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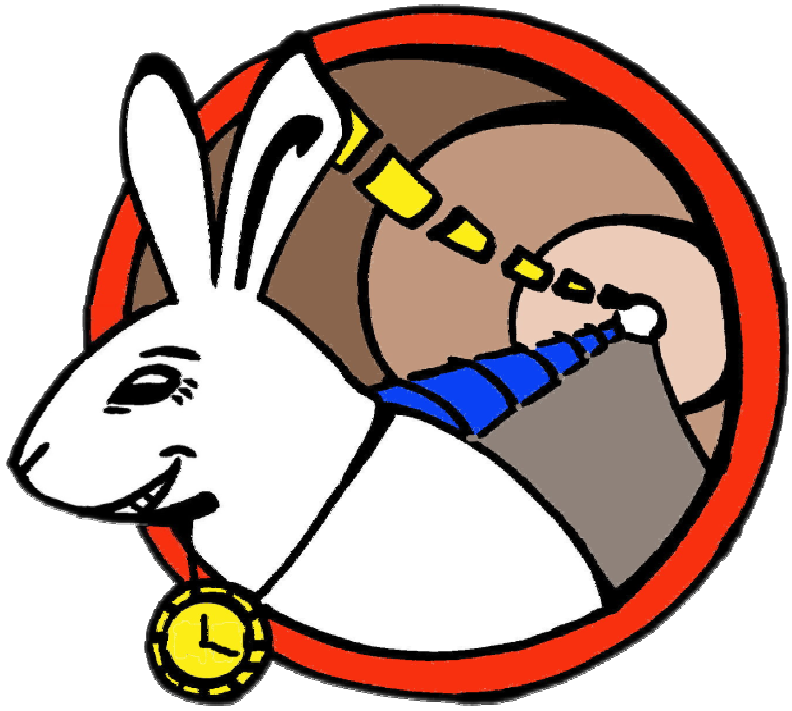
White Rabbit Switch
Management Specification



DRAFT FOR COMMENTS

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March 2011

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White Rabbit Switch Management Specification

1. Introduction

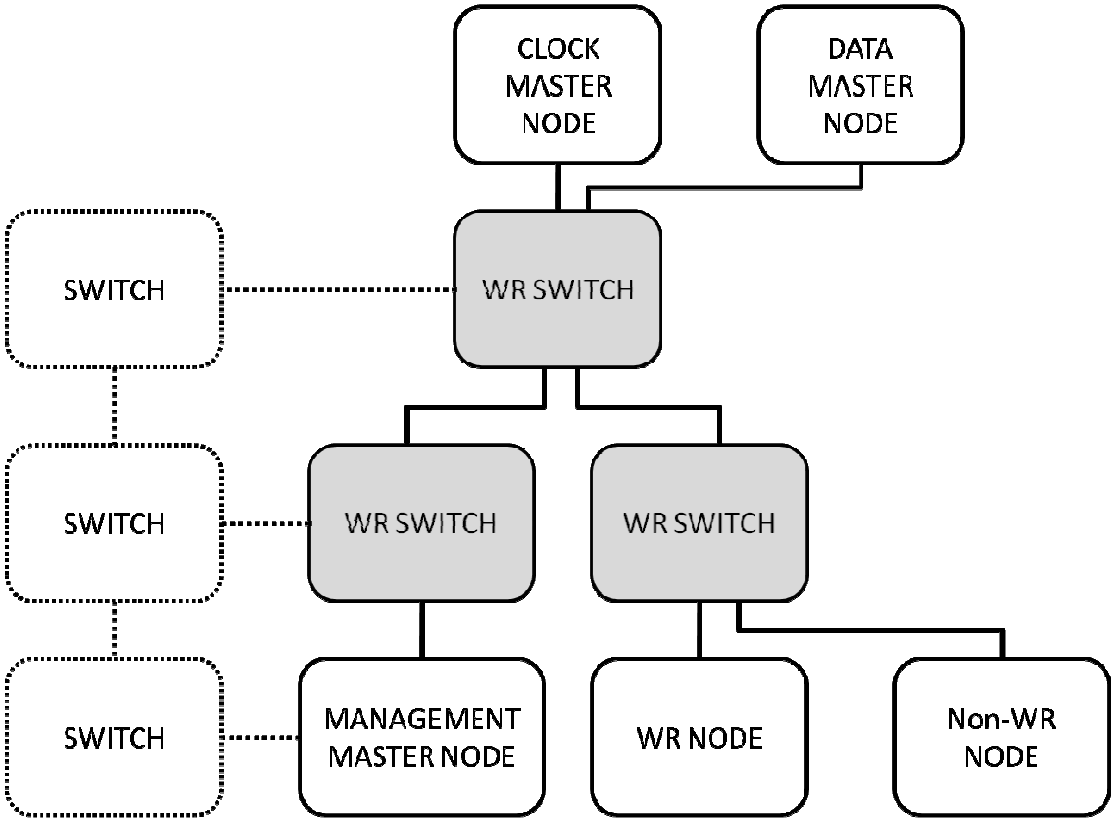
This document details the management functions, protocols and interfaces that the White Rabbit Switch shall support, based on its functional specification [1], the robustness requirements [2] , and the normative management reference standards specified in section 2.

The WRS management capabilities and interfaces aim to facilitate overall White Rabbit network management enabling centralized problem detection, cause analysis and error correction, straightforward WRS software and hardware configuration and a global understanding of network performance and behavior.

In order to leverage existing network management protocols, procedures and tools, and permit the seamless integration -from the management perspective- of WRSs in heterogeneous networks including non-WR nodes, the part of the management specification that refers to the standard WRS switching capabilities also adheres to the associated management standards. In fact, reference standards used in the WRS management specification are extensively used by industry in commercial switching products, which supports the claim for widespread WRS management interoperability.

Notwithstanding, the WRS further extends state-of-the-art switching technologies to provide real-time Ethernet networks with sub-nanosecond precision, based on innovative concepts and protocols that remain, due to its novelty, beyond the scope of current management standards. In these cases, non-standard ad-hoc management techniques and specifications will be applied as required to cover expected management support of such functionalities.

The following figure clarifies the scope of the document within the WR network architecture, which focuses on element level management aspects related to the WR switch. WR node management and the specification of network level management functions are out of this document scope.



2. Normative references

IEEE Std 802.1D-2004, IEEE Standard for Local and metropolitan area networks-Media Access Control (MAC) Bridges.

IEEE Std 802.1Q-2005, IEEE Standard for Local and metropolitan area networks- Virtual Bridged Local Area Networks

IEEE Std 802.1ak-2007, IEEE Standard for Local and metropolitan area networks—Virtual Bridged Local Area Networks, Amendment 7: Multiple Registration Protocol

IEEE Std 802.1ap-2008, IEEE Standard for Local and metropolitan area networks—Virtual Bridged Local Area Networks, Amendment 8: Management Information Base (MIB) Definitions for VLAN Bridges

IETF RFC 1155-1990: Structure and Identification of Management Information for TCP/IP-based Internets

IETF RFC 1156-1990: Management Information Base for Network Management of TCP/IP-based Internets

IETF RFC 1157-1990: A Simple Network Management Protocol (SNMP)

IETF RFC 1901-1996: Introduction to Community-based SNMPv2

IETF RFC 1905-1996: Protocol Operations for version 2 of the Simple Network Management Protocol (SNMPv2)

IETF RFC 1906-1996: Transport Mappings for version 2 of the Simple Network Management Protocol (SNMPv2)

IETF RFC 2863: The Interfaces Group MIB

IETF RFC 3410-2002: Introduction and Applicability Statements for Internet-Standard Management Framework

IETF RFC 3411-2002: An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks

IETF RFC 3412-2002: Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)

IETF RFC 3413-2002: Simple Network Management Protocol (SNMP) Applications

IETF RFC 3414-2002: User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)

IETF RFC 3415-2002: View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)

IETF RFC 3416-2002: Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)

IETF RFC 3417-2002: Transport Mappings for the Simple Network Management Protocol (SNMP)

IETF RFC 3418-2002: Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)

IETF RFC 4188: Definitions of Managed Objects for Bridges

IETF RFC 4318: Definitions of Managed Objects for Bridges with Rapid Spanning Tree Protocol

IETF RFC 4363: Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and Virtual LAN Extensions

3. Abbreviations

WR	White Rabbit
WRP	White Rabbit Protocol
WRPTP	White Rabbit PTP
WRIB	White Rabbit Information Block
HP	High Priority. Used to indicate special WR Ethernet Frames
SP	Standard Priority. Used to indicate special WR Ethernet Frames
WRN	White Rabbit Node
WRS	White Rabbit Switch
WRCM	White Rabbit General Clock Master Node
WRMM	White Rabbit Management Master Node
WRDM	White Rabbit Data Master Node
FESA	Front-End Software Architecture
NIC	Network Interface Controller
SNMP	Simple Network Management Protocol
DHCP	Dynamic Host Configuration Protocol
PTP	Precision Time Protocol
FMC	FPGA Mezzanine Card
FPGA	Field Programmable Gate Array
FEC	Forward Error Correction
UDP	User Datagram Protocol
IRQ	Interrupt Request
RSTP	Rapid Spanning Tree Protocol
MSTP	Multiple Spanning Tree Protocol
GARP	Generic Attribute Registration Protocol
GMRP	GARP Multicast Registration Protocol
GVRP	GARP VLAN Registration Protocol
MRP	Multiple Registration Protocol
MMRP	Multiple MAC Registration Protocol
MVRP	Multiple VLAN Registration Protocol
SNMP	Simple Network Management Protocol
OID	Object IDentifier

4. White Rabbit Switch management capabilities

The WRS management functionalities depend on the required network level management capabilities. In order to organise and classify such capabilities this section follows the ITU-T recommendation M.3010, which provides a generic model that considers five management categories: fault, configuration, accounting, performance and security. The ITU-T recommendation M.3400 further partitions each category into a number of management elements, thus facilitating the assessment of the management tasks that the system can accomplish, and the remaining functional gaps. This revision of the WRS management specification focuses on fault, configuration and performance management.

