executed.

Syntax:

```
ethernet0/1 OAM config>link-monitor symbol-period ?
  high-threshold    Set high-threshold value
  low-threshold     Set low-threshold value
  window            Set window value
ethernet0/1 OAM config>link-monitor symbol-period high-threshold ?
  high-threshold    Set high-threshold value (number of symbols)
ethernet0/1 OAM config>link-monitor symbol-period low-threshold ?
  <1..65535>        Set low-threshold value (number of symbols)
ethernet0/1 OAM config>link-monitor symbol-period window ?
  <500..65535>      Set window value (millions of symbols)
```

Example:

```
ethernet0/1 OAM config>link-monitor symbol-period low-threshold 10
ethernet0/1 OAM config>
```

9.3.3 NO

Recovers default values for each of the configurable OAM parameters and disables certain functions (OAM protocol, loopback mode, link monitoring, etc.).

Syntax:

```
ethernet0/1 OAM config>no ?
  link-monitor       Link monitor OAM configuration
  oam                General OAM configuration
  remote-failure     Remote-failure OAM configuration
  remote-loopback    Remote-loopback OAM configuration
```

Example:

```
ethernet0/1 OAM config>no link-monitor enable
ethernet0/1 OAM config>
```

9.3.4 OAM

Enables the OAM functionality and configures various global parameters that control protocol operation. The following parameters are available (amongst others):

Syntax:

```
ethernet0/1 OAM config>oam ?
  enable      Enable Ethernet OAM functionality
  max-rate    Set the maximum rate for OAMPDUs transmitted
  min-rate    Set the minimum rate for OAMPDUs transmitted
  mode        Set the OAM Client mode
  timeout     Set the OAM Discovery FSM timeout
```

Subsequent sections describe each of the configurable parameters.

9.3.4.1 OAM ENABLE

Enables the OAM functionality in the Ethernet interface that is being configured. Default is disabled.

Syntax:

```
ethernet0/1 OAM config>oam enable ?
  <cr>
```

Example:

```
ethernet0/1 OAM config>oam enable
ethernet0/1 OAM config>
```

9.3.4.2 OAM MAX-RATE

Configures the maximum rate of OAMPDUs transmitted per time unit (packets/s). Default is 10 packets/s.

Syntax:

```
ethernet0/1 OAM config>oam max-rate ?
  <1..10>    Set the maximum rate for OAMPDUs transmitted
```

Example:

```
ethernet0/1 OAM config>oam max-rate 4
ethernet0/1 OAM config>
```

9.3.4.3 OAM MIN-RATE

Configures the minimum rate of OAMPDUs transmitted per second, specifying the maximum time between transmitted OAMPDUs. Default is 1 second.

Syntax:

```
ethernet0/1 OAM config>oam min-rate ?
  <1..10>    Set the minimum rate for OAMPDUs transmitted
```

Example:

```
ethernet0/1 OAM config>oam min-rate 2
ethernet0/1 OAM config>
```

9.3.4.4 OAM MODE

Configures the operating mode of the local OAM client. There are two possibilities: active client or passive client. Please see the section that describes the Ethernet OAM protocol for further details on the characteristics of the two possible operating modes. Default is active mode.

Syntax:

```
ethernet0/1 OAM config>oam mode ?
  active     Set active mode
  passive    Set passive mode
```

Example:

```
ethernet0/1 OAM config>oam mode passive
ethernet0/1 OAM config>
```

9.3.4.5 OAM TIMEOUT

Configures the maximum wait time without receiving link maintenance OAMPDUs from the remote OAM client. Once this has timed out, the OAM session restarts and returns to the discovery stage. Default is 10 seconds.

Syntax:

```
ethernet0/1 OAM config>oam timeout ?
  <2..30>    Timeout value (seconds)
```

Example:

```
ethernet0/1 OAM config>oam timeout 15
ethernet0/1 OAM config>
```

9.3.5 REMOTE-FAILURE

Configures the actions to be executed on receiving OAMPDU packets from the remote OAM client where some of the flags reserved for critical events are activated. You can specify an action to be taken for each of the three possible critical events:*link-fault*, *critical-event* and *dying-gasp*. Currently, only one action is available: disable the interface. No action is specified by default in any of the three cases.

