IEEE P802.1Qbx/D0.0

Draft Standard for
Local and Metropolitan Area Networks—

Virtual Bridged Local Area Networks—Amendment: Customer Backbone Bridging

Sponsor
LAN/MAN Standards Committee
of the
IEEE Computer Society

Prepared by the Interworking Task Group of IEEE 802.1

Abstract: This amendment to IEEE Std. 802.1Q specifies a C-VLAN aware I-component for the purpose of interconnecting Customer Bridged Networks across a backbone without a requirement for S-VLAN awareness.
Keywords: Bridged Local Area Networks, LANs, local area networks, metropolitan area networks, MAC Bridges, MANs, Provider Backbone Bridge, Customer Backbone Bridging, Customer Backbone Bridged Network, C-tagging service interface

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Editors' Foreword

<<Notes>>

<<Throughout this document, all notes such as this one, presented between angle braces, are temporary notes inserted by the Editors for a variety of purposes; these notes and the Editors' Foreword will all be removed prior to publication and are not part of the normative text.>>

<<Comments and participation in 802.1 standards development

Comments on this draft are encouraged. **PLEASE NOTE: All issues related to IEEE standards presentation style, formatting, spelling, etc. are routinely handled between the 802.1 Editor and the IEEE Staff Editors prior to publication, after balloting and the process of achieving agreement on the technical content of the standard is complete.** Readers are urged to devote their valuable time and energy only to comments that materially affect either the technical content of the document or the clarity of that technical content. Comments should not simply state what is wrong, but also what might be done to fix the problem.>>

Full participation in the development of this draft requires individual attendance at IEEE 802 meetings. Information on 802.1 activities, working papers, and email distribution lists etc. can be found on the 802.1 Website:

http://ieee802.org/1/

Use of the email distribution list is not presently restricted to 802.1 members, and the working group has had a policy of considering ballot comments from all who are interested and willing to contribute to the development of the draft. Individuals not attending meetings have helped to identify sources of misunderstanding and ambiguity in past projects. Non-members are advised that the email lists exist primarily to allow the members of the working group to develop standards, and are not a general forum.

Comments on this document may be sent to the 802.1 email exploder, to the editors, or to the Chairs of the 802.1 Working Group and Interworking Task Group.

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PLEASE NOTE: Comments whose distribution is restricted in any way cannot be considered, and may not be acknowledged.>>
<<A reference to the IEEE's patent policy will be added to this introductory text.>>

<<Overview: Draft text and accompanying information

This document currently comprises:

A cover page, identical to the title page.
The editors' introductory notes to each draft, briefly summarizing the progress and focus of each successive draft.
The title page for this amendment including an Abstract and Keywords. This title page will be retained for the period that the amendment is published as a separate document.
The revision document proper, documented in the usual form for 802 standards.
An Annex Z comprising the editors' discussion of issues. This annex will be deleted from the document prior to sponsor ballot.
Editors' notes throughout the document, including requests for comment on specific issues and pointing deficiencies in the current draft.
IEEE boilerplate text.

The records of participants in the development of the standard, the introduction to 802 standards, and the introduction to this revision of the standard are not included, and will be added at an appropriate time.

During the early stages of draft development, 802.1 editors have a responsibility to attempt to craft technically coherent drafts from the resolutions of ballot comments and the other discussions that take place in the working group meetings. Preparation of drafts often exposes inconsistencies in editors instructions or exposes the need to make choices between approaches that were not fully apparent in the meeting. Choices and requests by the editors' for contributions on specific issues will be found in the editors' introductory notes to the current draft, at appropriate points in the draft, and in Annex Z. Significant discussion of more difficult topics will be found in the last of these.

The ballot comments received on each draft, and the editors' proposed and final disposition of comments, are part of the audit trail of the development of the standard and are available, along with all the revisions of the draft on the 802.1 website (for address see above).
>>

<<Editor's Introduction to draft 0.0.

This draft is intended to illustrate what a draft for the amendment "Customer Backbone Bridging" might look like.

>>

<<Project Authorization Request, Scope, Purpose, and Five Criteria

Scope of Proposed Project:

This standard specifies procedures and managed objects supporting the interconnection of Customer Bridged Networks (CBNs) across a Provider Backbone Bridged Network (PBBN) in such a way that individual Customer VLANs (CVLANs) can be mapped to particular Backbone Service Instances and supporting a C-tagging Service Interface utilizing an I-component comprising a CVLAN relay entity.

Purpose of Proposed Project:

This project allows the operator of a LAN carrying CVLAN traffic, for example a Data Center, to deploy a backbone network such that each CVLAN can be associated with a distinct Backbone Service Instance.

Need for Project:

It is anticipated that the operators of Data Centers and types of LANs that carry CVLAN traffic will increasingly require the hierarchical structure of a backbone network. This may be motivated by, for example, a desire to reduce the number of MAC addresses visible in the Filtering Database (FDB) of bridges in the core of the network or a desire to deploy the form of Shortest Path Bridging (SPB) that requires deployment of a PBBN (i.e., Shortest Path Bridging MAC).

Stakeholders for the Standard:

Vendors, users, administrators, designers, customers, and owners of Customer Bridged Networks such as Data Centers.

1. Broad Market Potential

A standards project authorized by IEEE 802 shall have a broad market potential. Specifically, it shall have the potential for:

a) Broad sets of applicability:
The commercial provision of Data Centers based on CVLAN service is a large and growing business. This existance of backbone technology in this environment would be advantageous.

b) Multiple vendors and numerous users:
The same large body of vendors and users having a requirement for Customer VLAN Bridging.

c) Balanced costs (LAN versus attached stations):
This project does not materially alter the existing cost structure of Provider Backbone Bridged Networks on which it is based.

