



IEEE Standard for Local and metropolitan area networks—

Virtual Bridged Local Area Networks

Amendment 7: Multiple Registration Protocol

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

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IEEE Std 802.1Q™-2005)

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Local and metropolitan area networks—**

Virtual Bridged Local Area Networks

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IEEE Computer Society**

Approved 22 March 2007

IEEE-SA Standards Board

Abstract: This amendment specifies a set of protocols that replaces the GARP, GMRP, and GVRP protocols specified in earlier versions of IEEE Std 802.1Q.

Keywords: Bridged Local Area Networks, LANs, local area networks, MAC Bridges, metropolitan area networks, MRP, MMRP, MVRP, Virtual Bridged Local Area Networks, virtual LANs

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IEEE Standard for Local and metropolitan area networks— Virtual Bridged Local Area Networks

Amendment 7: Multiple Registration Protocol

[This document amends IEEE Std 802.1Q™-2005.]

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

This amendment specifies changes to IEEE Std 802.1Q that specifies a replacement for the GARP, GMRP, and GVRP protocols. Changes are applied to the base text of IEEE Std 802.1Q-2005 as modified by IEEE Std 802.1ad™-2006. Text shown in bold italics in this amendment defines the editing instructions necessary to changes to this base text. Three editing instructions are used: ***change***, ***delete***, and ***insert***. ***Change*** is used to make a change to existing material. The editing instruction specifies the location of the change and describes what is being changed. Changes to existing text may be clarified using ~~strikeout~~ markings to indicate removal of old material, and underscore markings to indicate addition of new material). ***Delete*** removes existing material. ***Insert*** adds new material without changing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. Editorial notes will not be carried over into future editions of IEEE Std. 802.1Q.

1. Overview

1.1 Scope

Insert the following text at the end of this subclause, renumbering the list items appropriately:

In addition, this standard specifies protocols, procedures, and managed objects to support the Multiple Registration Protocol (MRP). MRP allows participants in an MRP Application to register attributes with other participants in a Bridged Local Area Network. Two applications are defined—one to register VLANs [Multiple VLAN Registration Protocol (MVRP)] and one to register MAC addresses [Multiple MAC Registration Protocol (MMRP)]. MVRP will furthermore provide for the rapid healing of network failures without interrupting services to unaffected VLANs. To this end, it specifies the following:

- a) MRP and the operation of the MRP protocol entities.^{1, 2}
- b) The generic frame formats used in MRP protocol exchanges.

¹MRP replaces the Generic Attribute Registration Protocol (GARP), defined in IEEE Std 802.1D, that was used to support GVRP and GMRP in earlier revisions of IEEE Std 802.1Q. Similarly, GVRP and GMRP are replaced by MVRP and MMRP respectively.

²As a result of the protocol changes described in this amendment, corresponding changes will be required in the managed objects and SNMP MIB modules, to reflect the fact that GARP, GMRP, and GVRP functionality are replaced by MRP, MMRP, and MVRP.

- c) The Multiple MAC Registration Protocol (MMRP) application of MRP, and the frame formats that it uses.
- d) The Multiple VLAN Registration Protocol (MVRP) application of MRP, and the frame formats that it uses.

3. Definitions

Change the introductory paragraphs of this clause as shown:

For the purposes of this standard, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms* [B1],³ should be referenced for terms not defined in this clause.

~~This Standard makes use of the following terms defined in IEEE Std 802.1D~~

- ~~— Active topology~~
- ~~— Bridge Port~~
- ~~— GARP Participant~~
- ~~— GARP Application~~
- ~~— GIP Context~~
- ~~— Group~~
- ~~— Port~~

Change the definition of Group as follows:

3.24 Group: A Group associates

- a) A group MAC address; and
- b) A set of properties that define membership characteristics; and
- c) A set of properties that define the forwarding/filtering behavior of a Bridge with respect to frames destined for members of that group MAC address;

with a set of end stations that all wish to receive information destined for that group MAC address. Members of such a set of end stations are said to be *Group members*.

A Group is said to *exist* if the properties associated with that Group are visible in an entry in the Filtering Database of a Bridge, or in the ~~GARP~~MRP state machines that characterize the state of the Group; a Group is said to *have members* if the properties of the Group indicate that members of the Group can be reached through specific Ports of the Bridge.

NOTE—An example of the information that Group members might wish to receive is a multicast video data stream.

³The numbers in brackets correspond to those of the bibliography in Annex H.

4. Abbreviations

Delete the following abbreviations from the list:

GARP
GID
GIP
GMRP
GVRP

Insert the following abbreviations in Clause 4 in the correct alphabetical sequence:

MAD	MRP Attribute Declaration
MAP	MRP Attribute Propagation
MMRP	Multiple MAC Registration Protocol
MMRPDU	Multiple MAC Registration Protocol Data Unit
MRP	Multiple Registration Protocol
MRPDU	Multiple Registration Protocol Data Unit
MVRP	Multiple VLAN Registration Protocol
MVRPDU	Multiple VLAN Registration Protocol Data Unit

5. Conformance

5.1 Requirements terminology

Change the penultimate paragraph as shown:

The PICS proformas (see Annex A for Bridges and Annex I for end station implementations) reflects the occurrences of the words shall, may, and should within the standard.

5.3 Protocol Implementation Conformance Statement (PICS)

Change the penultimate paragraph before NOTE 1 as shown:

The supplier of an implementation that is claimed to conform to this standard shall provide the information necessary to identify both the supplier and the implementation, and shall complete a copy of the PICS proforma provided in Annex A for that specific Bridge component or system, or Annex I for an end station implementation, together with ~~the~~ any further information and completed PICS(s) required to identify subcomponents.

