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**ICMP Locator Update message for ILNPv6
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This document is not on the IETF standards-track and does not specify any level of standard. This document merely provides information for the Internet community.

This document is part of the ILNP document set, which has had extensive review within the IRTF Routing Research Group. ILNP is one of the recommendations made by the RG Chairs. Separately, various refereed research papers on ILNP have also been published during this decade. So the ideas contained herein have had much broader review than the IRTF Routing RG. The views in this document were considered controversial by the Routing RG, but the RG reached a consensus that the document still should be published. The Routing RG has had remarkably little consensus on anything, so virtually all Routing RG outputs are considered controversial.

Abstract

This note specifies an experimental ICMPv6 message type used with the Identifier-Locator Network Protocol (ILNP). The Identifier-Locator Network Protocol (ILNP) is an experimental, evolutionary enhancement to IP. This message is used to dynamically update Identifier/Locator bindings for an existing ILNP session. This is a product of the IRTF Routing RG.

Table of Contents

1. Introduction	3
1.1 ILNP Document Roadmap.....	3
1.2 ICMPv6 Locator Update.....	3
1.3 Terminology.....	3
2. Syntax.....	4
2.1 Example ICMPv6 Locator Update message.....	5
3. Transport Protocol Effects.....	6
4. Implementation Considerations.....	6

Atkinson & Bhatti Expires in 6 months

[Page 2]

5. Backwards Compatibility.....	7
6. Security Considerations	7
7. IANA Considerations	8
8. References	8

[1. Introduction](#)

At present, the research and development community are examining various alternatives for evolving the Internet Architecture. Several different classes of evolution are being considered. One class is often called "Map and Encapsulate", where traffic would be mapped and then tunnelled through the inter-domain core of the Internet.

Another class being considered is sometimes known as "Identifier/Locator Split". This document relates to a proposal that is in the latter class of evolutionary approaches.

[1.1 ILNP Document Roadmap](#)

The ILNP Architecture document [[ILNP-ARCH](#)] is the best place to start reading about ILNP. ILNP has multiple possible instantiations. [[ILNP-ENG](#)] discusses engineering and implementation aspects common to all instances of ILNP. A new IPv6 Destination Option used with ILNPv6 is defined in [[ILNP-NONCEv6](#)]. This document discusses a new ICMP for IPv6 message. [[ILNP-DNS](#)] describes new Domain Name System (DNS) resource records used with ILNP. Other documents describe ILNP for IPv4 (ILNPv4).

[1.2 ICMPv6 Locator Update](#)

As described in [[ILNP-ARCH](#)] and [[ILNP-ENG](#)], an ILNP for IPv6 (ILNPv6) node might need to inform correspondent ILNPv6 nodes of changes to the set of valid Locator values. The new ICMPv6 Locator Update message described in this document enables an ILNP-capable node to update its correspondents about the currently valid set of Locators valid to use in reaching the node sending this message. [[RFC2460](#)] [[RFC4443](#)]

This new ICMPv6 message **MUST ONLY** be used for ILNPv6 sessions. Authentication is always required, as described in the Security Considerations section later in this note.

Some might consider any and all use of ICMP to be undesirable. In that context, please note that while this specification uses ICMP, on grounds that this is a control message, there is no architectural difference between using ICMP and using some different framing, for example UDP.

[1.3 Terminology](#)

Atkinson & Bhatti Expires in 6 months

[Page 3]

Type	XXX
Code	0
Checksum	The 16-bit one's complement of the one's complement sum of the ICMP message, starting with the ICMP Type. For computing the checksum, the Checksum field is set to 0.

Atkinson & Bhatti Expires in 6 months

[Page 4]

Num of Locs	The number of 64-bit Locator values that are advertised in this message. This field MUST NOT be zero.
Locator[i], i = 1..Num of Locs	The 64-bit Locator values currently valid for the sending ILNPv6 node.
Preference[i], i = 1..Num of Locs	The preferability of each Locator[i], relative to other valid Locator[i] values. The Preference numbers here are identical, both in syntax and semantics, to the Preference values for L64 records as specified by [ILNP-DNS].
Lifetime[i] i = 1..Num of Locs	The maximum number of seconds that this particular Locator may be considered valid. Normally, this is identical to the DNS lifetime of the corresponding L64 record, if one exists.
RESERVED	A field reserved for possible future use. At present, the sender MUST initialise this field to zero. Receivers should ignore this field at present. The field might be used for some protocol function in future.

All ILNPv6 ICMP Locator Update messages MUST contain a valid ILNPv6 Identifier option and MUST contain an ILNPv6 Nonce Option.

ILNPv6 ICMP Locator Update messages also MAY be protected using IP Security for ILNP [[ILNP-ENG](#)] [[RFC4301](#)]. Deployments in high-threat environments SHOULD also protect ILNPv6 ICMP Locator Update messages using IP Security. While IPsec ESP can protect a payload, no form of IPsec ESP is able to protect an IPv6 option that appears prior to the ESP header.

Note that even when IP Security for ILNP is in use, the ILNP Nonce Option still MUST be present. This simplifies protocol processing, and it also means that a receiver can perform the inexpensive check of the Nonce value before performing any (potentially expensive) cryptographic calculation.