4.1. Fault management

Fault management provides functions for fault detection, isolation and correction. The facilities provided by the WRS management in this functional area shall enable:

- *Fault detection*.
  1. Precise detection of data path errors, including both SP and HP packet loss and erroneous packets that have been either corrected[1] or dropped.
  2. Precise detection of clock path errors, including loss of clock syntonisation and synchronization.
  3. Precise detection of uplink/downlink breakdown[2].

- *Error logging*. The fact that the switch has a notion of UTC to within a nanosecond means that these events may be logged with a very accurate time-tag thus helping to precisely order network events and find out the problem root cause.

4.2 Configuration management

Configuration management provides functions for network resource identification, control, and device provisioning and set up. The facilities provided by the WRS management in this functional area shall enable:

[1] In case FEC techniques are applied

[2] The relevance of detected failures will depend on the location/layer of the affected WRS within the WRN hierarchy and on the actual WRN topology (v.g. data path and clock path redundancy). These factors should be handled at the network management level to trigger appropriate alarms.

- *Network discovery.*
  1. Identification of the WRSs that make up the WR network and their respective locations within the hierarchy.

- *Network provisioning*. WRS management shall support the following capabilities:
  1. Spanning tree configuration.
  2. Active topology monitoring. Optionally, supervision of alternate topologies[3].

- *Device configuration*.
  1. WRS port configuration.
  2. WRS port priority configuration.
  3. WRS filtering database management.
  4. VLAN configuration.
  5. Control of propagation of frames for specific group MAC addresses.

4.3 Performance management

The WRS performance management shall provide the means to analyse both specific WRS device behavior and overall WR network behavior (identifying network bottlenecks, detecting network congestion, etc).

- *Performance data collection.*
  1. WRS shall support gathering HP and SP traffic statistics.
  2. WRS shall provide the means to collect per-port traffic statistics (frame forward and frame discard counts).
  3. WRS shall provide the means to collect per-flow traffic statistics (frames per flow count)
  4. Additional statistics: data path delay and jitter measurements for high priority traffic.

5. White Rabbit Switch management compliance

This section specifies the technologies, protocols and interfaces that shall enable the provision of the management features, as described by the FCAPS model, compliant to the following industry standards:

[3] Redundant links and automatic switch over are the mechanisms suggested in [2] to support network resilience in case of failures.

a) The White Rabbit Switch shall support local and remote management, compliant to the IEEE 802.1Q-2005 industry standard.

b) The White Rabbit Switch shall support the mandatory management objects and operations, as defined in IEEE 802.1D-2004 Clause 14 and IEEE 802.1Q-2005 Clause 12, that provide the following management capabilities:

    a. Switch configuration

    b. Port configuration

    c. Port performance analysis

    d. Port priority configuration

    e. Filtering Database management

    f. Rapid Spanning Tree Protocol configuration

    g. MRP, MMRP and MVRP configuration[4]

    h. VLAN configuration

The complete list of features that the WRS management shall support to fulfill these capabilities compliant to the IEEE 802.1Q-2005 standard is provided in Annex A.

5.1. Local management

Local management of the WRS shall be carried out using Command Line Interface (CLI) via a serial console port (RS232_MGN) or Secure Shell (SSH). The CLI shall provide a direct method to gather WRS information and perform its configuration.

[4] MRP, MMRP and MVRP replace the Generic Attribute Registration Protocol (GARP), GARP Multicast Registration Protocol (GMRP) and GARP VLAN Registration Protocol (GVRP) respectively.

Availability of the serial console port is recommended to provide management access to the WRS upon network service failure and as a means for safe initial configuration, as suggested in [5].

Security privileges required to access the management CLI shall be granted by the system upon user access, based on user credentials.

The CLI management interface shall in no way limit system access through the SSH or serial port interfaces.

5.2 Remote management

Remote management of the WRS shall be carried out using the Simple Network Management Protocol (SNMP), as recommended by the 802.1Q-2005 (clause 8.12).

The WRS shall support both in-band and out-of-band management.

In-band management shall be available through any of the uplink or downlink ports. In-band management traffic shall be handled as normal data traffic (i.e. no priority will be assigned to management traffic)

An out-of-band management network infrastructure could be optionally provided to guarantee that the White Rabbit network continues being manageable even in critical situations (WRS failure, network congestion, etc), in case the WRN does not support redundancy. In such case, out-of-band management should be provided via Ethernet 10/100Mbps ETH_MGN interface.

Web based management is not deemed necessary to fulfill 802.1Q management requirements.

5.2.1. Transport mapping

SNMP shall be mapped onto the UDP[5] transport.

5.2.2. Security considerations

The WRS remote management shall support SNMPv3[6].

[5] UDP/IPv4

Since SNMPv1 and SNMPv2c only support authentication schemes based on plain-text community strings which are actually insecure, the IEEE 802.1ap-2008 recommends to deploy SNMPv3 and to enable cryptographic security.

The aim is filling security gaps opened by a number of IEEE8021-BRIDGE, IEEE8021-Q-BRIDGE and IEEE8021-SPANNING-TREE MIB objects which might be either directly manipulated to interfere bridge operation and cause network instability, or used to obtain information for mounting subsequent attacks[7].

However, superior SNMPv3 security comes at a cost in terms of network overhead, computational overhead, memory footprint and complexity. Therefore, it shall be possible to configure the SNMP agent to operate in trusted environments (such as the WRN at CERN/GSI) without encryption, authentication and access control capabilities.

5.2.3. Scalability considerations

To reduce unnecessary management traffic caused by frequent status polling, the WRS SNMP agent shall support SNMP traps.

5.2.4. Robustness considerations

The WRS SNMP agent shall ignore malformed SNMP packets. Malformed SNMP packets containing illegal or inconsistent value type/length/content shall not cause abnormal operation of the SNMP agent.

5.2.5. MIB definitions[8]

The WRS shall support the following Management Information Base (MIB) modules for the management of VLAN-aware Bridge capabilities, as specified in clause 17 of the IEEE 802.1ap-2008[9] (amendment 8 to IEEE 802.1Q-2005).

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[6] This requirement is subject to protocol performance evaluation on actual WRS hardware.

[7] 802.1ap-2008 clause 17.4 further details the detected security vulnerabilities.

[8] The complete MIB definitions are available at http://www.ieee802.org/1/files/public/MIBs/

[9] IETF RFC 4663 describes the transition of responsibility for MIB modules from the IETF WG to the IEEE 802.1 WG.

- SNMPv2-MIB module as specified in IETF RFC 3418, for relevant parts defined in IEEE 802.1ap-2008 clause 17.3.2.1. This module shall implement, at least, the objects listed in the systemGroup from the SNMPv2-MIB.

- IF-MIB module as specified in IETF RFC 2863, for relevant parts defined in IEEE 802.1ap-2008 clause 17.3.4.1. This module shall implement, at least, the objects listed in the ifGeneralInformationGroup from the IF-MIB.

- IEEE8021-TC MIB module as specified in IEEE 802.1ap-2008 clause 17.7.1

- IETF RFC 4318 MIB textual conventions used by the IEEE 802.1Q MIB and not contained in the 802.1-TC MIB.

- IETF RFC 4363 MIB textual conventions used by the IEEE 802.1Q MIB and not contained in the 802.1-TC MIB.

- IEEE8021-BRIDGE[10] MIB as specified in IEEE 802.1ap-2008 clause 17.7.2, with the provisions described in clause 17.3.4.2. This SMIv2 MIB module provides support for management of IEEE 802.1D devices, including MRP, MMRP and MVRP configuration and control. This module shall implement, at least, the objects listed in the following units of conformance:

    - Ieee8021BridgeBaseBridgeGroup *(Bridge level information)*

    - Ieee8021BridgeBasePortGroup *(Port level Information)*

    - Ieee8021BridgeTpPortGroup *(Dynamic Filtering DB information for each port)*

    - Ieee8021BridgePortMrpGroup *(Port-level control and status information for MRP)*

    - Ieee8021BridgePortMmrpGroup *(Port-level control and status information for MMRP)*

    - ieee8021QBridgeFdbStaticGroup

[10] Derived from IETF RFC 4188.

Since the WRS shall support traffic classes and user priorities, the following MIB groups shall be also implemented:

- Ieee8021BridgeDevicePriorityGroup *(Device-level control of priority)*
- ieee8021BridgePriorityGroup *(Define Traffic Classes for user priorities)*
- ieee8021BridgeDefaultPriorityGroup[11] *(Define User Priorities for each port)*

- IEEE8021-Q-BRIDGE MIB as specified in IEEE 802.1ap-2008 clause 17.7.4. This SMIv2 MIB module provides support for management of VLAN-aware bridges. This module shall implement, at least, the objects listed in the following units of conformance:
  - Ieee8021QBridgeBaseGroup *(Device-level control and status.)*
  - Ieee8021QBridgeVlanGroup *(Information on VLANs)*
  - Ieee8021QBridgeVlanStaticGroup *(Information on VLANs statically configured)*
  - Ieee8021QBridgePortGroup2 *(Port-level VLAN control and status for all ports)*
  - Ieee8021QBridgeFdbUnicastGroup *(Information on unicast addresses in Filtering DB)*
  - Ieee8021QBridgeFdbMulticastGroup *(Information on multicast addresses in Filtering DB)*
  - Ieee8021QBridgeFdbStaticGroup *(Filtering DB manipulation)*
  - Ieee8021QBridgeServiceRequirementsGroup *(Extended Filtering Services Support)*
  - Ieee8021QBridgeLearningConstraintDefaultGroup *(Default Filtering DB constraints)*
  - Ieee8021QBridgeLearningConstraintGroup[12]

[11] Note that only the BridgePortDefaultUserPriority will be implemented from this group.