5.4 VLAN-aware bridge component requirements

Change list item i) as shown:

- i) Allow automatic configuration and management of VLAN topology using the ~~Generic Attribute Registration Protocol (GARP)~~ Multiple VLAN Registration Protocol (GVRPMVVRP) (5.4.2, Clause 11) on all Ports;

5.4.1 VLAN-aware bridge component options

Change list item c) as follows:

- c) Support Extended Filtering Services (6.12.5) and the operation of ~~GARP Multiple MAC Multicast Registration Protocol (GMRPMMRP, see 10.9) (IEEE Std 802.1D-2004 Clause 10)~~ as modified by Clause 10 of this Standard to support automatic configuration and management of MAC address information on all Ports (5.4.1.3);

Change list item m) as follows:

- m) Allow configuration of the ~~Restricted Group Registration~~ Restricted MAC Address Registration parameter (~~IEEE Std 802.1D-10.12.2.3~~) for each Port of the Bridge;

5.4.1.1 Multiple Spanning Tree (MST) operation (optional)

Change item 10) as shown:

- 10) Support the operation of ~~GVRPMVVRP~~ in each supported spanning tree context (11.2.3.1.1, 11.2.3.1.2);

Insert new subclause 5.4.1.3, as follows:

5.4.1.3 Multiple MAC Registration Protocol (MMRP) operation (optional)

A VLAN-aware Bridge implementation in conformance to the provisions of this standard for the support of MMRP shall

- a) Conform to the operation of the MRP Applicant, Registrar, LeaveAll, and Periodic Transmission state machines, as defined in 10.7.7, 10.7.8, 10.7.9, and 10.7.10, as required for one or the other of the following variants of the MRP Participant, as defined in 10.6 and 10.7:
 - 1) The Full Participant.
 - 2) The Full Participant, point-to-point subset.
- b) Exchange MRPDUs as required by those state machines, formatted in accordance with the generic PDU format described in 10.8, and able to carry application-specific information as defined in 10.12, using the group MAC addresses reserved for use by MRP applications, as defined in Table 10-1.
- c) Implement the MMRP Application component as defined in 10.12.
- d) Propagate registration information in accordance with the operation of MAP for the Base Spanning Tree Context, as specified in 10.3.1.
- e) Forward, filter or discard MAC frames carrying any MRP Application address as the destination MAC Address in accordance with the requirements of 8.13.6.

Insert new subclause 5.4.2, as follows:

5.4.2 Multiple VLAN Registration Protocol (MVRP) requirements

A VLAN-aware Bridge implementation in conformance to the provisions of this standard for the support of MVRP shall

- a) Conform to the operation of the MRP Applicant, Registrar, LeaveAll, and Periodic Transmission state machines, as defined in 10.7.7, 10.7.8, 10.7.9, and 10.7.10, as required for one or the other of the following variants of the MRP Participant, as defined in 10.6 and 10.7:
 - 1) The Full Participant.
 - 2) The Full Participant, point-to-point subset.
- b) Exchange MRPDUs as required by those state machines, formatted in accordance with the generic PDU format described in 10.8, and able to carry application-specific information as defined in 11.2, using the group MAC addresses reserved for use by MRP applications, as defined in Table 10-1.
- c) Implement the MVRP Application component as defined in 11.2.
- d) Propagate registration information
 - 1) In an SST bridge, in accordance with the operation of MAP for the Base Spanning Tree Context, as specified in 10.3 and 10.3.1; or
 - 2) in an MST bridge, in accordance with the operation of MAP for multiple Spanning Tree contexts as specified in 11.2.3.1.2 of this standard.
- e) Forward, filter or discard MAC frames carrying any MRP Application address as the destination MAC Address in accordance with the requirements of 8.13.6.
- f) If a VID Translation Table (6.7) is in use for a Bridge Port, translate VIDs in MVRPDUs as specified in 11.2.4.

Renumber existing subclause 5.9 as 5.10. Insert the following as new subclauses 5.9, 5.9.1, and 5.9.2, following subclause 5.8, as follows:

5.9 End station requirements for MMRP and MVRP

This subclause defines the conformance requirements for end station implementations claiming conformance to MVRP and MMRP. Although this standard is principally concerned with defining the requirements for VLAN-aware Bridges, the conformance requirements for end station implementations of MVRP and MMRP are included in order to give guidance to such implementations. The PICS Proforma defined in Annex I is concerned with conformance claims with respect to end station implementations.

For the reasons stated in 10.6, it is recommended that end stations that do not require the ability to perform Source Pruning implement the Applicant-Only Participant, in preference to the Simple-Applicant Participant.

5.9.1 MMRP requirements and options

An end station for which conformance to MMRP is claimed shall

- a) Conform to the operation of the MRP Applicant, Registrar, LeaveAll, and Periodic Transmission state machines, as defined in 10.7.7, 10.7.8, 10.7.9, and 10.7.10, as required for one or more of the following variants of the MRP Participant, as defined in 10.6 and 10.7:
 - 1) The Full Participant.
 - 2) The Full Participant, point-to-point subset.
 - 3) The Applicant-Only Participant.
 - 4) The Simple-Applicant Participant.
- b) Exchange MPDUs as required by the MRP state machine(s) implemented, formatted in accordance with the generic PDU format described in 10.8, and able to carry application-specific information as defined in 10.12.1, using the MMRP Application address as defined in Table 10-1.

An end station for which conformance to the operation of the Applicant state machine (10.7.7) is claimed may

- c) Perform source pruning, as defined in 10.10.3 and 10.12.

It is recommended that only those end stations that require the ability to perform Source Pruning (10.10.3) conform to the operation of the Full Participant or the Full Participant, point-to-point subset.

NOTE—If an end station does not require the ability to perform Source Pruning, then there is no need for it to implement Registrar functionality.

