RADIUS Extensions Working Group
Internet-Draft
Intended status: Best Current Practice
Expires: April 30, 2015

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October 27, 2014

Considerations regarding the correct use of EAP-Response/Identity
draft-winter-radext-populating-eapidentity-01

Abstract

There are some subtle considerations for an EAP peer regarding the content of the EAP-Response/Identity packet when authenticating with EAP to an EAP server. This document describes two such considerations and suggests workarounds to the associated problems.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 30, 2015.

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1. Introduction

1.1. Problem Statement

An Extensible Authentication Protocol (EAP, [RFC3748]) conversation between an EAP peer and an EAP server starts with an (optional) request for identity information by the EAP server (EAP-Request/ Identity) followed by the peer's response with identity information (EAP-Response/Identity). Only after this identity exchange are EAP types negotiated.

EAP-Response/Identity is sent before EAP type negotiation takes place, but it is not independent of the later-negotiated EAP type. Two entanglements between EAP-Response/Identity and EAP methods' notions of a user identifier are described in this document.

1. The choice of identity to send in EAP-Response/Identity may have detrimental effects on the subsequent EAP type negotiation.

2. Using identity information from the preferred EAP type without thoughtful conversion of character encoding may have detrimental effects on the outcome of the authentication.

The following two chapters describe each of these issues in detail. The last chapter contains recommendations for implementers of EAP peers to avoid these issues.

1.2. Requirements Language

In this document, several words are used to signify the requirements of the specification. 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 RFC 2119. [RFC2119]

2. EAP-Response/Identity: Effects on EAP type negotiation

Assuming the EAP peer's EAP type selection is not the trivial case (i.e. it has more than one configured EAP type for a given network or application, and needs to make a decision which one to use), an issue arises when the configured EAP types are not all configured with the same user identifier.

Issue: if the user identifiers in the set of configured EAP types differ (e.g. have a different [RFC4282] "realm" portion), and the authenticator does not send identity selection hints as per [RFC4284], then EAP type negotiation may be limited to those EAP types which are terminated in the same EAP server. The reason for that is because the information in the EAP-Response/Identity is used for request routing decisions and thus determines the EAP server - a given user identifier may be routed to a server which exclusively serves the matching EAP type. Negotiating another EAP type from the set of configured EAP types during the running EAP conversation is then not possible.

Example:

Assume an EAP peer is configured to support two EAP types:

- EAP-AKA' [RFC5448] with user identifier imsi@mnc123.mcc123.3gpp-network.org

- EAP-TTLS [RFC5281] with user identifier john@realm.example

The user connects to hotspot of a roaming consortium which could authenticate him with EAP-TTLS and his john@realm.example identity. The hotspot operator has no business relationship at all with the 3GPP consortium; incoming authentication requests for realms ending in 3gppnetwork.org will be immediately rejected. Identity selection hints are not sent.

Consequence: If the EAP peer consistently chooses the imsi@mnc123.mcc123.3gpp-network.org user identifier as choice for its initial EAP-Response/Identity, the user will be consistently and perpetually rejected, even though in possession of a valid credential for the hotspot.

An EAP peer should always try all options to authenticate. As the example above shows, it may not be sufficient to rely on EAP method negotiation alone to iterate through all configured EAP types and

come to a conclusive outcome of the authentication attempt. Multiple new EAP authentications, each using a different user identifier from the set of configured user identities, may be required to fully iterate through the list of usable identities.

3. Character (re-)encoding may be required

The user identifier as configured in the EAP method configuration is not always suited as user identifier to choose as EAP-Response/ Identity. This is trivially true when using tunneled EAP types and configuring anonymous outer identity for the tunneling EAP type. There is at least one additional, non-trivial, case to consider however:

EAP methods define the encoding of their user identifiers; in particular, the encoding of the user identifiers as defined the EAP method may or may not be UTF-8; some EAP methods are even known not to put any encoding restrictions on their user identifiers at all.

It is not the intention of EAP, as a mere method-agnostic container which simply carries EAP types, to restrict an EAP method's choice of encoding of a user identifier. However, there are restrictions in what should be contained in the EAP-Response/Identity: EAP is very often carried over a AAA protocol (e.g over RADIUS as per [RFC3579]). The typical use for the contents of EAP-Response/Identity inside AAA protocols like RADIUS [RFC2865] and Diameter [RFC6733] is to copy the content of EAP-Response/Identity into a "User-Name" attribute; the encoding of the User-Name attribute is required to be UTF-8. EAP-Response/Identity does not carry encoding information itself, so a conversion between a non-UTF-8 encoding and UTF-8 is not possible for the AAA entity doing the EAP-Response/Identity to User-Name copying.

Consequence: If an EAP method's user identifier is not encoded in UTF-8, and the EAP peer verbatimly uses that method's notion of a user identifier for its EAP-Response/Identity field, then the AAA entity is forced to violate its own specification because it has to, but can not use UTF-8 for its own User-Name attribute. If the EAP method configuration sets an outer identity in a non UTF-8 character set, and the EAP peer verbatimly uses that outer identity for its EAP-Response/Identity field, then the same violation occurs.

This jeopardizes the subsequent EAP authentication as a whole; request routing may fail, lead to a wrong destination or introduce routing loops due to differing interpretations of the User-Name in EAP pass-through authenticators and AAA proxies.

4. Recommendations for EAP peer implementations

Where user identifiers between configured EAP types in an EAP peer differ, the EAP peer can not rely on the EAP type negotiation mechanism alone to provide useful results. If an EAP authentication gets rejected, the EAP peer SHOULD re-try the authentication using a different EAP-Response/Identity than before. The EAP peer SHOULD try all user identifiers from the entire set of configured EAP types before declaring final authentication failure.

EAP peers need to maintain state on the encoding of the user identifiers which are used in their locally configured EAP types. When constructing an EAP-Response/Identity from that user identifier, they MUST (re-)encode that user identifier as UTF-8 and use the resulting value for the EAP-Response/Identity. If the EAP type is configured for the use of anonymous outer identities, the desired outer identity MUST also be (re-)encoded in UTF-8 encoding before being put into the EAP-Response/Identity.

5. Privacy Considerations

Because the EAP-Response/Identity content is not encrypted, the backtracking to a new EAP-Response/Identity will systematically reveal all configured identities to intermediate passive listeners on the path between the EAP peer and the EAP server (until one authentication round succeeds).

This additional leakage of identity information is not very significant though because where privacy is considered important, the additional option for identity privacy which is present in most modern EAP methods can be used.

If the EAP peer implementation is certain that all EAP types will be terminated at the same EAP server (e.g. with a corresponding configuration option) then the iteration over all identities can be avoided, because the EAP type negotiation is then sufficient.

If a choice of which identity information to disclose needs to be made by the EAP peer, when iterating through the list of identities the EAP peer SHOULD

- in first priority honour a manually configured order of preference of EAP types, if any

- in second priority try EAP types in order of less leakage first; that is, EAP types with a configured outer identity should be tried before other EAP types which would reveal actual user identities.

6. Security Considerations

The security of an EAP conversation is determined by the EAP method which is used to authenticate. This document does not change the actual authentication with an EAP method, and all the security properties of the chosen EAP method remain. The format requirements (character encoding) and operational considerations (re-try EAP with a different EAP-Response/Identity) do not lead to new or different security properties.

7. IANA Considerations

There are no IANA actions in this document.

8. References

8.1. Normative References

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8.2. Informative References

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