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A Simple Control Protocol for MPLS SFLs
draft-bryant-mpls-sfl-control-09

Abstract

In draft-ietf-mpls-sfl-framework the concept of MPLS synonymous flow labels (SFL) was introduced. This document describes a simple control protocol that runs over an associated control header to request, withdraw, and extend the lifetime of such labels. It is not the only control protocol that moght be used to support SFL, but it has the benefit of being able to be used without modifying of the existing MPLS control prodocols. The existance of this design is not intended to restrict the ability to enhance an existing MPLS control protocol to add a similar capability.

A Querier MUST wait a configured time (suggested wait of 60 seconds) before re-attempting a Withdraw request. No more than three Withdraw requests SHOULD be made. These restricctions are to prevent overloading the control plane of the actioning router.

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1. Introduction

In [I-D.ietf-mpls-sfl-framework] the concept of MPLS synonymous flow labels (SFL) was introduced. This document describes a simple control protocol, for use in a well-managed MPLS network, that runs over an associated control header to request, withdraw, and extend the lifetime of such labels. It is not the only control protocol that moght be used to support SFL, but it has the benefit of being able to be used without modifying of the existing MPLS control

prodocols. The existance of this design is not intended to restrict the ability to enhance an existing MPLS control protocol to add a similar capability.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. SFL Control

EDITOR'S note look at whether we continue to use RFC6374 terms query respond, or normal client server terms.

This section describes the process by which the [RFC6374] Querier requests SFLs, the process by which the [RFC6374] Responder sends them to the Querier, and the process for managing the SFL lifetime. SFL Control Messages are carried over the SFL Control ACH. The SFL ACH is carried over a Pseudowire(PW) in place of the PW Control Word (CW), over an MPLS LSP using the GAL, or over some other mutually agreed path. Similarly the response may be returned over a PW, over a bidirectional LSP or over some other mutually agreed path. See Section 4.

3.1. SFL Control Message

The format of an SFL Control message, which follows the Associated Channel Header (ACH), is as follows:

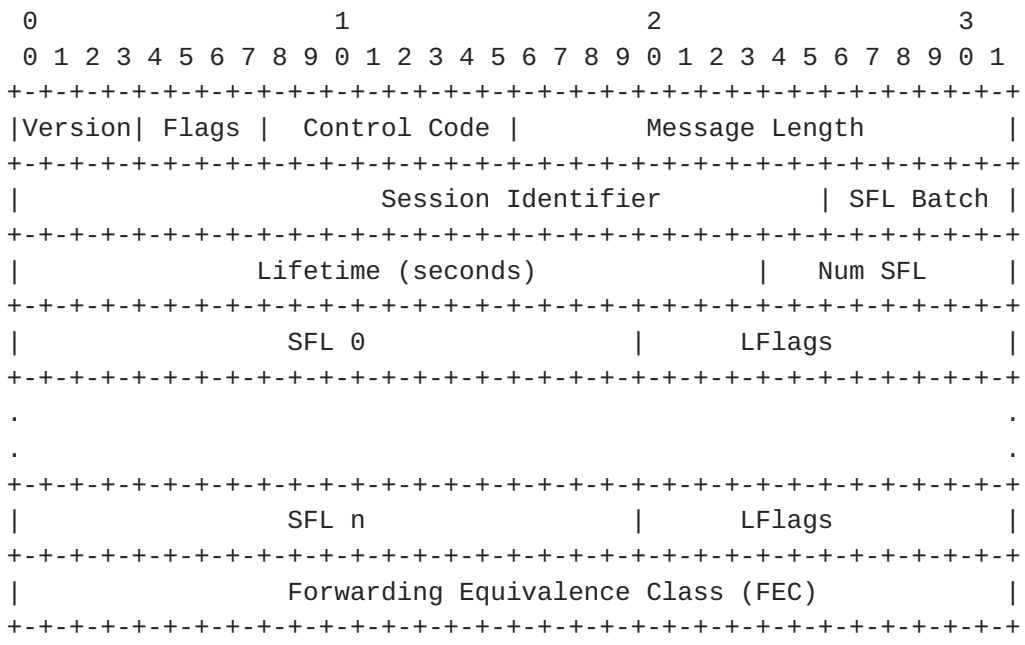
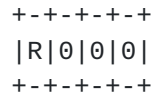


