IEEE P802.11
Wireless LANs

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| L4S Support in 802.11  |
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Abstract

This document proposes draft spec text for L4S support in 802.11bn.

**Revisions:**

* Rev 0: Initial version of the document.

**37.x.x.x Support for L4S**

**37.x.x.x.1 General**

Low Latency, Low Loss, and Scalable Throughout (L4S) architecture is defined in the IETF (RFCs 9330, 9331, 9332) with the purpose of providing low queuing delays, low packet loss, and fine rate adaptation for latency-sensitive applications such as video collaboration, video streaming, multiplayer games and XR (AR/VR) applications.

L4S uses the explicit congestion notification (ECN) field in the IP header to signal early and frequently the occurrence of network congestion to the receiver. The receiver relays congestion information back to the sender (e.g. in TCP acknowledgement packets or RTCP report) and the sender adjusts its sending data rate accordingly. This early congestion notification and fine grain rate adaptation by the sender minimizes queuing delay and packet drops due to congestion.

In 802.11, MAC layer transmit queues can build-up when the ingress rate exceeds the egress rate and as well when media access delays occur because of high level of channel contention. When congestion is experienced at the MAC layer due to transmit queue build up, the L4S ECN marking can be supported to signal the congestion back to the sender to trigger sender adapting its data rate. An MLME interface is defined on the transmit side to notify the upper layer when congestion is experienced in the MAC layer transmit queues. Based on this notification the upper layer can perform ECN marking in the IP header.

**37.x.x.x.2 L4S AP Mode of operation**

An AP that has dot11L4SActivated equal to true is called an L4S AP.

An L4S AP shall be capable of identifying L4S MSDUs received from the MAC SAP based on the L4S field in the MA-UNITDATA.request primitive (see 5.2.X.X MA-UNITDATA.request). The L4S field is used in addition to the priority and/or SCSID fields of the MA-UNITDATA.request.

An L4S AP should support buffering of L4S MSDUs in shallow queue(s) as per recommendation in IETF RFC 9330, RFC 9331 and RFC 9332. The specific implementation of queuing for L4S MSDUs is beyond the scope of this standard.

The L4S AP shall initiate the MLME-L4S-CONG-EXPERIENCED.Indication primitive (see 6.5.xx.2 (MLME-L4S-CONG-EXPERIENCED.Indication)) to signal to its upper layer that the congestion is experienced at the MAC layer for L4S traffic. Upon receiving the MLME-L4S-CONG-EXPERIENCED.Indication primitive, the upper layer performs ECN marking in the IP header of subsequent packets to signal congestion experienced. If the MAC layer congestion for L4S traffic is no longer experienced, then the L4S AP shall initiate the MLME-L4S-CONG-EXPERIENCED.Indication primitive (see 6.5.xx.2 (MLME-L4S-CONG-EXPERIENCED.Indication)) to signal to the upper layer that L4S congestion has cleared by setting the congestion experienced parameter to False.

NOTE — The conditions and criteria based on which the MAC layer determines to signal L4S congestion experienced notification to the upper layer is implementation specific and is outside the scope of this specification. Section 5 of RFC 9331 provides general requirements for a network node to support L4S and can be adapted for implementation in the MAC.

﻿**5.2.4 MA-UNITDATA.request**

**### TGbn editor: please make following changes in this clause ###**

5.2.4.1 Function

﻿5.2.4.2 Semantics of the service primitive

The parameters of the primitive are as follows:

MA-UNITDATA.request(

source address,

destination address,

routing information,

data,

priority,

drop eligible,

service class,

station vector,

MSDU format,

radio environment request vector,

SCSID,

L4S

)

<…>



Figure 1 ECN field definition ([RFC9331])

The L4S parameter is a Boolean that indicates whether the corresponding MSDU is an L4S enabled MSDU, for processing by an L4S AP. If the MSDU has the ECN bits set to 01 or 11 in the IP header (see Figure 1) contained within the MSDU then the L4S parameter is set to True, otherwise this parameter is set to False.

The L4S field is present if dot11L4SActivated is true.

**6.5 MLME SAP primitives**

**### TGbn editor: please add following new MLME primitive in this clause ###**

**6.5.xx L4S explicit congestion notification**

6.5.xx.1 Introduction

This mechanism supports the notification of congestion experienced at the MAC layer for L4S flows/MSDUs to the higher layer for marking of ECN bits at the IP layer for congestion experienced signalling.

6.5.xx.2 MLME-L4S-CONG-EXPERIENCED.Indication

﻿6.5.xx.2.1 Function

This primitive provides an indication that the congestion is experienced at the MAC layer for L4S MSDUs.

6.5.xx.2.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-L4S-CONG-EXPERIENCED.Indication(

source address,

 destination address,

 priority,

 SCSID,

 congestion experienced,

 MSDU congestion marking probability,

 congestion information,

)

﻿The source address (SA) parameter is an individual MAC address and is set to the SA field of the MSDU that experienced congestion at the MAC layer.

The destination address (DA) parameter is an individual MAC address and is set to the DA field of the MSDU that experienced congestion at the MAC layer.

﻿The priority parameter specifies the priority corresponding to the MSDU that experienced congestion at the MAC layer.

﻿The SCSID parameter is a nonzero value that identifies the SCS stream (if any) to which the MSDU that experienced congestion belongs. If the MSDU experiencing congestion does not belong to an SCS stream, then SCSID is not present.

The congestion experienced parameter is a Boolean that is set to True to indicate that the congestion is experienced at the MAC layer for L4S MSDU(s) belonging to the specified priority or SCSID (if present). If the MAC layer congestion for L4S traffic is no longer experienced, then this parameter is set to False.

The MSDU congestion marking probability provides the likelihood with which the upper layer should ECN congestion experienced (CE) mark subsequent MSDUs belonging to the specified source address, destination address, and priority or SCSID. This parameter is included if the congestion experienced parameter is set to True.

The congestion information parameter provides a container for further information related to congestion experienced at the MAC layer. This parameter is included if the congestion experienced parameter is set to True.

6.5.xx.2.3 ﻿When generated

This primitive is generated by the MAC layer when congestion is experienced at the MAC layer for L4S enabled MSDUs and dot11L4SActivated is true

6.5.32.2.4 Effect of receipt

The primitive triggers the upper layer to perform ECN Congestion Experienced marking of L4S MSDUs belonging to the specified priority or SCSID to signal congestion experienced (by setting ECN=11).

**9.4.2.x UHR Capabilities element**

The format of the UHR Capabilities element is shown in [Figure 9-X1 (UHR Capabilities element format)](#_bookmark181).

|  |  |  |  |
| --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | UHR MAC Capabilities Information |

Octets: 1 1 1 TBD

**Figure 9-X1—UHR Capabilities element format**

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The format of the UHR MAC Capabilities Information field is defined in Figure 9-X2 (UHR MAC

Capabilities Information field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1  |  B2 - TBD |
|  | *TBD* *Feature* | L4S Support | Reserved |
| Bits: | 1 | 1 | TBD |

**Figure 9-X2—** **UHR MAC Capabilities Information field format**

The L4S Support field indicates whether the STA supports ECN marking for L4S congestion notification. This field is set to 1 if the STA has dot11L4SActivated set to true, otherwise this field is set to 0.