[2.1](#) Example ICMPv6 Locator Update message

This example shows the ICMPv6 syntax for the case where 2 Locator values

are being indicated.

```

+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   Type   |   Code   |           Checksum           |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Num of Locs | RESERVED |           RESERVED           |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
/                               Locator [1]                               /
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Preference [1] | Lifetime [1] |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
/                               Locator [2]                               /
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Preference [2] | Lifetime [2] |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

3. Transport Protocol Effects

This message has no impact on any transport protocol.

The message may affect where packets for a given transport session are sent, but an ILNP design objective is to decouple transport-protocols from network-layer changes.

4. Implementation Considerations

Implementers may use any internal implementation they wish, provided that the external appearance is the same as this implementation approach.

To support ILNPv6, and to retain the incremental deployability and backwards compatibility needed, the network layer needs a mode bit in the Transport Control Block (or its equivalent) to track which IP sessions are using the classic IPv6 mode and which IP sessions are using the Identifier/Locator Split mode.

Further, when supporting ILNPv4, nodes will need to support a Identifier Locator Communication Cache (ILCC) in the network layer as described in [[ILNP-ENG](#)].

A node sending an ICMP Locator Update message MUST include all currently valid Locator values in that message. A node receiving a valid ICMP Locator Update message MUST replace the previously current set of Locator values for that correspondent node in its own ILCC with the newly received set of Locator values.

Atkinson & Bhatti Expires in 6 months

[Page 6]

Every implementation needs to support a large number of Locator values being sent or received in a single ICMP Locator Update message, because a multi-homed node or multi-homed site might have a large number of upstream links to different service providers, each with its own Locator value.

5. Backwards Compatibility

For all sessions operating in Identifier/Locator Split mode, inside each node the high-order 64-bits ("Locator") of the IPv6 address field **MUST** be set to zero before calculating TCP or UDP checksums. So, any changes in Locator values used on the wire will be invisible to the transport protocol. In this mode, transport-layer checksums (e.g. TCP pseudo-header checksum) will be calculated with both Source Locator and Destination Locator fields set to all zero.

When ILNPv6 is not in use, the receiving IPv6 node **MUST** discard the ICMP Locator Update packet without processing the packet. This is standard behaviour for a non-ILNPv6 node when receiving an ICMPv6 message with an unknown header field value.

6. Security Considerations

Security considerations for the overall ILNP Architecture are described in [[ILNP-ARCH](#)]. Additional common security considerations are described in [[ILNP-ENG](#)]. This section describes security considerations specific to ILNPv6 topics discussed in this document.

The ICMPv6 Locator Update message **MUST ONLY** be used for ILNPv6 sessions.

The ILNP Nonce Destination Option [[ILNP-NONCEv6](#)] **MUST** be present in packets containing an ICMPv6 Locator Update message. Further, the received Nonce Destination Option **MUST** contain the correct nonce value for the packet to be accepted by the recipient and then passed to the ICMPv6 protocol for processing. If either of these requirements are not met, the received packet **MUST** be discarded as not authentic, and a security event **SHOULD** be logged by the system receiving the non-authentic packet.

Sessions operating in higher risk environments **SHOULD** use IP Security for ILNP [[ILNP-ENG](#)] [[RFC4301](#)] *in addition* to the ILNPv6 Nonce Destination Option. Use of IP Security for ILNP to

protect a packet does NOT permit the packet to be sent without the Nonce Destination Option.

Implementations need to support the case where a single ICMP Locator Update message contains a large number of Locator and Preference values and ought not develop a security fault (e.g. stack overflow) due to a received message containing more Locator values than expected.

If the ILNP Nonce value is predictable, then an off-path attacker might be able to forge data or control packets. This risk also is mitigated by the existing common practice of IP Source Address filtering [[RFC2827](#)] [[RFC3704](#)].

7. IANA Considerations

IANA is requested to assign a value, replacing the XXX, to the ICMP Type listed in [Section 2](#), following the procedures in [[RFC4443](#)].

There are no other IANA actions for this document.

8. References

This document contains both normative and informative references.

8.1. Normative References

- [ILNP-ARCH] R. Atkinson and S. Bhatti, "ILNP Architecture", [draft-irtf-rrg-ilnp-arch](#), March 2012.
- [ILNP-DNS] R. Atkinson and S. Bhatti, "DNS Resource Records for ILNP", [draft-irtf-rrg-ilnp-dns](#), March 2012.
- [ILNP-ENG] R. Atkinson and S. Bhatti, "ILNP Engineering Considerations", [draft-irtf-rrg-ilnp-eng](#), March 2012.
- [ILNP-NONCEv6] R. Atkinson and S. Bhatti, "Nonce Destination Option", [draft-irtf-rrg-ilnp-noncev6](#), March 2012.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2460] S. Deering & R. Hinden, "Internet Protocol Version 6 Specification", [RFC 2460](#),

December 1998.

- [RFC3704] F. Baker, P. Savola, "Ingress Filtering for Multihomed Networks", [RFC 3704](#), March 2004.
- [RFC4301] S. Kent & K. Seo, "Security Architecture for the Internet Protocol", [RFC 4301](#), December 2005.
- [RFC4443] A. Conta, S. Deering, and M. Gupta (Ed.), "Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification", [RFC 4443](#), March 2006.

8.2. Informative References

- [RFC2827] P. Ferguson and D. Senie, "Network Ingress Filtering: Defeating Denial of Service Attacks which employ IP Source Address Spoofing", [RFC 2827](#), May 2000.

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RFC EDITOR NOTE

This section is to be removed prior to publication.

This document is written in English, not American. So English spelling is used throughout, rather than American spelling. This is consistent with existing practice in several other RFCs, for example [RFC-5887](#).

This document tries to be very careful with history, in the interest of correctly crediting ideas to their earliest identifiable author(s). So in several places the first published RFC about a topic is cited rather than the most recent published RFC about that topic.

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