AVTCORE Working Group
INTERNET-DRAFT
Updates: 7983, 5764
Category: Standards Track
Expires: November 11, 2022

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11 May 2022

Multiplexing Scheme Updates for QUIC
draft-ietf-avtcore-rfc7983bis-03.txt

Abstract

This document defines how QUIC, Datagram Transport Layer Security (DTLS), Real-time Transport Protocol (RTP), RTP Control Protocol (RTCP), Session Traversal Utilities for NAT (STUN), Traversal Using Relays around NAT (TURN), and ZRTP packets are multiplexed on a single receiving socket.

This document updates RFC 7983 and RFC 5764.

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 November 11, 2022.

Table of Contents

1. Introduction

"Multiplexing Scheme Updates for Secure Real-time Transport Protocol (SRTP) Extension for Datagram Transport Layer Security (DTLS)" [RFC7983] defines a scheme for a Real-time Transport Protocol (RTP) [RFC3550] receiver to demultiplex DTLS [RFC9147], Session Traversal Utilities for NAT (STUN) [RFC8489], Secure Real-time Transport Protocol (SRTP) / Secure Real-time Transport Control Protocol (SRTCP) [RFC3711], ZRTP [RFC6189] and TURN Channel packets arriving on a single port. This document updates [RFC7983] and [RFC5764] to also allow QUIC [RFC9000] to also be multiplexed on the same port. The scheme described in this document is compatible with QUIC version 2 [I-D.ietf-quic-v2].

The multiplexing scheme described in this document enables multiple usage scenarios. Peer-to-peer QUIC in WebRTC scenarios, described in [P2P-QUIC] [P2P-QUIC-TRIAL], uses RTP for transport of audio and video along with QUIC for data exchange. For this use case, SRTP [RFC3711] is keyed using DTLS-SRTP [RFC5764] and therefore SRTP/SRTCP [RFC3550], STUN, TURN, DTLS and QUIC need to be multiplexed on the same port. Were SRTP to be keyed using QUIC-SRTP, SRTP/SRTCP, STUN, TURN and QUIC would need to be multiplexed on the same port. Where QUIC is used for peer-to-peer transport of data as well as RTP [I-D.engelbart-rtp-over-quic] STUN, TURN and QUIC need to be multiplexed on the same port.

1.1. 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].

2. Multiplexing of TURN Channels

TURN channels are an optimization where data packets are exchanged with a 4-byte prefix instead of the standard 36-byte STUN overhead (see Section 3.5 of [RFC8656]). [RFC7983] allocated the values from 64 to 79 in order to allow TURN channels to be demultiplexed when the TURN Client does the channel binding request in combination with the demultiplexing scheme described in [RFC7983].

As noted in [I-D.aboba-avtcore-quic-multiplexing], the first octet of a QUIC short header packet falls in the range 64 to 127, thereby overlapping with the allocated range for TURN channels of 64 to 79.

The first octet of QUIC long header packets fall in the range 192 to 255. Since QUIC long header packets preceed QUIC short header packets, if no packets with a first octet in the range of 192 to 255

have been received, a packet whose first octet is in the range of 64 to 79 can be demultplexed unambiguously as TURN Channel traffic. Since WebRTC implementations supporting QUIC data exchange do not utilize TURN Channels, once packets with a first octet in the range of 192 to 255 have been received, a packet whose first octet is in the range of 64 to 127 can be demultiplexed as QUIC traffic.

3. Updates to RFC 7983

This document updates the text in Section 7 of [RFC7983] (which in turn updates [RFC5764]) as follows:

OLD TEXT

The process for demultiplexing a packet is as follows. The receiver looks at the first byte of the packet. If the value of this byte is in between 0 and 3 (inclusive), then the packet is STUN. If the value is between 16 and 19 (inclusive), then the packet is ZRTP. If the value is between 20 and 63 (inclusive), then the packet is DTLS. If the value is between 64 and 79 (inclusive), then the packet is TURN Channel. If the value is in between 128 and 191 (inclusive), then the packet is RTP (or RTCP, if both RTCP and RTP are being multiplexed over the same destination port). If the value does not match any known range, then the packet MUST be dropped and an alert MAY be logged. This process is summarized in Figure 3.

