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Commenté [MB1]: We need a section for changes vs these specs.

Entering IPv6 Zone Identifiers in User Interfaces
draft-ietf-6man-zone-ui-08

Abstract

This document describes how the zone identifier of an IPv6 scoped address, defined in the IPv6 Scoped Address Architecture (RFC 4007), should be entered into a user interface. It obsoletes RFC 6874 and updates RFC 4007, RFC 7622, and RFC 8089.

Discussion Venue

This note is to be removed before publishing as an RFC.

Discussion of this document takes place on the 6MAN mailing list (ipv6@ietf.org), which is archived at <https://mailarchive.ietf.org/arch/browse/ipv6/> (<https://mailarchive.ietf.org/arch/browse/ipv6/>).

Status of This Memo

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1. Introduction

A number of software tools require or permit the user to enter an IPv6 address via a User Interface (UI). The standard literal text format for an IPv6 address is defined by [RFC4291] and [RFC5952]. The IPv6 Scoped Address Architecture specification [RFC4007] extends the text representation of limited-scope IPv6 addresses, in particular link-local unicast addresses and multicast addresses with less than global scope, such that a zone identifier may be concatenated to an address, ~~for purposes described in that specification~~. Note that [RFC5952]~~RFC-5952~~ does not mention this extension.

Commenté [MB2]: Should point this is called «zone index» to match RFC4007?

Zone identifiers are especially useful in contexts in which literal addresses are typically used, for example, during fault diagnosis or device configuration, when it may be essential to specify which interface is used for sending to a link-local address. It should be noted that zone identifiers have purely local meaning within the node in which they are defined, usually being the same as IPv6 interface names. They are completely meaningless for any other node.

~~Today~~Typically, they are meaningful only when attached to link-local unicast and scoped multicast addresses, but it is possible that other uses might be defined in the future.

Examples of a link-local unicast address qualified by a zone identifier are "fe80::1234%eth0" on a Linux host, ~~r~~ or "fe80::4321%7" on a Windows host.

Such addresses are directly supported by socket API calls including "getaddrinfo()" [RFC3493].

~~Devices-Implementations~~ whose network stack does not support the RFC 4007 model of a human-readable zone identifier are out of scope for this document.

Commenté [MB3]: Covers NF/VNF/etc.

2. Use Cases

~~Some~~ A non-exhaustive list of ~~examples of sample~~ use cases for entering an address that includes a zone identifier into a UI are as follows:

1. A software tool may be used for simple debugging actions involving link-local addresses on a host with more than one active link interface. For example, the functioning of an interface and the existence of a device may today be checked via "ping fe80::1234%eth0". If this succeeds, the user learns that the remote device is reachable via the interface named "eth0".
2. A software tool must sometimes be used to configure ~~or reconfigure~~ a device which only has a link-local address, again in a host with more than one active link interface. For example, a typical home router may today be configured via a well-known private address [RFC1918] such as "192.168.178.1" but not via "fe80::1%eth0", if the tool in use does not support the input of zone identifiers.
3. Using a monitoring tool such as Wireshark, the user may need to specify a given link-local address on a given interface whose traffic is of interest. (At the time of writing, Wireshark supports capture from multiple interfaces, but does not appear to support the zone identifier in a display filter.)
4. The Microsoft Web Services for Devices (WSD) virtual printer port mechanism can present the user with an IPv6 link-local address such as "fe80::823b:f9ff:fe7b:d9dc%l0" in which the zone identifier is present, but is not recognized by appropriate software.
5. The National Marine Electronics Association (NMEA) has ~~recently~~ defined the "OneNet Marine IPv6 Ethernet Networking Standard" [ONE-NET], which uses IPv6 ~~link-local~~ link-local addresses exclusively. ~~Desired improvements to the standard~~ include a web page for device configuration using link-local addresses.

Commenté [MB4]: That's still «configure» ;-)

Commenté [MB5]: By whom?