Syntax:

```
ethernet0/1 OAM config>remote-failure ?
  critical-event    Set action on received critical-event from remote OAM client
```

```
  dying-gasp        Set action on received dying-gasp event from remote OAM client
  link-fault        Set action on received link-fault event from remote OAM client
ethernet0/1 OAM config>remote-failure critical-event ?
  shutdown    Disable the interface on event
ethernet0/1 OAM config>remote-failure dying-gasp ?
  shutdown    Disable the interface on event
ethernet0/1 OAM config>remote-failure l
ethernet0/1 OAM config>remote-failure link-fault ?
  shutdown    Disable the interface on event
ethernet0/1 OAM config>
```

Example:

```
ethernet0/1 OAM config>remote-failure dying-gasp shutdown
ethernet0/1 OAM config>
```

9.3.6 REMOTE-LOOPBACK

Configures parameters associated to the Ethernet OAM loopback. There are two configurable parameters:

9.3.6.1 REMOTE-LOOPBACK ENABLE

Enables the possibility for the interface to enter loopback mode in response to a control command received from the remote OAM client. Default is disabled.

Syntax:

```
ethernet0/1 OAM config>remote-loopback enable ?
  <cr>
```

Example:

```
ethernet0/1 OAM config>remote-loopback enable
ethernet0/1 OAM config>
```

9.3.6.2 REMOTE-LOOPBACK TIMEOUT

Configures the maximum wait time for a response to the remote OAM client after sending a **loopback** control command. Default is 5 seconds.

Syntax:

```
ethernet0/1 OAM config>remote-loopback timeout ?
  <1..10>    Timeout value (seconds)
```

Example:

```
ethernet0/1 OAM config>remote-loopback timeout 10
ethernet0/1 OAM config>
```

9.3.7 EXIT

Returns to the corresponding Ethernet interface configuration menu.

Syntax:

```
ethernet0/1 OAM config>exit
```

Example:

```
ethernet0/1 OAM config>exit
ethernet0/1 config>
```

Chapter 10 Ethernet OAM Monitoring

10.1 Introduction

Describes the commands that are available to monitor the OAM Ethernet protocol. It includes the following two sections:

- Accessing the OAM protocol monitoring menu in an Ethernet interface.
- Ethernet OAM monitoring commands.

10.2 Accessing the Ethernet OAM monitoring menu

Access OAM monitoring through the monitoring menu for the Ethernet interface, associated through **oam** , as shown in the following example.

Example:

```
*monitor
Console Operator
+network ethernet0/1
--  Ethernet Console  --
ethernet0/1 ETH+oam
-- Ethernet OAM interface monitor --
ethernet0/1 OAM monitor+
```

10.3 Ethernet OAM monitoring commands

The following table details the various monitoring commands available for the Ethernet OAM. Each command is described in detail further down.

Command	Function
? (HELP)	Displays the available commands and their options.
CLEAR	Deletes the OAM statistics for the Ethernet interface being monitored.
LIST	Displays information on the state of the Ethernet OAM protocol.
REMOTE-LOOPBACK	Loopback control commands in the remote OAM client.
EXIT	Exits the Ethernet OAM monitoring menu.

10.3.1 ? (HELP)

Displays all the available commands and their options.

Syntax:

```
ethernet0/1 OAM monitor+?
```

Example:

```
ethernet0/1 OAM monitor+remote-loopback ?
  start    Initiate loopback mode on remote client
  stop     Terminate loopback mode on remote client
```

10.3.2 CLEAR

Deletes the OAM protocol statistics in the Ethernet interface being monitored.

Syntax:

```
ethernet0/1 OAM monitor+clear statistics
```

Example:

```
ethernet0/1 OAM monitor+clear statistics
ethernet0/1 OAM monitor+
```

10.3.3 LIST

Displays a variety of information on the OAM protocol status in the Ethernet interface that is being monitored. The following options are available:

10.3.3.1 LIST DISCOVERY

Displays configuration information on the local OAM client and, where available, on the remote OAM client.

Syntax:

```
ethernet0/1 OAM monitor+list discovery
```

Example:

```
ethernet0/1 OAM monitor+list discovery
Local client configuration
        Mode: active
        Unidirection: not supported
        Link Monitor: supported
        Remote loopback: supported
        MIB retrieval: not supported
        MTU size: 1500
Remote client configuration
        MAC address: 0012430816D1
        Mode: active
        Unidirection: not supported
        Link Monitor: supported
        Remote loopback: supported
        MIB retrieval: not supported
        MTU size: 1500
        Organizationally Unique Identifier (OUI): 0x0C0
ethernet0/1 OAM monitor+
```

10.3.3.2 LIST RUNTIME

Displays internal information on the OAM protocol, such as the status variables for the different OAM subsystems (*Discovery*, *Parser* and *Multiplexer*), status of the OAM timers, the current status for the Discovery states machine, etc.