- IEEE8021-SPANNING-TREE[13] MIB module as specified in IEEE 802.1ap-2008 clause 17.7.3. This SMIv2 MIB module provides support for management of the Rapid Spanning Tree Protocol (RSTP) capability.
    - ieee8021SpanningTreeGroup *(Bridge-level spanning tree information)*
    - ieee8021SpanningTreePortGroup *(Port-level spanning tree information)*
    - ieee8021SpanningTreeRstpGroup *(Bridge-level RSTP information)*
    - ieee8021SpanningTreeRstpPortGroup *(Port-level RSTP information)*

The following MIBs shall be provided to enable remote configuration of the SNMPv3 administrative framework (authentication, privacy, authorization and access control).

- SNMP-FRAMEWORK-MIB as specified in IETF RFC-3411, which provides support for the SNMP management framework. Compliance to this MIB requires at least implementation of the snmpEngineGroup.

- SNMP-MPD-MIB as specified in IETF RFC-3412, which provides remote monitoring of the SNMP message processing and dispatching process. Compliance to this MIB requires implementation of the snmpMPDGroup.

- SNMP-TARGET-MIB as specified in IETF RFC-3413. According to the compliance statement for SNMP entities which include a command responder application (as it is the case for the WRS), this module will implement the snmpTargetCommandResponderGroup.

- SNMP-NOTIFICATION-MIB as specified in IETF RFC-3413, which provides the objects required to remotely configure the parameters used by the SNMP agent to generate SNMP notifications. This module will be compliant to the snmpNotifyBasicCompliance (unconfirmed notifications).

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[12] Since the WRS supports both Independent VLAN learning and Shared VLAN learning.

[13] Derived from the IETF RFC 4188.

- SNMP-USER-BASED-SM-MIB as specified in IETF RFC-3414, which provides the objects required to remote configure the user-based security model. This module will implement the usmMIBBasicGroup.

- SNMP-VIEW-BASED-ACM-MIB as specified in IETF RFC-3415, which provides the administrative framework to configure the view-based access control mechanism. This module will implement the vacmBasicGroup.

MIB module	**Relevant Standards**
SNMPv2-MIB	RFC3418 IEEE 802-1ap clause 17.3.2.1
IF-MIB	RFC2863 IEEE 802-1ap clause 17.3.2.2
IEEE8021-TC	IEEE 802-1ap clause 17.7.1
IEEE8021-BRIDGE	IEEE 802-1ap clause 17.7.2 IEEE 802-1ap clause 17.3.4.2
IEEE8021-Q-BRIDGE	IEEE 802-1ap clause 17.7.4
IEEE8021-SPANNING-TREE	IEEE 802-1ap clause 17.7.3
SNMP-FRAMEWORK-MIB	IETF RFC-3411
SNMP-MPD-MIB	IETF RFC-3412
SNMP-TARGET-MIB	IETF RFC-3413
SNMP-NOTIFICATION-MIB	IETF RFC-3413
SNMP-USER-BASED-SM-MIB	IETF RFC-3414
SNMP-VIEW-BASED-ACM-MIB	IETF RFC-3415

Annex B lists the specific MIB objects fulfilling the management features that shall be provided by the WRS.

6. WRS management architecture

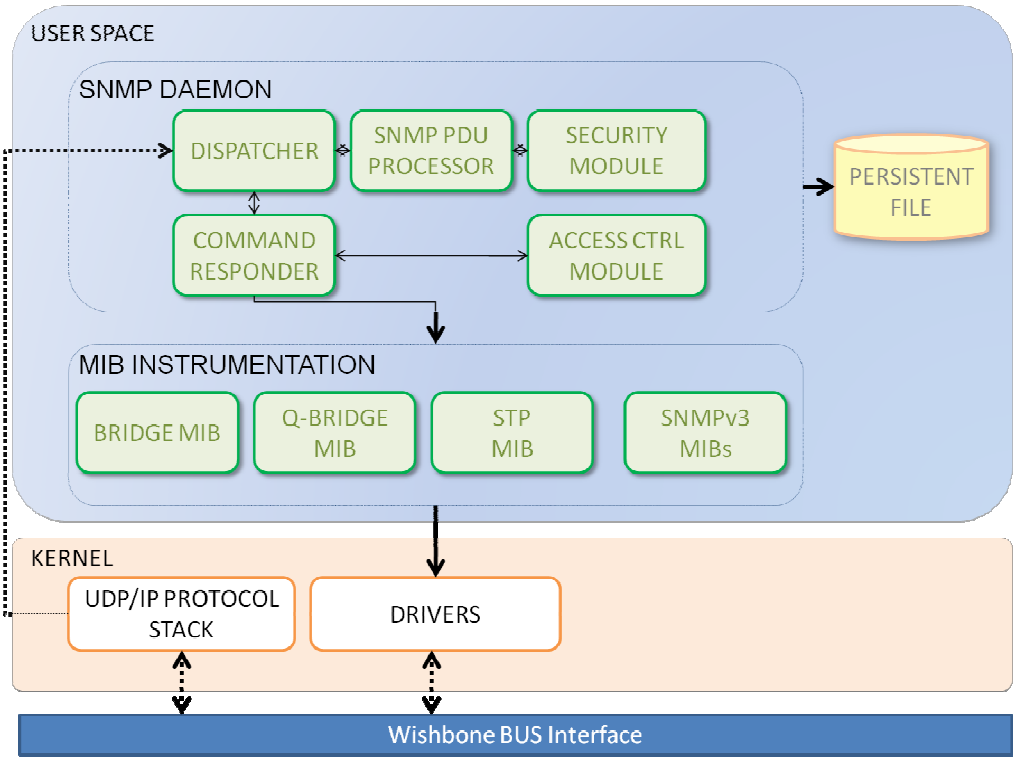
6.2. SNMP

The SNMP management architecture is based on the deployment of software components, traditionally known as *SNMP agents*, in each of the managed devices. These components provide the interfaces enabling distributed monitoring and control of the network elements and their resources.

Network level management is performed by components known as *SNMP managers*, which communicate with the SNMP agents to gather status information and control network devices operation.

The SNMP protocol information model associates an entity to each manageable device feature, representing its possibilities for monitoring and controlling a series of read/write attributes. These entities and attributes, hierarchically organised, define a *Management Information Based* (MIB). The MIB specification also defines the set of possible values for each attribute, and the effect that each of these values on the device operation.

Following this model, *each WRS will integrate an SNMP agent* which will handle the SNMP protocol and the information model provided by each MIB. *The SNMP agent will run in user space on top of a Linux operating system.*



The SNMP agent will access the MIB instrumentation modules in order to read/write the WRS operational parameters. The MIB modules will translate access to standard parameters into low level, WRS specific operations.

Security and access control will be provided by the security module and the access control module. The SNMPv3 administrative framework will offer the means to activate and deactivate these modules.

The basic operation of the SNMP agent will be as follows:

1. The *SNMP daemon* receives an SNMP PDU from the Linux UDP/IP protocol stack (+WR NIC).

2. The *dispatcher* checks the SNMP PDU protocol version and dispatches the PDU to the v3 *PDU processor*.

3. The *PDU processo*r gives the PDU to the *security module*. The *security module* checks security parameters (PDU integrity, authentication) and recovers (decrypt) the original PDU.

4. The *PDU processor* decodes the original PDU and returns it to the *dispatcher*. The *dispatcher* then sends the decoded SNMP message to the *command responder* module.

5. The *command responder* checks with the *access control module* whether the principal[14] that is requesting access to a MIB parameter is actually allowed to do so.

6. In case the operation is allowed, the *command responder* invokes the operation on the requested MIB module/object.

7. The MIB module then translates the operation request on a series of low level read/write calls, either to HW through corresponding drivers or to SW via IPC.

Write-access MIB parameters that must persist over power restart shall be stored on a persistent file in Flash memory.

6.2. CLI

The CLI module architecture will consist on:

- A command interpreter, responsible for understanding the command syntax, parsing input parameters, invoking the appropriate management operations and formatting gathered information.

[14] The principal represents the identity of the entity requesting the operation.

- A proxy component which will access the local SNMP agent to request reading and writing the MIB parameters associated to the requested management operation.

6.2.1 Optional MIB groups to be supported

Several MIB objects defined in optional groups will be also supported in order to exploit the CLI architecture based on the interaction with the local SNMP agent. These groups are:

- For the IEEE8021-BRIDGE MIB:
  - ieee8021BridgeCapGroup (Optional Capabilities of the device)
- For the IEEE8021-Q-BRIDGE MIB:
  - ieee8021QBridgeFdbStaticGroup (Information about addresses statically configured)

7. Non-functional requirements

MNG_REQ1: Writable MIB objects which must be retained across system reinitialization shall be made persistent.

TBD

Bibliography

[1] J. G. Ramirez, “White Rabbit Switch Functional Specification”, September 2010

[2] C. Prados, M. Lipinski, “White Rabbit and Robustness”, March 2011

[3] T. Fleck, C. Prados, “White Rabbit Node Functional Specification”, December 2010

[4] “ITU-T Recommendation M.3010 – Principles for a telecommunications management network”, http://www.itu.int/rec/T-REC-M.3010-200002-I/en

[5] Rich Seifert and Jim Edwards. “The All-New Switch Book: The Complete Guide to LAN Switching Technology.”

8. Annex A. WRS management capabilities

This section provides a detailed list of management capabilities provided by the WRS, considering solely its standard bridge functionalities and behavior.

Switch configuration

The WRS shall provide operations to support obtaining and modifying the general switch configuration, including:

- Switch discovery, which shall support WRSs identification in the network.
- Read switch configuration, which shall provide general information about a switch (switch name, number of ports, port addresses and uptime).
- Set switch name.
- Reset switch[15], which shall permit reinitializing the switch remotely.

Port configuration

The WRS shall provide operations to support obtaining and modifying switch port configuration, including:

- Read port, which shall provide each port name and type.
- Set port name.

Port Performance Analysis

The WRS shall provide capabilities to read per-port forwarding process counters enabling overall performance analysis, including:

- Count of frames received at each port.

[15] Note this operation will be only supported via CLI.

- Count of frames received at each port that were discarded.