Such requirements have already spawned hacks to work around current limitations, ~~—~~ (e.g., [LL-HACK], which is no longer maintained and has been archived).

For all such use cases, it is highly desirable that a complete IPv6 link-local address can be cut and pasted from one UI (such as the output from a system command) to another. Since such addresses may include quite long hexadecimal strings, for example "fe80::8d0f:7f26:f5c8:780b%enx525400d5e0fb", any solution except cut-and-paste is highly error prone.

3. Relationship to Other Documents

The use cases listed above apply to relatively simple actions on end systems. The zone identifiers that can be used are limited by the host operating system, since [RFC4007] only specifies that they are text strings, without specifying a maximum length.

It should be noted that whereas some operating systems and network APIs support a default zone identifier as recommended by RFC 4007,

others, including Linux, do not, and for them a solution is particularly important, since a link-local address without a zone index cannot be used in the Linux socket API.

The RFC 4007 model assumes that the human-readable zone identifier is mapped by the operating system into a numeric interface index. Typically, this mapping is performed by the socket API, e.g. by "getaddrinfo()". The mapping between the human-readable zone identifier string and the numeric value is a host-specific function that varies between operating systems. The present document is concerned only with the human-readable string that is typically displayed in an operating system's user interface. However, in most operating systems it is possible to use the underlying interface number, represented as a decimal integer, as an equivalent to the human-readable string. This is recommended by Section 11.2 of [RFC 4007], but not required. This possibility does not affect the UI requirement given below.

As IPv6 deployment becomes more widespread, the lack of a solution for handling complete link-local addresses in all tools is becoming an acute problem for increasing numbers of operational and support personnel. It will become critical as IPv6-only or IPv6-mostly networks [RFC8925] [draft-ietf-v6ops-6mops I-D.link-v6ops-6mops], with nodes lacking native IPv4 support, appear. For example, the NMEA use case mentioned above is an immediate requirement. This is the principal reason for documenting this requirement now.

This document obsoletes [RFC6874], which implementors of web browsers have determined is impracticable to support (See, e.g., Section 3.2 of [I-D.schinazi-httpbis-link-local-uri-bcp]), and replaces it by a generic UI requirement described below in Section 5. Note that obsoleting RFC 6874 reverts the change that it made to the URI syntax defined by [RFC3986], so RFC 3986 is no longer updated by RFC 6874. As far as is known, this change will have no significant impact on non-browser deployments of URIs.

This document also updates [RFC7622] and [RFC8089] by deleting their references to RFC 6874.

It also updates [RFC4007] by adding a new requirement that user interfaces support the zone identifier as described below in Section 5.

4. Normative Terminology

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] when, and only when, they appear in all capitals, as shown here.

5. Specification

A user interface (UI) that allows or requires the user to enter an IPv6 address SHOULD provide a means for entering a link-local address

Commenté [MB6]: draft-ietf-v6ops-6mops

Commenté [MB7]: I would simply delete.

This clarification is needed. No need to «over motivate» or «speculate», IMO.

Commenté [MB8]: (DISCUSS) How this is handled by our tracking tools?

Commenté [MB9]: Already introduced in previous sections

Commenté [MB10]: Including using programmatic means (not only manual configuration).

or a scoped multicast address and selecting a zone identifier identifier as specified by [RFC4007] (typically, an interface identifier as defined by the operating system). This is REQUIRED in the case of an operating system that does not support a default zone as specified in [RFC4007]~~RFC4007~~.

~~Ideally, the~~ UI SHOULD support the complete format specified in Section 6 of [RFC4007]~~by RFC 4007~~ (e.g., "fe80::1%eth0").

If this is impossible for practical reasons, the UI MAY support an alternative delimiter in place of "%". The hyphen ("-") is suggested (e.g., "fe80::1-eth0").