5.9.2 MVRP requirements and options

An end station for which conformance to MVRP is claimed shall

- a) Conform to the operation of the MRP Applicant, Registrar, LeaveAll, and Periodic Transmission state machines, as defined in 10.7.7, 10.7.8, 10.7.9, and 10.7.10, as required for one or more of the following variants of the MRP Participant, as defined in 10.6 and 10.7:
 - 1) The Full Participant.
 - 2) The Full Participant, point-to-point subset.
 - 3) The Applicant-OnlyParticipant-Only Participant.
 - 4) The Simple-Applicant Participant.
- b) Exchange MPDUs as required by the MRP state machine(s) implemented, formatted in accordance with the generic PDU format described in 10.8, and able to carry application-specific information as defined in 11.2.3, using the MVRP Application address as defined in Table 10-1.

An end station for which conformance to MVRP is claimed may

- c) Perform source pruning, as defined in 10.10.3 and 11.2.1.1.

It is recommended that only those end stations that require the ability to perform Source Pruning (11.2.1.1) conform to the operation of the Full Participant or the Full Participant, point-to-point subset.

NOTE—If an end station does not require the ability to perform Source Pruning, then there is no need for it to implement Registrar functionality.

6. Support of the MAC Service in VLANs

Insert the following as a new subclause 6.12:

6.12 Filtering services in Bridged Local Area Networks

MAC Bridges provide filtering services that support aspects of the maintenance of QoS—in particular, transit delay, priority, and throughput. In addition, these services provide a degree of administrative control over the propagation of particular MAC Addresses in the network.

The services described are services in the most general sense; i.e., descriptions of functionality available to a MAC Service user or an administrator to control and access filtering capabilities. The descriptions make no assumptions as to how the service might be realized. There are at least the following possibilities:

- a) Use of existing protocols and mechanisms, defined in IEEE 802® standards and elsewhere.
- b) Use of management functionality, either locally defined or via remote management protocols.
- c) Other means, standardized or otherwise.

6.12.1 Purpose(s) of filtering service provision

Filtering services are provided for the purposes described in 6.12.1.1 and 6.12.1.2.

6.12.1.1 Administrative control

Filtering services provide administrative control over the use of particular source and destination addresses in designated parts of the network. Such control allows network managers and administrators to limit the extent of operation of network layer and other protocols that use individual and group MAC addresses by establishing administrative boundaries across which specific MAC Addresses are not forwarded.

6.12.1.2 Throughput and end station load

Filtering services increase the overall throughput of the network, and reduce the load placed on end stations caused by the reception of frames that are destined for other end stations, by

- a) Limiting frames destined for specific MAC Addresses to parts of the network that, to a high probability, lie along a path between the source MAC Address and the destination MAC Address.
- b) Reducing the extent of group addressed frames to those parts of the network that contain end stations that are legitimate recipients of that traffic.
- c) In Virtual Bridged Local Area Networks, reducing the extent of frames on specific VLANs to those parts of the network that contain stations that are legitimate recipients of traffic on that VLAN.

NOTE—Some aspects of the filtering services described in this standard are dependent upon the active participation of end stations. Where such participation is not possible, those aspects of the filtering services will be unavailable.

6.12.2 Goals of filtering service provision

The filtering services provided can be used to

- a) Allow the MAC Service provider to dynamically learn where the recipients of frames addressed to individual MAC Addresses are located.
- b) Allow end stations that are the potential recipients of MAC frames destined for group MAC addresses to dynamically indicate to the MAC Service provider which destination MAC Address(es) they wish to receive.
- c) Exercise administrative control over the extent of propagation of specific MAC Addresses.

6.12.3 Users of filtering services

The filtering services provided are available to the following users:

- a) Network management and administration, for the purposes of applying administrative control. Interactions between administrators of the network and the filtering service provider may be achieved by local means or by means of explicit management mechanisms.
- b) End stations, for the purposes of controlling the destination addresses that they will receive. Interactions between end stations and the filtering service provider may be implicit, as is the case with the Learning Process (8.7), or by explicit use of filtering service primitives.

6.12.4 Basis of service

Filtering in Bridged Local Area Networks relies on the establishment of filtering rules, and subsequent filtering decisions, that are based on the value(s) contained in the Source MAC Address, Destination MAC Address, or VID fields in MAC frames.

NOTE—The filtering services defined by this standard use source address learning, destination address, and VID filtering.

6.12.5 Categories of service

Filtering services in Bridged Local Area Networks fall into the following categories:

- a) *Basic Filtering Services.* These services are supported by the Forwarding Process (8.6) and by Static Filtering Entries (8.8.1), Static VLAN Registration Entries (8.8.2), Dynamic Filtering Entries (8.8.3), and Dynamic VLAN Registration Entries (8.8.5) in the Filtering Database. The information contained in the Dynamic Filtering Entries is maintained through the operation of the Learning Process (8.7), while the information contained in the Dynamic VLAN Registration Entries is maintained through the operation of MVRP (Clause 11).
- b) *Extended Filtering Services.* These services are supported by the Forwarding Process (8.6), and the Static Filtering Entries (8.8.1) and Group Registration Entries (8.8.4) in the Filtering Database. The information contained in the Group Registration Entries is maintained through the operation of MMRP (10.9).

All Bridges shall support Basic Filtering Services and may support Extended Filtering Services.

6.12.6 Service configuration

In the absence of explicit information in the Filtering Database, the behavior of the Forwarding Process with respect to the forwarding or filtering of frames destined for group MAC addresses depends upon the categories of service supported by the Bridge.

Basic Filtering Services support the filtering behavior required for regions of a Bridged Local Area Network in which potential recipients of multicast frames exist, but where either the recipients or the Bridges are either unable to support the dynamic configuration of filtering information for those group MAC addresses, or the recipients have a requirement to receive all traffic destined for group MAC addresses.

Extended Filtering Services support the filtering behavior required for regions of a network in which potential recipients of multicast frames exist, and where both the potential recipients of frames and the Bridges are able to support dynamic configuration of filtering information for group MAC addresses. In order to integrate this extended filtering behavior with the needs of regions of the network that support only Basic Filtering Services, Bridges that support Extended Filtering Services can be statically and dynamically configured to modify their filtering behavior on a per-group MAC address basis, and also on the basis of the

overall filtering service provided by each outbound Port with regard to multicast frames. The latter capability permits configuration of the Port's default forwarding or filtering behavior with regard to group MAC addresses for which no specific static or dynamic filtering information has been configured.