- Count of frames forwarded to the MAC entity.

Port priority configuration

The WRS shall provide support to control the priority with which a given port transmit frames, including operations to:

- Read default port priority

- Set default port priority

Filtering database management

The WRS shall support obtaining and setting configuration of the filtering information used by the Forwarding Process, including operations to:

- Control the filtering database

    - Read filtering database general information (number of static and dynamic entries, aging time).

    - Read, create and delete static filtering entries from the filtering database.

    - Set filtering database aging time.

- Control the permanent database.

    - Read permanent database general information (number of filtering and VLAN registration entries)

    - Read, create and delete filtering entries from the permanent database.

Rapid Spanning Tree Protocol configuration

The WRS shall support operations to control the configuration of the Rapid Spanning Tree Protocol, including:

- Read RSTP protocol parameters (topology changes monitoring, designated root, root path, etc)
- Set RSTP protocol parameter (max age, hello time, forward delay, priority, forceVersion and txHoldCount).
- Read RSTP port parameters (uptime, state, parth cost, designated root, etc).
- Set RSTP port parameters.
- Force a specified port to transmit RST BPDUs.

MRP, MMRP and MVRP configuration

The WRS shall support the management functions required to configure MRP, MMRP and MRVP protocol operation, including:

- Read general MRP, MMRP and MVRP protocol configuration.
- Read MRP, MMRP and MVRP control parameters.
    - Read MRP timers
    - Others
- Set MRP, MMRP and MVRP control parameters.
    - Set MRP timers
    - Configure MMRP Restricted_Group_Registration parameter for each port.

    - Others

- Read MRP state.

- Notification of group registration failures.

VLAN configuration

The WRS shall support VLAN identification and the operations required to perform (per-port) VLAN set up, including:

- Read VLAN general information (version number, supported optional features, etc).

- Read, create and delete VLAN configuration.

Configuration of VID to FID allocations.

The WRS shall allow remotely reading and setting VID to FID allocations.

9. Annex B. List of supported MIB objects

Annex B lists the management data and operations that a switch must implement to be compliant to the management operations defined in Std IEEE 802.1Q-2005. The table follows the structure defined in the standard PICS pro-forma, along with the description of the management operations provided in Clause 12. For each input/output parameter used by these operations, the correspondence with one or more standard MIB objects is presented. Shadowed cells highlight SNMP unsupported operations (i.e. no objects are defined in the standard MIBs that allow performing the corresponding IEEE 802.1Q-2005 management operations). Thus for them to be supported, proprietary MIBs may be defined. In some cases they will be available exclusively through the CLI operations.

The definition of the MIB modules made in the amendment IEEE 802.1ap-2008 includes the identification of those groups of objects that are mandatory in order to fulfill the compliance statements for the different features that a device claims to support. The MIB Compliance field in the table indicates whether the referenced MIB objects in the row belongs to a mandatory or an optional group, according to the functionalities implemented in the WR Switch.

Given the proposed CLI architecture (i.e. based on the interaction with the local SNMP agent), all the mandatory operations defined by the Std IEEE 802.1Q-2005 and supported through MIBs will be implemented, even when the referenced objects in these MIBs do not belong to mandatory groups in the compliance statements.

Apart from those defined in the table, there are also several management operations that are not considered in the PICS Proforma of the Std IEEE 802.1Q-2005, though they are defined in its Clause 12. These operations, that will be available through management operations, are:

- Operations on the Bridge VLAN Configuration managed object (Clause 12.10.1 of the Std IEEE 802.1Q-2005)
    - Configure Restricted_VLAN_Registration parameters. The object to handle this operation in the MIBs is ieee8021QBridgePortRestrictedVlanRegistration (mandatory in the IEEE8021-Q-BRIDGE module).
- Operations on the MMRP Configuration managed object (Clause 12.11.1 of the Std IEEE 802.1Q-2005):

- Read MMRP Configuration. The object to handle this operation in the MIBs is ieee8021BridgePortRestrictedGroupRegistration (mandatory in the IEEE8021-BRIDGE module).
- Notify Group registration failure. There are no objects in MIBs to handle this operation as defined in the Std IEEE802.1Q-2005.
- Configure Restricted_Group_Registration parameters. The object to handle this operation in the MIBs is ieee8021BridgePortRestrictedGroupRegistration (mandatory in the IEEE8021-BRIDGE module).

The management operations specifically defined for the WR Switches are not included in this Annex.

Entity	Objects	Item	Operations	Data		References			MIB Compliance	Comments
						IEEE 802.1Q-2005	MIB module	MIB Object		
Bridge Management	Bridge Configuration	MGT-1	Discover Bridge	Inputs	Inclusion Range (ordered pairs of MAC Addresses specifying a range of MAC Addresses)					This operation is to solicit configuration information regarding the Bridge(s) in the network included in the "Inclusion Range" and not included in the "Exclusion List" (values specified by the user)
					Exclusion List (list of specific MAC Addresses)					
				Outputs	Bridge Address	12.4.1.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgeBaseBridgeAddress*	Mandatory	
					Bridge Name	12.4.1.1.3 b)	SNMPv2-MIB	*sysName*	Mandatory	sysDescr object may be used also, but the "Bridge Name" has to be limited to a maximum of 32 characters
					Number of Ports	12.4.1.1.3 c)	IEEE8021-BRIDGE	*ieee8021BridgeNumPorts*	Mandatory	
					Port Addresses (port number + port address)	12.4.1.1.3 d)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort* and *ieee8021BridgeBasePortIfIndex*	Mandatory	This data will be provided as a list indexed by ieee8021BridgeBasePort. The ieee8021BridgeBasePortIfIndex will be the value of the IfIndex object defined in IF-MIB, or the value 0.
					Uptime	12.4.1.1.3 e)	SNMPv2-MIB	*sysUpTime*	Mandatory	
		MGT-2	Read Bridge	Outputs	Bridge Address	12.4.1.2.3 a)	IEEE8021-BRIDGE	*ieee8021BridgeBaseBridgeAddress*	Mandatory	Remember that it's recommended that this be the numerically smallest MAC address of all ports belonging to the bridge.
					Bridge Name	12.4.1.2.3 b)	SNMPv2-MIB	*sysName*	Mandatory	sysDescr object may be used also, but the "Bridge Name" has to be limited to a maximum of 32 characters
					Number of Ports	12.4.1.2.3 c)	IEEE8021-BRIDGE	*ieee8021BridgeNumPorts*	Mandatory	
					Port Addresses (port number + port address)	12.4.1.2.3 d)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort* and *ieee8021BridgeBasePortIfIndex*	Mandatory	This data will be provided as a list indexed by ieee8021BridgeBasePort. The ieee8021BridgeBasePortIfIndex will be the value of the IfIndex object defined in IF-MIB, or the value 0.
					Uptime	12.4.1.2.3 e)	SNMPv2-MIB	*sysUpTime*	Mandatory	
		MGT-3	Set Bridge Name	Inputs	Bridge Name	12.4.1.3.2 a)	SNMPv2-MIB	*sysName*	Mandatory	sysDescr object may be used also, but the "Bridge Name" has to be limited to a maximum of 32 characters
		MGT-4	Reset Bridge			12.4.1.4	NOT CONSIDERED USEFUL			OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES
	Port Configuration	MGT-5	Read Port	Inputs	Port Number	12.4.2.1.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	
				Outputs	Port Name	12.4.2.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePortName*	Mandatory	
					Port Type	12.4.2.1.3 b)	IF-MIB	*ifType*		
		MGT-6	Set Port Name	Inputs	Port Number	12.4.2.2.2 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. (In the std 802.1Q this operation is described as: "To associate a text string, readable by the Read Port operation, with a Bridge Port". However, the object defining the Port Name (ieee8021BridgeBasePortName) is defined in the MIB as a read-only object)
					Port Name	12.4.2.2.2 b)				
		MGT-7 (a) (no VLAN Identifier specified)	Read Forwarding Port Counters	Inputs	Port Number	12.6.1.1.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	
				Outputs	Frames Received	12.6.1.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgeTpPortInFrames*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.
					Octets Received (optional)	12.6.1.1.3 b)				OPTIONAL: OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES
					Discard Inbound	12.6.1.1.3 c)	IEEE8021-BRIDGE	*ieee8021BridgeTpPortInDiscards*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.
					Forward Outbound	12.6.1.1.3 d)	IEEE8021-BRIDGE	*ieee8021BridgeTpPortOutFrames*	Mandatory	Referenced explicitly by the MIB modules
					Discard Lack of Buffers	12.6.1.1.3 e)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					Discard Transit Delay Exceeded	12.6.1.1.3 f)	IEEE8021-BRIDGE	*ieee8021BridgeBasePortDelayExceededDiscards*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.