Figure 1: SFL Control Message Format

Reserved fields MUST be set to 0 and ignored upon receipt. The possible values for the remaining fields are as follows:

Version	Protocol version. Set to zero in this specification.
Flags	Message control flags.
Control Code	Code identifying the query or response type.
Message Length	Total length of this message in bytes.
Session Identifier	Set arbitrarily by the querier and used as a message handle.
SFL Batch	(6 bits) Used where the SFLs for this Session Identifier are managed across multiple SFL Control Messages. A given set of SFLs MUST be retained in the same batch.
Lifetime	The lifetime in seconds of the SFLs in this message. In a Query message it is the requested lifetime. In a Response message it is the lifetime that the SFLs have been allocated for by the Responder. The Querier MUST NOT use an SFL after expiry of its lifetime, a Responder MUST make the SFL available for at least its lifetime.
Num SFL	The number of SFLs in this SFL Batch. This MUST be constant for the lifetime of the batch.
SFL n	The n'th SFL carried in this TLV. This is an MPLS label which is a component of a label stack entry as defined in Section 2.1 of [RFC3032]. The position of a label within a batch is constant for the lifetime of the batch. Enumeration starts at zero.
LFlags	The set of flags associated with the immediately preceding SFL. See below.
FEC	The Forwarding Equivalence Class that the SFLs in this TLV correspond to. This is encoded as per Section 3.4.1 of [RFC5036].

Flags: The format of the Flags field is shown below.



SFL Control Message Flags.

The meanings of the flag bits are:

R: Query/Response indicator. Set to 0 for a Query and set to 1 for a Response.

0: Set to zero by the Sender and ignored by the Receiver.

Control Code: Set as follows according to whether the message is a Query or a Response as identified by the R flag.

For a Query:

0x0: SFL Request. This indicates that the responder is requested to allocate the set of SFLs marked with the R LFlag in this message.

0x1: SFL Refresh. This indicates that the responder is requested to refresh the set of SFLs marked with the V LFlag in this message.

0x2: SFL Withdraw. This indicates that the querier will no longer use the set of SFLs marked with the V Lflag and the responder may expire their lifetime.

For a Response:

Codes 0x0-0xF are reserved for non-error responses.

0x1: SFL Grant. This indicates that the responder allocated the set of SFLs marked with the A LFlag in this Message.

0x2: SFL Refresh-Ack. This indicates that the responder has refreshed the set of SFLs marked with the V LFlag in this message, and the lifetime is now as indicated by the lifetime field.

0x3: SFL Withdraw-Ack. This indicates that the responder has received the Withdraw message and will withdraw the SFLs

0x10: Unspecified Error. Indicates that the operation failed for an unspecified reason.

0x11: SFL-Unable. The Responder was unable to satisfy the SFL Request. The details of the failure can be determined by comparing the Request and Grant messages.

Editors Note - We need to revisit the RFC6374 errors and the protocol to see if we need some more error codes.

The LFlags field is defined as follows:

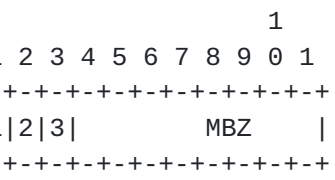


Figure 2: LFlags Bit Definition

Where:

0 (Valid (V)) The Label value of the corresponding SFL is valid. In an SFL Request setting the V Lflag indicates a request for the specified label value. Where an SFL has a valid flag clear in a request message this indicates that any SFL value is acceptable.

1 (Request (R)) Indicates to the Querier that this member of the SFL batch is requested. Where a value is specified in the request, but the Responder is unable honour that request, no SFL is allocated and the corresponding A flag MUST be cleared.

2 (Allocated (A) Indicates to the Querier that this SFL was allocated.

3 (Withdraw (W)) Indicates to the Responder that this SFL is to be withdrawn and to the Querier that the withdrawal has been carried out.

