

Network Working Group  
Internet-Draft  
Updates: [6613](#), [6614](#) (if approved)  
Intended status: Experimental  
Expires: August 16, 2015

S. Hartman  
Painless Security  
February 12, 2015

**Larger Packets for RADIUS over TCP**  
**draft-ietf-radext-bigger-packets-02.txt**

Abstract

The RADIUS over TLS experiment described in [RFC 6614](#) has opened RADIUS to new use cases where the 4096-octet maximum RADIUS packet proves problematic. This specification extends the RADIUS over TCP experiment to permit larger RADIUS packets. This specification compliments other ongoing work to permit fragmentation of RADIUS authorization information. This document registers a new RADIUS code, an action which requires IESG approval.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on August 16, 2015.

Copyright Notice

Copyright (c) 2015 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must

include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

|                      |                                                              |                   |
|----------------------|--------------------------------------------------------------|-------------------|
| <a href="#">1.</a>   | <a href="#">Introduction . . . . .</a>                       | <a href="#">2</a> |
| <a href="#">1.1.</a> | <a href="#">Requirements notation . . . . .</a>              | <a href="#">3</a> |
| <a href="#">2.</a>   | <a href="#">Changes to Packet Processing . . . . .</a>       | <a href="#">3</a> |
| <a href="#">2.1.</a> | <a href="#">Status-Server Considerations . . . . .</a>       | <a href="#">4</a> |
| <a href="#">3.</a>   | <a href="#">Forward and backward Compatibility . . . . .</a> | <a href="#">4</a> |
| <a href="#">3.1.</a> | <a href="#">Rationale . . . . .</a>                          | <a href="#">5</a> |
| <a href="#">3.2.</a> | <a href="#">Discovery . . . . .</a>                          | <a href="#">6</a> |
| <a href="#">4.</a>   | <a href="#">Protocol Error Type . . . . .</a>                | <a href="#">6</a> |
| <a href="#">5.</a>   | <a href="#">Too Big Response . . . . .</a>                   | <a href="#">6</a> |
| <a href="#">6.</a>   | <a href="#">IANA Considerations . . . . .</a>                | <a href="#">7</a> |
| <a href="#">7.</a>   | <a href="#">Security Considerations . . . . .</a>            | <a href="#">7</a> |
| <a href="#">8.</a>   | <a href="#">Acknowledgements . . . . .</a>                   | <a href="#">8</a> |
| <a href="#">9.</a>   | <a href="#">References . . . . .</a>                         | <a href="#">8</a> |
| <a href="#">9.1.</a> | <a href="#">Normative References . . . . .</a>               | <a href="#">8</a> |
| <a href="#">9.2.</a> | <a href="#">References . . . . .</a>                         | <a href="#">8</a> |
|                      | <a href="#">Author's Address . . . . .</a>                   | <a href="#">9</a> |

## [1.](#) Introduction

The Remote Access Dial-In User Server (RADIUS) over TLS [[RFC6614](#)] experiment provides strong confidentiality and integrity for RADIUS [[RFC2865](#)]. This enhanced security has opened new opportunities for using RADIUS to convey additional authorization information. As an example, [[I-D.ietf-abfab-aaa-saml](#)] describes a mechanism for using RADIUS to carry Security Assertion Markup Language (SAML) messages in RADIUS. Many attributes carried in these SAML messages will require confidentiality or integrity such as that provided by TLS.

These new use cases involve carrying additional information in RADIUS packets. The maximum packet length of 4096 octets is proving insufficient for some SAML messages and for other structures that may be carried in RADIUS.

One approach is to fragment a RADIUS message across multiple packets at the RADIUS layer. RADIUS Fragmentation [[I-D.ietf-radext-radius-fragmentation](#)] provides a mechanism to split authorization information across multiple RADIUS messages. That mechanism is necessary in order to split authorization information across existing unmodified proxies.

However, there are some significant disadvantages to RADIUS fragmentation. First, RADIUS is a lock-step protocol, and only one



fragment can be in transit at a time as part of a given request. Also, there is no current mechanism to discover the path Maximum Transmission Unit (MTU) across the entire path that the fragment will travel. As a result, fragmentation is likely both at the RADIUS layer and at the transport layer. When TCP is used, much better transport characteristics can be achieved by fragmentation only at the TCP layer. This specification provides a mechanism to achieve these better transport characteristics when TCP is used. As part of this specification, a new RADIUS code is registered.

This specification is published as an experimental specification because the TCP extensions to RADIUS are currently experimental. The need for this specification arises from operational experience with the TCP extensions. However, this specification introduces no new experimental evaluation criteria beyond those in the base TCP specification; this specification can be evaluated along with that one for advancement on the standards track.

### **1.1. Requirements notation**

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](#)].

