IEEE P802.11  
Wireless LANs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | IPSEC Classifier | | | | | | Date: 2019-02-15 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Matthew Fischer | Broadcom |  |  | [Matthew.fischer@broadcom.com](mailto:Matthew.fischer@broadcom.com) | | Gabor Bajko | Mediatek |  |  | Gabor.bajko@mediatek.com | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

This document includes proposed language to add a classifier for the TCLAS element that allows the use of IPSEC header information for classification. There is no CID of reference for this document.

Changes are referenced to TGmd D2.1.

**REVISION NOTES:**

**R0**:

Initial

**R1**:

9.4.2.30 – modified wording a bit to clarify how to apply the classifier, noting that like classifier types 1 and 4, it applies to IP packets

9.4.2.30 – removed the interpretation of the classifier as reserved if no type 1 or 4 is present, as the new language indicates that this classifier is always applied to an IP packet

**R2**:

9.4.2.30 – removed mention of MMPDU, NA for IP case

**R3**:

Discussion – added rationale for new changes that affect the existing classifiers of types 1 and 4

9.4.2.30 – rearrange and rewrite some text to add clarity to the description of the Protocol Number or Next Header field

9.4.2.30 – added proposed changes for existing classifiers of types 1 and 4

**R4**:

Spelling error corrected: Nubmers -> Numbers

For classifier type 10 (the new one) change Classifier Mask subfield to Protocol Instance subfield to account for the possibility of more than one header with the same protocol number/next header field value. This is only possible in an IPv6 packet and only with the Destination Options header and that header can have a maximum of two instances.

**R5**:

Various modifications to fix accuracy regarding references to IP headers

**R6**:

Add instruction to globally change references of RFC2460 to RFC8200

Add Gabor Bajko as co author

**END OF REVISION NOTES**

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGm Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGm Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGm Editor: Editing instructions preceded by “TGm Editor” are instructions to the TGm editor to modify existing material in the TGm draft. As a result of adopting the changes, the TGm editor will execute the instructions rather than copy them to the TGm Draft.***

**CIDs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |

**Discussion:**

In examining the case for inclusion of 802.11 for use as a 5G technology, the common use case of multiple IPSEC tunnels for varying traffic flows is identified and in order to accommodate the QOS requirements of those varying flows, and given that all of the header information beyond the IPSEC header is scrambled by the IPSEC function, it is necessary, if TCLAS classifiers are to be used to assist in the provisioning of the QOS for those flows, that the IPSEC header itself be available for classification decisions. Therefore, this document proposes to add a new classifier type which will allow the specification of a classification for QOS purposes based on the subfields of an IPSEC header and as a side benefit, for other functions within 802.11 which also use the TCLAS element. In order to avoid additional classifier type additions in the future, the proposed classifier type is made to be rather generic for IP encapsulation. I.e. it can be used to identify and match on any fields of any protocol that is specified within an IP header of either IPv4 or IPv6 type.

In addition to these changes, there are some changes necessary to the existing classifier types 1 and 4 for IPv4 and IPv6 which are both underspecified and incorrect. Specifically, these classifiers call for a match to Source Port and Destination Port, but these fields to not exist in either an IPv4 or IPv6 header, but rather, inside of headers for protocols above the IP layer. Also, the discussion for classifier type 4 says that the Next Header field can only match extension headers, but this precludes the use of the classifier for matching a TCP/IP or UDP/IP packet using IPv6, which is clearly intended to be included, due to the presence of the Source Port and Destination Port matching fields in the classifier pictured for IPv6.

An examination of the literature confirms that in a series of IP headers, each type of header may appear only once, except that the Destination Options extension header is allowed to appear zero, one or two times. The Protocol Instance field allows the selection of either the first or second instance of appearance of that header.