Service configuration provides the ability to configure the overall filtering for the following cases:

- a) Bridges that only implement Basic Filtering Services.
- b) Bridges that support Extended Filtering Services in a heterogeneous environment, where some equipment is unable to participate in Dynamic Multicast Filtering, or where some equipment (e.g., routers) have specific needs to see unfiltered traffic.
- c) Bridges that support Extended Filtering Services in a homogeneous environment, where all equipment is able to participate in Dynamic Multicast Filtering.

6.12.7 Service definition for Extended Filtering Services

The Filtering Services are described by means of service primitives that define particular types of interaction between MAC Service users and the MAC Service provider across the MAC Service boundary. As these interactions are not defined between peer entities, they are described simply in terms of service requests sent from the MAC Service user to the MAC Service provider.

6.12.7.1 Dynamic registration and de-registration services

These services allow MAC Service users dynamic control over the set of destination MAC Addresses that they will receive from the MAC Service provider, by:

- a) Registering/deregistering membership of specific Groups associated with those addresses.
- b) Registering/deregistering individual MAC address information.
- c) Registering/deregistering service requirements with regard to the overall forwarding/filtering behavior for Groups.

Provision of these services is achieved by means of MMRP and its associated procedures, as described in 10.9.

NOTE 1—These services can provide the MAC Service user with dynamic control over access to multicast data streams, for example, multiple video channels made available by a server using a different group MAC address for each channel. The ability to both register and deregister Group membership, coupled with the filtering action associated with the Group membership, limits the impact of such services on the bandwidth available in the network. These services can be used to control the reception of other categories of multicast traffic, for similar reasons.

REGISTER_MAC_ADDRESS (MAC_ADDRESS)

Indicates to the MAC Service provider that the MAC Service user wishes to receive frames containing the MAC Address indicated in the MAC_ADDRESS parameter as the destination address. The MAC Addresses that can be carried by this parameter do not include the following:

- d) Any of the Reserved Addresses identified in Table 8-1 or Table 8-2.
- e) Any of the MRP Application addresses, as defined in Table 10-1.

DEREGISTER_MAC_ADDRESS (MAC_ADDRESS)

Indicates to the MAC Service provider that the MAC Service user no longer wishes to receive frames containing the MAC Address indicated in the MAC_ADDRESS parameter as the destination address.

REGISTER_SERVICE_REQUIREMENT (REQUIREMENT_SPECIFICATION)

Indicates to the MAC Service provider that the MAC Service user has a requirement for any devices that support Extended Filtering Services to forward frames in the direction of the MAC Service user in accordance with the definition of the service requirement defined by the REQUIREMENT_SPECIFICATION parameter. The values that can be carried by this parameter are as follows:

- f) Forward All Groups.
- g) Forward Unregistered Groups.

DEREGISTER_SERVICE_REQUIREMENT (REQUIREMENT_SPECIFICATION)

Indicates to the MAC Service provider that the MAC Service user no longer has a requirement for any devices that support Extended Filtering Services to forward frames in the direction of the MAC Service user in accordance with the definition of the service requirement defined by the REQUIREMENT_SPECIFICATION parameter. The values that can be carried by this parameter are as follows:

- h) Forward All Groups.
- i) Forward Unregistered Groups.

The use of these services can result in the propagation of group MAC address and service requirement information across the Spanning Tree, affecting the contents of Group Registration Entries (8.8.4) in Bridges and end stations, and thereby affecting the frame forwarding behavior of the Bridges and end stations with regard to multicast frames.

NOTE 2—If the Enhanced Internal Sublayer Service (EISS) is supported, the Extended Filtering Service primitives issued by the MAC Service user should also include a VID parameter in order to identify the VLAN associated with the MAC_ADDRESS or REQUIREMENT_SPECIFICATION specified.

7. Principles of network operation

Delete existing Figure 7-1 and insert new Figure 7-1 as follows:

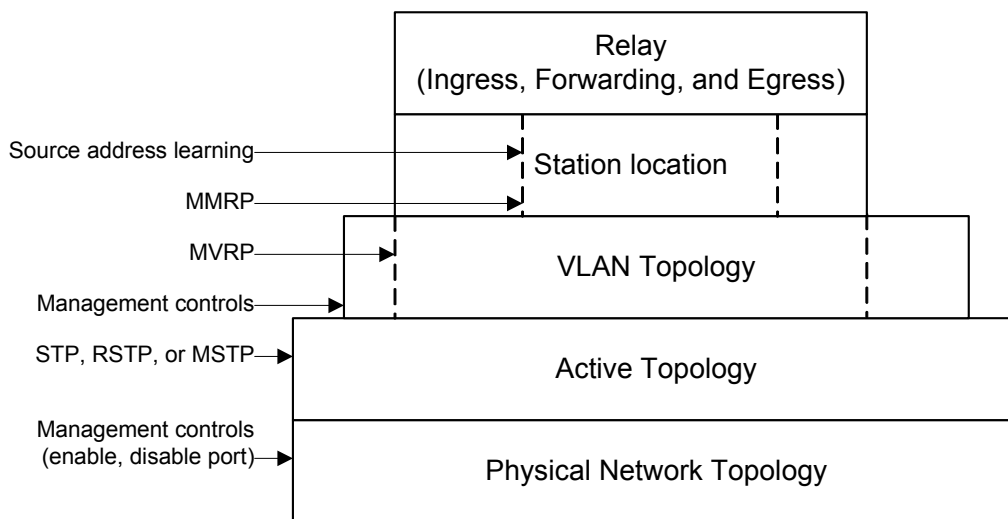


Figure 7-1—VLAN Bridging overview

7.3 VLAN Topology

Change NOTE 2 as follows:

NOTE 2—To accommodate end stations that do not participate in the ~~GVRP~~MVRP protocol specified in Clause 11, management controls associated with each Bridge Port allow the Port to identify the attached LAN segment as connecting end stations that require services using specified VLANs.

