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TCP Extended Options
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Abstract

The TCP header can accommodate 40 octets of TCP options. However, modern applications may require more than 40 octets of TCP Options. Therefore, this document describes an experiment that extends the TCP Options field. If this experiment is successful, it will demonstrate that the extension procedures described herein are implementable and deployable. It will also demonstrate that they maintain backwards compatibility.

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1. Introduction

Figure 1 depicts a TCP [RFC9293] segment.

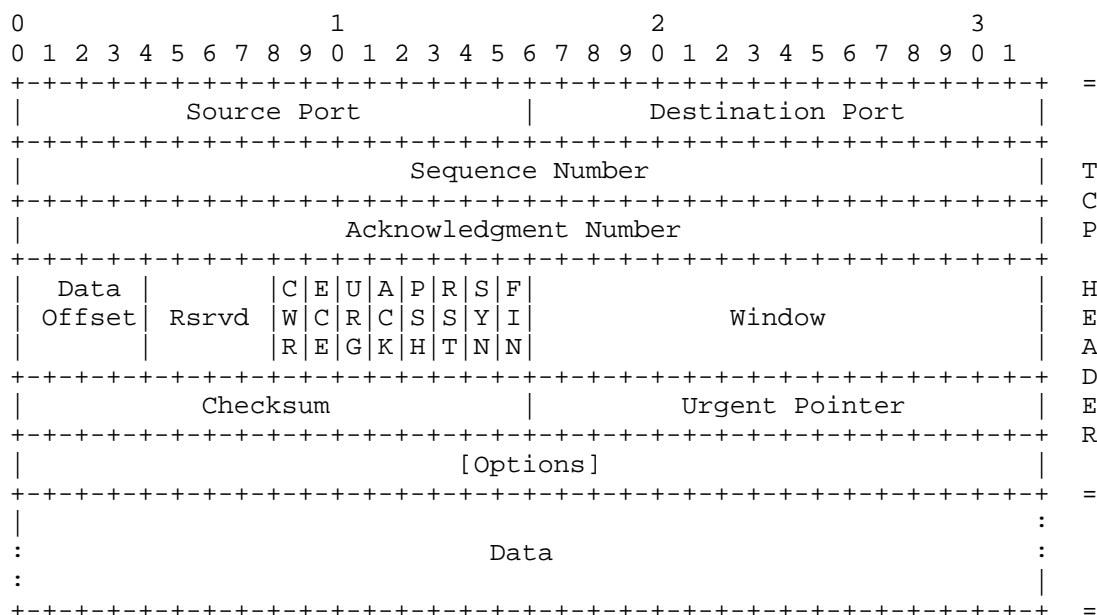


Figure 1: TCP Segment

Every TCP segment contains a header. Some TCP segments also contain data.

Each field in the TCP header, except for the last, has a fixed length. The fixed length fields in the TCP header occupy 20 octets. One of these fields is called the Data Offset field.

The last field in the TCP header is called the Options field. When present, the Options field contains a list of TCP options [TCPOPTS]. Its length varies from 0 to 40 octets.

The Data Offset field represents the offset of the Data field in the TCP segment, measured in 4-octet units. The Data Offset field also determines the length of the Options field. This is because the Options field consumes all of the space between the fixed length fields in the TCP header and the Data field.

The Data Offset field contains 4 bits. So, its value ranges nominally from 0 to 15. However, the value of the Data Offset field must be 5 or greater. This is because the Data field must follow the fixed length fields in the TCP header. As stated above, those fields occupy 20 octets.

Because the value of the Data Offset field cannot exceed 15, the offset of the Data field cannot exceed 60 and the length of the Options field cannot exceed 40 (i.e., 60 minus 20).

Modern applications may require more than 40 octets of TCP Options. Therefore, this document describes an experiment that extends the TCP Options field. If this experiment is successful, it will demonstrate that the extension procedures described herein are implementable and deployable. It will also demonstrate that they maintain backwards compatibility.

2. Conventions and Definitions

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 BCP14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Extending The TCP Options field

According to [RFC9293]:

- * The Data Offset field must have a value of 5 or greater
- * TCP Options can be present only when the Data Offset field has a value greater than 5.

This document allows the Data Offset field to have a value of 0. When the Data Offset field has a value of 0, the format of the TCP Options field is as depicted in Figure 2.

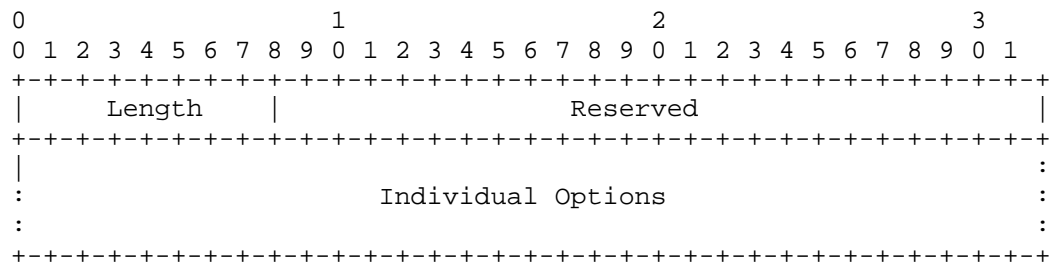


Figure 2: TCP Options

- * Length: 8-bit unsigned integer. Represents the length of the TCP Options field, including the length and reserved fields. Measured in 4-octet units. Value MUST be greater than 11.

- * Reserved: MUST be set to 0 by the sender and MUST be ignored by the receiver.
- * Individual Options: Defined in [RFC9293].

When a TCP segment contains 40 bytes of TCP Options or fewer, it MUST be formatted exactly as described in [RFC9293]. When a TCP segment contains more than 40 bytes of TCP Options, the Data Offset field MUST be equal to 0 and the Options field MUST be formatted as described in this section.

When the Data Offset field is equal to 0, a TCP segment can include over 1,000 bytes of options. While this may be required in the distant future, it is RECOMMENDED that TCP options not exceed 256 bytes.

4. Checksum Considerations

As per [RFC9293], checksums are calculated over the entire Options field.

5. Backwards Compatibility Considerations

5.1. Extended Options Used During Connection Establishment

When one TCP endpoint is not capable of processing segments with Data Offset equal to 0, and such a segment is sent during connection establishment, the segment will be ignored and the connection will not establish.

5.2. Extended Options Used After Connection Establishment

Once a TCP session has been established, TCP implementations MUST NOT send segments with Data Offset equal to 0 unless extended options were used during connection establishment.

6. Future Work

In the future, the WG may develop a signaling mechanism so that the restriction mentioned in Section 5.2 can be lifted.

6.1. Middleboxes and Accelerators

Legacy middleboxes and hardware accelerators discard packets with Data Offset equal to 0. Therefore, this experiment should not be performed in the presence of such devices.

7. Security Considerations

This document inherits security considerations from [RFC9293].

8. IANA Considerations

This document makes no IANA requests.

9. Experimental Results

Parties participating in this experiment should publish experimental results within one year of the publication of this document
Experimental results should address the following:

- * Effort required to deploy
 - Was deployment incremental or network-wide?
 - Was there a need to synchronize configurations at each node or could nodes be configured independently?
 - Did the deployment require hardware upgrade?
- * Scale of deployment
- * Interoperability
 - Did you deploy two interoperable implementations?
 - Did you experience interoperability problems?
- * Effectiveness and sufficiency of OAM mechanisms
 - Did Wireshark work?
 - Did TCPDUMP work?

10. Acknowledgements

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11. References

11.1. Normative References

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11.2. Informative References

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