IEEE P802.1Qat/D0.4

Draft Standard for
Local and Metropolitan Area Networks—

Virtual Bridged Local Area Networks - Amendment 9: Stream Reservation Protocol (SRP)

Sponsor
LAN/MAN Standards Committee
of the
IEEE Computer Society

Prepared by the Audio/Video Bridging Task Group of IEEE 802.1

Abstract: This amendment specifies protocols, procedures and managed objects, usable by existing higher layer mechanisms, that allow network resources to be reserved for specific traffic streams traversing a bridged local area network.
Keywords: LANs, local area networks, MAC Bridges, Bridged Local Area Networks, virtual LANs, Virtual Bridged Local Area Networks, Audio/Video Bridging, resource reservation, Multiple Registration Protocol (MRP).

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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 Audio/Video Bridging Task Group.

This draft was prepared by:

Feifei Feng
Mt.14-1, Nongseo-Dong, Giheung-Gu
Yongin-Si
Gyeonggi-Do, 446-712
Korea
+82 31 280 9549 (Tel)
Email:feng.fei@samsung.com

Michael Johas Teener
Chair, 802.1 Audio/Video Bridging Task Group
3151 Zanker Road
San Jose
CA 95134-1933
USA
+1 408 992 7542 (Tel)
Email:mikejt@broadcom.com

Tony Jeffree
Chair, 802.1 Working Group
11A Poplar Grove
Sale
Cheshire
M33 3AX
UK
+44 161 973 4278 (Tel)
+44 161 973 6534 (Fax)
Email: tony@jeffree.co.uk

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 the current draft

P802.1at/D0.00 is an initial draft based on 802.1 WG discussions prior to submission of the PAR and presentations and subsequent meetings. It has not yet been subject to any formal comment process.

>>

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

A PAR (Project Authorization Request) for this project was first discussed in the March 2006 802.1 meeting, and forwarded SEC consideration by vote of the 802.1 Working Group at its closing plenary during the July 2006 meeting of P802, and approved by the SEC at that meeting. The Scope and Purpose, as approved by the SEC, are:

Scope of Proposed Project:

This standard specifies protocols, procedures and managed objects, usable by existing higher layer mechanisms, that allow network resources to be reserved for specific traffic streams traversing a bridged local area network. It identifies traffic streams to a level sufficient for bridges to determine the required resources and provides a mechanism for dynamic maintenance of those resources.

Purpose of Proposed Project:

This standard provides a signaling protocol to enable the end-to-end management of resource reservation for QoS guaranteed streams. The signaling protocol facilitates the registration, deregistration, and retention of resource reservation information in relevant network elements. The

signaling protocol is an essential component for automatic configuration in bridged local area network applications that require latency and bandwidth guarantees.

1. Broad Market Potential

a) Carrying time-sensitive streaming applications with guaranteed QoS represent a new and very broad application space for IEEE 802 technologies. This requires a protocol to signal the resource reservation along the end-to-end paths of streams.

b) Many vendors and users have expressed their support for a standard means of end-to-end stream resource reservation to facilitate the use of bridged LANs for time-sensitive applications.

c) As a control protocol, SRP makes no new demands on a bridge or station's data forwarding capabilities. It does not upset the cost model for bridges.

2. Compatibility

a) As an extension to IEEE Std. 802.1Q-2005, the proposed standard will conform to the aforementioned documents.

b) The standard defines a control protocol, and does not modify the existing forwarding characteristics and control protocols of bridges.

3. Distinct Identity

a) There is no existing 802 standard or approved project that provides end-to-end stream registration. The admission control in some existing 802 standards (e.g.,802.11e, 802.15.3) has no end-to-end meaning.

b) Previous efforts (e.g., SBM) were too complex to be taken up by the market; this standard will minimize complexity by confining itself to applications with homogenous one-to-many reservation, and well defined streams with simple traffic profiles.

4. Technical Feasibility

a) SRP will be based on MRP which is a refinement of the well established GARP architecture. It will be defined as a new MRP application.

b) We are confident that a MRP based application is a suitable solution.

