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Chargeable User Identity

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Abstract

This document describes a new Remote Authentication Dial-In User Service (RADIUS) attribute, Chargeable-User-Identity. This attribute can be used by a home network to identify a user for the purpose of roaming transactions that occur outside of the home network.

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1. Introduction

Some authentication methods, including EAP-PEAP, EAP-TTLS, EAP-SIM and EAP-AKA, can hide the true identity of the user from RADIUS servers outside of the user's home network. In these methods, the User-Name(1) attribute contains an anonymous identity (e.g., @example.com) sufficient to route the RADIUS packets to the home network but otherwise insufficient to identify the user. While this mechanism is good practice in some circumstances, there are problems if local and intermediate networks require a surrogate identity to bind the current session.

This document introduces an attribute that serves as an alias or handle (hereafter, it is called Chargeable-User-Identity) to the real user's identity. Chargeable-User-Identity can be used outside the home network in scenarios that traditionally relied on User-Name(1) to correlate a session to a user.

For example, local or intermediate networks may limit the number of simultaneous sessions for specific users; they may require a Chargeable-User-Identity in order to demonstrate willingness to pay or otherwise limit the potential for fraud.

This implies that a unique identity provided by the home network should be able to be conveyed to all parties involved in the roaming transaction for correlating the authentication and accounting packets.

Providing a unique identity, Chargeable-User-Identity (CUI), to intermediaries, is necessary to fulfill certain business needs. This should not undermine the anonymity of the user. The mechanism provided by this document allows the home operator to meet these business requirements by providing a temporary identity representing the user and at the same time protecting the anonymity of the user.

When the home network assigns a value to the CUI, it asserts that this value represents a user in the home network. The assertion should be temporary -- long enough to be useful for the external applications and not too long such that it can be used to identify the user.

Several organizations, including WISPr, GSMA, 3GPP, Wi-Fi Alliance, and IRAP, have been studying mechanisms to provide roaming services, using RADIUS. Missing elements include mechanisms for billing and fraud prevention.

The CUI attribute is intended to close operational loopholes in RADIUS specifications that have impacted roaming solutions negatively. Use of the CUI is geared toward EAP methods supporting privacy (such as PEAP and EAP-TTLS), which are, for the most part, recent deployments. A chargeable identity reflecting the user profile by the home network is needed in such roaming scenarios.

1.1. Motivation

Some other mechanisms have been proposed in place of the CUI attribute. These mechanisms are insufficient or cause other problems. It has been suggested that standard RADIUS Class(25) or User-Name(1) attributes could be used to indicate the CUI. However, in a complex global roaming environment where there could be one or more intermediaries between the NAS [RFC4282] and the home RADIUS server, the use of aforementioned attributes could lead to problems as described below.

- On the use of RADIUS Class(25) attribute:

[RFC2865] states: "This Attribute is available to be sent by the server to the client in an Access-Accept packet and SHOULD be sent unmodified by the client to the accounting server as part of the Accounting-Request packet if accounting is supported. The client MUST NOT interpret the attribute locally." So RADIUS clients or intermediaries MUST NOT interpret the Class(25) attribute, which precludes determining whether it contains a CUI. Additionally, there could be multiple class attributes in a RADIUS packet, and since the contents of Class(25) attribute is not to be interpreted by clients, this makes it hard for the entities outside the home network to determine which one contains the CUI.

- On the use of RADIUS User-Name(1) attribute:

The User-Name(1) attribute included in the Access-Request packet may be used for the purpose of routing the Access-Request packet, and in the process may be rewritten by intermediaries. As a result, a RADIUS server receiving an Access-Request packet relayed by a proxy cannot assume that the User-Name(1) attribute remained unmodified.

On the other hand, rewriting of a User-Name(1) attribute sent within an Access-Accept packet occurs more rarely, since a Proxy-State(33) attribute can be used to route the Access-Accept packet without parsing the User-Name(1) attribute. As a result, a RADIUS server cannot assume that a proxy stripping routing information from a User-Name(1) attribute within an Access-Request packet will add this information to a User-Name(1) attribute

included within an Access-Accept packet. The result is that when a User-Name(1) attribute is sent in an Access-Accept packet, it is possible that the Access-Request packet and Accounting-Request packets will follow different paths. Where this outcome is undesirable, the RADIUS client should use the original User-Name(1) in accounting packets. Therefore, another mechanism is required to convey a CUI within an Access-Accept packet to the RADIUS client, so that the CUI can be included in the accounting packets.

The CUI attribute provides a solution to the above problems and avoids overloading RADIUS User-Name(1) attribute or changing the usage of existing RADIUS Class(25) attribute. The CUI therefore provides a standard approach to billing and fraud prevention when EAP methods supporting privacy are used. It does not solve all related problems, but does provide for billing and fraud prevention.

1.2. Terminology

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].

The following acronyms are used:

3GPP - Third Generation Partnership Project
AAA - Authentication, Authorization, and Accounting
AKA - Authentication and Key Agreement
CUI - Chargeable-User-Identity
GSMA - GSM Association
IRAP - International Roaming Access Protocols Program
NAS - Network Access Server
PEAP - Protected Extensible Authentication Protocol
SIM - Subscriber Identity Modules
TTLS - Tunneled Transport Layer Security
WISPr - Wireless ISP Roaming
WPA - Wi-Fi Protected Access

2. Operation

This document assumes that the RADIUS protocol operates as specified in [RFC2865] and [RFC2866], dynamic authorization as specified in [RFC3576], and the Diameter protocol as specified in [RFC3588].