Syntax:

```
ethernet0/1 OAM monitor+list runtime
```

Example:

```
ethernet0/1 OAM monitor+list runtime
Runtime settings
        Local_pdu: ANY
        Local_mux: FWD
        Local_par: FWD
        Local_link_status: OK
        Local_satisfied: YES
        Local_stable: YES
        Loopback_state: OFF
        PDU_cnt: 9
        PDU_timer: ON
        Lost_link_timer: ON
        Link_monitor_timer: ON
        Loopback_timer: OFF
        Remote_state_valid: YES
        Remote_stable: YES
        Remote_evaluating: NO
Current local Discovery FSM state: SEND_ANY
ethernet0/1 OAM monitor+
```

10.3.3.3 LIST STATISTICS

Shows a summary of the different OAM protocol statistics organized by categories: number of OAMPDUs transmitted and received (per type), number and type of critical events (both local and remote) and the number or type of link monitoring events produced in both OAM stations (local and remote).

Syntax:

```
ethernet0/1 OAM monitor+list discovery
```

Example:

```
ethernet0/1 OAM monitor+list statistics
Ethernet OAM interface statistics
        Information OAMPDUs Tx: 256
        Information OAMPDUs Rx: 256
        Event Notification OAMPDUs Tx: 0
        Event Notification OAMPDUs Rx: 0
        Duplicated Event Notification OAMPDUs Tx: 0
        Duplicated Event Notification OAMPDUs Rx: 0
        Loopback Control OAMPDUs Tx: 0
        Loopback Control OAMPDUs Rx: 0
        Variable Request OAMPDUs Tx: 0
        Variable Request OAMPDUs Rx: 0
        Variable Response OAMPDUs Tx: 0
        Variable Response OAMPDUs Rx: 0
        Organization Specific OAMPDUs Tx: 0
        Organization Specific OAMPDUs Rx: 0
        Unknown OAMPDUs Rx: 0
Local critical events
        Link fault: 0
        Critical event: 0
        Dying gasp: 0
Remote critical events
        Link fault: 0
        Critical event: 0
        Dying gasp: 0
Local event errors
        Errored Symbol Period: 0
        Errored Frame: 0
        Errored Frame Period: 0
        Errored Frame Second: 0
Remote event errors
        Errored Symbol Period: 0
        Errored Frame: 0
        Errored Frame Period: 0
        Errored Frame Second: 0
ethernet0/1 OAM monitor+
```

10.3.3.4 LIST STATUS

Displays active configuration information on the OAM protocol: operating mode, OAMPDUs transfer rate, timeout to restart the Discovery status machine, thresholds and windows for link monitoring, action to take whenever the high threshold is exceeded, and actions to take when critical events are received from the remote OAM station.

Syntax:

```
ethernet0/1 OAM monitor+list status
```

Example:

```
ethernet0/1 OAM monitor+list status
General OAM configuration
        Mode: active
        OAMPDU max-rate: 10 packets/s
        OAMPDU min-rate: 10 packets/s
        Lost-link timeout: 15 seconds
Link Monitoring
        Status: on
```

```
        High-threshold action: none
        Symbol-period error
                Window: 500 million symbols
                Low-threshold: 1 error symbols
                High-threshold: 0 error symbols
        Frame error
                Window: 100 x 100 ms
                Low-threshold: 1 error frames
                High-threshold: 0 error frames
        Frame-period error
                Window: 2000 x 10.000 frames
                Low-threshold: 1 error frames
                High-threshold: 0 error frames
        Frame-seconds error
                Window: 600 x 100 ms
                Low-threshold: 1 error seconds
                High-threshold: 0 error seconds
Remote failure
        Critical-event action: none
        Dying-gasp action: none
        Link-fault action: none
ethernet0/1 OAM monitor+
```

10.3.4 REMOTE-LOOPBACK

Provided the necessary conditions are present, this option sends loopback control commands to the remote OAM station. Three conditions are required to send a **loopback** control command to the remote OAM client:

- The local OAM client must be configured in active mode.
- The remote OAM client must support loopback. This aspect is learned by the local OAM client during the protocol discovery phase. To verify that this requirement is fulfilled, enter the **list discovery** monitoring command.
- The OAM session must be established. To check this, enter the **list runtime** monitoring command.

The two available options for this command are as follows:

10.3.4.1 REMOTE-LOOPBACK START

Sends a **loopback start** control command to the remote OAM client. If the operation is successful, the remote station returns all the traffic received through the Ethernet interface with the exception of the OAMPDU packets, which it continues to treat as usual.