## **2. Changes to Packet Processing**

The maximum length of a RADIUS message is increased from 4096 to 65535. A RADIUS Server implementing this specification MUST be able to receive a packet of maximum length. Servers MAY have a maximum size over which they choose to return an error as discussed in [Section 5](#) rather than processing a received packet; this size MUST be at least 4096 octets.

Clients implementing this specification MUST be able to receive a packet of maximum length; that is clients MUST NOT close a TCP connection simply because a large packet is sent over it. Clients MAY include the Response-Length attribute defined in [Section 6](#) to indicate the maximum size of a packet that they can successfully process. Clients MAY silently discard a packet greater than some configured size; this size MUST be at least 4096 octets. Clients MUST NOT retransmit an unmodified request whose response is larger than the client can process as subsequent responses will likely continue to be too large.

Proxies SHOULD be able to process and forward packets of maximum length. Proxies MUST include the Response-Length attribute when forwarding a request received over a transport with a 4096-octet maximum length over a transport with a higher maximum length.



### **2.1. Status-Server Considerations**

This section extends processing of Status-Server messages as described in [section 4.1](#) and 4.2 of [[RFC5997](#)].

Clients implementing this specification SHOULD include the Response-Length attribute in Status-Request messages. Servers are already required to ignore unknown attributes received in this message. by including the attribute, the client indicates how large of a response it can process to its Status-Server request. It is very unlikely that a response to Status-Server is greater than 4096 octets. However the client also indicates support for this specification which triggers server behavior below.

If a server implementing this specification receives a Response-Length attribute in a Status-Server request, it MUST include a Response-Length attribute indicating the maximum size request it can process in its response to the Status-Server request.

### **3. Forward and backward Compatibility**

An implementation of [[RFC6613](#)] will silently discard any packet larger than 4096 octets and will close the TCP connection. This section provides guidelines for interoperability with these implementations. These guidelines are stated at the SHOULD level. In some environments support for large packets will be important enough that roaming or other agreements will mandate their support. In these environments, all implementations might be required to support this specification removing the need for interoperability with [RFC 6613](#). It is likely that these guidelines will be relaxed to the MAY level and support for this specification made a requirement if RADIUS over TLS and TCP are moved to the standards track in the future.

Clients SHOULD provide configuration for the maximum size of a request sent to each server. Servers SHOULD provide configuration for the maximum size of a response sent to each client. If dynamic discovery mechanisms are supported, configuration SHOULD be provided for the maximum size of clients and servers in each dynamic discovery category.

If a client sends a request larger than 4096 octets and the TCP connection is closed without a response, the client SHOULD treat the request as if a request too big error ([Section 5](#)) specifying a maximum size of 4096 is received. Clients or proxies sending multiple requests over a single TCP connection without waiting for responses SHOULD implement capability discovery as discussed in [Section 3.2](#).



By default, a server SHOULD not generate a response larger than 4096 octets. The Response-Length attribute MAY be included in a request to indicate that larger responses are desirable. Other attributes or configuration MAY be used as an indicator that large responses are likely to be acceptable.

A proxy that implements both this specification and RADIUS Fragmentation [[I-D.ietf-radext-radius-fragmentation](#)] SHOULD use RADIUS fragmentation when the following conditions are met:

1. A packet is being forwarded towards an endpoint whose configuration does not support a packet that large.
2. RADIUS Fragmentation can be used for the packet in question.

### **3.1. Rationale**

The interoperability challenge appears at first significant. This specification proposes to introduce behavior where new implementations will fail to function with existing implementations.

However, these capabilities are introduced to support new use cases. If an implementation has 10000 octets of attributes to send, it cannot in general trim down the response to something that can be sent. Under this specification a large packet would be generated that will be silently discarded by an existing implementation. Without this specification, no packet is generated because the required attributes cannot be sent.

The biggest risk to interoperability would be if requests and responses are expanded to include additional information that is not strictly necessary. So, avoiding creating situations where large packets are sent to existing implementations is mostly an operational matter. Interoperability is most impacted when the size of packets in existing use cases is significantly increased and least impacted when large packets are used for new use cases where the deployment is likely to require updated RADIUS implementations.

There is a special challenge for proxies or clients with high request volume. When an [RFC 6113](#) implementation receives a packet that is too large, it closes the connection and does not respond to any requests in process. Such a client would lose requests and might find distinguishing request-too-big situations from other failures difficult. In these cases, the discovery mechanism described in [Section 3.2](#) can be used.

Also, [RFC 6613](#) is an experiment. Part of running that experiment is to evaluate whether additional changes are required to RADIUS. A



lower bar for interoperability should apply to changes to experimental protocols than standard protocols.

This specification provides good facilities to enable implementations to understand packet size when proxying to/from standards-track UDP RADIUS.

### **3.2. Discovery**

As discussed in [Section 2.1](#), a client MAY send a Status-Server message to discover whether an authentication or accounting server supports this specification. The client includes a Response-Length attribute; this signals the server to include a Response-Length attribute indicating the maximum packet size the server can process. In this one instance, Response-Length indicate the size of a request that can be processed rather than a response.

