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RADIUS Attributes for Virtual LAN and Priority Support

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Abstract

This document proposes additional RADIUS (Remote Authentication Dial In User Service) attributes for dynamic Virtual LAN assignment and prioritization, for use in provisioning of access to IEEE 802 local area networks. These attributes are usable within either RADIUS or Diameter.

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1. Introduction

This document describes Virtual LAN (VLAN) and re-prioritization attributes that may prove useful for provisioning of access to IEEE 802 local area networks [[IEEE-802](#)] with the Remote Authentication Dialin User Service (RADIUS).

While [[RFC3580](#)] enables support for VLAN assignment based on the tunnel attributes defined in [[RFC2868](#)], it does not provide support for a more complete set of VLAN functionality as defined by [[IEEE-802.1Q](#)]. The attributes defined in this document provide support within RADIUS analogous to the management variables supported in [[IEEE-802.1Q](#)] and MIB objects defined in [[RFC4363](#)]. In addition, this document enables support for a wider range of [IEEE-802.1X] configurations.

1.1. Terminology

This document uses the following terms:

Network Access Server (NAS)

A device that provides an access service for a user to a network.

1.2. 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](#)].

1.3. Attribute Interpretation

If a NAS conforming to this specification receives an Access-Accept packet containing an attribute defined in this document which it cannot apply, it MUST act as though it had received an Access-Reject.

Similarly, [[RFC3576](#)] requires that a NAS receiving a Change of Authorization Request (CoA-Request) containing an unsupported attribute reply with a CoA-NAK. It is recommended that an Error-Cause attribute with value set to "Unsupported Attribute" (401) be included in the packet. As noted in [[RFC3576](#)], authorization changes are atomic so that this situation does not result in session termination and the pre-existing configuration remains unchanged. As a result, no accounting packets should be generated.

2. Attributes

2.1. Egress-VLANID

Description

The Egress-VLANID attribute represents an allowed IEEE 802 Egress VLANID for this port, indicating if the VLANID is allowed for tagged or untagged packets as well as the VLANID.

Multiple Egress-VLANID attributes MAY be included in Access-Request, Access-Accept, CoA-Request or Accounting-Request packets; this attribute MUST NOT be sent within an Access-Challenge, Access-Reject, Disconnect-Request, Disconnect-ACK, Disconnect-NAK, CoA-ACK or CoA-NAK. Each attribute adds the specified VLAN to the list of allowed egress VLANs for the port.

The Egress-VLANID attribute is shown below. The fields are transmitted from left to right:

```

      0                               1                               2                               3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|      Type      |      Length      |      Value      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|      Value (cont)      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

Type

TBD

Length

6

Value

The Value field is four octets. The format is described below:

```

      0                               1                               2                               3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Tag Indic. |      Pad      |      VLANID      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

The Tag Indication field is one octet in length, and indicates whether the frames on the VLAN are tagged (0x31) or untagged

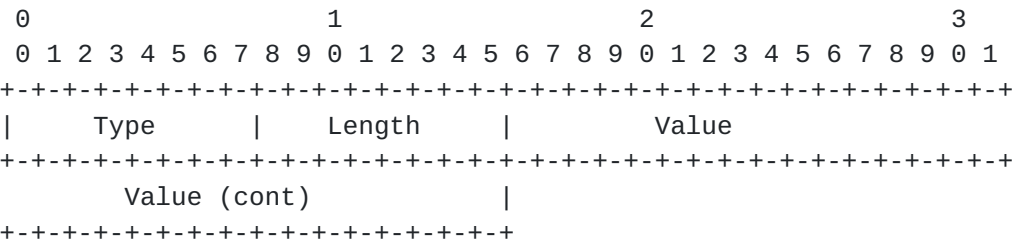
(0x32). The Pad field is 12-bits in length and MUST be 0 (zero). The VLANID is 12-bits in length and contains the [IEEE-802.1Q] VLAN VID value.

2.2. Ingress-Filters

Description

The Ingress-Filters attribute corresponds to the Ingress Filter per-port variable defined in [IEEE-802.1Q] clause 8.4.5. When the attribute has the value "Enabled", the set of VLANs that are allowed to ingress a port must match the set of VLANs that are allowed to egress a port. Only a single Ingress-Filters attribute MAY be sent within an Access-Request, Access-Accept, CoA-Request or Accounting-Request packet; this attribute MUST NOT be sent within an Access-Challenge, Access-Reject, Disconnect-Request, Disconnect-ACK, Disconnect-NAK, CoA-ACK or CoA-NAK.

The Ingress-Filters attribute is shown below. The fields are transmitted from left to right:



Type

TBD

Length

6

Value

The Value field is four octets. Supported values include:

- 1 - Enabled
- 2 - Disabled

The Tag Indication field is one octet in length, and indicates whether the frames on the VLAN are tagged (0x31, ASCII '1') or untagged (0x32, ASCII '2'). These values were chosen so as to make them easier for users to enter.

String

The String field is at least one octet in length, and contains the the VLAN Name as defined in [\[IEEE-802.1Q\]](#) clause 12.10.2.1.3 (a). [\[RFC3629\]](#) UTF-8 encoded 10646 characters are RECOMMENDED, but a robust implementation SHOULD support the field as undistinguished octets.