7.4 Locating end stations

Change the paragraph following NOTE 1, and NOTE 2, as follows:

The ~~multiple multicast~~MAC registration protocol (~~GMRP~~MMRP), specified in ~~Clause 10 of IEEE Std 802.1D~~Clause 10, allows end stations to advertise their presence and their desire to join (or leave) a multicast group, or to register an individual MAC address, in the context of a VLAN. The protocol communicates this information to other Bridges, using the VLAN and its active topology.

NOTE 2—To accommodate end stations that do not participate in ~~GMRP~~MMRP, management controls associated with each Bridge Port allow the Port to identify the attached LAN segment as connecting end stations that are intended to receive specified group addresses. The continuous operation of ~~GMRP~~MMRP, and the propagation of location information through Bridges using the current active topology for the VLAN, supports multicast traffic reduction, while ensuring rapid restoration of multicast connectivity, without management intervention, if alternate connectivity is selected following network component failure.

7.5 Ingress, forwarding, and egress rules

Change the NOTE, and the preceding paragraph, as follows:

Frames that carry control information to determine the active topology and current extent of each VLAN, i.e., spanning tree and ~~GVRP~~MVRP BPDUs, and frames from other link constrained protocols, such as

EAPOL and LLDP, are not forwarded. Permanently configured static entries in the filtering database (8.2, 8.3, and 8.12) ensure that such frames are discarded by the Forwarding Process (8.6).

NOTE—~~GARP PDUs~~ MRPDUs destined for any ~~GARP~~MRP application are forwarded or filtered depending upon whether the application concerned is supported by the bridge, as specified in 8.12.

8. Principles of bridge operation

8.1 Bridge operation

8.1.4 Traffic segregation

Change list item e) as follows:

- e) Configuration of Static Filtering Entries (8.8.1) and ~~Group~~ MAC Address Registration Entries (8.8.4).

8.1.5 Traffic reduction

Change list items c) through f) as follows:

- c) Automatic inclusion and removal of Bridge Ports in the VLAN, through configuration of Dynamic VLAN Registration Entries by means of ~~GVRP~~MVRP (8.8.5 and 11.2);
- d) Explicit configuration of management controls associated with the operation of ~~GVRP~~MVRP by means of Static VLAN Registration Entries (8.8.2 and 11.2);
- e) Automatic configuration of Group Registration Entries by means of ~~GMRP~~MMRP exchanges;
- f) Explicit configuration of the management controls associated with the operation of ~~GMRP~~MMRP by means of Group Registration Entries.

8.3 Model of operation

Change list item b) 2), as shown:

- 2) ~~Generic Attribute Registration Protocol~~Multiple Registration Protocol;

Change the 7th paragraph, and Figure 8-6, as shown:

Figure 8-6 illustrates the operation of the ~~Generic Attribute~~Multiple Registration Protocol (~~GARP~~MRP) Entity (8.10).

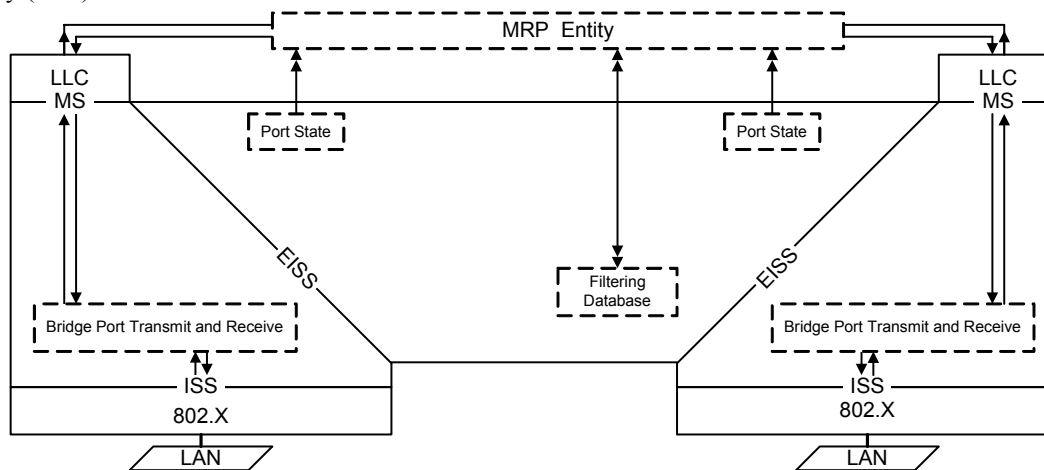


Figure 8-6—Operation of ~~GARP~~MRP

8.6 The Forwarding Process

8.6.3 Frame filtering

Change Table 8-1 as shown:

Table 8-1—C-VLAN component Reserved addresses

Assignment	Value
Bridge Group Address	01-80-C2-00-00-00
IEEE Std 802.3 Full Duplex PAUSE operation	01-80-C2-00-00-01
IEEE Std 802.3 Slow_Protocols_Multicast address	01-80-C2-00-00-02
IEEE Std 802.1X PAE address	01-80-C2-00-00-03
Reserved for future standardization—media access method specific	01-80-C2-00-00-04
Reserved for future standardization—media access method specific	01-80-C2-00-00-05
Reserved for future standardization	01-80-C2-00-00-06
Reserved for future standardization	01-80-C2-00-00-07
Provider Bridge Group Address	01-80-C2-00-00-08
Reserved for future standardization	01-80-C2-00-00-09
Reserved for future standardization	01-80-C2-00-00-0A
Reserved for future standardization	01-80-C2-00-00-0B
Reserved for future standardization	01-80-C2-00-00-0C
Provider Bridge ~~GVRP~~ MVRP Address ^a	01-80-C2-00-00-0D
IEEE Std 802.1AB Link Layer Discovery Protocol multicast address	01-80-C2-00-00-0E
Reserved for future standardization	01-80-C2-00-00-0F

^aIn IEEE Std 802.1ad-2005, this was assigned as the Provider Bridge GVRP address; as this amendment replaces GVRP with MVRP, the same address has been assigned for use with MVRP.

