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Deprecation of ICMP Source Quench Messages

Abstract

This document formally deprecates the use of ICMP Source Quench messages by transport protocols, formally updating RFC 792, RFC 1122, and RFC 1812.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

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1. Introduction

The ICMP specification [RFC0792] defined the ICMP Source Quench message (type 4, code 0), which was meant as a mechanism for congestion control. ICMP Source Quench has been known to be an ineffective (and unfair) antidote for congestion, and generation of ICMP Source Quench messages by routers has been formally deprecated by [RFC1812] since 1995. However, reaction to ICMP Source Quench messages in transport protocols has never been formally deprecated.

This document formally deprecates reaction to ICMP Source Quench messages by transport protocols such as TCP [RFC0793], formally updating [RFC0792], [RFC1122], and [RFC1812]. Additionally, it provides a recommendation against the implementation of [RFC1016]. The rationale for these specification updates is as follows:

- o Processing of ICMP Source Quench messages by routers has been deprecated for nearly 17 years [RFC1812].
- o Virtually all popular host implementations have removed support for ICMP Source Quench messages since (at least) 2005 [RFC5927].
- o Widespread deployment of ICMP filtering makes it impossible to rely on ICMP Source Quench messages for congestion control.
- o The IETF has moved away from ICMP Source Quench messages for congestion control (e.g., note the development of Explicit Congestion Notification (ECN) [RFC3168] and the fact that ICMPv6 [RFC4443] does not even specify a Source Quench message).

ICMP Source Quench messages are not normally seen in the deployed Internet and were considered rare at least as far back as 1994 [Floyd1994].

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. ICMP Source Quench Messages

The ICMP specification [RFC0792] defined the ICMP Source Quench message (type 4, code 0), which was meant to provide a mechanism for congestion control. The Host Requirements RFC [RFC1122] stated in Section 4.2.3.9 that hosts MUST react to ICMP Source Quench messages by slowing transmission on the connection, and further added that the RECOMMENDED procedure was to put the corresponding connection in the slow-start phase of TCP's congestion control algorithm [RFC5681].

[RFC1812] noted that research suggested that ICMP Source Quench was an ineffective (and unfair) antidote for congestion, and formally deprecated the generation of ICMP Source Quench messages by routers, stating that routers SHOULD NOT send ICMP Source Quench messages in response to congestion.

[RFC5927] discussed the use of ICMP Source Quench messages for performing "blind throughput-reduction" attacks, and noted that most TCP implementations silently ignore ICMP Source Quench messages.

We note that TCP implements its own congestion control mechanisms [RFC5681] [RFC3168], which do not depend on ICMP Source Quench messages.

It is interesting to note that ICMPv6 [RFC4443] does not specify a Source Quench message.

3. Updating RFC 1122

This document hereby updates Section 3.2.2.3 of [RFC1122] as follows:

A host MUST NOT send ICMP Source Quench messages.

If a Source Quench message is received, the IP layer MAY silently discard it.

Section 4.2.3.9 of [RFC1122] is updated as follows:

TCP MUST silently discard any received ICMP Source Quench messages.

The consensus of the TSV WG was that there are no valid reasons for a host to generate or react to an ICMP Source Quench message in the current Internet. The recommendation that a sender "MUST NOT" send an ICMP Source Quench message is because there is no known valid reason for a host to generate this message. The only known impact of a sender ignoring this requirement is that it may necessarily consume network and endpoint resources. Discarding ICMP Source Quench messages at the Internet layer (rather than at the transport layer) is a performance optimization that is permitted by this update.

4. Updating RFC 1812

This document hereby updates Section 4.3.3.3 of [RFC1812] as follows:

A router MUST ignore any ICMP Source Quench messages it receives.

The consensus of the TSV WG was that there are no valid reasons for a router to react to ICMP Source Quench messages in the current Internet.

5. Clarification for UDP, SCTP, and DCCP

UDP [RFC0768] did not explicitly specify support for ICMP Source Quench messages. Hereby, we clarify that UDP endpoints MUST silently discard received ICMP Source Quench messages.

It is understood that SCTP [RFC4960] and DCCP [RFC4340] did not specify support for processing received ICMP Source Quench messages. Hereby, we clarify that DCCP and SCTP endpoints MUST silently discard received ICMP Source Quench messages.

6. General Advice to Transport Protocols

If a Source Quench message is received by any other transport-protocol instance, it MUST be silently ignored.

The TSV WG is not aware of any mechanism that requires processing of these messages and therefore expects other transports to follow the recommendations in Section 3. Note that since generation of ICMP Source Quench messages has been deprecated for many years, and since this document additionally deprecates reaction to ICMP Source Quench messages by IETF-specified transports, future applications cannot expect to receive these messages.

7. Recommendation Regarding RFC 1016

[RFC1016] describes an experimental approach to the handling of ICMP Source Quench messages in hosts that was considered in 1987. Even though RFC 1016 has never been on the IETF Standards Track, for clarity and avoidance of doubt we note that the approach described in [RFC1016] MUST NOT be implemented.

8. Security Considerations

ICMP Source Quench messages could be leveraged for performing blind throughput-reduction attacks against TCP and similar protocols. This attack vector, along with possible countermeasures, has been discussed in great detail in [RFC5927] and [CPNI-TCP]. Silently ignoring ICMP Source Quench messages, as specified in this document, eliminates the aforementioned attack vector.

For current TCP implementations, receipt of an ICMP Source Quench message should not result in security issues because, as noted in [RFC5927] and [CPNI-TCP], virtually all current versions of popular TCP implementations already silently ignore ICMP Source Quench messages. This is also the case for SCTP and DCCP implementations.

Hosts, security gateways, and firewalls MUST silently discard received ICMP Source Quench packets and SHOULD log such drops as a security fault with at least minimal details (IP Source Address, IP Destination Address, ICMP message type, and date/time the packet was seen).

We note that security devices such as the Snort Network Intrusion Detection System (NIDS) have logged ICMP Source Quench messages as such for more than ten years [Anderson2002].

9. IANA Considerations

IANA has marked ICMP type 4 (Source Quench) as "Deprecated" in the ICMP Parameters registry [ICMPPARREG] with a reference to this document.

10. Acknowledgements

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Appendix A. Survey of Support of ICMP Source Quench in Some Popular TCP/IP Implementations

A large number of implementations completely ignore ICMP Source Quench messages meant for TCP connections. This behavior has been implemented in, at least, Linux [Linux] since 2004, and in FreeBSD [FreeBSD], NetBSD [NetBSD], OpenBSD [OpenBSD], and Solaris 10 since 2005. Additionally, OpenSolaris [OpenSolaris] has always shipped with support for ICMP Source Quench messages disabled.

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