Forwarding Process	Port Counters				Discard on Error	12.6.1.1.3 g)	IEEE8021-BRIDGE	*ieee8021BridgeBasePortMtuExceededDiscards*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.
					Discard on Ingress Filtering (if Ingress Filtering is supported)	12.6.1.1.3 h)				Ingress Filtering is not supported if no VLAN Identifier is provided as input of the operation.
					Discard on Error Details (optional)	12.6.1.1.3 I)				OPTIONAL: OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES
		MGT-7 (b) (VLAN Identifier specified)	Read Forwarding Port Counters	Inputs	Port Number	12.6.1.1.2 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. (In Clause 12.6.1.1.2, the std 802.1q states that "If the VLAN identifier (12.6.1.1.2 b) parameters is supported, then the forwarding Port counters are maintained per VLAN per Port", however ieee8021QBridgeVlanStatisticsGroup is not mandatory as there may be significant implementation cost associated with its support)
					VLAN Identifier (optional)	12.6.1.1.2 b)				
				Outputs	Frames Received	12.6.1.1.3 a)				
					Octets Received (optional)	12.6.1.1.3 b)				
					Discard Inbound	12.6.1.1.3 c)				
					Forward Outbound	12.6.1.1.3 d)				
					Discard Lack of Buffers	12.6.1.1.3 e)				
					Discard Transit Delay Exceeded	12.6.1.1.3 f)				
					Discard on Error	12.6.1.1.3 g)				
					Discard on Ingress Filtering (if Ingress Filtering is supported)	12.6.1.1.3 h)				
					Discard on Error Details (optional)	12.6.1.1.3 I)				
	Priority Handling	MGT-8	Read Port Default Priority	Inputs	Port Number	12.6.2.1.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	
				Outputs	Default Priority Value	12.6.2.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgePortDefaultUserPriority*	Mandatory	As stated by the IEEE8021-BRIDGE MIB, this object "only has effect on media, such as Ethernet, that do not support native User Priority". It defines "the default ingress User Priority" for this port. This Default Priority parameter is described in Clause 6.4 of the Std 802.1D, and is referenced as the user_priority parameter, which is used to enqueue the frames to be transmitted.
		MGT-9 (requires MAC-6)	Set Port Default Priority	Inputs	Port Number	12.6.2.2.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	This operation is Mandatory if the Item MAC-6 in the PICS proforma is implemented (i.e. can be the default priority set for each port?)
					Default Priority Value	12.6.2.2.3 b)	IEEE8021-BRIDGE	*ieee8021BridgePortDefaultUserPriority*	Mandatory	
		MGT-10 (requires RLY-5)	Read Port Priority Regeneration Table	NOT APPLICABLE						At a HW level, in the WR Switch, Priority Regeneration Tables are not supported; only procedures to substitute priorities are provided.
		MGT-11 (requires RLY-5)	Set Port Priority Regeneration Table	NOT APPLICABLE						At a HW level, in the WR Switch, Priority Regeneration Tables are not supported; only procedures to substitute priorities are provided.
		MGT-14	Read Outbound Access Priority Table	NOT APPLICABLE						This is a table mapping Regenerated User Priority to Outbound Access Priority. This is useful for Token Ring or FDDI, but not for CSMA/CD media.
	The Traffic Class Table	MGT-12 (requires TC)	Read Port Traffic Class Table	Inputs	Port Number	12.6.3.1.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	
				Outputs	Number of Traffic Classes	12.6.3.1.3 a)	IEEE8021-BRIDGE	Count rows in *ieee8021BridgeTrafficClassTable*	Optional	It can be computed by reading all the Traffic Classes instantiated in the table for a given port.
					Value of the Traffic Class and the set of priority values associated to it	12.6.3.1.3 b)	IEEE8021-BRIDGE	*ieee8021BridgeTrafficClassPriority* and *ieee8021BridgeTrafficClass*	Optional	The ieee8021BridgeTrafficClassTable is indexed by port and then by the priority determined for the received frame (either ieee8021BridgePortDefaultUserPriority or ieee8021BridgeRegenUserPriority).
		MGT-13 (requires TC-3)	Set Port Traffic Class Table	Inputs	Port Number	12.6.3.2.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	
					Value of the Traffic Class and the set of priority values associated to it	12.6.3.2.2 b)	IEEE8021-BRIDGE	*ieee8021BridgeTrafficClassPriority* and *ieee8021BridgeTrafficClass*	Optional	Only the ieee8021BridgeTrafficClass value can be modified (ieee8021BridgeTrafficClassPriority is an index)

	The Filtering Database	MGT- 15	Read Filtering Database	Outputs	Filtering Database Size	12.7.1.1.3 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					Number of Static Filtering Entries	12.7.1.1.3 b)	IEEE8021-QBRIDGE	Count rows in *ieee8021QBridgeStaticUnicastTable* + *ieee8021QBridgeStaticMulticastTable*	Optional	As suggested by Std. 802.1Q, Table 17.8
					Number of Dynamic Filtering Entries	12.7.1.1.3 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeFdbDynamicCount*	Mandatory	Here, Dynamic Filtering Entries (Std 802.1Q, Clause 8.8.3) refers to the ones created and updated by the learning process. It only comprises unicast MAC addresses. This "Read Filtering Database" operation is related to all the Filtering Databases defined in the system. However ieee8021QBridgeFdbDynamicCount is indexed for each fdb ID.
					Number of Static VLAN Registration Entries	12.7.1.1.3 d)	IEEE8021-QBRIDGE	Count rows in *ieee8021QBridgeVlanStaticTable*	Mandatory	As suggested by 802.1Q, Table 17.8
					Number of Dynamic VLAN Registration Entries	12.7.1.1.3 e)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. A Dynamic VLAN Registration Entry may specify dynamic filtering information for an existing Static VLAN Registration Entry (Std 802.1Q, Clause 8.8.5). However, this kind of entries will be still marked as permanent (ieee8021QBridgeVlanStatus) in the ieee8021QBridgeVlanCurrentTable. This makes difficult the identification of Dynamic VLAN Registration Entries in a simple manner.
					Ageing Time	12.7.1.1.3 f)	IEEE8021-QBRIDGE	*ieee8021QBridgeFdbAgingTime*	Mandatory	
					Number of MAC Address Registration Entries (if EFS are supported)	12.7.1.1.3 g)	IEEE8021-QBRIDGE	Count rows applicable to each FDB in *ieee8021QBridgeTpGroupTable* (=> only the entries with *ieee8021QBridgeTpGroupLearnt* specified should be considered)	Mandatory	As suggested by 802.1Q, Table 17.8 Remember that MAC Address Registration Entries are created/updated only as a result of MRP protocol exchanges.
		MGT- 16	Set Filtering Database Ageing Time	Inputs	Ageing Time	12.7.1.2.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeFdbAgingTime*	Mandatory	
	Permanent Database	MGT-17	Read Permanent Database	Outputs	Permanent Database Size	12.7.6.1.3 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					Number of Static Filtering Entries	12.7.6.1.3 b)	IEEE8021-QBRIDGE	Not directly supported, but can be calculated: (Count rows in *ieee8021QBridgeStaticUnicastTable* marked in *ieee8021QBridgeStaticUnicastStorageType* as permanent(4)) + (Count rows in *ieee8021QBridgeStaticMulticastTable* marked in *ieee8021QBridgeStaticMulticastStorageType* as permanent(4)) + (Count rows in *ieee8021QBridgeTpFdbTable* marked in *ieee8021QBridgeTpFDBStatus* as self(4))	Optional	OPERATION PARTIALLY SUPPORTED WITH STANDARD MIB MODULES. Instead of "permanent", we could use "nonVolatile" (see "StorageType" options in RFC 2579). Should the "self" addresses be included in the permanent database, or considered as "reserved"? (Remember that "management shall not provide the capability to modify or remove entries for Reserved MAC Addresses"; however the permanent database can be modified through management)
					Number of Static VLAN Registration Entries	12.7.6.1.3 c)	IEEE8021-QBRIDGE	Count rows in *ieee8021QBridgeVlanStaticTable*	Mandatory	As suggested by 802.1Q, Table 17.8
					Identifier	12.7.7.1.2 a)				This Identifier is used to select the Filtering Database or the Permanent Database. This operation applies to: Static Filtering Entries (802.1Q 8.8.1) or Static VLAN Registration Entries (802.1Q 8.8.2) in the Filtering or Permanent Database. The MIB tables where these entries may be created/updated are ieee8021QBridgeForwardAllTable (only update), ieee8021QBridgeForwardUnregisteredTable (only update), ieee8021QBridgeStaticUnicastTable, ieee8021QBridgeStaticMulticastTable and ieee8021QBridgeVlanStaticTable.

Filtering Database	General Filtering Database Operations	MGT-18	Create Filtering Entry	Inputs	Address (not present in VLAN Registration Entries)	12.7.7.1.2 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeStaticUnicastAddress* or *ieee8021QBridgeStaticMulticastAddress*	Optional	We'll choose an object depending on which table of the MIB we want to create/update an entry in. Entries could be created for unicast addresses, in ieee8021QBridgeStaticUnicastTable, and for multicast addresses in ieee8021QBridgeStaticMulticastTable.
					VID	12.7.7.1.2 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeForwardAllVlanIndex* (it can't be created) or *ieee8021QBridgeForwardUnregisteredVlanIndex* (it can't be created) or *ieee8021QBridgeStaticUnicastVlanIndex* or *ieee8021QBridgeVlanIndex* or *ieee8021QBridgeVlanStaticVlanIndex*	Mandatory and Optional	We'll choose an object depending on which table of the MIB we want to create/update an entry in. For ieee8021QBridgeForwardAllTable and ieee8021QBridgeForwardUnregisteredTable, this value can be only used as a read-only index (it can't be created as part of a new entry) (The VID for a local VLAN entry (not 802.1Q) should be extracted from ieee8021QBridgeNextFreeLocalVlanTable)
					Port Map	12.7.7.1.2 d)	IEEE8021-QBRIDGE	*ieee8021QBridgeForwardAllStaticPorts* or *ieee8021QBridgeForwardAllForbiddenPorts* or *ieee8021QBridgeForwardUnregisteredStaticPorts* or *ieee8021QBridgeForwardUnregisteredForbiddenPorts* or *ieee8021QBridgeStaticUnicastStaticEgressPorts* or *ieee8021QBridgeStaticUnicastForbiddenEgressPorts* or *ieee8021QBridgeStaticMulticastStaticEgressPorts* or *ieee8021QBridgeStaticMulticastForbiddenEgressPorts* or *ieee8021QBridgeVlanStaticEgressPorts* or *ieee8021QBridgeVlanForbiddenEgressPorts* or *ieee8021QBridgeVlanStaticUntaggedPorts*	Mandatory and Optional	As specified by the Std 802.1Q (Clause 12.7.7.1.2 d)), this port map is related to egress ports (not to receive ports). We'll choose an object depending on which table of the MIB we want to create/update an entry in. For Static VLAN Registration Entries (802.1Q 8.8.2), the untagged ports can be identified through this operation.
				Outputs	Operation rejected	12.7.7.1.3 a)				Data introduced by Std 802.1ah. The operation is rejected if a Port identified by the Port Map includes a port already in the member set of a VLAN of a different type than the currently registered VLAN
					Operation accepted	12.7.1.1.3 b)				Data introduced by Std 802.1ah
		MGT-19	Delete Filtering Entry	Inputs	Identifier	12.7.7.2.2 a)				OPERATION PARTIALLY SUPPORTED WITH STANDARD MIB MODULES. This Identifier is used to select the Filtering Database or the Permanent Database. This operation applies to: Filtering Entries (static or dynamic) or VLAN Registration Entries (static) in the Filtering or Permanent Database. The MIB tables where these entries may be deleted are ieee8021QBridgeStaticUnicastTable, ieee8021QBridgeStaticMulticastTable and ieee8021QBridgeVlanStaticTable. Some objects holding dynamic information cannot be removed through remote management (Read-Only access). However dynamic information can be deleted if it is part of a static entry (which will usually have permissions to be removed by remote management)
					Address (not present in VLAN Registration Entries)	12.7.7.2.2 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeStaticUnicastAddress* or *ieee8021QBridgeStaticMulticastAddress*	Optional	We'll choose an object depending on which table of the MIB we want to delete an entry in.
					VID	12.7.7.2.2 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeStaticUnicastVlanIndex* or *ieee8021QBridgeVlanIndex* or *ieee8021QBridgeVlanStaticVlanIndex*	Mandatory and Optional	We'll choose an object depending on which table of the MIB we want to delete an entry in. For ieee8021QBridgeForwardAllTable and ieee8021QBridgeForwardUnregisteredTable, an entry will be deleted only if the associated entry in ieee8021QBridgeVlanStaticTable is deleted