5. Economic Feasibility

a) Other registration protocols (GMRP/GVRP) are standardized. P802.1ak MRP builds on that knowledgebase.

b) Running another MRP application will have a negligible impact on the current cost of bridges.

c) We expect that applications will be developed and run in stations that automatically request services from SRP without intervention by the user. Therefore, there are no incremental installation costs for the provision of SRP.

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Participants

The following is a list of participants in the Interworking activities of the IEEE 802.1 Working Group during the development of IEEE Std 802.1Q-1998 . Voting members at the time of publication are marked with an asterisk (*).

<<The list of participants will be supplied prior to publication of IEEE 802.1at.>>

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Editorial Note

This amendment specifies changes to IEEE Std 802.1Q that allow network resources to be reserved for specific traffic streams traversing a bridged local area network. Changes are applied to the base text of IEEE Std. 802.1Q-2005 as amended by IEEE Std 802.1ad-2005, P802.1ag, P802.1ah, P802.1aj, P802.1ak and P802.1aq. 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

Insert the following after the initial paragraphs of clause 1.

This standard specifies protocols, procedures and managed objects, usable by existing higher layer mechanisms, that allow network resources to be reserved for specific traffic streams traversing a bridged local area network.

1.1 Scope

Insert the following text and bullets (renumbered appropriately) immediately after the existing text of this clause:

To enable the end-to-end management of resource reservation for QoS guaranteed streams, this standard further specifies protocols, procedures and managed objects, usable by existing higher layer mechanisms, that allow network resources to be reserved for specific traffic streams traversing a bridged local area network. To this end it:

a) Specifies the use of stream registration entries in filtering database. It allows control of Forwarding of frames associated with particular Stream.

b) Specifies a Stream Reservation Protocol (SRP). SRP facilitates the registration, de-registration and related maintenance operations of stream reservation information in relevant bridges to establish end-to-end stream path.

2. References

<<No additional references are currently included.

Insert the following reference at the appropriate point:

AVB architecture

802.1Qav

>>

3. Definitions

Insert the following definitions into Clause 3, in appropriate collating sequence, renumbering existing/new definitions as appropriate:

3.1

4. Abbreviations

Add the following abbreviations, in the appropriate collating sequence.

5. Conformance

Insert the following new subclause 5.5 to the end of clause 5.

5.5 Conformance to SRP

This subclause defines the conformance requirements for implementations claiming conformance to SRP. Three cases are covered: implementation of SRP in MAC bridges, implementation of SRP in talker stations and implementation of SRP in listeners.

5.5.1 Conformance to SRP in MAC Bridges

A MAC bridge for which conformance to SRP is claimed shall

a)

<<Editor's note: conformance requirements to be added.>>

5.5.2 Conformance to SRP in Talker stations

A Talker station for which conformance to SRP is claimed shall

b)

<<Editor's note: conformance requirements to be added.>>

5.5.3 Conformance to SRP in Listener stations

A Listener end station for which conformance to SRP is claimed shall

c)

<<Editor's note: conformance requirements to be added.>>

6. Support of MAC Service in VLANs

This amendment makes no changes to the clause 6.

7. Principles of network operation

This amendment makes no changes to clause 7.

8. Principles of bridge operation

This amendment makes no changes to the introductory paragraphs of clause 8, or to clause 8.1 thru 8.7.

8.1 Bridge operation

8.1.1 Relay

8.1.2 Filtering and relaying information

8.1.3 Duplicate frame prevention

8.1.4 Traffic segregation

8.1.5 Traffic reduction

8.1.6 Traffic expediting

8.1.7 Conversion of frame formats

8.2 Bridge architecture

8.3 Model of operation

8.4 Port states and the active topology

8.5 Bridge Port Transmit and Receive

8.5.1 Bridge Port connectivity

8.5.2 Support of Higher Layer Entities

8.6 The Forwarding Process

8.6.1 Active topology enforcement

8.6.2 Ingress

8.6.3 Frame filtering

8.6.4 Egress

8.6.5 Flow classification and metering

8.6.6 Queuing frames

8.6.7 Queue management

8.6.8 Transmission selection

8.7 The Learning Process

8.7.1 Default filtering utility criteria

8.7.2 Enhanced filtering utility criteria

8.8 The Filtering Database

This amendment makes no changes to the introductory paragraphs of clause 8.8, or to clause 8.8.1 thru 8.8.4.