If this too is impossible for practical reasons, the UI MAY provide two separate input fields (e.g., "fe80::1" in one box, "eth0" in another), selection from a list of active zone identifiers, or a separate command line parameter for the zone identifier.

The program providing the UI will then store the address and the zone identifier, converting the latter to an interface index (typically via the socket API). A faulty zone identifier will be detected when attempting to convert it and this should be reported to the user as an error. The resulting interface index will be used for any subsequent socket calls using the link-local address.

Note that an address string such as "fe80::1%eth0" cannot be converted to binary by the POSIX socket API function "inet_pton()". It must either be converted using "getaddrinfo()", or by splitting it into two strings and using "inet_pton()" and "if_nametoindex()" successively, in order to obtain the required interface index value.

In this model, the zone identifier is considered independently of the IPv6 address itself. However, this does not in itself resolve the difficulties in considering the zone identifier as part of the HTTP origin model [RFC6454]. Therefore, this approach does not resolve the issue of how browsers should support link-local addresses, discussed further in [I-D.schinazi-httpbis-link-local-uri-bcp]. Because of this, the recommendations and normative statements in this document do not apply to URIs fetched by web browsers.

6. Security Considerations

As explained in [RFC4007], zone identifiers are of local significance only and must not be sent on the wire. In particular, see the final security consideration of RFC 4007, which indicates that software should not trust packets that contain textual non-global addresses as data. Software that obtains a zone identifier through a UI should, therefore, not transmit it further.

There is no formal limit on the length of the zone identifier string in RFC 4007. A UI implementation should apply an appropriate length limit when inputting a zone identifier, in order to minimize the risk of a buffer overrun. Typically, this limit would be the same as the host operating system's limit on interface names.

RFC 4007 does not specify or restrict the character set allowed in a

Commenté [MB11]: This is drawn with the assumption of a graphical user interface.

Consider «input parameters» or similar?

Commenté [MB12]: Identifiers in referrals: Can we also mention (including in any referral object)?

zone identifier. Therefore, each implementation processing zone identifiers needs to make checks appropriate for the environment it is used in. For example, a UI implementation should not allow ASCII NUL characters in a zone identifier string as this could cause inconsistencies in subsequent string processing.

7. IANA Considerations

This document makes no request of IANA.

8. References

8.1. Normative References

- [BCP14] Best Current Practice 14,
<<https://www.rfc-editor.org/info/bcp14>>.
At the time of writing, this BCP comprises the following:
- Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC4007] Deering, S., Haberman, B., Jinmei, T., Nordmark, E., and B. Zill, "IPv6 Scoped Address Architecture", RFC 4007, DOI 10.17487/RFC4007, March 2005, <<https://www.rfc-editor.org/info/rfc4007>>.
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- [RFC5952] Kawamura, S. and M. Kawashima, "A Recommendation for IPv6 Address Text Representation", RFC 5952, DOI 10.17487/RFC5952, August 2010, <<https://www.rfc-editor.org/info/rfc5952>>.

8.2. Informative References

- [I-D.ietf-6man-rfc6874bis] Carpenter, B. E., Cheshire, S., and R. M. Hinden, "Representing IPv6 Zone Identifiers in Address Literals and Uniform Resource Identifiers", Work in Progress, Internet-Draft, draft-ietf-6man-rfc6874bis-09, 2 July 2023, <<https://datatracker.ietf.org/doc/html/draft-ietf-6man-rfc6874bis-09>>.
- [I-D.link-v6ops-6mops] Linkova, J. and N. Buraglio, "IPv6-Mostly Networks: Deployment and Operations Considerations", Work in Progress, Internet-Draft, draft-link-v6ops-6mops-01, 7 July 2024, <<https://datatracker.ietf.org/doc/html/draft-link-v6ops-6mops-01>>.