2.1. Chargeable-User-Identity (CUI) Attribute

The CUI attribute serves as an alias to the user's real identity, representing a chargeable identity as defined and provided by the home network as a supplemental or alternative information to User-Name(1). Typically, the CUI represents the identity of the actual user, but it may also indicate other chargeable identities such as a group of users. RADIUS clients (proxy or NAS) outside the home network MUST NOT modify the CUI attribute.

The RADIUS server (a RADIUS proxy, home RADIUS server) may include the CUI attribute in the Access-Accept packet destined to a roaming partner. The CUI support by RADIUS infrastructure is driven by the business requirements between roaming entities. Therefore, a RADIUS server supporting this specification may choose not to send the CUI in response to an Access-Request packet from a given NAS, even if the NAS has indicated that it supports CUI.

If an Access-Accept packet without the CUI attribute was received by a RADIUS client that requested the CUI attribute, then the Access-Accept packet MAY be treated as an Access-Reject.

If the CUI was included in an Access-Accept packet, RADIUS clients supporting the CUI attribute MUST ensure that the CUI attribute appears in the RADIUS Accounting-Request (Start, Interim, and Stop). This requirement applies regardless of whether the RADIUS client requested the CUI attribute.

RFC 2865 includes the following statements about behaviors of RADIUS client and server with respect to unsupported attributes:

- "A RADIUS client MAY ignore Attributes with an unknown Type."
- "A RADIUS server MAY ignore Attributes with an unknown Type."

Therefore, RADIUS clients or servers that do not support the CUI may ignore the attribute.

A RADIUS client requesting the CUI attribute in an Access-Accept packet MUST include within the Access-Request packet a CUI attribute. For the initial authentication, the CUI attribute will include a single NUL character (referred to as a nul CUI). And, during

re-authentication, the CUI attribute will include a previously received CUI value (referred to as a non-nul CUI value) in the Access-Accept.

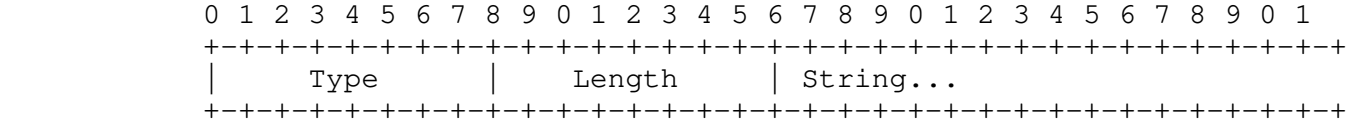
Upon receiving a non-nul CUI value in an Access-Request, the home RADIUS server MAY verify that the value of CUI matches the CUI from the previous Access-Accept. If the verification fails, then the RADIUS server SHOULD respond with an Access-Reject message.

If a home RADIUS server that supports the CUI attribute receives an Access-Request packet containing a CUI (set to nul or otherwise), it MUST include the CUI attribute in the Access-Accept packet. Otherwise, if the Access-Request packet does not contain a CUI, the home RADIUS server SHOULD NOT include the CUI attribute in the Access-Accept packet. The Access-Request may be sent either in the initial authentication or during re-authentication.

A NAS that requested the CUI during re-authentication by including the CUI in the Access-Request will receive the CUI in the Access-Accept. The NAS MUST include the value of that CUI in all Accounting Messages.

2.2. CUI Attribute

A summary of the RADIUS CUI attribute is given below.



Type: 89 for Chargeable-User-Identity.

Length: >= 3

String:

The string identifies the CUI of the end-user. This string value is a reference to a particular user. The format and content of the string value are determined by the Home RADIUS server. The binding lifetime of the reference to the user is determined based on business agreements. For example, the lifetime can be set to one billing period. RADIUS entities other than the Home RADIUS server MUST treat the CUI content as an opaque token, and SHOULD NOT perform operations on its content other than a binary equality comparison test, between two instances of CUI. In cases where the

attribute is used to indicate the NAS support for the CUI, the string value contains a nul character.

3. Attribute Table

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

Request	Accept	Reject	Challenge	Accounting Request	#	Attribute
0-1	0-1	0	0	0-1	89	Chargeable-User-Identity

Note: If the Access-Accept packet contains CUI, then the NAS MUST include the CUI in Accounting Requests (Start, Interim, and Stop) packets.

4. Diameter Consideration

Diameter needs to define an identical attribute with the same Type value. The CUI should be available as part of the NASREQ application [RFC4005].

5. IANA Considerations

This document uses the RADIUS [RFC2865] namespace; see http://www.iana.org/assignments/radius-types. The IANA has assigned a new RADIUS attribute number for the CUI attribute.

CUI 89

6. Security Considerations

It is strongly recommended that the CUI format used is such that the real user identity is not revealed. Furthermore, where a reference is used to a real user identity, it is recommended that the binding lifetime of that reference to the real user be kept as short as possible.

The RADIUS entities (RADIUS proxies and clients) outside the home network MUST NOT modify the CUI or insert a CUI in an Access-Accept. However, there is no way to detect or prevent this.

Attempting theft of service, a man-in-the-middle may try to insert, modify, or remove the CUI in the Access-Accept packets and Accounting packets. However, RADIUS Access-Accept and Accounting packets already provide integrity protection.

If the NAS includes CUI in an Access-Request packet, a man-in-the-middle may remove it. This will cause the Access-Accept packet to not include a CUI attribute, which may cause the NAS to reject the session. To prevent such a denial of service (DoS) attack, the NAS SHOULD include a Message-Authenticator(80) attribute within Access-Request packets containing a CUI attribute.

7. Acknowledgements

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