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Handling the TC and TTL fields in a Label Stack Entry when the Generic Associated Channel Label is Present
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Abstract

This document clarifies handling of the Traffic Class (TC) and Time-to-Live (TTL) fields of a Label Stack Entry that contains the Generic Associated Channel (G-ACh) Label (GAL). These clarifications are intended to aid interoperability of implementations.

Original handling was defined in RFC 5586, and this document updates that RFC.

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1. Introduction

[RFC5586] introduced an alert mechanism for the Generic Associated Channel (G-ACh) that uses a Generic Associated Channel Label (GAL). In particular, [RFC5586] allocated one of the values from the special purpose label space to be the GAL, specified that the Label Stack Entry (LSE) containing GAL must be always at the bottom of the label stack in the case of MPLS transport profile (MPLS-TP) Label Switched Paths (LSPs), and that G-ACh packets must not be forwarded based on the GAL.

Per [RFC3032] each LSE contains, in addition to the label value and bottom-of-stack (BoS) flag, two additional fields:

- Traffic Class (TC) field - 3 bits (renamed from Experimental (EXP) field [RFC5462]). [RFC5586] defined that the handling of this field in an LSE that contains the GAL is as specified and referenced in RFC 5462.

- Time-to-Live (TTL) field - 8 bits. [RFC5586] defined that the handling of this field in an LSE that contains the GAL is in accordance with [RFC3443].

Implementations of [RFC5586] have encountered interoperability problems in their interpretation of these two fields when present in an LSE that contains the GAL. Section 4.2.1.1 of [RFC5586] states:

> The TTL field of the GAL LSE MUST be set to at least 1. The exact value of the TTL is application specific.

When this LSE becomes the top entry in the label stack (because the previous label has been popped) some receiving implementations have attempted to interpret the fields and this has resulted in errors, packet drops, or poor performance. In particular, packets with an LSE with TTL set to zero have been dropped as "expired" while those with TTL set to one can be trapped to the generic (slow) MPLS exception handler with appropriate rate limiting before the GAL is noticed (which would otherwise result in trapping the packet to a fast OAM handler). This document clarifies the rules for setting and processing them in the Label Stack Entry that includes the GAL.

The above-mentioned references are not useful for the implementers and testers because they don't give enough information about the correct processing actions. For example, [RFC5462] says only that the use of TC field for Quality of Service (QoS) and Explicit Congestion Notification (ECN) "is intended to be flexible'. On the other hand, while [RFC3443] is very detailed with regard to processing of the TTL field, it mainly deals with issues that are irrelevant for an LSE that contains the GAL.

This document defines handling of the TC and TTL fields in an LSE that contains GAL in an unambiguous way without referring to any other documents. It updates [RFC5586] in that regard.

2. Terminology

2.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2.2. Abbreviations

BoS: Bottom of Stack

G-ACh: Generic Associated Channel

GAL: Generic Associated Channel Label

LER: Label Edge Router

LSE: Label Stack Entry

LSP: Label Switching Path

LSR: Label Switching Router

PW: Pseudowire

TC: Traffic Class field (formerly named EXP)

TTL: Time-to-Live

3. New Procedures

3.1. New Procedures for Handling the TC Field in an LSE That Contains the GAL

Setting the value of the TC field in an LSE that contains the GAL is done by the LER that originates the G-ACh packet and is a matter of local policy for that LER. It is RECOMMENDED that implementations set the TC field of an LSE that contains the GAL to all zero (0b000).

The LER that inspects an LSE that contains the GAL MUST ignore the value of the TC field.

3.2. New Procedures for Handling the TTL Field in an LSE Containing GAL

Setting the value of the TTL in an LSE that contains the GAL is done by the LER that originates the G-ACh packet and is a matter of local policy for that LER. The LER that originates the G-ACh packet SHOULD NOT set this value to 0 or 1: this will avoid possible misinterpretation by the LER that inspects an LSE that contains the GAL if that LER does not comply with this document. It is RECOMMENDED that implementations set the TTL of an LSE that contains the GAL to 255.

The LER that examines an LSE that contains the GAL MUST ignore the value of the TTL field.

3.3. Scope of the new Procedures

[RFC5586] disallowed the use of the GAL in PWs, but that limitation was relaxed in [RFC6423].

The new procedures defined in this document for handling the TC field and the TTL field in an LSE that contains the GAL apply equally to all possible uses of the GAL including the so-called "Section G-ACh" where the GAL is the only label in the label stack, and the use of the GAL in LSPs and PWs.

4. IANA Considerations

This document makes no requests for IANA action.

5. Security Considerations

This document makes a minor update to the processing for MPLS packets containing the GAL and does not change any of the security fundamentals of MPLS. For a discussion of security considerations relating to MPLS, please refer to [RFC5920].

Note that the rules set out in this document specify that a receiver must ignore the values in the two MPLS LSE fields that are discussed. As such, this clarification removes a potential (and minor) attack vector where those fields could be malignly set and might cause incorrect action by the receiver.

6. Acknowledgments

The authors would like to thank Nadav Baadany whose question triggered this work, and Jeff Haas, Jie Dong, Mach Chen, and Huub van Helvoort for their comments on this document.

7. References

7.1. Normative References

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[RFC3032] Rosen, E., Tappan, D., Fedorkow, G., Rekhter, Y., Farinacci, D., Li, T., and A. Conta, "MPLS Label Stack Encoding", RFC 3032, January 2001.

[RFC3443] Agarwal, P. and B. Akyol, "Time To Live (TTL) Processing in Multi-Protocol Label Switching (MPLS) Networks", RFC 3443, January 2003.

[RFC5462] Andersson, L. and R. Asati, "Multiprotocol Label Switching (MPLS) Label Stack Entry: "EXP" Field Renamed to "Traffic Class" Field", RFC 5462, February 2009.

[RFC5586] Bocci, M., Vigoureux, M., and S. Bryant, "MPLS Generic Associated Channel", RFC 5586, June 2009.

[RFC6423] Li, H., Martini, L., He, J., and F. Huang, "Using the Generic Associated Channel Label for Pseudowire in the MPLS Transport Profile (MPLS-TP)", RFC 6423, November 2011.

7.2. Informative References

[RFC5920] Fang, L., "Security Framework for MPLS and GMPLS Networks", RFC 5920, July 2010.

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