				Inputs	Identifier	12.7.7.3.2 a)				This Identifier is used to select the Filtering Database or the Permanent Database. The operation applies to: Filtering Entries, VLAN Registration Entries and Group Registration Entries in the Filtering or Permanent Database (static or dynamic entries). We'll choose an object depending on which table of the MIB we want to read an entry in. The tables to read will be ieee8021QBridgeTpFdbTable, ieee8021QBridgeTpGroupTable, ieee8021QBridgeForwardAllTable, ieee8021QBridgeForwardUnregisteredTable, ieee8021QBridgeStaticUnicastTable, ieee8021QBridgeStaticMulticastTable, ieee8021QBridgeVlanCurrentTable and ieee8021QBridgeVlanStaticTable.
					Address (not present in VLAN Registration Entries)	12.7.7.3.2 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeTpFdbAddress* or *ieee8021QBridgeTpGroupAddress* or *ieee8021QBridgeStaticUnicastAddress* or *ieee8021QBridgeStaticMulticastAddress*	Mandatory and Optional	
					VID	12.7.7.3.2 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex* or *ieee8021QBridgeForwardAllVlanIndex* or *ieee8021QBridgeForwardUnregisteredVlanIndex* or *ieee8021QBridgeStaticUnicastVlanIndex* or or *ieee8021QBridgeVlanStaticVlanIndex*	Mandatory and Optional	
					Type	12.7.7.3.2 d)	IEEE8021-QBRIDGE	*ieee8021QBridgeTpFdbStatus* or *ieee8021QBridgeStaticUnicastStorageType* or *ieee8021QBridgeStaticMulticastStorageType* *Ieee8021QBridgeVlanStatus*	Mandatory and Optional	
		MGT-20	Read Filtering Entry	Outputs	Address (not present in VLAN Registration Entries)	12.7.7.3.3 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeTpFdbAddress* or *ieee8021QBridgeTpGroupAddress* or *ieee8021QBridgeStaticUnicastAddress* or *ieee8021QBridgeStaticMulticastAddress*	Mandatory and Optional	
					VID	12.7.7.3.3 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex* or *ieee8021QBridgeForwardAllVlanIndex* or *ieee8021QBridgeForwardUnregisteredVlanIndex* or *ieee8021QBridgeStaticUnicastVlanIndex* or or *ieee8021QBridgeVlanStaticVlanIndex*	Mandatory and Optional	
					Type	12.7.7.3.3 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeTpFdbStatus* or *ieee8021QBridgeStaticUnicastStorageType* or *ieee8021QBridgeStaticMulticastStorageType* *Ieee8021QBridgeVlanStatus*	Mandatory and Optional	
					Port Map	12.7.7.3.3 d)	IEEE8021-QBRIDGE	*ieee8021QBridgeTpFdbPort* or *ieee8021QBridgeTpGroupEgressPorts* or *ieee8021QBridgeTpGroupLearnt* or *ieee8021QBridgeForwardAllPorts* or *ieee8021QBridgeForwardAllStaticPorts* or *ieee8021QBridgeForwardAllForbiddenPorts* or *ieee8021QBridgeForwardUnregisteredPorts* or *ieee8021QBridgeForwardUnregisteredStaticPorts* or *ieee8021QBridgeForwardUnregisteredForbiddenPorts* or *ieee8021QBridgeStaticUnicastStaticEgressPorts* or *ieee8021QBridgeStaticUnicastForbiddenEgressPorts* or *ieee8021QBridgeStaticMulticastStaticEgressPorts* or *ieee8021QBridgeStaticMulticastForbiddenEgressPorts* or *ieee8021QBridgeVlanCurrentEgressPorts* or *ieee8021QBridgeVlanCurrentUntaggedPorts* or *ieee8021QBridgeVlanStaticEgressPorts* or *ieee8021QBridgeVlanForbiddenEgressPorts* or *ieee8021QBridgeVlanStaticUntaggedPorts*	Mandatory and Optional	
					Identifier	12.7.7.4.2 a)				

		MGT-21	Read Filtering Entry Range	Inputs	Start Index	12.7.7.4.2 b)				As suggested by Std 802.1Q, Table 17.8: "Use GetNext operation"
					Stop Index	12.7.7.4.2 c)				
				Outputs	Start Index	12.7.7.4.3 a)				
					Stop Index	12.7.7.4.3 b)				
					For each index: Address, VID, Type, Port Map	12.7.7.4.3 c)				
	The Protocol Entity	MGT-22	Read CIST Bridge Protocol Parameters	Outputs	Bridge Identifier	12.8.1.1.3 a)	IEEE8021-SPANNING-TREE	Combination of *ieee8021SpanningTreePriority* and *ieee802BridgeBaseBridgeAddress*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module and by the Table 17.6 of the Std 802.1ap. The ieee8021SpanningTreePriority is the write-able portion of the Bridge ID (i.e. first two octets). The last six octets are given by the value of ieee8021BridgeBaseBridgeAddress
					Time Since Topology Change	12.8.1.1.3 b)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeTimeSinceTopologyChange*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Topology Change Count	12.8.1.1.3 c)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeTopChanges*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Topology Change	12.8.1.1.3 d)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. The Table 17.6 of the Std 802.1ap states "Since this is transitory, it is not considered useful"
					Designated Root	12.8.1.1.3 e)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeDesignatedRoot*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Root Path Cost	12.8.1.1.3 f)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRootCost*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Root Port	12.8.1.1.3 g)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRootPort*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Max Age	12.8.1.1.3 h)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeMaxAge*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Forward Delay	12.8.1.1.3 I)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeForwardDelay*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Bridge Max Age	12.8.1.1.3 j)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeBridgeMaxAge*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Bridge Hello Time (only if the Bridge supports STP or RSTP)	12.8.1.1.3 k)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeBridgeHelloTime*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Bridge Forward Delay	12.8.1.1.3 l)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeBridgeForwardDelay*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Transmission Limit	12.8.1.1.3 m)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRstpTxHoldCount*	Mandatory (if RSTP is implemented)	Referenced explicitly by the IEEE8021-SPANNING-TREE module. (For the Std 802.1D-1998, this data was referenced as "Hold Time")
					forceVersion (if the Bridge supports RSTP or MSTP)	12.8.1.1.3 n)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeVersion*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					CIST Regional Root Identifier (if the Bridge supports MSTP)	12.8.1.1.3 o)	NOT APPLICABLE			MSTP not implemented
					CIST Path Cost (if the Bridge supports MSTP)	12.8.1.1.3 p)	NOT APPLICABLE			MSTP not implemented
					MaxHops (if the Bridge supports MSTP)	12.8.1.1.3 q)	NOT APPLICABLE			MSTP not implemented
		MGT-23	Set CIST Bridge Protocol Parameters	Inputs	Bridge Max Age	12.8.1.3.2 a)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeBridgeMaxAge*	Mandatory	
					Bridge Hello Time (only if the Bridge supports STP or RSTP)	12.8.1.3.2 b)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeBridgeHelloTime*	Mandatory	
					Bridge Forward Delay	12.8.1.3.2 c)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeBridgeForwardDelay*	Mandatory	
					Bridge Priority	12.8.1.3.2 d)	IEEE8021-SPANNING-TREE	ieee8021SpanningTreePriority	Mandatory	