8.8.1 Static Filtering Entries

8.8.2 Static VLAN Registration Entries

8.8.3 Dynamic Filtering Entries

8.8.4 Group Registration Entries

Insert the following clause after clause 8.8.4, and appropriately re-number the clauses following.

8.8.5 Stream Registration Entries

A Stream Registration Entry specifies

a) The Stream Identifier to which this filtering information applies;
b) A Stream Data Port Map consisting of a control element for each outbound Port that specifies forwarding or filtering of Stream data frames of the Stream. The initial value shall be filtering.

8.8.6 Dynamic VLAN Registration Entries

8.8.7 Default Group filtering behavior

Insert the following clause after clause 8.8.7 (re-numbered), and appropriately re-number the clauses following.

8.8.8 Default Stream filtering behavior

A Stream data frame is filtered unless an applicable explicit Stream Registration Entry (according to Stream Data Port Map) exists specifying forwarding.

<<Editor's note: Should this behavior be documented in .1Qav rather than here?>>

8.8.9 Allocation of VIDs to FIDs

8.8.9.1 Fixed and dynamic VID to FID allocations

8.8.9.2 VLAN Learning Constraints

8.8.9.3 VLAN Learning Constraint inconsistencies and violations

8.8.10 Querying the Filtering Database

8.8.11 Determination of the member set for a VLAN

8.8.12 Permanent Database

8.9 MST configuration information

8.9.1 MST Configuration Table

8.9.2 MST configuration identification

8.9.3 FID to MSTI Allocation Table

8.10 Spanning Tree Protocol Entity

8.11 GARP Entities

8.12 Bridge Management Entity

8.13 Addressing

8.13.1 End stations

8.13.2 Bridge Ports

8.13.3 Use of LLC by Spanning Tree Protocol and GARP Entities

8.13.4 Reserved MAC Addresses

8.13.5 Group MAC Addresses for spanning tree protocols

8.13.6 Group MAC Addresses for GARP Applications

8.13.7 Bridge Management Entities

8.13.8 Unique identification of a Bridge

8.13.9 Points of attachment and connectivity for Higher Layer Entities

8.13.10 VLAN attachment and connectivity for Higher Layer Entities

9. Tagged frame format

This amendment makes no changes to clause 9.

10. Multiple Registration Protocol (MRP) and Multiple MAC Registration Protocol

This amendment makes no changes to the clause 10.

Insert the following clause after clause 10, and appropriately re-number the clauses following.

11. Stream reservation protocol (SRP)

This clause describes the Stream Reservation Protocol (SRP). SRP is a signaling protocol to enable the end-to-end management of resource reservation for QoS guaranteed streams. It facilitates the registration, de-registration, and retention of stream resource reservation information in relevant network elements. As a part of the AVB protocol family, SRP is an essential component for the automatic configuration of AVB applications that require latency and bandwidth guarantees.

This clause:

a) Provides an overview of the use of SRP within an AVB network,
b) Provides an overview of protocol operations,
c) Describes the SRP protocol entities for end stations and bridges,
d) Provides a detailed specification of the protocol, and
e) Describes the structures of protocol data units exchanged between SRP entities.

11.1 SRP overview

An AVB network can reliably deliver stream data with a deterministic low latency and low jitter only if the network resources is available along the entire data path before transmission takes place. SRP is therefore used in AVB networks to signal the resource reservation along the end-to-end path of streams.

SRP is only a signaling protocol carrying the requests and results of stream reservations; it does not specify any traffic control mechanisms and corresponding local admission control algorithms. IEEE Std. 802.1Qav, an accompanying standard in the AVB protocol family, specifies the necessary traffic control mechanisms to enforce the resource reservation negotiated by SRP in an AVB network. Those traffic control mechanisms include per priority ingress metering, priority regeneration, and timing-aware queue draining algorithms.

IEEE Std. 802.1Qav also provides a local admission control (LAC) service where SRP can make requests and get indications for allocating, de-allocating, and updating local resources associated with the AVB port and LAN in question.

SRP is designed to work with both shared media LANs and point-to-point LANs. It supports both unicast and multicast applications, but the multicast applications are confined to scenarios with homogenous one-to-many streams. More specifically, each stream has only one talker, and every listeners of the stream have the same resource requirement on the paths from the talker to themselves.