2. Compatibility

IEEE 802 defines a family of standards. All standards shall be in conformance with the IEEE 802.1 Architecture, Management and Interworking documents as follows: 802. Overview and Architecture, 802.1D, 802.1Q, and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802:

This project will be compatible with existing 802.1 Architecture, Management and Interworking standards..

Each standard in the IEEE 802 family of standards shall include a definition of managed objects which are compatible with systems management standards:

Such a definition will be included.

3. Distinct Identity

Each IEEE 802 standard shall have a distinct identity. To achieve this, each authorized project shall be:

a) Substantially different from other IEEE 802 standards:
This enhancement to 802.1ah-2008 is distinct because it supports the mapping of individual CVLANs to particular Backbone Service Instances.

b) One unique solution per problem (not two solutions to a problem):
There are no other standard solutions to support deployment of a backbone network in a CVLAN environment such that each CVLAN can be mapped to a distinct Backbone Service Instance.

c) Easy for the document reader to select the relevant specification:
This project will amend the only IEEE 802 standard defining Provider Backbone Bridged Networks.

4. Technical Feasibility

For a project to be authorized, it shall be able to show its technical feasibility. At a minimum, the proposed project shall show:

a) Demonstrated system feasibility:
The function is similar in complexity to PBBN which is currently specified by amendment 802.1ah to 802.1Q, which has been successfully implemented.

b) Proven technology, reasonable testing:
The function can be implemented using existing bridge behaviors. Compliance with the project can be tested using straightforward extensions of existing test tools for bridged networks.

c) Confidence in reliability:
The reliability of the backbone network supporting the mapping of individual CVLANs to distinct Backbone Service Instances will be not be measurably worse than that of existing Provider Backbone Bridged Networks.

5. Economic Feasibility

For a project to be authorized, it shall be able to show economic feasibility (so far as can reasonably be estimated), for its intended applications. At a minimum, the proposed project shall show:

a) Known cost factors, reliable data:
This project introduces no hardware costs different from those associated with existing Provider Backbone Bridging.

b) Reasonable cost for performance:
This project has the same cost for performance characteristics as existing Provider Backbone Bridged Networks..

c) Consideration of installation costs:
The cost of installing upgraded devices is more than balanced by the benefits derived from deployment of a backbone in a Customer Bridged Network such as a Data Center.

>>

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Draft Standard for Local and Metropolitan Area Networks—Virtual Bridged Local Area Networks—Amendment: Customer Backbone Bridging

Editorial Note

This amendment specifies changes to IEEE Std 802.1Q-2005 as amended by IEEE Std 802.1ad-2005, IEEE Std 802.1ag-2007, IEEE Std 802.1ak-2007, IEEE Std 802.1ah-2008, IEEE Std 802.1ap-2008, IEEE Std 802.1Qaw-2009, IEEE Std 802.1Qay-2009, and IEEE Std 802.1aj-2009 that support localized protection of selected Traffic Engineered Service Instances (TESIs) traversing a common sequence of Provider Network Ports. Changes are applied to the base text of IEEE Std. 802.1Q-2005 as amended by IEEE Std 802.1ad-2005, IEEE Std 802.1ag-2007, IEEE Std 802.1ak-2007, IEEE Std 802.1ah-2008, IEEE Std 802.1ap-2008, IEEE Std 802.1Qaw-2009, IEEE Std 802.1Qay-2009, and IEEE Std 802.1aj-2009 Text shown in ***bold italics*** in this amendment defines the editing instructions for 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

Change bullet ae as follows:

ae) Specifies the interfaces that a Provider Backbone Bridged Network can provide to transport service frames. These comprise a Port-based service interface that assigns all received untagged and priority-tagged frames to a single S-VLAN transported over a single backbone service instance, an S-tagged service interface capable of mapping individual S-VLANs to different backbone service instances, a C-tagged service interface capable of mapping individual C-VLANs to different backbone service instances, and an I-tagged service interface capable of mapping frames from one set of backbone service instances to another.

<< Editor's note: The scope of this amendment includes the addition of a C-tagged service interface (described above) and the use of a C-VLAN relay rather than an S-VLAN relay in the I-component when the C-tagged service interface is instantiated. The current scope says nothing about the S-VLAN relay associated with the I-component. Is it necessary to specify a new scope item indicating that the I-component instantiates

a CVLAN relay in the case of the C-tagged service interface. Or, can we just follow what is done currently and omit this from the scope statement in this clause? >>

5. Conformance

5.7I-component conformance

Modify clause 5.7 as follows:

An I-component comprises exactly one of the following:

a) an S-VLAN component (5.6) with the EISS on each Customer Network Port supported by the use of a Service VLAN tag (6.9, 9.5), and the EISS for each Virtual Instance Port configured on a Provider Instance Port supported by the use of both a Service VLAN tag (6.9, 9.5) and a Backbone Service Instance tag (I-TAG) (6.10, 9.5).

b) a C-VLAN component (5.5) with the EISS on each Customer Network Port supported by the use of a Customer VLAN tag (6.9, 9.5), and the EISS for each Virtual Instance Port configured on a Provider Instance Port supported by the use of both a Customer VLAN tag (6.9, 9.5) and a Backbone Service Instance tag (I-TAG) (6.10, 9.5).

7. Principles of Network Operation

7.4 The Filtering Database

Change the paragraph following list item h) as follows:

Clause 15 and Clause 16 describe how the mapping of Customer VLANs (C-VLANs) into Service VLANs (S-VLANs) is accomplished within Provider Bridged Networks and Provider Backbone Bridged Networks. These networks provide additional mapping facilities to support hierarchies of VLANs allowing a provider a separate filtering database from customers. The conformance definitions of 5.3 have been extended to support S-VLANs. Clause 25 and Clause 26 describe how the mapping of C-VLANs and S-VLANs into backbone service instances is accomplished within Provider Backbone Bridged Networks.