Syntax:

```
ethernet0/1 OAM monitor+remote-loopback start
```

Example:

```
ethernet0/1 OAM monitor+remote-loopback start
ethernet0/1 OAM monitor+
```

10.3.4.2 REMOTE-LOOPBACK STOP

Through this option, a **loopback stop** control command is sent to the remote OAM client. This operation is only executed if the remote OAM client is in loopback mode. Once the operation is completed, the remote OAM client transmits traffic received through the interface as usual.

Syntax:

```
ethernet0/1 OAM monitor+remote-loopback stop
```

Example:

```
ethernet0/1 OAM monitor+remote-loopback stop
ethernet0/1 OAM monitor+
```

10.3.5 EXIT

Returns to the monitoring menu of the relevant Ethernet interface.

Syntax:

```
ethernet0/1 OAM monitor+exit
```

Example:

```
ethernet0/1 OAM monitor+exit
ethernet0/1 ETH+
```

Chapter 11 Examples

11.1 PVST+

11.1.1 Scenario

This scenario shows three switches joined to a loop so that, if a failure occurs, there is an alternative route for the data. If you want each switch to act as the *root* for each of the VLANs used, use 20, 21 and 30.

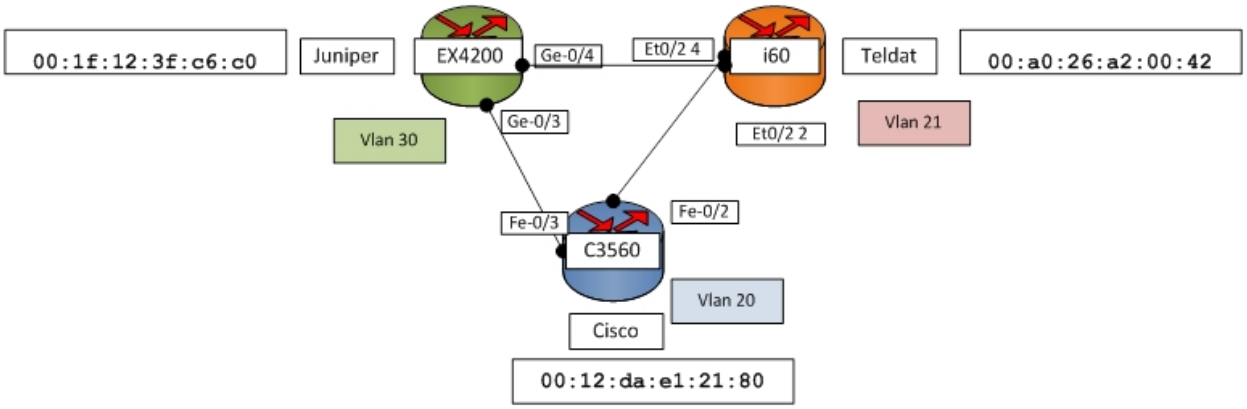

Fig. 2: **Scenario**

3 devices are used:

- Juniper EX4200 (Bridge ID= 00:1f:12:3f:c6:c0).
- Atlas i60 (Bridge ID= 00:a0:26:a2:00:42).
- Cisco Catalyst 3560 (Bridge ID= 00:12:da:e1:21:80).

Device IPs for VLAN

Vlan	**EX4200**	**Atlas i60**	**Catalyst 3560**
Vlan 20	172.16.10.1	172.16.10.2	172.16.10.3
Vlan 21	172.16.12.1	172.16.12.2	172.16.12.3
Vlan 30	172.16.30.1	172.16.30.2	172.16.30.3

Spanning tree priorities for VLAN:

PVST+	**Root**	**Priority Ex4200**	**Catalyst 3560**	*Teldat* Atlas i60
Vlan 20	Catalyst 3560	4096	0	8192
Vlan 21	Atlas i60	8192	4096	0
Vlan 30	Juniper EX4200	0	8192	4096

11.1.2 Configuration

The first step is to create the Ethernet subinterfaces and associate the IP addresses and the VLANs that use them.

```
   network ethernet0/0.20
; -- Ethernet Subinterface Configuration --
      ip address 172.16.10.2 255.255.255.0
;
      encapsulation dot1q 20
;
   exit
;
```

```
   network ethernet0/0.21
; -- Ethernet Subinterface Configuration --
      ip address 172.16.12.2 255.255.255.0
;
      encapsulation dot1q 21
;
   exit
;
;
   network ethernet0/0.30
; -- Ethernet Subinterface Configuration --
      ip address 172.16.30.2 255.255.255.0
;
      encapsulation dot1q 30
;
   exit
;
```