MBZ MUST be sent as zero and ignored on receive.

A flag value of one is true/set and a flag value of zero is false/clear. The use of these bits is described in more detail in the following sub-sections.

3.2. SFL Control Procedures

3.2.1. Request/Grant

To request a batch of SFLs the Querier constructs an SFL Control Request, encapsulates it in an SFL Control ACH and sends it to the Responder via an appropriate path. The Querier sets the Control Message Flag to Query and the Control Code to Request. The Querier chooses a session identifier as a handle for this transaction and as a way of binding this batch of SFLs to other operations that will use members of this SFL batch. Since members of the batch are treated as a group, the SFL Batch identifier is used to identify different SFL batches used in conjunction with the same session identifier.

The Querier sets the requested lifetime. This is the number of seconds from the time of the query to the time when the batch of SFLs will expire unless refreshed.

The Num SFL field is set to the SFL batch size.

Each SFL is set as follows: if a specific value is requested (for example for continuity across system restarts) this is written into the SFL n field and the V LFlag set. Otherwise, and including spare SFLs where an allocation is not requested, the label value is set to zero and the V LFlag is cleared. For each SFL entry where an allocation is requested the R LFlag is set. All other LFlags are cleared.

The Forwarding Equivalence Class (FEC) is set to the FEC for which the SFLs are requested.

The Message Length is determined and filled in.

The Responder proceeds as follows:

The Responder sets the control Message Flag to Response and initially sets the Control Code to Grant.

For each SFL with an R flag set, the Responder determines whether it can honour the request, if so sets the A Lflag, and if the SFL value in the query was zero it overwrites it with the allocated SFL label value. In all other cases it leaves the SFL value and LFlag unchanged.

The lifetime field is updated with the lifetime of the SFLs if this is different from the requested lifetime.

All other fields in the Query message are left unchanged and the message is sent back to the Querier using the signaled or previously agreed message path.

Where the offered lifetime is other than the requested lifetime the Querier may accept the proposed value, or withdraw the SFLs and attempt to negotiate a new set of SFLs with a different lifetime.

If the Responder is unable to allocate all of the requested SFLs it MUST respond with a response code of SFL-Unable. The Querier MUST determine whether the allocated SFLs were adequate for its purposes and MUST send a withdraw if there are not adequate. A Querier MUST NOT attempt to hoard labels in the hope that the residual labels needed may become available in the future.

A Querier MUST wait a configured time (suggested wait of 60 seconds) before re-attempting negotiation for a resource. Any failure to negotiate the required resources MUST be notified through the management interface of both Querier and Responder.

A Querier MUST NOT send an expired SFL to a Responder since to do so may invalidate another SFL operation.

3.2.2. Refresh

To request the lifetime refresh of a batch of SFLs the Querier constructs an SFL Refresh Request, encapsulates it in an SFL Control ACH and sends it to the Responder via an appropriate path. The Querier sets the Control Message Flag to Query and the Control Code to Refresh. The Querier uses the session identifier and the SFL Batch identifier that it used to request this SFL batch.

The Querier sets the requested lifetime. This is the number of seconds from the time of the query to the time when the batch of SFLs will expire unless refreshed.

The Querier sets the Num SFL field to the SFL batch size.

The Querier sets each SFL as follows: the allocated SFL label value is written into the SFL n field and the V LFlag set. All other LFlags are cleared.

The Forwarding Equivalence Class (FEC) is set to the FEC for which the SFLs are requested.

The Message Length is determined and filled in.

The Responder proceeds as follows:

The Responder sets the control Message Flag to Response and sets the Control Code to Refresh-Ack.

The Responder sets the lifetime to the lifetime of the SFL.

All other fields in the Query message are left unchanged and the message is sent back to the Querier using the signaled or previously agreed message path.

Where the offered lifetime is other than the requested lifetime the Querier may accept the proposed value, or withdraw the SFLs and attempt to negotiate a new set of SFLs with a different lifetime.

A Querier MUST wait a configured time (suggested wait of 60 seconds) before re-attempting negotiation for a resource. Any failure to negotiate the required resources MUST be notified through the management interface of both Querier and Responder.