25. Support of the MAC Service by Provider Backbone Bridged Networks

Modify the first paragraph following figure 25-1 as follows:

Each I-component or T-component is responsible for encapsulating frames received from customers and assigning each frame to a backbone service instance. The backbone service instance consists of a set of BEBs that support a given customer's C-VLANs and/or S-VLANs, and is uniquely identified within the PBBN by a Backbone Service Instance Identifier (I-SID).

Modify the second paragraph following figure 25-1 as follows:

A PBBN or a series of PBBNs providing the MAC service to attached end stations is typically modeled as a symmetric sequence of relay functions, as illustrated in Figure 25-1. The outermost peer relay functions are identified as I-components. The next peer relay functions in the sequence are identified as B-components. Between the peer B-components are one or more S-VLAN relay functions. A B-component relay forms the service layer to an I-component relay. A B-component relay forwards frames taking into account the identity of a B-VLAN (B-VID), while an I-component relay forwards frames taking into account the identity of a C-VLAN (C-VID) or an S-VLAN (S-VID).

25.1 Service transparency

Modify the following paragraph as indicated:

The operation of PBBNs is, by design, largely transparent to Customer Bridges and Customer Bridged Networks and to Provider Bridges and Provider Bridged Networks as illustrated by Figure 25-1. The service provided by BEBs is transparent to the use of the MAC Service by end stations attached to the customer Bridged LANs through Provider Bridged Networks and transparent to the operation of media access method independent functions by Customer Bridges (CB).

25.2 Customer service interface

A backbone provider can offer to customers one or more types of service interfaces, each providing different capabilities for service selection, priority selection, and service access protection (25.7, 25.8, 25.9). In some cases it is assumed the customer provides a C-VLAN aware component of a Customer Bridge or an S-VLAN aware component of a Provider Bridge while in other cases, more generic customer systems are also allowed. There are five ~~four~~ basic types of customer service interfaces—Port-based, S-tagged, C-tagged, I-tagged, and transparent ~~service interface~~. The customer service interface types are summarized by Figure 25-3.

<< Editor's note: or should 'a C-VLAN aware component of a Customer Bridge or' just be 'a Customer Bridge'. >>

<< Editor's note: For the Q-REV editor - There should be a paragraph describing the 'transparent' service interface below, where each of the other service interface is described. This seems to be missing. >>

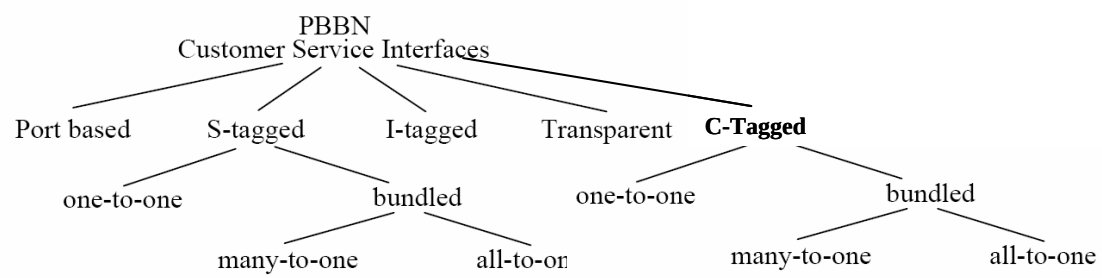

Figure 25-3—Customer service interface types

Modify Clause 25.4 as follows:

25.3 Port-based service interface

A PBBN may provide a Port-based service interface for customer attachment. The PBBN Port-based interface provides the same type of service to a customer as the PBN Port-based interface described in 15.3. A Port-based service interface is delivered on a Customer Network Port (CNP) provided by a BEB as illustrated in Figure 25-4 and Figure 25-5. A Port-based service interface may attach to a C-VLAN Bridge (5.9), IEEE 802.1D bridge, router, or end-station. The service provided by this interface forwards all frames without an S-TAG over the backbone on a single backbone service instance. All frames with an S-TAG that has a non-null VID are discarded by a Port-based service interface.

The Port-based service interface is supported only on an S-VLAN aware I-component and requires specific constraints on the configuration of the I-component.

Modify Clause 25.4 as follows:

25.4 S-tagged service interface

The S-tagged service interface maps a service instance from a Provider Bridged Network, identified by an S-VID, to a backbone service instance on the PBBN, identified by an I-SID. There are two types of S-tagged service interfaces—one performing a one-to-one mapping of S-VIDs to I-SIDs and the other bundling S-VIDs to I-SIDs. Frames that are mapped to the I-SID are carried over the PBBN while frames that are not mapped to an I-SID are not carried over the PBBN.

NOTE 1—The restriction that each PBN S-VLAN map to a single backbone service instance on the PBBN allows the PBN equipment receiving frames to correctly identify the service instance used to deliver that frame and prevents the configuration of the I-component to create a multipoint service from point-to-point service instances, which could result in accidental creation of data loops. The backbone provider can offer a multipoint service through appropriate configuration of the B-VLAN component.

A PBBN may provide an S-tagged service interface for attachment to customer Provider Bridged Networks (15.5). An S-tagged service interface is provided by a BEB over a CNP as illustrated by Figure 25-4 and Figure 25-5. The attached Provider Bridges can in turn provide Port-based, C-tagged, or S-tagged service interfaces to their customers as described in 15.2, 15.3, 15.4, and 15.5.