2.4. User-Priority-Table

Description

[\[IEEE-802.1D\]](#) clause 7.5.1 discusses how to regenerate (or re-map) user priority on frames received at a port. This per-port configuration enables a bridge to cause the priority of received traffic at a port to be mapped to a particular priority. [\[IEEE-802.1D\]](#) clause 6.3.9 describes the use of remapping:

The ability to signal user priority in IEEE 802 LANs allows user priority to be carried with end-to-end significance across a Bridged Local Area Network. This, coupled with a consistent approach to the mapping of user priority to traffic classes and of user priority to access_priority, allows consistent use of priority information, according to the capabilities of the Bridges and MACs in the transmission path...

Under normal circumstances, user priority is not modified in transit through the relay function of a Bridge; however, network management can control how user priority is propagated. Table 7-1 provides the ability to map incoming user priority values on a per-Port basis. By default, the regenerated user priority is identical to the incoming user priority.

This attribute represents the IEEE 802 prioritization that will be applied to packets arriving at this port. There are eight possible user priorities, according to the [\[IEEE-802\]](#) standard. [\[IEEE-802.1D\]](#) clause 14.6.2.3.3 specifies the regeneration table as 8 values, each an integer in the range 0-7. The management variables are described in clause 14.6.2.2.

A single User-Priority-Table attribute MAY be included in an Access-Accept or CoA-Request packet; this attribute MUST NOT be sent within an Access-Request, Access-Challenge, Access-Reject, Disconnect-Request, Disconnect-ACK, Disconnect-NAK, CoA-ACK, CoA-NAK or Accounting-Request. Since the regeneration table is only maintained by a bridge conforming to [\[IEEE-802.1D\]](#), this attribute should only be sent to a RADIUS client supporting that specification.

The User-Priority-Table attribute is shown below. The fields are transmitted from left to right:

```

      0               1               2               3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|      Type      | Length      |      String      |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
                        String
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
                        String      |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+

```

Type

TBD

Length

10

String

The String field is 8 octets in length, and includes a table which maps the incoming priority (if it is set - the default is 0) into one of eight regenerated priorities. The first octet maps to incoming priority 0, the second octet to incoming priority 1, etc. The values in each octet represent the regenerated priority of the packet.

It is thus possible to either remap incoming priorities to more appropriate values; to honor the incoming priorities; or to override any incoming priorities, forcing them to all map to a single chosen priority.

The [IEEE-8021.D] specification, Annex G, provides a useful description of traffic type - traffic class mappings.

3. Table of Attributes

The following table provides a guide to which attributes may be found in which kinds of packets, and in what quantity.

Access-Request	Access-Accept	Access-Reject	Access-Challenge	CoA-Req	Acct-Req	#	Attribute
0+	0+	0	0	0+	0+	TBD	Egress-VLANID
0-1	0-1	0	0	0-1	0-1	TBD	Ingress-Filters
0+	0+	0	0	0+	0+	TBD	Egress-VLAN-Name
0	0-1	0	0	0-1	0	TBD	User-Priority-Table

The following table defines the meaning of the above table entries.

- 0 This attribute MUST NOT be present in the packet.
- 0+ Zero or more instances of this attribute MAY be present in the packet.
- 0-1 Zero or one instance of this attribute MAY be present in the packet.

4. Diameter Considerations

Diameter needs to define identical attributes with the same Type values. The attributes should be available as part of the NASREQ application [[RFC4005](#)], as well as the Diameter EAP application [[RFC4072](#)].

5. IANA Considerations

This specification does not create any new registries.

This document uses the RADIUS [[RFC2865](#)] namespace, see <http://www.iana.org/assignments/radius-types>. Allocation of four updates for the section "RADIUS Attribute Types" is requested. The RADIUS attributes for which values are requested are:

- TBD - Egress-VLANID
- TBD - Ingress-Filters
- TBD - Egress-VLAN-Name
- TBD - User-Priority-Table

6. Security Considerations

This specification describes the use of RADIUS for purposes of authentication, authorization and accounting in IEEE 802 local area networks. Threats and security issues for this application are described in [[RFC3579](#)] and [[RFC3580](#)]; security issues encountered in roaming are described in [[RFC2607](#)].

This document specifies new attributes that can be included in existing RADIUS packets, which are protected as described in [RFC3579] and [RFC3576]. See those documents for a more detailed description.

The security mechanisms described in [RFC3579] and [RFC3576] are focused on preventing an attacker from spoofing packets or modifying packets in transit. They do not prevent an authorized RADIUS server or proxy from inserting attributes with malicious intent.

VLAN attributes sent by a RADIUS server or proxy may enable access to unauthorized VLANs. These vulnerabilities can be limited by performing authorization checks at the NAS. For example, a NAS can be configured to accept only certain VLANIDs from a given RADIUS server/proxy.

Similarly, an attacker gaining control of a RADIUS server or proxy can modify the user priority table, causing either degradation of quality of service (by downgrading user priority of packets arriving at a port), or denial of service (by raising the level of priority of traffic at multiple ports of a device, oversubscribing the switch or link capabilities).

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