3.2.3. Withdraw

To request the withdrawal of some or all of a batch of SFLs the Querier constructs an SFL Withdraw Request, encapsulates it in an SFL Control ACH and sends it to the Responder via an appropriate path. The Querier sets the Control Message Flag to Query and the Control Code to Withdraw. It uses the session identifier and the SFL Batch identifier that it used to request this SFL batch.

The Querier sets the requested lifetime to zero.

The Querier sets the Num SFL field to the SFL batch size.

Each SFL being withdrawn is set as follows: the allocated SFL label value is written into the SFL n field and the V and W LFlags set. All other LFlags are cleared.

The Forwarding Equivalence Class (FEC) is set to the FEC for which the SFLs are requested.

The Message Length field is determined and filled in.

The Responder proceeds as follows:

The Responder sets the control Message Flag to Response and sets the Control Code to Withdraw-Ack.

All other fields in the Query message are left unchanged and the message is sent back to the Querier using the signaled or previously agreed message path.

A Querier MUST wait a configured time (suggested wait of 60 seconds) before re-attempting a Withdraw request. No more than three Withdraw requests SHOULD be made. These restricctions are to prevent overloading the control plane of the actioning router.

3.2.4. Timer Accuracy

The lifetime of SFLs is expected to be sufficiently long that there are no significant constraints on timer accuracy. A node should be conservative in its assumptions concerning the lifetime of an SFL. A Querier MUST stop using a SFL significantly before the expiry of its lifetime and a Responder must maintain an SFL in active operation

significantly beyond nominal expiry. A margin of the order of minutes is RECOMMENDED.

4. Return Path

Where the LSP (or other MPLS construct) is multi-point to point, or multi-point to multi- point the RFC6374 Address TLV MUST be included in Query packet, even if the response is requested in-band, since this is needed to provide the necessary return address for this request.

EDITIORS NOTE - Look at this text and see if we need to make changes regarding operation over IP.

5. Privacy Considerations

The inclusion of originating and/or flow information in a packet provides more identity information and hence potentially degrades the privacy of the communication. Whilst the inclusion of the additional granularity does allow greater insight into the flow characteristics it does not specifically identify which node originated the packet other than by inspection of the network at the point of ingress, or inspection of the control protocol packets. This privacy threat may be mitigated by encrypting the control protocol packets, regularly changing the synonymous labels and by concurrently using a number of such labels.

6. Security Considerations

It is assumed that this protocol is run in a well-managed MPLS network with strict access controls preventing unwanted parties from generating MPLS packets. The control protocol described in this memo thus introduced no additional MPLS security vulnerabilities.

7. IANA Considerations

7.1. Allocation of MPLS Generalized Associated Channel (G-ACh) Type

As per the IANA considerations in [RFC5586], IANA is requested to allocate the following Channel Type in the "MPLS Generalized Associated Channel (G-ACh) Types" registry:

Value	Description	TLV Follows	Reference
0x0XXX	SFL Control	No	This

A value of 0x5A is suggested.

7.2. Creation of SFL Simple Control Code Registry

IANA is requested to created a new "SFL Simple Control Code" registry within the Generic Associated Channel (G-ACh) Parameters namespace. This registry is divided into two separate parts, one for Query Codes and the other for Response Codes, with formats and initial allocations as follows:

Query Codes

Code	Description	Reference
0x0	SFL Request	This
0x1	SFL Refresh	This
0x2	SFL Withdraw	This

Response Codes

Code	Description	Reference
0x0	Reserved	This
0x1	SFL Grant	This
0x2	SFL Refresh-Ack	This
0x3	SFL Withdraw-Ack	This
0x10	Unspecified Error	This
0x11	SFL-Unable	

IANA should indicate that the values 0x0 - 0xF in the Response Code section are reserved for non-error response codes.

The range of the Code field is 0 - 255.

The allocation policy for this registry is IETF Review.

8. Acknowledgments

The authors thank Haomian Zheng for his review comments.

RFC Editor please remove this note which is used to force the following references to appear [RFC3032] [RFC5036]

9. References

9.1. Normative References

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9.2. Informative References

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