The S-tagged service interface has the variations shown in Figure 25-3 under the S-tagged branch. The first variation, called a one-to-one S-tagged interface, uses a one-to-one mapping between S-VIDs and I-SIDs.

This interface variation maps each S-VID to a single I-SID for use over the PBBN. The one-to-one mapped interface does not carry the S-TAG over the PBBN. The DEI and PCP bits may be re-generated on ingress and are then carried in the I-DEI and I-PCP bits in the I-TAG across the PBBN. On egress from the one-to-one S-tagged interface, the S-TAG can be deduced from the I-TAG received from the PBBN (the I-SID is mapped to an S-VID, the I-DEI and I-PCP bits may be regenerated and are then carried in the DEI and PCP bits).

The second S-tagged service interface variation is the bundling S-tagged service interface. This interface variation maps multiple S-VIDs to a single I-SID for delivery over the PBBN. To allow the remote end to reconstruct the S-VID, this interface variation will carry an S-TAG over the PBBN. On a bundled S-tagged interface, the DEI and PCP bits of the S-TAG may be re-generated and are then carried in both the DEI and PCP bits of the S-TAG and the I-DEI and I-PCP bits of the I-TAG over the PBBN.

A special case of the bundling S-tagged service interface is where all S-VIDs are mapped to a single I-SID. This special case is called an all-to-one bundling S-tagged service interface. The I-component used for an all-to-one bundled S-tagged service interface is constrained to supporting a single S-tagged service interface.

Figure 25-4 illustrates the information passed over each of the ISS interfaces of a BEB for the case of an S-VLAN aware I-component.

<< Editor's note: Figure 25-4 has been modified. The label 'I-component' has been changed to 'S-VLAN aware I-component'. >>

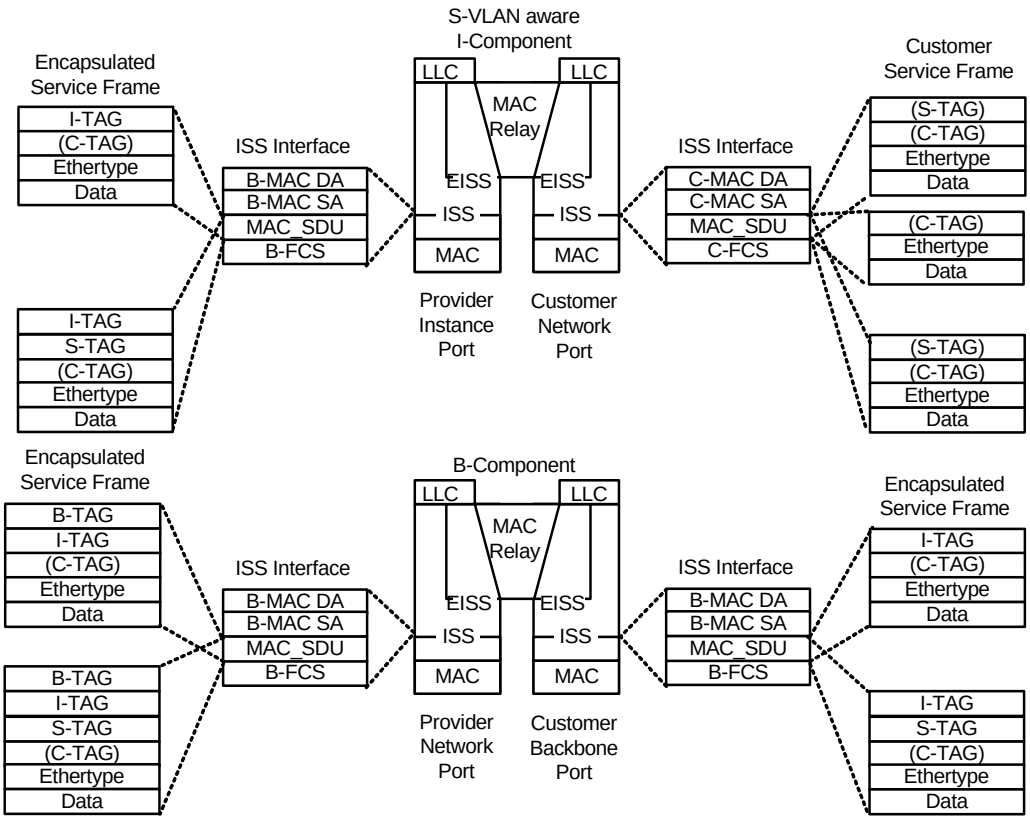

Figure 25-4—Encapsulated service frames at ISS: S-VLAN aware I-component

Figure 25-5 illustrates a customer network attached to a PBBN using an S-tagged service interface. The customer network uses Provider Bridges with S-VLAN aware components for connecting to the PBBN. The PBBN in turn is composed of BEBs interfacing to the customer Provider Bridges and Backbone Core Bridges used to forward frames between the BEBs.

