Stream: Internet Engineering Task Force (IETF)
RFC: 9895
Category: Standards Track
Published: January 2026
ISSN: 2070-1721
Authors: D. Wiggins, L. Berger (*LabN Consulting, L.L.C.*), D. Eastlake 3rd, Ed. (*Independent*)

RFC 9895
Dynamic Link Exchange Protocol (DLEP) IEEE 802.1Q Aware Credit Window Extension

Abstract

This document defines an extension to the Dynamic Link Exchange Protocol (DLEP) that enables an Ethernet IEEE 802.1Q aware credit window scheme for destination-specific and shared flow control.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc9895.

Copyright Notice

Table of Contents

1. Introduction

The Dynamic Link Exchange Protocol (DLEP) is defined in [RFC8175]. The protocol provides the exchange of link-related control information between DLEP peers. DLEP peers consist of a modem and a router. DLEP defines a base set of mechanisms as well as support for possible extensions. This document defines one such extension.

The DLEP specification does not define any flow control mechanisms. While in theory various flow control techniques could be implemented with DLEP, this document specifies a DLEP extension that introduces an Ethernet-based flow control mechanism for traffic transmitted from a router to a modem. This mechanism utilizes one or more logical "credit windows", each of which is typically associated with a virtual or physical queue. The router leverages traffic flow classification information provided by the modem to determine the appropriate credit window for a given traffic flow. Credit windows may be shared across multiple flows or used on a per-flow basis. For a Diffserv-based approach to credit window flow control, refer to [RFC9894]. As specified in Section 2.3.1 of [RFC9892], when both Diffserv and Ethernet traffic classification are applied to a flow, Ethernet-based classification takes precedence.

This document leverages the traffic classification and credit window flow control mechanisms defined in [RFC9892] and [RFC9893] to enable credit-window-based flow control based on DLEP destinations, Ethernet Virtual Local Area Networks (VLANs), and Priority Code Points (PCPs). Ethernet PCP support is specified as part of the IEEE 802.1Q tag format [IEEE8021Q], which includes a 3-bit "PCP" field. The tag format also incorporates a 12-bit "VLAN Identifier (VID)" field.

The defined mechanism allows credit windows to be shared across traffic destined for multiple DLEP destinations, VLANs, and PCPs, or to be dedicated exclusively to traffic associated with a specific destination, VLAN, and/or PCP. Additionally, this extension supports "wildcard" matching for any PCP or VID.

The extension defined in this document is referred to as the "IEEE 802.1Q Aware Credit Window" or, more simply, the "Ethernet Credit" extension. The reader should be familiar with both the traffic classification and credit window flow control mechanisms defined in [RFC9892] and [RFC9893].

This document defines a new DLEP Extension Type value that is used to indicate support for the extension. See Section 2.

1.1. Key Words

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.

2. Extension Usage and Identification

The extension defined in this document is built on the mechanisms and processing defined in [RFC9892] and [RFC9893]. To indicate that the IEEE 802.1Q Aware Credit Window Extension is to be used, an implementation **MUST** include the IEEE 802.1Q Aware Credit Window Extension Type value in the Extensions Supported Data Item (see Section 13.6 of [RFC8175]). The Extensions Supported Data Item is sent and processed according to [RFC8175]. Any implementation that indicates the use of the IEEE 802.1Q Aware Credit Window Extension **MUST** support all message types, Data Items, the Ethernet Traffic Classification Sub-Data Item, and all related processing defined in [RFC9892] and [RFC9893].

The IEEE 802.1Q Aware Credit Window Extension Type value is 5. See Section 5.

3. Management Considerations

This section provides several network management guidelines for implementations supporting the IEEE 802.1Q Aware Credit Window Extension.

If this extension is supported, that support **MUST** be declared using the Extensions Supported Data Item (see Section 13.6 of [RFC8175]), which is configurable on both modems and routers. Diffserv Aware Credit Window Extension Data Items **MUST NOT** be emitted by a DLEP participant unless such support was specified in the initialization message received from its peer. The use of the extension defined in this document **SHOULD** be configurable on both modems and routers.

Modems **SHOULD** support the configuration of mapping a PCP to a credit window (queue).

Modems **MAY** support the configuration of mapping a PCP to a credit window (queue) on a per-VLAN basis. VID value zero (0x0000) is used by [RFC9892] to indicate that the VID is ignored. VID 0xFFFF is reserved. Any other VID value from 0x0001 through 0xFFFE can be used in traffic classification.