Next, define the Spanning Tree instances. Please note, you need to explicitly create the instance associated to the VLAN.

```
   network ethernet0/0
; -- Ethernet Interface User Configuration --
      repeater-switch
; -- Switch User Config --
         port 1 stp enable instance 1
         port 2 stp enable instance 1
         port 2 stp enable instance 2
         port 2 stp enable instance 3
         port 2 stp enable instance 4
         port 4 stp enable instance 1
         port 4 stp enable instance 2
         port 4 stp enable instance 3
         port 4 stp enable instance 4
         stp 1 vlan 20
         stp 1 bridge-priority 8192
;
         stp 2 vlan 21
         stp 2 bridge-priority 0
;
         stp 3 vlan 30
         stp 3 bridge-priority 4096
;
         stp 4 vlan 1
;
      exit
;
   exit
;
```

Lastly, configure the VLAN in the switch.

```
   feature vlan
; -- VLAN configuration --
      enable
;
      vlan 20 ethernet0/0 port 2
      vlan 20 ethernet0/0 port 4
      vlan 20 ethernet0/0 port internal
      vlan 21 ethernet0/0 port 2
      vlan 21 ethernet0/0 port 4
      vlan 21 ethernet0/0 port internal
      vlan 30 ethernet0/0 port 2
      vlan 30 ethernet0/0 port 4
      vlan 30 ethernet0/0 port internal
;
      ingress-filter ethernet0/0 port 2
      ingress-filter ethernet0/0 port 3
```

```
      ingress-filter ethernet0/0 port 4
;
      tag-insertion ethernet0/0 port 2
      tag-insertion ethernet0/0 port 3
      tag-insertion ethernet0/0 port 4
;
   exit
;
```

The full configuration displayed is as follows:

```
; Showing Menu and Submenus Configuration for access-level 15 ...
; KFRouter  WL IPSec SNA VoIP T+ 32 132 Version 10.09.13

   log-command-errors
   no configuration
   set hostname  Atlas i60
   add device eth-subinterface ethernet0/0 20
   add device eth-subinterface ethernet0/0 21
   add device eth-subinterface ethernet0/0 30
   network ethernet0/0
; -- Ethernet Interface User Configuration --
      repeater-switch
; -- Switch User Config --
         port 1 stp enable instance 1
         port 2 stp enable instance 1
         port 2 stp enable instance 2
         port 2 stp enable instance 3
         port 2 stp enable instance 4
         port 4 stp enable instance 1
         port 4 stp enable instance 2
         port 4 stp enable instance 3
         port 4 stp enable instance 4
         stp 1 vlan 20
         stp 1 bridge-priority 8192
;
         stp 2 vlan 21
         stp 2 bridge-priority 0
;
         stp 3 vlan 30
         stp 3 bridge-priority 4096
;
         stp 4 vlan 1
;
      exit
;
   exit
;
;
   network ethernet0/0.20
; -- Ethernet Subinterface Configuration --
      ip address 172.16.10.2 255.255.255.0
;
      encapsulation dot1q 20
;
   exit
;
   network ethernet0/0.21
; -- Ethernet Subinterface Configuration --
      ip address 172.16.12.2 255.255.255.0
;
      encapsulation dot1q 21
;
   exit
;
;
   network ethernet0/0.30
; -- Ethernet Subinterface Configuration --
```

```
      ip address 172.16.30.2 255.255.255.0
;
      encapsulation dot1q 30
;
   exit
;
   feature vlan
; -- VLAN configuration --
      enable
;
      vlan 20 ethernet0/0 port 2
      vlan 20 ethernet0/0 port 4
      vlan 20 ethernet0/0 port internal
      vlan 21 ethernet0/0 port 2
      vlan 21 ethernet0/0 port 4
      vlan 21 ethernet0/0 port internal
      vlan 30 ethernet0/0 port 2
      vlan 30 ethernet0/0 port 4
      vlan 30 ethernet0/0 port internal
;
      ingress-filter ethernet0/0 port 2
      ingress-filter ethernet0/0 port 3
      ingress-filter ethernet0/0 port 4
;
      tag-insertion ethernet0/0 port 2
      tag-insertion ethernet0/0 port 3
      tag-insertion ethernet0/0 port 4
;
   exit
;
   dump-command-errors
   end
```