For the proper operation of SRP, each active stream within an AVB network should use one unique stream identifier which is in the form of MAC address. It is assumed the talker and listeners will use some high layer mechanism to determine what stream identifier they will use.

<<Editor's note: As discussed during the March 2007 meeting, we may document a layer 2 signaling based stream identifier allocation protocol in this document if needed.>>

Higher layer applications sit on the top of SRP and use it to take care of resource reservation within a AVB LAN. Examples of these higher layer applications include RSVP and UPnP-QoS. SRP procedures are triggered by these higher layer applications through standard service primitives (11.3).

11.2 Protocol operations

This subclause provides an informal introduction. The definitive specification of SRP is contained in subclause 11.4 and 11.5.

SRP consists of a registration protocol (11.4.1) and a reservation protocol (11.4.2). The registration protocol is initiated by listeners. Its operation makes the talker and bridges aware the presence of listeners, and creates a subtree of the spanning tree that provides a forwarding path between a talker and any registered listeners. A talker could use the presence or absence of a registration as an indication of whether or not a listener exists now; bridges could use the presence or absence of a registration to determine via which ports a listener can be reached.

NOTE-Unless otherwise stated, all “talker” and “listener(s)” in this document should be interpreted as “talker of the stream in question” and “listener(s) of the stream in question”.

The operation of registration protocol relies upon the Multiple MAC Registration Protocol (MMRP) defined in (10.9). Listeners send out JOIN messages to declare their interest in receiving traffic of a stream, or LEAVE messages to declare their interest in leaving a stream. These declarations are disseminated over the AVB network by transmission of MMRP messages. Group membership information and individual MAC address information used in MMRP messages correspond to stream identifiers in SRP.

The registration protocol generates a registration event on a port whenever one or more listeners become reachable via its attached LAN where none existed before. In this way the first listener in the network will result in a registration event on the egress port of the talker; new listeners joining an already established stream through a new path will result in registration events on the corresponding ports of one or more intervening bridges. De-registration is simply the reverse of the above. The registration protocol generates a de-registration events on a port whenever all listeners reachable before via its attached LAN go away.

The reservation protocol is triggered by the registration and de-registration events. It operates the reception and transmission of reservation messages over the subtree that the registration protocol created.

The information contained in the reservation messages includes stream identifier, traffic specification, reservation status, and per-hop resource details, etc. The stream identifier indicates to which stream this message is associated. The traffic specification describes the characteristic of the stream such that an end station of bridge can reserve resources required for this stream appropriately. The reservation status conveys the result of resource reservation on the upstream. There could be either a positive status or a negative status. A reservation message with positive reservation status indicates the downstream bridges the required resources should be reserved for the stream. On the contrary, a negative reservation status typically implies no further resource reservation is needed on the downstream bridges. The reservation messages also serve as reservation confirmation or failure indication to the listeners. The per-hop resource details information records various parameters such as link type, egress MAC address, and available resources etc. for each hop that this message has traversed. This information is useful for listeners to diagnose the reservation failure and determine their reactions.

<<Editor’s note: Current design of reservation message structure implies two assumptions:

1) .1Qav will guarantee that the traffic specification of a stream will be strictly maintained as long as the admission control is successful. Otherwise, we may need to include two traffic specifications into the reservation message. A talker traffic specification describes the characteristic of the stream source, and an effective traffic specification indicates the characteristic of the stream on the ingress port of the receiving bridge. The effective traffic specification could be updated in a hop-by-hop way. Furthermore, an editor’s note later shows that to support the dynamic updating function, the effective traffic specification concept is desired.

2) There is a well-known per-hop performance requirement which the .1Qav admission control algorithm will use as criteria for example the specific per-hop latency requirement. Otherwise, we may need to include a

performance requirement field into the reservation message. Discussion is needed to make sure whether these two assumptions are correct in .1Qav.>>

NOTE-The reservation protocol of SRP is simply a one way declarative protocol with reservation messages propagated from the talker towards listeners. It contains no backward propagated acknowledgement or status report messages. If needed a talker could leverage higher layer applications for getting feedback from listeners. Note for a multicast stream feedbacks from different listeners may be inconsistent; the reaction of the talker to these feedbacks is application specific. A talker can also simply initiate the reservation message and then wait enough long time before starting data transmission to ensure that the stream data can be served appropriately.