When VLANs are supported by a modem without support from PCPs, the modem **SHOULD** support the configuration of mapping a VLAN to a credit window (queue).

Modems **MAY** support the configuration of the number of credit windows (queues) that they advertise to a router.

Routers may impose limitations on the number of queues they can support and on the allowable credit window configurations. In some cases, per-destination queues may not be supported. If the credit window information provided by the modem exceeds the router's capabilities, the router **SHOULD** utilize a subset of the advertised credit windows. Alternatively, the router **MAY** reset the session and indicate that the extension is not supported. In either case, any mismatch in capabilities **SHOULD** be reported to the user through standard network management mechanisms, such as user interface notifications or error logging.

Regardless of implementation, if credit windows are in use, the router **MUST NOT** send traffic to the modem unless sufficient credits are available.

4. Security Considerations

This document defines a DLEP extension that uses DLEP mechanisms and the credit window flow control mechanisms defined in [RFC9892] and [RFC9893]. See also the Security Considerations sections of those documents.

The defined extension is exposed to vulnerabilities similar to existing DLEP messages and discussed in the Security Considerations section of [RFC8175], such as an injected message resizing a credit window to a value that results in a denial of service. The security mechanisms documented in [RFC8175] can be applied equally to the mechanism defined in this document.

Wildcards for matching PCP and VID fields are provided. Note that wildcards may be convenient for matching a number of packet flows but could inadvertently match unexpected flows or new flows that appear after the wildcard matching has been set up. It is therefore **RECOMMENDED** that wildcards not be used unless clearly needed.

5. IANA Considerations

IANA has assigned the following code point in the "Extension Type Values" registry in the "Dynamic Link Exchange Protocol (DLEP) Parameters" registry group:

Code	Description
5	IEEE 802.1Q Aware Credit Window

Table 1: Extension Type Value

6. References

6.1. Normative References

[IEEE8021Q] IEEE, "IEEE Standard for Local and Metropolitan Area Networks--Bridges and Bridged Networks", DOI 10.1109/IEEESTD.2022.10004498, IEEE Std 802.1Q-2022, December 2022, <https://ieeexplore.ieee.org/document/10004498>.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC8175] Ratliff, S., Jury, S., Satterwhite, D., Taylor, R., and B. Berry, "Dynamic Link Exchange Protocol (DLEP)", RFC 8175, DOI 10.17487/RFC8175, June 2017, <https://www.rfc-editor.org/info/rfc8175>.

[RFC9892] Cheng, B., Wiggins, D., Berger, L., and D. Fedyk, Ed., "Dynamic Link Exchange Protocol (DLEP) Traffic Classification Data Item", RFC 9892, DOI 10.17487/RFC9892, January 2026, <https://www.rfc-editor.org/info/rfc9892>.

[RFC9893] Cheng, B., Wiggins, D., Ratliff, S., Berger, L., and E. Kinzie, Ed., "Dynamic Link Exchange Protocol (DLEP) Credit-Based Flow Control Messages and Data Items", RFC 9893, DOI 10.17487/RFC9893, January 2026, <https://www.rfc-editor.org/info/rfc9893>.

6.2. Informative References

[RFC9894] Cheng, B., Wiggins, D., Berger, L., and D. Eastlake 3rd, Ed., "Dynamic Link Exchange Protocol (DLEP) Diffserv Aware Credit Window Extension", RFC 9894, DOI 10.17487/RFC9894, January 2026, <https://www.rfc-editor.org/info/rfc9894>.

Acknowledgments

This document was motivated by discussions in the MANET Working Group. Many useful comments were received from contributors to the MANET Working Group, notably Ronald in 't Velt.

We had the honor of working too briefly with David Wiggins on this and related DLEP work. His contribution to the IETF and publication of the first and definitive open-source DLEP implementation have been critical to the acceptance of DLEP. We mourn his passing on November 26, 2023. We wish to recognize his guidance, leadership, and professional excellence. We were fortunate to benefit from his leadership and friendship. He shall be missed.

Authors' Addresses

David Wiggins

Lou Berger
LabN Consulting, L.L.C.
Email: lberger@labn.net

Donald E. Eastlake 3rd (EDITOR)
Independent
2386 Panoramic Circle
Apopka, FL 32703
United States of America
Phone: +1-508-333-2270
Email: d3e3e3@gmail.com