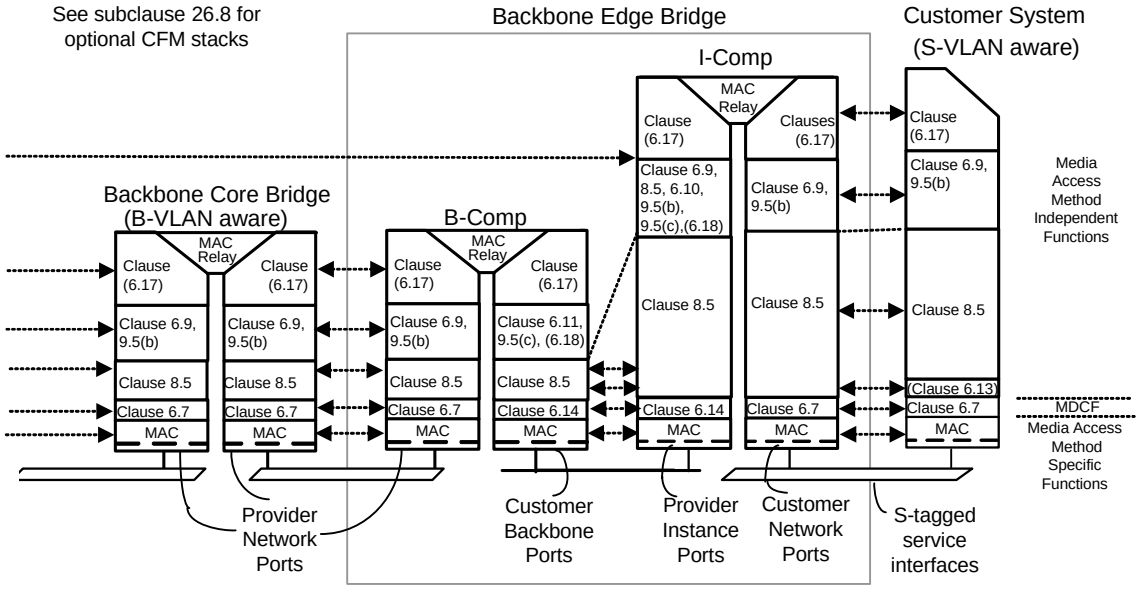

Figure 25-5—S-tagged service interface

Figure 25-6 shows an example of equipment used to implement an unprotected S-tagged service interface. For details on redundant connections and equipment, see 25.10 <<was 25.9>>. In this diagram, a BEB is formed by connecting two I-components and a B-component. These connections may be over a backplane or over a LAN. An S-VLAN aware I-component may support one or more S-tagged service interfaces. When an I-component supports an all-to-one bundled S-tagged service interface, the entire I-component must be dedicated to a single S-tagged service interface. Each CNP may be associated with one S-tagged service interface. A CNP is connected to a customer system (or network) using a LAN.

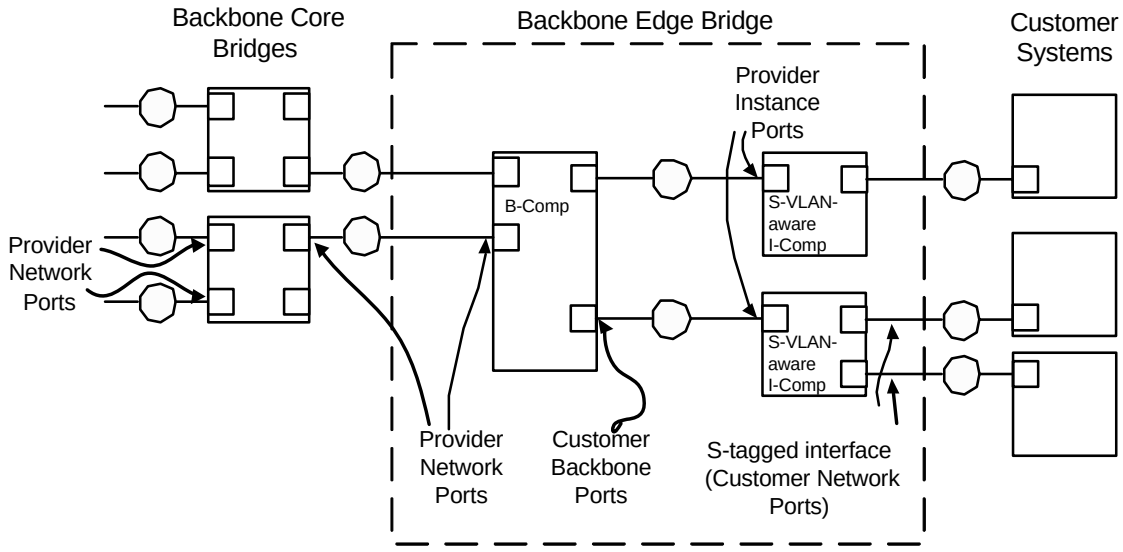

Figure 25-6—S-tagged service interface equipment

Insert paragraph 24.4 as follows, renumbering subsequent subclauses, and associated figures and tables:

25.5 C-tagged service interface

<< Editor's note: This clause is similar to Clause 25.4, except that the term 'S-VID' is replaced by 'C-VID', the I-component is explicitly identified as containing a C-VLAN relay, and changes are made generally to support a C-tagged service interface in a manner similar to the way in which Clause 25.4 supports an S-tagged service interface. >>

The C-tagged service interface maps a service instance from a Customer Bridged Network, identified by a C-VID, to a backbone service instance on the PBBN, identified by an I-SID. There are two types of C-tagged service interfaces—one performing a one-to-one mapping of C-VIDs to I-SIDs and the other bundling C-VIDs to I-SIDs. Frames that are mapped to the I-SID are carried over the PBBN while frames that are not mapped to an I-SID are not carried over the PBBN.

NOTE 1—The restriction that each CBN C-VLAN map to a single backbone service instance on the PBBN allows the CBN equipment receiving frames to correctly identify the service instance used to deliver that frame and prevents the configuration of the I-component to create a multipoint service from point-to-point service instances, which could result in accidental creation of data loops. The backbone provider can offer a multipoint service through appropriate configuration of the B-VLAN component.

A PBBN may provide a C-tagged service interface for attachment to Customer Bridged Networks (15.4). A C-tagged service interface is provided by a BEB over a CNP as illustrated by Figure 25-7 and Figure 25-8. The attached Customer Bridges can in turn provide Port-based or C-tagged service interfaces to their customers as described in 15.2, 15.3, and 15.4.

