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DLEP IEEE 802.1Q Aware Credit Window Extension
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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.

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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 various flow control techniques could be theoretically 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 allocated on either a shared or a per-flow basis. For a DiffServ-based approach to credit window flow control, refer to [I-D.ietf-manet-dlep-da-credit-extension]. As specified in Section 2.3.1 of [I-D.ietf-manet-dlep-traffic-classification], 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 control mechanisms defined in [I-D.ietf-manet-dlep-traffic-classification] and [I-D.ietf-manet-dlep-credit-flow-control] to enable credit window-based flow control based on DLEP destinations, Ethernet VLANs, and Priority Code Points (PCPs). Ethernet PCP support is specified as part of the IEEE 802.1Q [IEEE8021Q] tag format, 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, Virtual Local Area Networks (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 "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 control mechanisms defined in [I-D.ietf-manet-dlep-traffic-classification] and [I-D.ietf-manet-dlep-credit-flow-control].

This document defines a new DLEP Extension Type Value in Section 2 which is used to indicate support for the extension.

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 composed of the mechanisms and processing defined in [I-D.ietf-manet-dlep-traffic-classification] and [I-D.ietf-manet-dlep-credit-flow-control]. 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 Type Value in the Extensions Supported Data Item. The Extensions Supported Data Item is sent and processed according to [RFC8175]. Any implementation that indicates use of the IEEE 802.1Q Aware Credit Window Extension MUST support all Messages, Data Items, the Ethernet Traffic Classification Sub-Data Item, and all related processing defined in [I-D.ietf-manet-dlep-traffic-classification] and [I-D.ietf-manet-dlep-credit-flow-control].

The IEEE 802.1Q Aware Credit Window Extension Type Value is TBA1, see Section 5.

3. Management Considerations

This section provides several network management guidelines to 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 PCP to credit window (queue) mapping.

Modems MAY support the configuration of PCP to credit window (queue) mapping on a per VLAN basis. VID value zero (0) is used by [I-D.ietf-manet-dlep-traffic-classification] to indicate that VID is ignored and any VID value is used in traffic classification.

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

Modems MAY support 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 control and flow mechanisms defined in [I-D.ietf-manet-dlep-traffic-classification] and [I-D.ietf-manet-dlep-credit-flow-control]. 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 which may be convenient to match 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 is requested to assign one code point in the "Extension Type Values" registry in the "Dynamic Link Exchange Protocol (DLEP) Parameters" registry group as follows:

Code	Description
TBA1	IEEE 802.1Q Aware Credit Window

Table 1: Requested Extension Type Value

6. References

6.1. Normative References

[I-D.ietf-manet-dlep-credit-flow-control]
Cheng, B., Wiggins, D., Berger, L., Ratliff, S., and E. Kinzie, "Dynamic Link Exchange Protocol (DLEP) Credit-Based Flow Control Messages and Data Items", Work in Progress, Internet-Draft, draft-ietf-manet-dlep-credit-flow-control, 3 January 2025, <https://datatracker.ietf.org/doc/draft-ietf-manet-dlep-credit-flow-control>.

[I-D.ietf-manet-dlep-traffic-classification]
Cheng, B., Wiggins, D., Berger, L., and D. Fedyk, "Dynamic Link Exchange Protocol (DLEP) Traffic Classification Data Item", Work in Progress, Internet-Draft, draft-ietf-manet-dlep-traffic-classification, 19 November 2024, <https://datatracker.ietf.org/doc/draft-ietf-manet-dlep-traffic-classification>.

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[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>.

6.2. Informative References

[I-D.ietf-manet-dlep-da-credit-extension]
Cheng, B., Wiggins, D., Berger, L., and D. E. Eastlake, "DLEP DiffServ Aware Credit Window Extension", Work in Progress, Internet-Draft, draft-ietf-manet-dlep-da-credit-extension, 15 December 2024, <https://datatracker.ietf.org/doc/draft-ietf-manet-dlep-da-credit-extension/>.

Appendix A. Acknowledgments

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