8.8 The Filtering Database

Change list items i) and j) as shown:

- i) ~~Group-MAC Address~~ Registration Entries support the registration of group MAC addresses. They are created, updated, and removed by the ~~GMRP~~MVRP protocol in support of Extended Filtering Services (8.8.4; Clause 10), subject to the state of the Restricted ~~Group-MAC Address~~ Registration management control (10.12.2.3~~10.3.2.3 of IEEE Std 802.1D~~). If the value of this control is TRUE, then the creation of a ~~Group-MAC Address~~ Registration Entry is not permitted unless a Static Filtering Entry exists that permits dynamic registration for the Group concerned.
- j) Dynamic VLAN Registration Entries are used to specify the Ports on which VLAN membership has been dynamically registered. They are created, updated, and removed by the ~~GVRP~~MVRP protocol, in support of automatic VLAN membership configuration (Clause 11), subject to the state of the Restricted_VLAN_Registration management control (11.2.3.2.3). If the value of this control is

TRUE, then the creation of a Dynamic VLAN Registration Entry is not permitted unless a Static VLAN Registration Entry exists that permits dynamic registration for the VLAN concerned.

Change the line following list item j) as follows:

Static Filtering Entries and ~~Group-MAC Address~~ Registration Entries comprise

Change the line immediately before list item s) as follows:

In Bridges that support Extended Filtering Services, the default forwarding behavior for group MAC addresses, for each Port, and for each VID, can be configured both statically and dynamically by means of Static Filtering Entries and/or ~~Group-MAC Address~~ Registration Entries that can carry the following MAC Address specifications:

Change list item t) as follows:

- t) All Unregistered Group Addresses (i.e., all group MAC addresses for which no ~~Group-MAC Address~~ Registration Entry exists), for which no more specific Static Filtering Entry exists.

Change the paragraph following NOTE 1 as follows:

The Filtering Database shall support the creation, updating and removal of Dynamic Filtering Entries by the Learning Process (8.7). In Bridges that support Extended Filtering Services, the Filtering Database shall support the creation, updating, and removal of ~~Group-MAC Address~~ Registration Entries by ~~GMRP/MMRP~~ (Clause 10 of IEEE Std 802.1D Clause 10).

Change list item u) as follows:

- u) The total number of entries (Static Filtering Entries, Dynamic Filtering Entries, ~~Group-MAC Address~~ Registration Entries, Static VLAN Registration Entries, and Dynamic VLAN Registration Entries) that the implementation of the Filtering Database can support, and

8.8.1 Static Filtering Entries

Change the final paragraph of this subclause as follows:

In addition to controlling the forwarding of frames, Static Filtering Entries ~~for group MAC Addresses~~ provide the Registrar Administrative Control values for the ~~GMRP/MMRP~~ protocol (~~Clauses 10, 12, and 12.9.1 of IEEE Std 802.1D Clause 10~~). Static configuration of forwarding of ~~specific group-addressed frames~~ a specific destination MAC address to an outbound port indicates Registration Fixed on that port, which indicates a desire to receive the specific frames addressed to that Group even in the absence of dynamic information. Static configuration of filtering of frames that might otherwise be sent to an outbound port indicates Registration Forbidden. The absence of a Static Filtering Entry for ~~the group a MAC~~ address, or the configuration of forwarding or filtering on the basis of dynamic filtering information, indicates Normal Registration.

8.8.2 Static VLAN Registration Entries

Change list item b) 1) as follows:

- b) A Port Map, consisting of a control element for each outbound Port, specifying
 - 1) The Registrar Administrative Control values for the ~~GVRP/MVRP~~ protocol (Clause 11) for the VLAN. In addition to providing control over the operation of ~~GVRP/MVRP~~, these values can also directly affect the forwarding behavior of the Bridge, as described in 8.8.9. The values that can be represented are

Change the heading and text of subclause 8.8.4 as shown:

8.8.4 ~~Group~~ MAC Address Registration Entries

A ~~Group~~ MAC Address Registration Entry specifies

- a) A MAC Address specification, comprising
 - 1) An individual MAC address; or
 - 2) A group MAC address; or
 - 3) All Group Addresses, for which no more specific Static Filtering Entry exists; or
 - 4) All Unregistered Group Addresses, for which no more specific Static Filtering Entry exists.
- b) The VID of the VLAN in which the dynamic filtering information was registered;
- c) A Port Map, consisting of a control element for each outbound Port, which specifies forwarding (Registered) or filtering (Not registered) of frames destined to the MAC Address and VID.

~~Group~~ MAC Address Registration Entries are created, modified and deleted by the operation of ~~GMRP~~ MMRP (~~Clause 10 of IEEE Std 802.1D, as modified by Clause 10 of this standard~~). No more than one ~~Group~~ MAC Address Registration Entry shall be created in the Filtering Database for a given combination of MAC Address specification and VID.

NOTE—It is possible to have a Static Filtering Entry which has values of Forward or Filter on some or all Ports that mask the dynamic values held in a corresponding ~~Group~~ MAC Address Registration Entry. The values in the ~~Group~~ MAC Address Registration Entry will continue to be updated by ~~GMRP~~ MMRP; hence, subsequent modification of that entry to allow the use of dynamic filtering information on one or more Ports immediately activates the true ~~GMRP~~ MMRP registration state that was hitherto masked by the static information.

The creation of ~~Group~~ MAC Address Registration Entries is subject to the Restricted ~~Group~~ MAC Address Registration management control (~~10.3.2.3 of IEEE Std 802.1D-10.12.2.3~~). If the value of this control is TRUE, a dynamic entry for a given ~~Group~~ MAC address may only be created if a Static Filtering Entry already exists for that ~~Group~~ MAC address, in which the Registrar Administrative Control value is Normal Registration.