The C-tagged service interface has the variations shown in Figure 25-3 under the C-tagged branch. The first variation, called a one-to-one C-tagged interface, uses a one-to-one mapping between C-VIDs and I-SIDs. This interface variation maps each C-VID to a single I-SID for use over the PBBN. The one-to-one mapped

interface does not carry the C-TAG over the PBBN. The CFI and PCP bits may be re-generated on ingress and are then carried in the I-DEI and I-PCP bits in the I-TAG across the PBBN. On egress from the one-to-one C-tagged interface, the C-TAG can be deduced from the I-TAG received from the PBBN (the I-SID is mapped to a C-VID, the I-DEI and I-PCP bits may be regenerated and are then carried in the CFI and PCP bits).

<< Editor's Note: I am assuming that it's not a problem to maintain the field name I-DEI although the field may now carry the value of a CFI. >>

The second C-tagged service interface variation is the bundling C-tagged service interface. This interface variation maps multiple C-VIDs to a single I-SID for delivery over the PBBN. To allow the remote end to reconstruct the C-VID, this interface variation will carry a C-TAG over the PBBN. On a bundled C-tagged interface, the CFI and PCP bits of the C-TAG may be re-generated and are then carried in both the CFI and PCP bits of the C-TAG and the I-DEI and I-PCP bits of the I-TAG over the PBBN.

A special case of the bundling C-tagged service interface is where all C-VIDs are mapped to a single I-SID. This special case is called an all-to-one bundling C-tagged service interface. The I-component used for an all-to-one bundled C-tagged service interface is constrained to supporting a single C-tagged service interface.

Figure 25-7 illustrates the information passed over each of the ISS interfaces of a BEB for the case of a C-VLAN aware I-component.

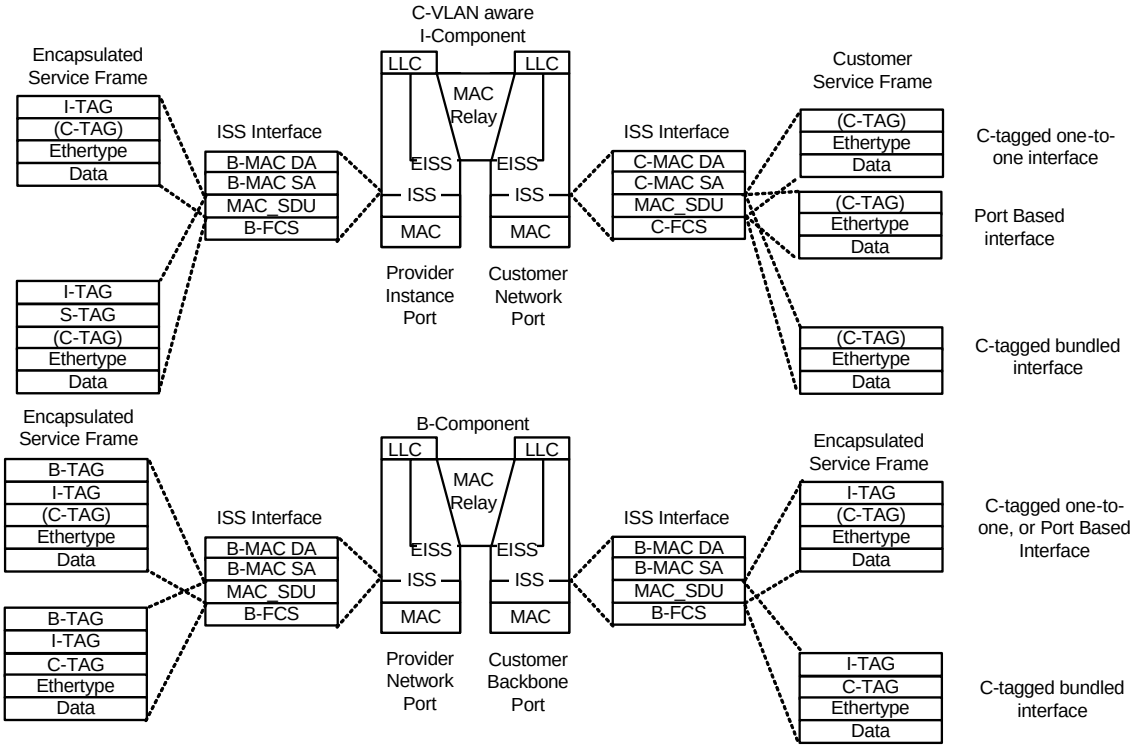

Figure 25-7—Encapsulated service frames at ISS: C-VLAN aware I-component

Figure 25-8 illustrates a customer network attached to a PBBN using a C-tagged service interface. The customer network uses Customer Bridges with C-VLAN aware components for connecting to the PBBN. The PBBN in turn is composed of BEBs interfacing to the Customer Bridges and Backbone Core Bridges used to forward frames between the BEBs.