The registration event triggering can take ~~places~~ alkers or intermediate bridges. The talker is triggered by the registration event which indicates the joining of the first listener in the network. Upon the registration event, the talker should reserve the required resources in the local node as well as on the LAN to which its egress port is attached. The talker should configure itself appropriately according to the reservation results. It then records the result into the status information field of a new generated reservation message and sends the message out.

NOTE-SRP ~~assume~~ dmission control is based on egress port rather than ingress port. ort which is connected to a point-to-point link, the local node can make admission control decisions by itself. On a port which is connected to a shared media LAN, a segment resource manager for this LAN or some kinds of distributed cooperation between all the ports on this LAN could be needed. The implementation of admission control is outside the scope of this standard.

Reservation messages are propagated over the subtree by which the talker and listeners are connect for each receiving bridge along the path from the talker to listeners, reservation messages convey the result of resource reservation on the upstream, and will trigger any necessary local resource reservation operations.

The talker refresh the reservation on a regular basis. Each listener should keep a timer which will timeout the reservation if there is no reservation message received during the timer period.

On receiving the first reservation message of a stream, a bridge will create a reservation record for it. The reservation record contains information obtained from the reservation message including stream identifier, talker MAC address, traffic specification, upstream reservation status, and reservation message inbound port.

If the received reservation message carries a positive reservation status, the bridge should reserve the required resources for each egress port which has registered for this stream. It configures its forwarding resources appropriately according to the reservation results, then transmits the reservation message out of each registered egress port. Each reservation message should carry the updated reservation status and per-hop resource details according to the local reservation result on the corresponding port.

NOTE-Since SRP is a one way declarative protocol, a failed reservation in an intermediate bridge will not influence any reservation that has been made on upstream. Relevant listeners will receive reservation messages with negative reservation status. A listener could choose to either withdraw the registration therefore release any unnecessary reserved resources, or keep the registration therefore the stream reservation can be made along the whole path when all necessary resources become available.

If the received reservation message carries a negative reservation status, the bridge should ~~simply~~ figure its forwarding resources appropriately, update the per-hop resource details information in the reservation message, and then transmits the reservation message out of each registered egress port.

After a reservation record has been created, a bridge could receive a reservation message later which is inconsistent with the reservation record. While an ~~inconsistence in talker~~ MAC address shall be reported as an error, the changes in traffic specification, upstream reservation status, and reservation message inbound port should be acceptable.

The talker could ~~dynamic~~ update the traffic specification according to the characteristic of the stream or the requirement of the high ayer application. This update could ~~be either downgrading or upgrading.~~ A

downgrading update should always be successful; an upgrading update could be failed but should not impact the existing resource reservation for the stream.

<<Editor's note: It has been agreed during March plenary that SRP should support dynamic updating function. In case an update is failed, SRP should keep the existing reservations, and retain any extra resources reserved on upstream hops. Detail operations for dynamic updating needed here. Inputs on this needed.>>

<<Editor's note: Exact meaning of downgrade and upgrade should be defined according to the final traffic specification format. Inputs on Tspec definitions needed.

It is assumed that .1Qav will strictly maintain the traffic specification of a stream as long as the admission control is successful. For the upgrading scenario, it seems an additional assumption is needed: if a bridge reserves resources according to a certain Tspec_reserved, then for the ingress stream with Tspec_stream "inferior" to Tspec_reserved, .1Qav should guarantee the egress stream satisfy not only Tspec_reserved but also Tspec_stream.

Otherwise, suppose the talker upgrades a Tspec_original to Tspec_upgraded; the admission control for Tspec_upgraded is successful in the first hop Bridge_1 but failed in the second hop Bridge_2. Since Bridge_1 will configure its forwarding resources according to Tspec_upgraded, the stream forwarded out of the egress port could be satisfying Tspec_upgraded but not Tspec_original even the talker is still sending stream based on Tspec_original. Therefore the bridge Bridge_2 will need to be receiving a stream with Tspec_upgraded but send it with Tspec_original. So there is a question for .1Qav that which case is supported.>>

A bridge could receive a succeeding reservation message on a port different from the previous receiving port, for example caused by the re-configuration of spanning tree or talker's point of attachment. The bridge should operate based on the latest incoming reservation message.