					forceVersion (if the Bridge supports RSTP or MSTP)	12.8.1.3.2 e)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeVersion*	Mandatory	
					TxHoldCount (if the Bridge supports RSTP or MSTP)	12.8.1.3.2 f)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRstpTxHoldCount*	Mandatory	
					MaxHops (if the Bridge supports MSTP)	12.8.1.3.2 g)	NOT APPLICABLE			MSTP not implemented
				Outputs	Operation Status	12.8.1.3.3 a)				This can take 2 main values: - Operation accepted; or - Operation rejected (see Clause 12.8.1.3.3 in Std 802.1Q for the reason to be rejected)
		MGT-33 (requires MSTP)	Read MSTI Bridge Protocol Parameters			12.8.1.2	NOT APPLICABLE			MSTP not implemented
		MGT-34 (requires MSTP)	Set MSTI Bridge Protocol Parameters			12.8.1.4	NOT APPLICABLE			MSTP not implemented
				Inputs	Port Number	12.8.2.1.2 a)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePort*		Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Uptime	12.8.2.1.3 a)	IF-MIB	*ifLastChange*	Mandatory	Referenced by the Table 17.6 of the Std 802.1ap
					Port State	12.8.2.1.3 b)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortState*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Port Identifier	12.8.2.1.3 c)	IEEE8021-SPANNING-TREE	Combination of *ieee8021SpanningTreePort* and *ieee8021SpanningTreePortPriority*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module and by the Table 17.6 of the Std 802.1ap.
					Path Cost	12.8.2.1.3 d)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortPathCost* (which can be complemented by *ieee8021SpanningTreeRstpPortAdminPathCost*)	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Designated Root	12.8.2.1.3 e)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortDesignatedRoot*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Designated Cost	12.8.2.1.3 f)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortDesignatedCost*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Designated Bridge	12.8.2.1.3 g)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortDesignatedBridge*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Designated Port	12.8.2.1.3 h)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortDesignatedPort*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Topology Change Acknowledge	12.8.2.1.3 I)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. The Table 17.6 of the Std 802.1ap states “Since this is transitory, it is not considered useful”
					Hello Time	12.8.2.1.3 j)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeHelloTime*	Mandatory	There's not a MIB object specifying the “Hello Time” per port. The ieee8021SpanningTreeHelloTime object is common for all the ports of the bridge.
					adminEdgePort (if the identification of edge ports is supported)	12.8.2.1.3 k)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRstpPortAdminEdgePort*	Mandatory (if RSTP is implemented)	Referenced explicitly by the IEEE8021-SPANNING-TREE module. Edge Ports are those ports attached to a LAN that has no other bridges or switches attached.
					operEdgePort (if the identification of edge ports is supported)	12.8.2.1.3 l)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRstpPortOperEdgePort*	Mandatory (if RSTP is implemented)	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
		MGT- 24	Read CIST Port Parameters	Outputs	MAC Enabled (if the implementation supports the MAC Enabled parameter)	12.8.2.1.3 m)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortEnable*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					MAC Operational (if the implementation supports the MAC Operational parameter)	12.8.2.1.3 n)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					adminPointToPointMAC (if the implementation supports the adminPointToPointMAC parameter)	12.8.2.1.3 o)	IEEE8021-BRIDGE	*ieee8021BridgeBasePortAdminPointToPoint*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.

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	Bridge Port				OperPointToPointMAC (if the implementation supports the OperPointToPointMAC parameter)	12.8.2.1.3 p)	IEEE8021-BRIDGE	*ieee8021BridgeBasePortOperPointToPoint*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.
					restrictedRole	12.8.2.1.3 q)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					restrictedTcn	12.8.2.1.3 r)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					Port Role	12.8.2.1.3 s)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					Disputed	12.8.2.1.3 t)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					CIST Regional Root Identifier (if the Bridge supports MSTP)	12.8.2.1.3 u)	NOT APPLICABLE			MSTP not implemented
					CIST Path Cost (if the Bridge supports MSTP)	12.8.2.1.3 v)	NOT APPLICABLE			MSTP not implemented
					Port Hello Time (if the Bridge supports MSTP)	12.8.2.1.3 w)	NOT APPLICABLE			MSTP not implemented
		MGT-26	Set CIST Port Parameters	Inputs	Port Number	12.8.2.3.2 a)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePort*	Mandatory	Referenced explicitly by the IEEE8021-SPANNING-TREE module.
					Path Cost	12.8.2.3.2 b)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortPathCost* (which can be complemented by *ieee8021SpanningTreeRstpPortAdminPathCost*)	Mandatory	
					Port Priority	12.8.2.3.2 c)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortPriority*	Mandatory	
					adminEdgePort (if the identification of edge ports is supported)	12.8.2.3.2 d)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreeRstpPortAdminEdgePort*	Mandatory (if RSTP is implemented)	
					MAC Enabled (if the implementation supports the MAC Enabled parameter)	12.8.2.3.2 e)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePortEnable*	Mandatory	
					adminPointToPointMAC (if the implementation supports the adminPointToPointMAC parameter)	12.8.2.3.2 f)	IEEE8021-BRIDGE	*ieee8021BridgeBasePortAdminPointToPoint*	Mandatory	Referenced explicitly by the IEEE8021-BRIDGE module.
					restrictedRole	12.8.2.3.2 g)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					restrictedTcn	12.8.2.3.2 h)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
				Outputs	Operation Status	12.8.2.3.3 a)				This can take 2 main values: - Operation accepted; or - Operation rejected (due to invalid Port Priority value)
		MGT-27	Force BPDU Migration Check	Inputs	Port Number	12.8.2.5.2 a)	IEEE8021-SPANNING-TREE	*ieee8021SpanningTreePort*	Mandatory	OPERATION AVAILABLE ONLY IN BRIDGES THAT SUPPORT RSTP OR MSTP. This operation is executed by setting the ieee8021SpanningTreeRstpPortProtocolMigration value to TRUE (referenced explicitly by the IEEE8021-SPANNING-TREE module.)
		MGT-35 (requires MSTP)	Read MSTI Port Parameters			12.8.2.2	NOT APPLICABLE			MSTP not implemented

		MGT-37 (requires MSTP)	Set MSTI Port Parameters			12.8.2.4	NOT APPLICABLE			MSTP not implemented
MRP Entities	The MRP Timer Object	MGT-28 (requires MRP)	Read MRP Timers	Inputs	Port Identifier	12.9.1.1.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	
				Outputs	Current value of JoinTime	12.9.1.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgePortMrpJoinTime*	Mandatory	
					Current value of LeaveTime	12.9.1.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgePortMrpLeaveTime*	Mandatory	
					Current value of LeaveAllTime	12.9.1.1.3 a)	IEEE8021-BRIDGE	*ieee8021BridgePortMrpLeaveAllTime*	Mandatory	
		MGT-29 (requires MRP)	Set MRP Timers	Inputs	Port Identifier	12.9.1.2.2 a)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	This value is just used as an index.
					New value of JoinTime	12.9.1.2.2 b)	IEEE8021-BRIDGE	*ieee8021BridgePortMrpJoinTime*	Mandatory	
					New value of LeaveTime	12.9.1.2.2 c)	IEEE8021-BRIDGE	*ieee8021BridgePortMrpLeaveTime*	Mandatory	
					New value of LeaveAllTime	12.9.1.2.2 d)	IEEE8021-BRIDGE	*ieee8021BridgePortMrpLeaveAllTime*	Mandatory	
	The MRP Attribute Type Object	MGT-30 (requires MRP)	Read MRP Applicant Controls			12.9.2.1				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
		MGT-31 (requires MRP)	Set MRP Applicant Controls			12.9.2.2				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
	The MRP State Machine Object	MGT-32	Read MRP State			12.9.3.1	NOT CONSIDERED USEFUL			OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES (reference: Table 17.8 in Std 802.1ap)
	The Bridge VLAN Configuration managed object	MGT-38	Read Bridge VLAN Configuration	Outputs	The IEEE 802.1Q VLAN Version number	12.10.1.1.3 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanVersionNumber*	Mandatory	
					Maximum number of VLANs supported	12.10.1.1.3 b.1)	IEEE8021-QBRIDGE	*ieee8021QBridgeMaxSupportedVlans*	Mandatory	
					Whether the implementation supports the ability to override the default PVID and its egress status on each port	12.10.1.1.3 b.2)	IEEE8021-BRIDGE	*ieee8021BridgeBaseDeviceCapabilities*	Mandatory	Egress status can be “VLAN-tagged” or “untagged”
					Protocol Template formats	12.10.1.1.3 b.3)	NOT APPLICABLE			Port-and-Protocol-based VLAN classification not implemented
					Maximum number of MSTIs supported	12.10.1.1.3 b.4)	NOT APPLICABLE			MSTP not implemented
					For each port: The port number	12.10.1.1.3 c.1)	IEEE8021-BRIDGE	*ieee8021BridgeBasePort*	Mandatory	Used as an index for the ieee8021QBridgePortVlanTable
					For each port: The PVID value currently assigned to that port	12.10.1.1.3 c.2)	IEEE8021-QBRIDGE	*ieee8021QBridgePvid*	Mandatory	
					For each port: Support of Port-and-Protocol-based VLAN classification	12.10.1.1.3 c.3)	NOT APPLICABLE			Port-and-Protocol-based VLAN classification not implemented
					For each port: VID Set information	12.10.1.1.3 c.4)	NOT APPLICABLE			Port-and-Protocol-based VLAN classification not implemented
					For each port: The state of the Acceptable Frame Types	12.10.1.1.3 c.5)	IEEE8021-QBRIDGE	*ieee8021QBridgePortAcceptableFrameTypes*	Mandatory	
					For each port: The state of the Enable Ingress Filtering parameter	12.10.1.1.3 c.4)	IEEE8021-QBRIDGE	*ieee8021QBridgePortIngressFiltering*	Mandatory	The permissible values are “Enabled” or “Disabled”
					For each port: The state of the Restricted_VLAN_Registration parameter	12.10.1.1.3 c.5)	IEEE8021-QBRIDGE	*ieee8021QBridgePortRestrictedVlanRegistration*	Mandatory	The permissible values are “TRUE” or “FALSE”
					Port-and-Protocol-based VLAN information	12.10.1.1.3 d)	NOT APPLICABLE			Port-and-Protocol-based VLAN classification not implemented