<< Editor's note: Figure 25-8 is similar to Figure 25-5 except the I-Comp is explicitly labeled as a 'C-VLAN aware' I-Comp and the shim 9.5b has been replaced by 9.5a. >>

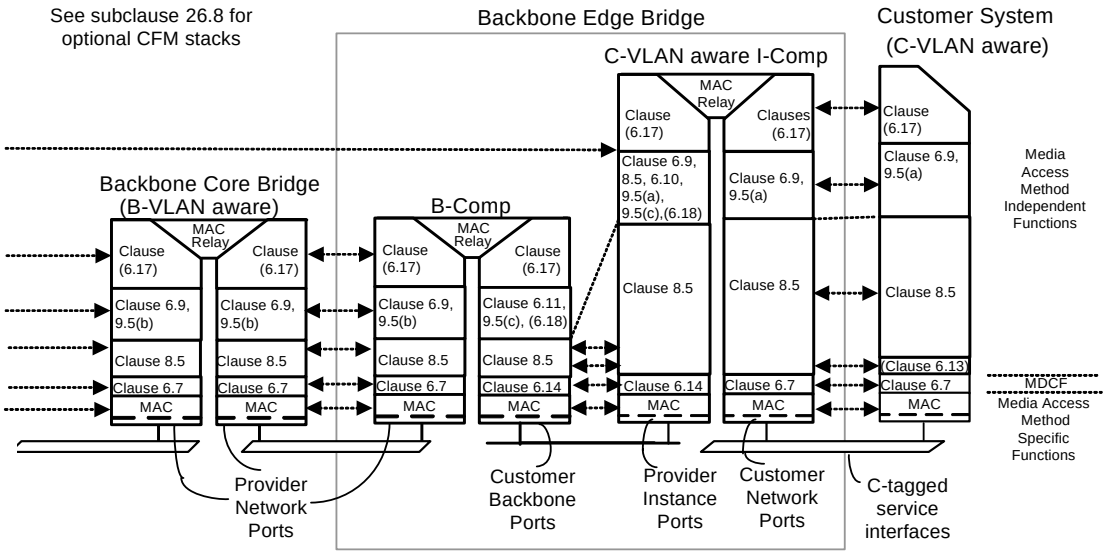

Figure 25-8—C-tagged service interface

Figure 25-9 shows an example of equipment used to implement an unprotected C-tagged service interface. For details on redundant connections and equipment, see 25.10 <<was 25.9>>. In this diagram, a BEB is formed by connecting two I-components and a B-component. These connections may be over a backplane or over a LAN. A C-VLAN aware I-component may support one or more C-tagged service interfaces. When an I-component supports an all-to-one bundled C-tagged service interface, the entire I-component must be dedicated to a single C-tagged service interface. Each CNP may be associated with one C-tagged service interface. A CNP is connected to a customer system (or network) using a LAN.

<< Editor's note: Figure 25-9 is similar to Figure 25-6 except the I-Comp is now labeled explicitly to indicate that it is a C-VLAN aware I-comp.>>

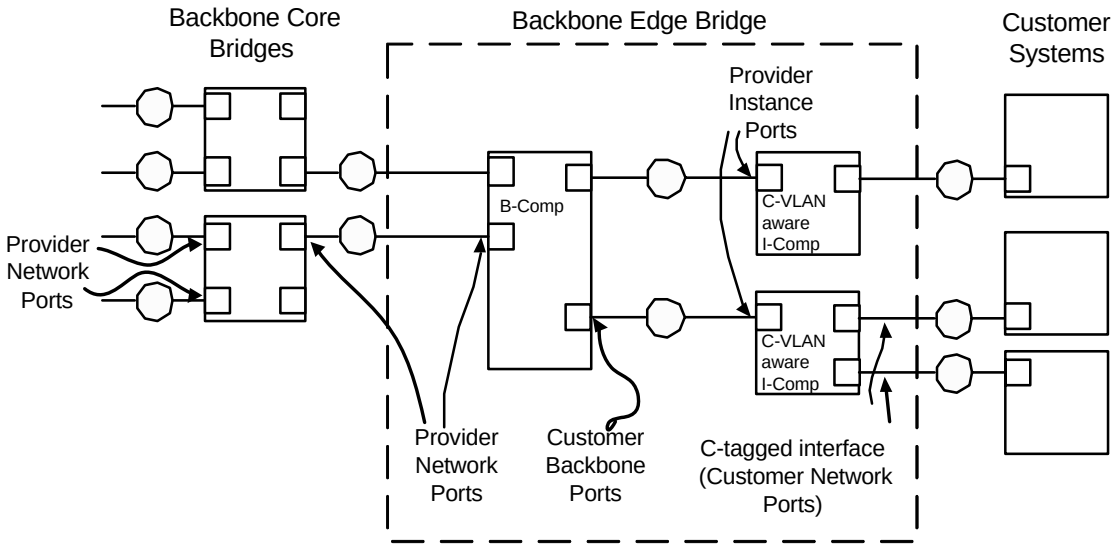

Figure 25-9—C-tagged service interface equipment

26. Principles of Provider Backbone Bridged Network Operation

26.2 Provider Backbone Bridged Network example

Insert a new paragraph between the first paragraph (describing Port-based Service Interfaces) and second paragraph (describing S-tagged service interfaces) following figure 26-1 as follows:

For C-tagged service interfaces, each instance of MAC service is carried over the C LANs on one or more C-VLANs. The BEBs preserve the C-VLAN over the backbone by mapping them onto a Backbone Service Instance Identifier (I-SID) and in the case of C-VLAN bundling, carrying the C-TAG. This operation is performed by the backbone provider operating the PBBN by configuring the VIP-ISID on each BEB attached to a C LAN. The BEB maps the C-VID to I-SID and encapsulates the original service frame with a new I-TAG, B-SA, and B-DA. The BEB then maps the frame onto a B-VLAN, which interconnects BEBs. This new frame is transmitted over the B LANs by the BEBs and by the Backbone Core Bridges. Since the initial octets of the data conveyed in each backbone frame comprise a Service VLAN tag, the frames may be forwarded by Backbone Core Bridges of the PBBN until they reach the next BEB where they might be de-encapsulated.