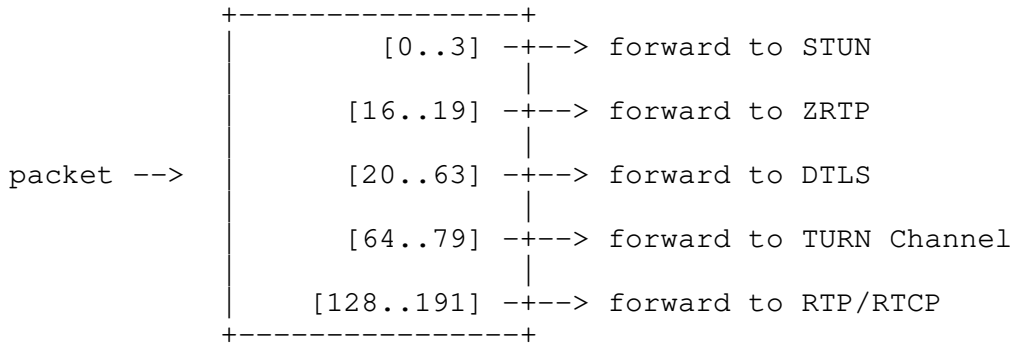

Figure 3: The DTLS-SRTP receiver's packet demultiplexing algorithm.

END OLD TEXT

NEW TEXT

The process for demultiplexing a packet is as follows. The receiver looks at the first byte of the packet. If the value of this byte is in between 0 and 3 (inclusive), then the packet is STUN. If the value is between 16 and 19 (inclusive), then the packet is ZRTP. If the value is between 20 and 63 (inclusive), then the packet is DTLS. If the value is in between 128 and 191 (inclusive) then the packet is RTP (or RTCP, if both RTCP and RTP are being multiplexed over the same destination port). If the value is between 80 and 127 or between 192 and 255 (inclusive) then the packet is QUIC. If the value is between 64 and 79 inclusive, then if a packet has been previously forwarded that is in the range of 192 and 255, then the packet is QUIC, otherwise it is TURN Channel.

If the value does not match any known range, then the packet MUST be dropped and an alert MAY be logged. This process is summarized in Figure 3.

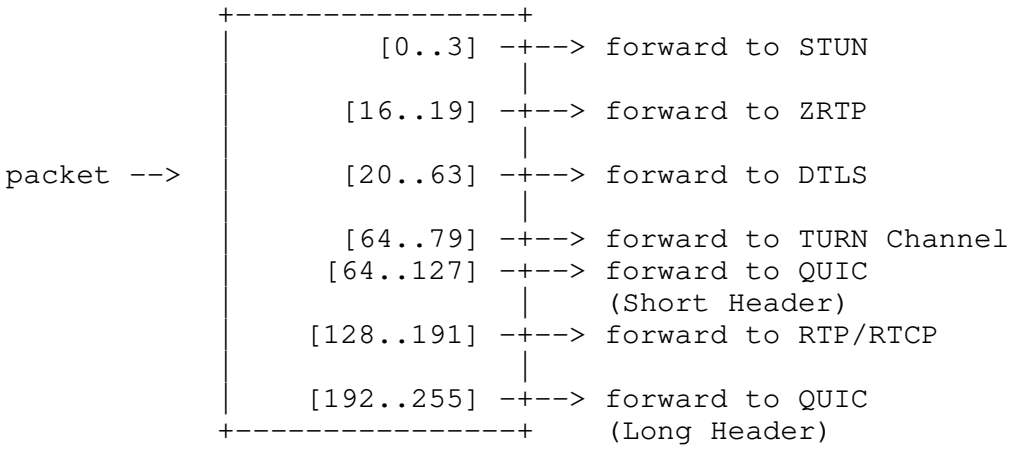

Figure 3: The receiver's packet demultiplexing algorithm.

END NEW TEXT

4. Security Considerations

The solution discussed in this document could potentially introduce some additional security considerations beyond those detailed in [RFC7983]. Due to the additional logic required, if mis-implemented, heuristics have the potential to mis-classify packets.

When QUIC is used only for data exchange, the TLS-within-QUIC exchange [RFC9001] derives keys used solely to protect the QUIC data packets. If properly implemented, this should not affect the

transport of SRTP nor the derivation of SRTP keys via DTLS-SRTP. However, were the TLS-within-QUIC exchange to be used to derive SRTP keys, both transport and SRTP key derivation could be aversely impacted by a vulnerability in the QUIC implementation.

5. IANA Considerations

This document does not require actions by IANA.

6. References

6.1. Normative References

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6.2. Informative References

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Acknowledgments

We would like to thank Martin Thomson, Roni Even and other participants in the IETF QUIC and AVTCORE working groups for their discussion of the QUIC multiplexing issue, and their input relating to potential solutions.

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