## **4. Protocol Error Type**

This document defines a new RADIUS code, TBD (IANA), called Protocol-Error. This packet code may be used in response to any request packet, such as Access-Request, Accounting-Request, CoA-Request, or Disconnect-Request. It is a response packet sent by a server to a client. The packet indicates to the client that the server is unable to process the request for some reason.

A Protocol-Error packet MUST contain a Original-Packet-Code attribute, along with an Error-Cause attribute. Other attributes MAY be included if desired. The Original-Packet-Code contains the code from the request that generated the protocol error. Regardless of the original packet code, the RADIUS server calculates the Message-Authenticator attribute as if the original packet were an Access-Request packet. The identifier is copied from the original request.

Clients processing Protocol-Error MUST ignore unknown or unexpected attributes.

## **5. Too Big Response**

When a RADIUS server receives a request that is larger than can be processed, it generates a Protocol-Error response as follows:

The code is Protocol-Error.

The Response-Length attribute MUST be included and its value is the maximum size of request that will be processed.

The Error-Cause attribute is included with a value of TOOBIGTBD.



The Original-Packet-Code attribute is copied from the request.

Clients will not typically be able to adjust and resend requests when this error is received. In some cases the client can fall back to RADIUS Fragmentation. In other cases this code will provide for better client error reporting and will avoid retransmitting requests guaranteed to fail.

## 6. IANA Considerations

A new RADIUS packet type code is registered in the RADIUS packet type codes registry discussed in [section 2.1 of RFC 3575](#) [[RFC3575](#)]. The name is "Protocol-Error" and the code is TBDCODE. The IESG is requested to approve this registration along with approving publication of this document.

The following RADIUS attribute type values [[RFC3575](#)] are assigned. The assignment rules in [section 10.3 of \[RFC6929\]](#) are used.

| Name                 | Attribute | Description                                                                                    |
|----------------------|-----------|------------------------------------------------------------------------------------------------|
| Response-Length      | TBD       | 2-octet unsigned integer maximum response length                                               |
| Original-Packet-Code | TBD2      | An integer attribute containing the code from a packet resulting in a Protocol-Error response. |

The Response-Length attribute MAY be included in any RADIUS request. In this context it indicates the maximum length of a response the client is prepared to receive. Values are between 4096 and 65535. The attribute MAY also be included in a response to a Status-Server message. In this case the attribute indicate the maximum size RADIUS request that is permitted.

A new Error-Cause value is registered in the registry at <http://www.iana.org/assignments/radius-types/radius-types.xhtml#radius-types-18> for "Response Too Big" with value TOOBIGTBD.

## 7. Security Considerations

This specification updates [RFC 6613](#) and will be used with [[RFC6614](#)]. When used over plain TCP, this specification creates new



opportunities for an on-path attacker to impact availability. these attacks can be entirely mitigated by using TLS.

## 8. Acknowledgements

Sam Hartman's time on this draft was funded by JANET as part of Project Moonshot.

Alan DeKok provided valuable review and text for the Protocol-Error packet code.

## 9. References

### 9.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2865] Rigney, C., Willens, S., Rubens, A., and W. Simpson, "Remote Authentication Dial In User Service (RADIUS)", [RFC 2865](#), June 2000.
- [RFC3575] Aboba, B., "IANA Considerations for RADIUS (Remote Authentication Dial In User Service)", [RFC 3575](#), July 2003.
- [RFC5997] DeKok, A., "Use of Status-Server Packets in the Remote Authentication Dial In User Service (RADIUS) Protocol", [RFC 5997](#), August 2010.
- [RFC6613] DeKok, A., "RADIUS over TCP", [RFC 6613](#), May 2012.
- [RFC6614] Winter, S., McCauley, M., Venaas, S., and K. Wierenga, "Transport Layer Security (TLS) Encryption for RADIUS", [RFC 6614](#), May 2012.
- [RFC6929] DeKok, A. and A. Lior, "Remote Authentication Dial In User Service (RADIUS) Protocol Extensions", [RFC 6929](#), April 2013.

### 9.2. References

- [I-D.ietf-abfab-aaa-saml]  
Howlett, J. and S. Hartman, "A RADIUS Attribute, Binding, Profiles, Name Identifier Format, and Confirmation Methods for SAML", [draft-ietf-abfab-aaa-saml-09](#) (work in progress), February 2014.



[I-D.ietf-radext-radius-fragmentation]

Perez-Mendez, A., Lopez, R., Pereniguez-Garcia, F., Lopez-Millan, G., Lopez, D., and A. DeKok, "Support of fragmentation of RADIUS packets", [draft-ietf-radext-radius-fragmentation-06](#) (work in progress), April 2014.

Author's Address

Sam Hartman  
Painless Security

Email: hartmans-ietf@mit.edu