

conex Working Group  
Internet-Draft  
Intended status: Standards Track  
Expires: September 15, 2011

S. Krishnan  
Ericsson  
M. Kuehlewind  
IKR University of Stuttgart  
C. Ucendo  
Telefonica  
March 14, 2011

**Options for Conex marking in IPv6 packets  
draft-krishnan-conex-ipv6-02**

Abstract

Conex is a mechanism by which senders inform the network about the congestion encountered by packets earlier in the same flow. This document describes the requirements for conex markings in IPv6 datagrams and describes the various options for performing conex markings in IPv6.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on September 15, 2011.

Copyright Notice

Copyright (c) 2011 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must

include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

- [1. Introduction . . . . .](#) [3](#)
- [2. Conventions used in this document . . . . .](#) [3](#)
- [3. Requirements for marking IPv6 packets . . . . .](#) [3](#)
- [4. Possible Solutions . . . . .](#) [3](#)
  - [4.1. Hop-by-hop options . . . . .](#) [3](#)
  - [4.2. Destination options . . . . .](#) [4](#)
  - [4.3. Header bits . . . . .](#) [4](#)
  - [4.4. Extension Headers . . . . .](#) [4](#)
- [5. ConEx Encoding . . . . .](#) [4](#)
- [6. Acknowledgements . . . . .](#) [5](#)
- [7. Security Considerations . . . . .](#) [5](#)
- [8. IANA Considerations . . . . .](#) [5](#)
- [9. Normative References . . . . .](#) [5](#)
- [Authors' Addresses . . . . .](#) [5](#)



## **1. Introduction**

Conex is a mechanism by which senders inform the network about the congestion encountered by packets earlier in the same flow. This document describes the requirements for conex markings in IPv6 datagrams and describes the various options for performing conex markings in IPv6.

## **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 [[RFC2119](#)].

## **3. Requirements for marking IPv6 packets**

R-1: The marking mechanism needs to be visible to all conex-capable nodes on the path.

R-2: The mechanism needs to be able to traverse nodes that do not understand the markings. This is required to ensure that conex can be incrementally deployed over the Internet.

R-3: The presence of the marking mechanism should not significantly alter the processing of the packet. This is required to ensure that conex marked packets do not face any undue delays or drops due to a badly chosen mechanism.

R-4: The markings should be immutable once set by the sender. At the very least, any tampering should be detectable.

## **4. Possible Solutions**

### **4.1. Hop-by-hop options**

The base IPv6 standard [[RFC2460](#)] defines hop-by-hop options. These options are processed by every node on the path. Hence they meet R-1. The options have variable semantics based on the 3 MSB of the option code. The state of these bits controls the behavior of nodes to either ignore unknown options or drop packets containing them. It also defines the ICMPv6 error message sending behavior and the mutability of the options en-route. This means that it is possible for hop-by-hop options to satisfy R-2 and R-4. In most commercial router implementations the mere presence of hop-by-hop options results in the packet being punted to the Slow path instead of being accorded



regular forwarding behavior (Fast Path). This means that R-3 is not satisfied.

#### **4.2. Destination options**

The base IPv6 standard [[RFC2460](#)] defines the destination options. These options are processed only by the ultimate receiver of the packet (as specified in the Destination Address field) and not by nodes on the path. Hence they do not meet R-1. The options have the same variable semantics based on the 3 MSBs as the hop-by-hop option which means that they can satisfy R-2 and R-4. As intermediate nodes currently do not process destination options R-3 is easily satisfied.

#### **4.3. Header bits**

The IPv6 header has no free bits. The only bits in the IPv6 header that are not widely used are the flow label bits [[RFC3697](#)]. There are some initiatives to redefine the use of the flow label for other purposes (e.g. Load balancing, nonce). It may be possible (but highly unlikely) to save a few bits from the flow label for alternate purposes to end up with a shorter flow label. The use of IPv6 header bits can satisfy all the requirements for conex markings but using valuable header bits for experimental purposes (such as conex) may not be acceptable.

#### **4.4. Extension Headers**

The base IPv6 standard [[RFC2460](#)] defines extension headers as an expansion mechanism to carry optional internet layer information. Extension headers, with the exception of the hop-by-hop options header, are not usually processed on intermediate nodes. This means that R-1 cannot be met. Unknown extension headers cause the packet to be dropped and hence such mechanism is not incrementally deployable. Hence R-3 is not met either.

### **5. ConEx Encoding**

The decision about where to code the ConEx inform might also influence the decision on how to code congestion information itself. Of course, a ConEx capable transport has to inform the network that it is actually ConEx enabled. Thus, as a minimum, every packet has to carry the information that the sender is ConEx enabled and, also whether it is ConEx marked. Moreover, the abstract conex mechanism [[CAM](#)] requires that that a distinction between loss or ECN marks as congestion signal is needed in addition to the so-called 'congestion credits'. This implies that a minimum of 4 bits is needed if bit-wise encoding is used , and a minimum of 3 bits is needed if



codepoints are used. Further ideas on additional ConEx information are currently discussed on the mailing list. Moreover, the ConEx information could be represented in a more sophisticated manner than a binary signal (Yes/No), if additional bits are available for use.

## **6. Acknowledgements**

The authors would like to thank Marcelo Bagnulo, Bob Briscoe, Ingemar Johansson, Joel Halpern and John Leslie for the discussions that led to this document.

## **7. Security Considerations**

This document does not bring up any new security issues.

## **8. IANA Considerations**

This document does not require any IANA action.

## **9. Normative References**

- [CAM] Briscoe, B., "Congestion Exposure (ConEx) Concepts and Abstract Mechanism", [draft-ietf-conex-abstract-mech-01](#) (work in progress), March 2011.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2460] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", [RFC 2460](#), December 1998.
- [RFC3697] Rajahalme, J., Conta, A., Carpenter, B., and S. Deering, "IPv6 Flow Label Specification", [RFC 3697](#), March 2004.





Authors' Addresses

Suresh Krishnan  
Ericsson  
8400 Blvd Decarie  
Town of Mount Royal, Quebec  
Canada

Email: [suresh.krishnan@ericsson.com](mailto:suresh.krishnan@ericsson.com)

Mirja Kuehlewind  
IKR University of Stuttgart

Email: [mirja.kuehlewind@ikr.uni-stuttgart.de](mailto:mirja.kuehlewind@ikr.uni-stuttgart.de)

Carlos Ralli Ucendo  
Telefonica

Email: [ralli@tid.es](mailto:ralli@tid.es)