Bridge VLAN managed objects		MGT-39	Configure PVID values	Inputs	A Port number and the PVID value to be associated with that port	12.10.1.2.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgePvid*	Mandatory	The port number will be used as an index to modify the ieee8021QBridgePvid in the ieee8021QBridgePortVlanTable
					Port-and-Protocol-based VLAN information	12.10.1.2.2 b)	NOT APPLICABLE			Port-and-Protocol-based VLAN classification not implemented
				Outputs	Operation Status	12.10.1.2.3 a)				This can take 2 main values: - Operation accepted; or - Operation rejected (due to the PVID being of the supported range for this Port)
		MGT-40 (requires VLAN-2)	Configure Acceptable Frame Types parameter	Inputs	For each port, a Port number and the value of its Acceptable Frame Types parameter	12.10.1.3.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgePortAcceptableFrameTypes*	Mandatory	Referenced explicitly by the IEEE8021-QBRIDGE module. The port number will be used as an index to modify the ieee8021QBridgePortAcceptableFrameTypes in the ieee8021QBridgePortVlanTable
		MGT-41 (requires VLAN-9)	Configure Enable Ingress Filtering parameters	Inputs	For each port, a Port number and the value of its Enable Ingress Filtering parameter	12.10.1.4.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgePortIngressFiltering*	Mandatory	Referenced explicitly by the IEEE8021-QBRIDGE module. The port number will be used as an index to modify the ieee8021QBridgePortIngressFiltering in the ieee8021QBridgePortVlanTable
		MGT-42	Reset Bridge			12.10.1.5	NOT CONSIDERED USEFUL			OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES (reference: Table 17.8 in Std 802.1ap)
		MGT-43	Notify VLAN Registration Failure			12.10.1.6	NOT CONSIDERED USEFUL			OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES (reference: Table 17.8 in Std 802.1ap)
	VLAN Configuration managed object	MGT-44	Read VLAN Configuration	Inputs	VLAN Identifier	12.10.2.1.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex* or *ieee8021QBridgeVlanStaticVlanIndex*	Mandatory	The MIB tables where these entries may be read are ieee8021QBridgeVlanCurrentTable and ieee8021QBridgeVlanStaticTable
				Outputs	VLAN Name	12.10.2.1.3 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanStaticName*	Mandatory	Referenced explicitly by the IEEE8021-QBRIDGE module. Conforming IEEE8021-QBRIDGE module, only static entries will have a VLAN Name.
					List of Untagged Ports	12.10.2.1.3 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanCurrentUntaggedPorts* or *ieee8021QBridgeVlanStaticUntaggedPorts*	Mandatory	Referenced explicitly by the IEEE8021-QBRIDGE module.
					List of Egress Ports	12.10.2.1.3 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanCurrentEgressPorts*	Mandatory	Referenced explicitly by the IEEE8021-QBRIDGE module.
		MGT-45	Create VLAN Configuration	Inputs	VLAN Identifier	12.10.2.2.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanStaticVlanIndex*	Mandatory	Std 802.1Q-2005 states that "Static configuration of the Member set and the Untagged set is achieved by means of the management operations defined in 12.7"
					VLAN Name	12.10.2.2.2 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanStaticName*	Mandatory	
		MGT-46	Delete VLAN Configuration	Inputs	VLAN Identifier	12.10.2.3.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanStaticVlanIndex*	Mandatory	The MIB table where these entries may be deleted is ieee8021QBridgeVlanStaticTable
		MGT-56	Does the implementation support the configuration of VLAN learning constraints via management?							YES, IT DOES. The WR Switch implementation supports Shared and/or Independent VLAN Learning (SVL and/or IVL). This Learning behavior shall be read/modified through the ieee8021BridgeBaseDeviceCapabilities object. The interpretation and presentation of the data of the VLAN Learning Constraints Table specified by the Std 802.1Q in Clause 12.10.3.1 is different from the one made through MIB modules. However, the objects in the MIBs contain all the information of the VLAN Learning Constraints Table, and the same operations defined by the Std 802.1Q can be made via SNMP. The tables to manage the learning constraint rules are: ieee8021QBridgeLearningConstraintsTable and ieee8021QBridgeLearningConstraintDefaultsTable
		MGT-57 (requires MGT-56)	Read VLAN Learning Constraints	Inputs	First Entry	12.10.3.1.2 a)				Specified by the user
					Last Entry	12.10.3.1.2 b)				Specified by the user
					For each entry, the Entry Index	12.10.3.1.3 a)				OPERATION NOT SUPPORTED WITH

	The VLAN Learning Constraints managed objects			Outputs	For each entry, the type of the Learning Constraint	12.10.3.1.3 b)				STANDARD MIB MODULES. Each table entry either defines a single Learning Constraint or is undefined. The VLAN Learning Constraints Table in the MIBs is indexed by VID and Constraint Set, not by the number of the entry.
					For each entry, the value of the Learning Constraint	12.10.3.1.3 c)				
		MGT-58 (requires MGT-56)	Read VLAN Learning Constraints for VID	Inputs	VID	12.10.3.2.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeConstraintVlan*	Mandatory	If there's not an explicit entry in the ieee8021QBridgeLearningConstraintsTable for this VID, then the info in ieee8021QBridgeLearningConstraintDefaultsTable applies for the learning constraints.
				Outputs	All learning constraints values that identify the VID requested	12.10.3.2.3 a)	IEEE8021-QBRIDGE	Operate with: *ieee8021QBridgeConstraintVlan* and *ieee8021QBridgeConstraintsSet* and *ieee8021QBridgeConstraintsType*	Mandatory	OPERATION PARTIALLY SUPPORTED WITH STANDARD MIB MODULES. Remember that the presentation of the data of the Learning Constraints Table made by the IEEE8021-QBRIDGE module differs from that defined in Std 802.1Q
		MGT-59 (requires MGT-56)	Set VLAN Learning Constraint	Inputs	Entry Index	12.10.3.3.2 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. Entries in ieee8021QBridgeLearningConstraintsTable are indexed by VID, not by Entry number.
					The type of Learning Constraint	12.10.3.3.2 b)				
					The value of the Learning Constraint	12.10.3.3.2 c)				
				Outputs	Operation Status	12.10.3.3.3 a)				
		MGT-60 (requires MGT-56)	Delete VLAN Learning Constraint	Inputs	Entry Index	12.10.3.4.2 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. Entries in ieee8021QBridgeLearningConstraintsTable are indexed by VID, not by Entry number.
				Outputs	Operation Status	12.10.3.4.3 a)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES.
		MGT-61 (requires MGT-56)	Notify Learning Constraint Violation			12.10.3.10	NOT CONSIDERED USEFUL			OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES (reference: Table 17.8 in Std 802.1ap)
		MGT-62	Does the implementation support configuration of VID to FID allocations via management?							YES, IT DOES. But it won' be through remote means, since there are no objects in MIBs modules to handle it (although it is possible to read the resultant allocation of VID to FID by means of ieee8021QBridgeVlanIndex and ieee8021QBridgeVlanFdbId objects in the ieee8021QBridgeVlanCurrentTable). The type of an entry in the VID to FID allocations Table may be: fixed (defined via management), or dynamic (defined as a result of applying the VLAN Learning Constraints Table) or undefined.
		MGT-63 (requires MGT-62)	Read VID to FID allocations	Inputs	First Entry	12.10.3.5.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex*		Specified by the user
					Last Entry	12.10.3.5.2 b)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex*		Specified by the user
				Outputs	For each entry, the VID	12.10.3.5.3 a.1)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex*		
					For each entry, the Allocation Type	12.10.3.5.3 a.2)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					For each entry, the FID	12.10.3.5.3 a.3)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanFdbId*		The value of this object is extracted from the VID to FID allocation Table.
		MGT-64 (requires MGT-62)	Read FID allocation for VID	Inputs	VID	12.10.3.6.2 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex*		Specified by the user
				Outputs	VID	12.10.3.6.3 a)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanIndex*		
					Allocation Type	12.10.3.6.3 b)				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
					FID	12.10.3.6.3 c)	IEEE8021-QBRIDGE	*ieee8021QBridgeVlanFdbId*		
		MGT-65 (requires MGT-62)	Read VIDs allocated to FID			12.10.3.7				OPERATION PARTIALLY SUPPORTED WITH STANDARD MIB MODULES. This operation reports all the VIDs allocated to a FID. It could be computed using “GetNext” operation over the ieee8021QBridgeVlanCurrentTable, returning only those outputs including the given FID.

		MGT-66 (requires MGT-62)	Set VID to FID allocation			12.10.3.8				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
		MGT-67 (requires MGT-62)	Delete VID to FID allocation			12.10.3.9				OPERATION NOT SUPPORTED WITH STANDARD MIB MODULES. There are no objects in MIBs to carry out this operation.
MST configuration entities	The MSTI List	MGT-47 (requires MSTP)	Read MSTI List			12.12.1.1	NOT APPLICABLE			MSTP not implemented
		MGT-48 (requires MSTP)	Create MSTI			12.12.1.2	NOT APPLICABLE			MSTP not implemented
		MGT-49 (requires MSTP)	Delete MSTI			12.12.1.3	NOT APPLICABLE			MSTP not implemented
	The FID to MSTID Allocation Table	MGT-50 (requires MSTP)	Read FID to MSTID allocation			12.12.2.1	NOT APPLICABLE			MSTP not implemented
		MGT-51 (requires MSTP)	Set FID to MSTID allocation			12.12.2.2	NOT APPLICABLE			MSTP not implemented
	The MST Configuration Table	MGT-52 (requires MSTP)	Read MST Configuration Table Element			12.12.3.1	NOT APPLICABLE			MSTP not implemented
		MGT-53 (requires MSTP)	Read VIDs assigned to MSTID			12.12.3.2	NOT APPLICABLE			MSTP not implemented
		MGT-54 (requires MSTP)	Read MST Configuration Identifier			12.12.3.3	NOT APPLICABLE			MSTP not implemented
		MGT-55 (requires MSTP)	Set MST Configuration Identifier Elements			12.12.3.4	NOT APPLICABLE			MSTP not implemented
		MGT-68 (requires MSTP)	Support Bridge management for the bridge protocol entity in all supported spanning trees				NOT APPLICABLE			MSTP not implemented
		MGT-69 (requires MSTP)	Support independent management of bridge and port priority and path cost per spanning tree				NOT APPLICABLE			MSTP not implemented
		MGT-70 (requires MSTP)	Support VLAN management per spanning tree				NOT APPLICABLE			MSTP not implemented
		MGT-71 (requires MSTP)	Support MSTI configuration management				NOT APPLICABLE			MSTP not implemented

Table based on the PICS proforma A.14 in Std 802.1Q-2005