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Shared Use of Experimental TCP Options
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Abstract

This document describes how TCP option codepoints can support concurrent experiments. The suggested mechanism avoids the need for a coordinated registry, and is backward-compatible with currently known uses.

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[1.](#) Introduction

TCP includes options to enable new protocol capabilities that can be activated only where needed and supported [[RFC793](#)]. The space for identifying such options is small - 256 values, of which 31 are assigned at the time this document was published [[IANA](#)]. Two of these codepoints are allocated to support experiments (253, 254) [[RFC4727](#)]. These numbers are intended for testing purposes, and implementations need to assume they can be used for other purposes, but this is often not the case.

There is no mechanism to support shared use of the experimental option codepoints. Experimental options 245 and 255 are deployed in operational code to support an early version of TCP authentication. Option 253 is also documented for the experimental TCP Cookie Transaction option [[RFC6013](#)]. This shared use results in collisions in which a single codepoint can appear multiple times in a single TCP segment and each use is ambiguous.

Other options have been used without assignment, notably 31-32 (TCP cookie transactions, as originally distributed and in its API doc) and 76-78 (tcpcrypt) [[Bi11](#)][[Si11](#)]. Commercial products reportedly also use unassigned options 33 and 76-78 as well.

There are a variety of proposed approaches to address this issue. The first is to relax the requirements for assignment of TCP

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options, allowing them to be assigned more readily for protocols that have not been standardized through the IETF process [[RFC5226](#)]. A second would be to assign a larger pool to options, and to manage their sharing through IANA coordination [[Ed11](#)].

This document proposes a solution that does not require additional codepoints and also avoids IANA participation. A short nonce is added to the structure of the experimental TCP option structure. The nonce helps reduce the probability of collision of independent experimental uses of the same option codepoint. This feature increases the size of experimental options, but the size can be reduced when the experiment is converted to a standard protocol with a conventional codepoint assignment.

2. Conventions used in this document

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](#)].

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying [RFC-2119](#) significance.

In this document, the characters ">>" preceding an indented line(s) indicates a compliance requirement statement using the key words listed above. This convention aids reviewers in quickly identifying or finding the explicit compliance requirements of this RFC.

3. TCP Experimental Option Structure

TCP options have the current common structure, where the first byte is the codepoint (Kind) and the second is the length of the option in bytes (Length):

```
+-----+-----+-----+-----+
| Kind  | Length |      ...      |
+-----+-----+-----+-----+
|      ...
+-----+
```

Figure 1 TCP Option Structure [[RFC793](#)]

This document extends the option structure for experimental codepoints (253, 254) as follows:

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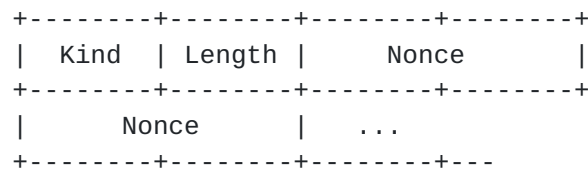


Figure 2 TCP Experimental Option with a Nonce

>> Protocols using the TCP experimental option codepoints (253, 254) SHOULD use nonces as described in this document.

The nonce is selected by the protocol designer when the experimental option is defined. The Nonce is selected any of a variety of ways, e.g., using the Unix time() command or bits selected by an arbitrary function (such as a hash).

>> The nonce SHOULD be selected to reduce the probability of collision.

The length of the nonce is intended to be 32 bit in network standard byte order. It can be shorter if desired (e.g., 16 bits), with a corresponding increased probability of collision and thus false positives.

During TCP processing, experimental options are matched against both the experimental codepoints and the Nonce value for each implemented protocol.

>> Experimental options that have nonces that do not match implemented protocols MUST be ignored.

The remainder of the option is specified by the particular experimental protocol.

Use of a nonce uses additional space in the TCP header and requires additional protocol processing by experimental protocols. Because these are experiments, neither consideration is a substantial impediment; a finalized protocol can avoid both issues with the assignment of a dedicated option codepoint later.

4. Security Considerations

The mechanism described in this document is not intended to provide security for TCP option processing. False positives are always possible, where a Nonce matches a legacy use of these options or a protocol that does not implement the mechanism described in this document.

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>> Protocols that are not robust to such false positives SHOULD implement other measures to ensure they process options for their protocol only, such as checksums or digital signatures among cooperating parties of their protocol.

5. IANA Considerations

This document has no IANA considerations. This section should be removed prior to publication.

6. References

6.1. Normative References

- [RFC793] Postel, J., "Transmission Control Protocol", STD 7, [RFC 793](#), Sep. 1981.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
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6.2. Informative References

- [Bi11] Bittau, A., D. Boneh, M. Hamburg, M. Handley, D. Mazieres, Q. Slack, "Cryptographic protection of TCP Streams (tcpcrypt)", work in progress, [draft-bittau-tcp-crypt-01](#), Aug. 29, 2011.
- [Ed11] Eddy, W., "Additional TCP Experimental-Use Options", work in progress, [draft-eddy-tcpm-addl-exp-options-00](#), Aug. 16, 2011.
- [IANA] IANA web pages, <http://www.iana.org/>
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- [RFC6013] Simpson, W., "TCP Cookie Transactions (TCPCT)", [RFC 6013](#), Jan. 2011.
- [Si11] Simpson, W., "TCP Cookie Transactions (TCPCT) Sockets Application Program Interface (API)", work in progress, [draft-simpson-tcpct-api-04](#), Apr. 7, 2011.

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7. Acknowledgments

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