8.8.6 Default Group filtering behavior

Change list item b) 2) as follows:

- 2) An explicit Static Filtering Entry specifies forwarding or filtering on the basis of dynamic filtering information, and an applicable explicit ~~Group~~ MAC Address Registration Entry exists specifying filtering; or

Change list items c) 2) and c) 3) as follows:

- 2) An explicit Static Filtering Entry specifies forwarding or filtering on the basis of dynamic filtering information, and an applicable explicit ~~Group~~ MAC Address Registration Entry exists specifying forwarding; or
- 3) An applicable explicit Static Filtering Entry does not exist, but an applicable ~~Group~~ MAC Address Registration entry specifies forwarding.

Change NOTE 2 as follows:

NOTE 2—Forward All Groups corresponds directly to the behavior specified in ISO/IEC 10038:1993 when forwarding group MAC addressed frames for which no static filtering information exists in the Filtering Database. Forward All Groups makes use of information contained in Static Filtering Entries for specific group MAC addresses, but overrides any information contained in ~~Group~~ MAC Address Registration Entries. Forward Unregistered Groups is analogous to the forwarding behavior of a Bridge with respect to individual MAC Addresses. If there is no static or dynamic information for a specific group MAC address, then the frame is forwarded; otherwise, the frame is forwarded in accordance with the statically configured or dynamically learned information.

Change list item e) as follows:

- e) Any Group-MAC Address Registration Entries applicable to that VLAN with Group Addresses or All Unregistered Group Addresses.

Change NOTE 3 as follows:

NOTE 3—The result is that the default Group filtering behavior for each VLAN can be configured for each Port of the Bridge via Static Filtering Entries, determined dynamically via Group Registration Entries created/updated by GMRPMMRP (Clause 10), or both. For example, in the absence of any static or dynamic information in the Filtering Database for All Group Addresses or All Unregistered Group Addresses, the default Group filtering behavior will be Filter Unregistered Groups on all Ports, for all VLANs. Subsequently, the creation of a Dynamic Group Registration Entry for All Unregistered Group Addresses indicating “Registered” for a given VLAN on a given Port would cause that Port to exhibit Forward Unregistered Groups behavior for that VLAN. Similarly, creating a Static Filtering Entry for All Group Addresses indicating “Registration Fixed” on a given Port for that VLAN would cause that Port to exhibit Forward All Groups behavior.

Hence, by using appropriate combinations of “Registration Fixed,” “Registration Forbidden,” and “Normal Registration” in the Port Maps of Static Filtering Entries for the All Group Addresses and All Unregistered Group Addresses address specifications, it is possible, for a given Port and VLAN, to

- Fix the default Group filtering behavior to be just one of the three behaviors described above; or
- Restrict the choice of behaviors to a subset of the three, and allow GMRPMMRP registrations (or their absence) to determine the final choice; or
- Allow any one of the three behaviors to be adopted, in accordance with any registrations received via GMRPMMRP.

8.8.7 Allocation of VIDs to FIDs

8.8.7.3 VLAN Learning Constraint inconsistencies and violations

Change list item d) as follows:

- d) When a VLAN that was hitherto not a member of the set of active VLANs (8.8.7) becomes active, either as a result of management action or as a result of the operation of GVRP, resulting in the Bridge no longer being able to support the defined set of constraints and/or fixed allocations for the set of active VLANs; or

8.8.8 Querying the Filtering Database

Change the first and second paragraphs following Table 8-5, and change Table 8-6 and Table 8-7, as follows:

Table 8-6 specifies the result, Registered or Not Registered, of combining a Static Filtering Entry and a Group-MAC Address Registration Entry for the “All Group Addresses” address specification, and for the “All Unregistered Group Addresses” address specification for an outbound Port.

Table 8-7 combines Static Filtering Entry and Group-MAC Address Registration Entry information for a specific group MAC address with the Table 8-6 results for All Group Addresses and All Unregistered Group Addresses to specify forwarding, or filtering, of a frame with that destination group MAC address through an outbound Port.

Table 8-6—Combining Static Filtering Entry and Group MAC Address Registration Entry for “All Group Addresses” and “All Unregistered Group Addresses”

Filtering Information	Static Filtering Entry Control Element for this group MAC address, VID, and outbound Port specifies:				
	Registration Fixed (Forward)	Registration Forbidden (Filter)	Use <u>Group MAC Address</u> Registration Information, or no Static Filtering Entry present. <u>Group MAC Address</u> Registration Entry Control Element for this group MAC address, VID and outbound Port specifies:		
			Registered (Forward)	Not Registered (Filter)	No <u>Group MAC Address</u> Registration Entry present
Result	Registered	Not Registered	Registered	Not Registered	Not Registered

Table 8-7—Forwarding or Filtering for specific group MAC addresses

				Static Filtering Entry Control Element for this group MAC address, VID and outbound Port specifies:				
				Registration Fixed (Forward)	Registration Forbidden (Filter)	Use ~~Group~~ <u>MAC Address</u> Registration Information, or no Static Filtering Entry present. ~~Group~~ <u>MAC Address</u> Registration Entry Control Element for this group MAC address, VID and outbound Port specifies:		
						Registered (Forward)	Not Registered (Filter)	No ~~Group~~ <u>MAC Address</u> Registration Entry present
All Group Addresses control elements for this VID and Port specify (Table 8-6):	Not Registered	All Unregistered Group Addresses control elements for this VID and Port specify (Table 8-6):	Not Registered	Forward	Filter	Forward	Filter	Filter (Filter Unregistered Groups)
	Registered		Forward	Filter	Forward	Filter	Forward (Forward Unregistered Groups)	
	Registered				Forward	Filter	Forward (Forward All Groups)	Forward (Forward All Groups)

8.8.10 Permanent Database

Change NOTE 2 as follows:

NOTE 2—Subclause ~~10.3.2.3 of IEEE Std 802.1D~~ 10.12.2.3 defines an initial state for the contents of the Permanent Database, required for the purposes of ~~GMRP/MRP~~ operation.