<< Editor's note: In the last sentence of the above description, it is indicated that the backbone traffic carries an S-VLAN tag (which is identical to a B-VLAN tag). It would be possible to allow the backbone traffic to alternatively carry a C-VLAN tag, in which case C-VLAN Bridges could be used as BCBs. If a Data Center currently uses C-VLAN bridges in the core, this would make it unnecessary for the operator to purchase new core bridges. I have not included this possibility in the text, but suggest this as a topic for discussion. >>

Insert the following two subclauses after subclause 26.8

Enabling the enhanced filtering criteria (8.7.2) on a VIP will prevent the I-component from creating Dynamic Filtering Entries for Customer MAC Addresses unnecessarily when the backbone service instance is point-to-point and the C-VLAN or S-VLAN that maps to the backbone service instance has only the VIP and one CNP in its member set.

26.4 Backbone addressing

26.4.3 Backbone addressing considerations for CFM Maintenance Points

Possible placement of CFM shims in a PIP and a CBP are shown in Figure 26-2. In the PIP, these include MPs to monitor backbone service instances (identified by I-SIDs) in the PBBN, as well as MPs to monitor service instances (identified by VLAN IDs of C-VLANs) in the attached CBNs and service instances (identified by VLAN IDs of S-VLANs) in the attached PBNs. In the CBP, these include MPs to monitor backbone service instance (identified by I-SIDs) in the PBBN, as well as MPs to monitor BVLANs in the PBBN. All of these MPs are assigned individual addresses subject to the constraints specified in 19.3.12; however, there are additional considerations for the addresses used by MPs in PIPs and CBPs.

In a PIP, the individual address assigned to the backbone service instance level MPs must be unique within the PBBN. The individual address assigned to the C-VLAN and S-VLAN level MPs must be unique within the set of PBNs interconnected by any backbone service instance supported by the PIP. Therefore these two groups of MPs may use a common address that is globally unique; however, they may need distinct addresses if local addressing is used in the PBBN.

26.8 Connectivity Fault Management in Provider Backbone Bridges

In these figures, four distinct categories of MAs are depicted. These are the S-VLAN and C-VLAN MAs, the backbone service instance MAs, the B-VLAN MAs, and the LAN link segment MAs. Each of these four classes of MAs is associated with independent sets of MDs introducing four independent sets of eight maintenance levels. The selection of which levels for each of these MDs to use in a particular network depends on the specific network implementation. The C-VLAN and S-VLAN MAs are only visible within the I-component where customer frames are un-encapsulated. Customer CFM frames are encapsulated along with the other customer frames at the VIPs within the I-component. Once the C-VLAN and S-VLAN CFM frames are encapsulated, they appear just like any data frame within the PBBN; therefore, they do not activate any CFM functions within the PBBN past the VIPs. The backbone service instance CFM frames may optionally be generated at the Service Instance Multiplexing Entity within the PIP or CBP. These CFM frames are only visible within the PBBN where the I-TAG is being processed, that is at the CBP and at the PIP. Each backbone service instance MD may be assigned to one of eight maintenance levels. Since the backbone service instance CFM maintenance domain may extend over E-NNI boundaries, these eight levels extend over all interconnected PBBNs until they are terminated at a VIP. B-VLAN MAs manage the B-VLANs within a single PBBN. The B-VLAN MDs have a new set of eight maintenance levels, which are separate for each PBBN and never extend out of the PBBN. Finally, the LAN links within a PBBN (PIP to CBP, PNP to PNP), between two PBBNs (CBP to CBP, PIP to CBP) and entering/egressing the PBBN (to/from CNP) may optionally be monitored by LAN link MAs, generated/terminated within the PIP, CBP, PNP, and CNP. LAN link MAs are typically confined to the LAN link.

26.8.1 CFM over Port-based, C-tagged, and S-tagged Service Interfaces

Figure 26-3 shows example MAs for the Port-based, ~~or~~ S-tagged, or C-tagged, service interface described in 25.3, ~~and~~ 25.4, and 25.5, and depicted in Figure 26-1 labeled 1 and 2.

MAs (a) and (b) illustrated in 26-3 through 26-6 are used to monitor the PBBN core. Each PBBN has an independent backbone MD level space. MAs (a) and (b) are assigned Backbone Maintenance Levels from the backbone MD level space of their PBBN in the same manner used to assign S-VLAN MAs described in Clause 22. The MAs (a) are used to monitor each individual LAN segment that interconnects PNPs. The MAs (b) monitor specific B-VLANs. The B-VLAN monitoring, illustrated in the example, begins at the up MEP located at the top of the CBP. A given B-VLAN may exit a B-component on multiple PNPs, each of which may have a MIP on MA (b) if desired.

MAs (i) and (j) illustrated in Figure 26-3 through Figure 26-6 are two possible customer MAs. Attached customers have an independent customer MD level space. MAs (i) and (j) are assigned Customer Maintenance Domain Levels from their customer MD level space in the manner used for C-VLAN or S-VLAN MAs described in Clause 22. The MAs (i) monitor the link segments between the customer equipment and the CNP or the PBBN. At the Port-based, ~~or the~~ S-tagged, C-tagged service interface, MAs (i) may be terminated by the provider by an MEP at the CNP and used to monitor the customer's access link. The MAs (j) monitor the service instance from the customer over the PBBN. MAs (j) extend between all the customer attachments of the extended PBBN, passing through any PBBN E-NNI interfaces. At the VIPs located at the edge of the extended PBBN, the CFM frames for MA(j) will be mapped to/from an I-SID and carried over the extended PBBN as encapsulated frames. These CFM frames are encapsulated by the PBBN in the same manner as data frames. The encapsulation makes them invisible to any MPs within the extended PBBN.