The reservation protocol entity in an intermediate bridge could be triggered by the registration event which indicates the joining of a listener on a new port. The bridge should response to the registration event if it has received relevant reservation messages before from upstream and therefore established the reservation record for this stream. Similar to the procedures when the bridge receives a reservation message, in this case the bridge checks the reservation record, reserves resources on the new registered port if necessary, configures the forwarding resource appropriately, and sends out a corresponding reservation message out of the new port.

If this bridge has not received any reservation message for this stream before from upstream it will ignore the registration event, while the registration protocol will disseminate the registration towards upstream until the talker or an intermediate bridge, which has already established the reservation record for this stream, is triggered by the corresponding registration event.

A de-registration event on the talker will cause the talker to release the reserved resources on its egress port, cease the refresh of reservation messages, and stop the stream transmission. A de-registration event on a intermediate bridge port will cause the bridge to release any reserved resources on this

Figure 11-1 illustrates an example of registration operation in an AVB network.

<<Editor's note: SRP operation examples to be added.>>

11.3 SRP protocol entities and primitives

There are three separate and distinct types of SRP protocol entity: listener protocol entity, talker protocol entity and bridge protocol entity.

The SRP listener protocol entity is responsible for joining and leaving stream on behalf of the application in the listener that is making use of the stream, and reporting the result of the associated reservation back to the application.

The listener protocol entity receives following request primitives passed from the application:

a) INITIATE_STREAM_REGISTRATION(STREAM_IDENTIFIER) requests the listener to join the stream.
b) TERMINATE_STREAM_REGISTRATION(STREAM_IDENTIFIER) requests the listener to leave the stream.

The listener protocol entity also passes the following indication primitive to the application:

c) STREAM_RESERVATION_STATUS(STREAM_IDENTIFIER, RESOURCE_REQUIREMENT, RESERVATION_STATUS, PER_HOP_DETAILS) indicates the reservation results for the stream to the application.

<<Editor's note: Should the PER_HOP_DETAILS parameter be included? The structure and format of PER_HOP_DETAILS need to be discussed.>>

The SRP talker protocol entity is responsible for monitoring presence and absence of listeners, reporting them to the application in the talker that is responsible for sourcing the stream, and initiating, updating, or terminating the associated reservation using the information provided by the application.

The talker protocol entity passes following indication primitives to the application:

d) STREAM_REGISTRATION_RECEIVED(STREAM_IDENTIFIER) indicates the joining of the first listener in the network for the stream to the application.
e) STREAM_DEREGISTRATION_RECEIVED(STREAM_IDENTIFIER) indicates the leaving of the last listener in the network for the stream to the application.

The talker protocol entity receives following request primitives passed from the application:

f) INITIATE_STREAM_RESERVATION(STREAM_IDENTIFIER, RESOURCE_REQUIREMENT, APPLICATION_DATA) requests the talker to start reserving local resources and sending corresponding reservation messages for the stream on a regular basis. The APPLICATION_DATA parameter is carried in the reservation messages as part of the per-hop resource details and conveys higher layer application information from the talker to the listener. The application could dynamic update the RESOURCE_REQUIREMENT and APPLICATION_DATA parameters by issuing corresponding updated primitives whenever needed.
g) TERMINATE_STREAM_RESERVATION(STREAM_IDENTIFIER, APPLICATION_DATA) requests the talker to release any reserved resources and send corresponding negative reservation messages for the stream on a regular basis. The APPLICATION_DATA parameter is carried in the reservation messages as part of the per-hop resource details and conveys higher layer application information from the talker to the listener. For example, it can indicate to the listeners the reason of reservation termination.

<<Editor's note: The necessity, structure and format of APPLICATION_DATA need to be discussed.>>

The SRP bridge protocol entity has no need to communicate with any higher layer application. It is responsible for disseminating the presence and absence status of listeners, receiving reservation messages from upstream ports, processing the reservation information, requesting any necessary admission control, and propagating reservation messages on downstream ports.

