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Next Header Option in UDP Options

Abstract

This document defines the next header option in UDP options. The next header option specifies the protocol immediately following the UDP header.

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 25 April 2024.

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1. Introduction

The User Datagram Protocol [RFC0768] provides only a port number and a checksum as a minimum functional transport protocol. Because of its simplicity and interoperability in the Internet, new transport protocols such as QUIC [RFC9000] and SCTP [RFC6951] are implemented over UDP. However, UDP has no field in the header that identifies the encapsulated protocol. Typically, the IANA port number [IANA_service_names_port_numbers] is used for that purpose, but the port number corresponds to the service of the communication. We argue that it is a clear misuse of the port number to indicate the protocol on UDP. Currently, it is not possible to provide the UDP layer with information about the transport protocols implemented on top of UDP.

Transport Options for UDP [I-D.ietf-tsvwg-udp-options] is a proposal for extending UDP to have an options area. This creates an options area behind the UDP payload to allow TLV(Type-Length-Value) format options to be added.

This document describes the next header option. This option allows information about the protocol following the UDP header. This option is provided as one of the UDP options.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and

"OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Transport Protocols based on UDP

Using new IP-based transport protocols on the Internet is difficult bacause of ossified middle boxes. Therefore, in order to maintain affinity with the Internet, it is often used to encapsulate the transport protocol with UDP. The following are transport protocols used for UDP-based.

Registered in IP Protocol Numbers

* DCCP [RFC6773] - DCCP-UDP: A Datagram Congestion Control Protocol UDP Encapsulation for NAT Traversal

* SCTP [RFC6951] - UDP Encapsulation of Stream Control Transmission Protocol (SCTP) Packets for End-Host to End-Host Communication

Not registered in IP Protocol Numbers

* QUIC [RFC9000] - QUIC: A UDP-Based Multiplexed and Secure Transport

4. UDP-based Protocols Extensibility

4.1. Spread of applications using UDP-based transport protocols

Transport protocols implemented based on UDP such as QUIC often are used as transport protocols for existing applications.

The following are examples of applications that operate using UDP-based transport protocols.

HTTP

* HTTP/3 [RFC9114] - HTTP over QUIC, uses UDP port 443.

DNS

* DNS over Datagram Transport Layer Security [RFC8094] - uses UDP port 853.

* DNS over Dedicated QUIC Connections [RFC9250] - uses UDP port 853, same as DNS over DTLS.

4.2. Concerns about limited UDP-based transport extensibility

The UDP header does not have any information to identify the encapsulated protocol. Without this information, problems may arise when there are applications that can communicate with multiple transport protocols using the same port number. In the case of client-server communication, the server cannot instantly determine which transport protocol was used to send the packet sent by the client.

For instance, when a new transport protocol other than QUIC is developed and used that is based on UDP and works as a transport for HTTP, the server will not be able to instantly identify whether QUIC is used as the transport protocol or the new one is used.

Therefore, if the next protocol after the UDP header is a transport protocol, it should be possible to have a field in the UDP layer information that identifies the protocol that follows the UDP header.

5. Value of Next Header Option

The next header option is a number to identify the protocol immediately following the UDP header. This number used be the same as IP Protocol Numbers[IANA_protocol_numbers] In many cases, the protocol number is available, but a new protocol number is needed for protocols that do not have a protocol number, such as QUIC.

6. Option Format

The UDP option is provided in the form of a TLV. The value of next header option is represented by 8 bits. It is shown in Figure 1.

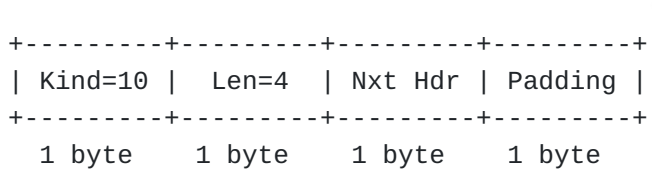

Figure 1: Option format

7. Recommendation

7.1. Next Header Options is for Transport Ends

The next header option is intended to be interpreted by transport ends. As with the original UDP Options, not intended to be interpreted in-transit.

7.2. TBD

TBD

8. IANA Considerations

On publication, request IANA to assign one number from the Safe Options range of the UDP Option Kind Number as Next Header (NXTHDR).

9. Security Considerations

This document should not affect the security of the Internet.

10. References

10.1. Normative References

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10.2. Informative References

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