**Proposed Changes to TGmd D2.1:**

***TGm editor: within TGmd D2.1, modify Table 9-164 Frame classifier type and the paragraph that follows the table within subclause 9.4.2.30 TCLAS element, as shown:***

**9.4.2.30 TCLAS element**

**Table 9-164—Frame classifier type**

|  |  |
| --- | --- |
| **Classifier type** | **Classifier parameters** |
| 0 | Ethernet parameters |
| 1 | TCP/UDP IP parameters |
| 2 | IEEE 802.1Q parameters |
| 3 | Filter Offset parameters |
| 4 | IP and higher layer parameters |
| 5 | IEEE 802.1D/Q parameters |
| 6 | IEEE 802.11 MAC header parameters |
| 7(11ah) | (11ah) IEEE Std 802.11 downlink PV1 MPDU MAC header parameters (From DS field of the Frame Control field equal to 1) |
| 8(11ah) | IEEE Std 802.11 nondownlink PV1 MPDU MAC header parameters (From DS field of the Frame Control field equal to 0) |
| 9(11ah) | IEEE Std 802.11 PV1 MPDU Full Address MAC header parameters |
| 10 | IP extensions and higher layer parameters |
| 11-255 | Reserved |

When the Classifier type is a value less than or equal to 5, but not equal to 3, the Classifier Mask subfield specifies a bitmap in which bits that have the value 1 identify a subset of the classifier parameters whose values need to match those of the corresponding parameters in a given MSDU for that MSDU to be classified to the TS of the affiliated TSPEC. The bitmap is ordered from the LSB to the MSB, with each bit pointing to one of the classifier parameters of the same relative position as shown in this subclause based on classifier type. When there are more bits in the bitmap than classifier parameters that follow, the MSBs that do not point to any classifier parameters are reserved.

***TGm editor: within TGmd D2.1, modify the following text within the description of classifier type 1 of 9.4.2.30 TCLAS element, as shown:***

For Classifier Type 1, frame classifier is defined for both IPv4 and IPv6, shown in Figure 9-305 (Frame Classifier field of Classifier Type 1 for traffic over IPv4) and Figure 9-306 (Frame Classifier field of Classifier Type 1 for traffic over IPv6), and distinguished by the Version field. Use of Classifier Type 1 for IPv6 is deprecated and replaced by Classifier Type 4. The subfields in the classifier parameters are represented and transmitted in the big-endian format. The classifier parameters are the following parameters:

In the IP header: Source Address, Destination Address and Version.

In a TCP or UDP header: Source Port and Destination Port, plus

***TGm editor: within TGmd D2.1, modify the following text within the description of classifier type 4 of 9.4.2.30 TCLAS element, as shown and insert two references to the Normative References section:***

The value in the Version subfield is the value specified in IETF RFC 791 or IETF RFC 8200.

The DSCP subfield contains the value as described in IETF RFC 2474 in the 6 least significant bits. The 2 most significant bits are reserved. For an IPv6 packet, this corresponds to the Traffic Class subfield of the IPv6 header.

The Source IP Address and Destination IP Address correspond to the identically named fields of the IPv4 and IPv6 headers.

The Source Port and Destination Port correspond to the identically named fields of various protocol headers that are encapsulated within an IPv4 or IPv6 packet.

The Next Header subfield contains the next encapsulated protocol which is either the value specified in the IPv4 header’s Protocol field or the value in the Next Header field of the IPv6 header. In the presence of options in the IPv6 header, the Next Header field specifies the presence of one or more extension headers as registered in [B60a] and defined by the corresponding IETF RFCs.

***TGm editor: within TGmd D2.1, replace all references of “IETF RFC 2460” with “IETF RFC8200”***

***TGm editor: within TGmd D2.1, insert the following new text and figure to describe the new classifier type 10 at the end of subclause 9.4.2.30 TCLAS element, as shown:***

For Classifier Type 10, the Frame Classifier subfield for IP extensions and higher layer parameters is defined for packets using IPv4 and IPV6 as shown in Figure 9-326b (Frame Classifier subfield of Classifier Type 10 for packets using IPv4 or IPv6). The subfields in the classifier parameters are represented and transmitted in the big-endian format.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Classifier Type (10) | Protocol Instance | Protocol Number or Next Header | Filter Value | Filter Mask |
| Octets: | 1 | 1 | 1 | Variable | Variable |

**Figure 9-326b—Frame Classifier subfield of Classifier Type 10 for packets using IPV4 or IPV6**

The Protocol Instance subfield indicates the instance number of the protocol identified by the Protocol Number or Next Header subfield. A value of 0 in this field matches the first instance of the Protocol Number or Next Header. A value of 1 matches the second instance, and so on. The only value of Protocol Number or Next Header subfield that is allowed to appear more than once within an IP packet is the Destination Options extension header of IPv6.