Change the title and text of subclause 8.11 as follows:

8.11 ~~GARP~~MRP Entities

The ~~GARP Protocol Entities~~ MRP protocol entities operate the algorithms and protocols associated with the ~~GARP~~MRP applications supported by the Bridge, and consist of the set of ~~GARP~~MRP Participants for those ~~GARP~~MRP applications (Clause 10 ~~and 12.3 of IEEE Std 802.1D~~).

Figure 8-6 illustrates the operation of a ~~GARP Protocol Entity~~ MRP protocol entity including the reception and transmission of frames containing ~~GARP PDUs~~ MRPDUs, the use of control information contained in the Filtering Database, and notification of the Filtering Database of changes in filtering information.

8.13 Addressing

8.13.1 End stations

Change the second paragraph as follows:

In the absence of explicit filters configured via management as Static Filtering Entries, or via ~~GMRP/MRP~~ as Group Registration Entries (8.8, Clause 10), frames with a destination address of the broadcast address or any other group address that is not a Reserved Address (8.6.3) are assigned to a VLAN and relayed throughout that VLAN.

Change the title and text of subclause 8.13.3 as follows:

8.13.3 Use of LLC by Spanning Tree Protocol ~~and GARP~~ Entities

~~Both~~ Spanning Tree Protocol ~~and GARP~~ Entities uses the DL_UNITDATA.request and DL_UNITDATA.indication primitives (ISO/IEC 8802-2) provided by individual LLC Entities associated with each Bridge Port to transmit and receive frames. The source_address and destination_address parameters of the DL_UNITDATA.request shall both denote the standard LLC address assigned to the Bridge Spanning Tree Protocol (Table 8-9). Each DL_UNITDATA request primitive gives rise to the transmission of an LLC UI command PDU, which conveys the BPDU ~~or GARP PDU~~ in its information field.⁴

IEEE Std 802.1D defines a Protocol Identifier field, present in all BPDUs (IEEE Std 802.1D, Clause 9) ~~and GARP PDUs (IEEE Std 802.1D, 12.11)~~, which serves to identify different protocols supported within the scope of the LLC address assignment. Further values of this field are reserved for future standardization. A Spanning Tree Protocol Entity ~~or GARP Protocol Entity~~ that receives a BPDU ~~or a GARP PDU~~ with an unknown Protocol Identifier shall discard that PDU.

⁴ISO/IEC TR 11802-1: 1997, Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Technical reports and guidelines—Part 1: The structure and coding of Logical Link Control addresses in Local Area Networks, contains the full list of standard LLC address assignments, and documents the criteria for assignment. Administration of LLC address assignments is the responsibility of the IEEE Registration Authority (IEEE RA). A full list of standard LLC address assignments, and the criteria for assignment, can be found on the IEEE RA website at <http://standards.ieee.org/regauth/index.html>.

Table 8-9—Standard LLC address assignment

Assignment	Value
Bridge spanning tree protocol	01000010

Code Representation: The least significant bit of the value shown is the right-most. The bits increase in significance from right to left. It should be noted that the code representation used here has been chosen in order to maintain consistency with the representation used elsewhere in this standard, and with the representation used in IEEE Std 802.1D.

8.13.4 Reserved MAC Addresses

Change the text of this subclause as shown:

Any frame with a destination address that is a Reserved MAC Address shall not be forwarded by a Bridge. Reserved MAC Addresses for C-VLAN components and S-VLAN components are specified in Table 8-1 and Table 8-2 respectively. These group MAC addresses are reserved for assignment to standard protocols, according to the criteria for such assignments.⁵ ~~(Clause 5.5 of ISO/IEC TR 11802-2)~~

Change the title and text of subclause 8.13.6 as follows:

8.13.6 Group MAC Addresses for ~~GARP~~MRP Applications

~~A GARP~~An MRP Entity that supports a given ~~GARPMRP~~Application transmits frames addressed to all other ~~GARPMRP~~Entities that implement the same ~~GARPMRP~~Application. The peers of each such entity bound a region of the network that contains no peers, commonly a single LAN in the case where all Bridges attached to the LAN implement the application.

~~A distinct universally administered 48-bit Group Address is assigned to each GARP application. Filtering Database Entries for each GARP Application address assigned to an application that is supported by a C-VLAN component should be configured in the Filtering Database so as to confine frames for that application to the peer region, while addresses for applications that are not supported should not be included.~~

~~A set of 48-bit Universal Addresses, known as GARP Application addresses, have been assigned for use by C-VLAN components. The values of the GARP Application addresses are defined in IEEE Std 802.1D, Table 12-1. These group MAC Addresses are reserved for assignment to standard protocols, according to the criteria for such assignments (Clause 5.5 of ISO/IEC TR 11802-2).~~

~~NOTE—Table 11-1 allocates a group MAC Address for use by the GVRP application; however, the value allocated in that table is one of the GARP Application addresses reserved by IEEE Std 802.1D, Table 12-1.~~

~~Since a network of Provider Bridges needs to appear to attached Customer Bridges as if it were a single LAN, Customer Bridge MRP Application Addresses are always forwarded by S-VLAN components. Certain MRP Applications may also be used by Provider Bridges, so distinct 48-bit universally administered Group Addresses that are C-VLAN component Reserved MAC Addresses but not S-VLAN component Reserved MAC Addresses are assigned for such use. One such address, the Provider Bridge GVRP Address, is assigned by this standard (Table 8-1).~~

⁵Administration of standard Group MAC address assignments is the responsibility of the IEEE Registration Authority (IEEE RA). A full list of standard Group MAC address assignments, and the criteria for assignment, can be found on the IEEE RA website at <http://standards.ieee.org/regauth/index.html>.