The talker protocol entity and bridge protocol entity should communicate with the LAC service provided by IEEE Std. 802.1Qav. They pass following request primitives to the LAC protocol entity:

h) Initiate_Admission.request(Port, Stream_Identifier, Resource_Requirement) requests the LAC service to reserve and configure the forwarding resources according to the Resource_Requirement parameter for the stream on the specified Port.

i) Update_Admission.request(Port, Stream_Identifier, Resource_Requirement) requests the LAC service to modify an existing reservation according to the updated Resource_Requirement parameter for the stream on the specified Port. If this updated resource requirement is rejected, the current reservation should be left in force.

j) Terminate_Admission.request(Port, Stream_Identifier) requests the LAC service to release an existing reservation for the stream on the specified Port.

k) Per_Hop_Details.request(Port) requests the LAC service to provide the current details of the forwarding resources on the specified Port.

The talker protocol entity and bridge protocol entity also receive following indication primitives from the the LAC protocol entity:

l) Admission_Result.indication(Port, Stream_Identifier, Result) indicates to the SRP protocol entity the result of the corresponding Initiate_Admission.request or Update_Admission.request primitive that the LAC protocol entity receives before.

m) Terminate_Admission.indication(Port, Stream_Identifier) confirms the release of an existing reservation for the stream on the specific Port, based on the corresponding Terminate_Admission.request primitive that the LAC protocol entity receives before.

n) Per_Hop_Details.indication(Port, Per_Hop_Details) returns the current details of the forwarding resources on the specified Port in response to the corresponding Per_Hop_Details.request primitive that the LAC protocol entity receives before.

<<Editor's note: Whether the Per_Hop_Details primitives are needed?>>

11.4 Protocol specification

11.4.1 Registration protocol specification

SRP reuses MMRP as its registration protocol. It makes use of the services provides by MMRP as follows:

a) On reception of a INITIATE_STREAM_REGISTRATION(STREAM_IDENTIFIER) service primitive, SRP issues a REGISTER_MAC_ADDRESS(MAC_ADDRESS) primitive (6.12.7) to MMRP entity, where the value of MAC_ADDRESS parameter is identical to that of STREAM_IDENTIFIER parameter.

b) On reception of a TERMINATE_STREAM_REGISTRATION(STREAM_IDENTIFIER) service primitive, SRP issues a DEREGISTER_MAC_ADDRESS(MAC_ADDRESS) primitive (6.12.7) to MMRP entity, where the value of MAC_ADDRESS parameter is identical to that of STREAM_IDENTIFIER parameter.

11.4.2 Reservation protocol specification

<<This sub-clause specifies the reservation protocol. Procedures of sending and receiving reservation signaling will be described here.>>

11.5 Structure and encoding of SRP reservation protocol data units

<<Editor's note: Inputs on this sub-clause are needed, including the structure and format of Tspec, Per-hop details, etc.>>

Annex A (normative)

<<PICS proforma for SRP should be added here.>>

A.1 PICS proforma for IEEE P802.1Qat/D0.4

A.1.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification - e.g., name(s) and version(s) of machines and/or operating system names	

NOTE 1—Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

NOTE 2—The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, Model).

A.1.2 Protocol summary, IEEE P802.1Qat/D0.4

Identification of protocol specification	IEEE P802.1Qat/D0.4, IEEE Standards for Local and metropolitan area networks—Virtual Bridged Local Area Networks -Amendment 9: Stream Reservation Protocol (SRP)
Identification of amendments and corrigenda to the PICS proforma which have been completed as part of the PICS	Amd. : Corr. : Amd. : Corr. :
Have any Exception items been required? (See A.3.3: the answer Yes means that the implementation does not conform to IEEE P802.1Qat/D0.4)	No [ ] Yes [ ]

Date of Statement	

A.2 Major capabilities

Item	Feature	Status	References	Support
<<Name>>	<<Description>>	M <<Mandatory>>	<<As needed>>	Yes [ ]
<<Name>>	<<Description>>	O <<Optional>>	<<As needed>>	Yes [ ] No [ ]

<<Add more tables as necessary.>>

Annex Z (informative)

COMMENTARY

<<Editor's Note: This is a temporary Annex intended to record issues/resolutions thereof as the project proceeds. It will be removed prior to Sponsor ballot, and should be ignored for the purposes of TG/WG ballot.>>

Z.1 Issue 1

a)