The Protocol Number or Next Header subfield contains an IPv4 Protocol Number or an IPv6 Next Header value, which share a common interpretation also known as an IP Protocol Number. The Protocol Number or Next Header subfield value is compared against the Protocol field value of an IPv4 header and to all Next Header field values in an IPv6 packet. This is also true for an IPv6 packet that is encapsulated within an IPv4 packet. This matching operation is not maskable.

The lengths of the Filter Value and Filter Mask subfields are the same and are each equal to (*Length* – 4)/2 octets, where *Length* is the value in the Length field of the TCLAS element.

The Filter Value subfield is an octet string that is compared to the MSDU content, beginning at the first octet of the protocol information which is identified by the Protocol Number or Next Header subfield.

The Filter Mask subfield is an octet string that is used to indicate which bits in the Filter Value subfield are compared. A bit in the Filter Value subfield is compared only if the matching bit in the Filter Mask subfield is 1.

Figure 9-326c (IPv4 packet example for Classifier Type 10) shows an example of how the Filter Value subfield is applied to an IPv4 packet.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| B0 |  |  |  |  | B31 | |
| Version | IHL | DSCP | ECN | Total Length | | |
| Identification | | | | Flags | Fragment Offset | |
| Time To Live | | Protocol [containing the Identifier for Protocol XYZ] | | Header Checksum | | |
| Source IP Address | | | | | | |
| Destination IP Address | | | | | | |
| Options | | | | | | |
| Protocol XYZ octet 0 | | Protocol XYZ octet 1 | | Protocol XYZ octet 2 | | Protocol XYZ octet 3 |
| etc | |  | |  | |  |

**Figure 9-326c—IPv4 packet example for Classifier Type 10**

When the Protocol Number or Next Header subfield value of the Frame Classifier matches the value in the Protocol subfield of the IPv4 header, in this case the identifier that corresponds to protocol XYZ, then the first Filter Value octet is compared to Protocol XYZ octet 0 and so on.

Figure 9-326d (IPv6 packet example for Classifier Type 10) shows an example of how the Filter Value subfield is applied to an IPv6 packet that contains multiple extension headers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| B0 |  |  |  |  | B31 |
| Version | Traffic Class | | Flow Label | | |
| Payload Length | | | | Next Header [containing the identifier for Extension Header ABC] | Hop Limit |
| Source IP Address | | | | | |
| Destination IP Address | | | | | |
| Next Header [Extension Header ABC octet 0][containing the identifier for Extension Header DEF] | | Extension Header ABC octet 1 | | Extension Header ABC octet 2 | Extension Header ABC octet 3 |
| Extension Header ABC octet 4 | | etc | |  |  |
| Next Header [Extension Header DEF octet 0][ containing the identifier for Extension Header GHI] | | Extension Header DEF octet 1 | | Extension Header DEF octet 2 | Extension Header DEF octet 3 |
| Extension Header DEF octet 4 | | etc | |  |  |
| Next Header [Extension Header GHI octet 0] [ containing the identifier for Protocol XYZ] | | Extension Header GHI octet 1 | | Extension Header GHI octet 2 | Extension Header GHI octet 3 |
| Extension Header GHI octet 4 | | etc | |  |  |
| Protocol XYZ octet 0 | | Protocol XYZ octet 1 | | Protocol XYZ octet 2 | Protocol XYZ octet 3 |
| etc | |  | |  |  |

**Figure 9-326c—IPv6 packet example for Classifier Type 10**

When the Protocol Number or Next Header subfield value of the Frame Classifier matches the value of a Next Header field of any IPv6 Header or IPv6 Extension Header, then the first Filter Value octet is compared to the first octet of the header of of the payload that is identified by the matching Protocol Number or Next Header subfield value and so on. For example, if the Protocol Number or Next Header subfield value of a Frame Classifier of Classifier Type 10 contains the identifier for IPv6 Extension Header GHI, then this value matches the first entry of the seventh row in the figure and the Filter Value comparison begins at the first octet indicated on the ninth row of the figure. The comparison stops after the first match of a Next Header field.

***TGm editor: within TGmd D2.1, add the following references to Annex A Bibliography:***

[B60a] IPv6 Extension Header Types, https://www.iana.org/assignments/ipv6-parameters/ipv6-parameters.xhtml#ipv6-parameters-1

[B60b] IETF RFC 8200, Internet Protocol, Version 6 (IPv6) Specification

**End of proposed changes.**