- [I-D.schinazi-httpbis-link-local-uri-bcp] Schinazi, D., "Best Practices for Link-Local Connectivity in URI-Based Protocols", Work in Progress, Internet-Draft, draft-schinazi-httpbis-link-local-uri-bcp-03, 22 February 2024, <<https://datatracker.ietf.org/doc/html/draft-schinazi-httpbis-link-local-uri-bcp-03>>.
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- [ONE-NET] NMEA, "The OneNet Standard for IP Networking of Marine Electronic Devices", 2023, <<https://www.nmea.org/nmea-onenet.html>>.
- [RFC1918] Rekhter, Y., Moskowitz, B., Karrenberg, D., de Groot, G. J., and E. Lear, "Address Allocation for Private Internets", BCP 5, RFC 1918, DOI 10.17487/RFC1918, February 1996, <<https://www.rfc-editor.org/info/rfc1918>>.
- [RFC3493] Gilligan, R., Thomson, S., Bound, J., McCann, J., and W. Stevens, "Basic Socket Interface Extensions for IPv6", RFC 3493, DOI 10.17487/RFC3493, February 2003, <<https://www.rfc-editor.org/info/rfc3493>>.
- [RFC3986] Berners-Lee, T., Fielding, R., and L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", STD 66, RFC 3986, DOI 10.17487/RFC3986, January 2005, <<https://www.rfc-editor.org/info/rfc3986>>.
- [RFC6454] Barth, A., "The Web Origin Concept", RFC 6454, DOI 10.17487/RFC6454, December 2011, <<https://www.rfc-editor.org/info/rfc6454>>.
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- [RFC8089] Kerwin, M., "The "file" URI Scheme", RFC 8089, DOI 10.17487/RFC8089, February 2017, <<https://www.rfc-editor.org/info/rfc8089>>.
- [RFC8925] Colitti, L., Linkova, J., Richardson, M., and T. Mrugalski, "IPv6-Only Preferred Option for DHCPv4", RFC 8925, DOI 10.17487/RFC8925, October 2020, <<https://www.rfc-editor.org/info/rfc8925>>.

Appendix A. Change log

This section is to be removed before publishing as an RFC.

- * draft-carpenter-6man-zone-ui-00, 2024-01-15:
 - Initial version
- * draft-carpenter-6man-zone-ui-01, 2024-02-17:
 - Weakened use of normative keywords to allow flexibility
- * draft-carpenter-6man-zone-ui-02, 2024-02-21:
 - Note that RFC 6874 was found unimplementable.
 - Note that HTTP "origin" issues are not resolved.
 - Cite new httpbis draft.
 - Open issue: Updates: 4007 ?
- * draft-carpenter-6man-zone-ui-03, 2024-03-01:
 - Small clarifications.
 - Updated some references.
- * draft-carpenter-6man-zone-ui-04, 2024-04-01:
 - Mentioned scoped multicast addresses.
 - Mentioned inet_pton() issue.
 - Added reference.
- * draft-ietf-6man-zone-ui-00, 2024-06-28:
 - Adopted by WG.
 - Clarified inapplicability to browsers.
- * draft-ietf-6man-zone-ui-01, 2024-08-05:
 - Clarified extensions of RFC 4007.
 - Clarified relationship with RFC 5952
- * draft-ietf-6man-zone-ui-02, 2024-09-05:
 - Clarified non-impact on URI syntax.
- * draft-ietf-6man-zone-ui-03, 2024-09-09:
 - Update RFC 7622 and RFC 8089 to remove citations of RFC 6874.
 - Explicit mention of cancelled update to RFC 3986.
- * draft-ietf-6man-zone-ui-04, 2024-10-14:
 - Avoid specific example of length limit.

- Added optional command line parameter.
- Split Introduction into three sections.
- Added formal update to RFC 4007.
- Added three normative keywords.
- Minor text improvements.
- * draft-ietf-6man-zone-ui-05, 2024-12-10:
 - Corrected BCP14 tags.
- * draft-ietf-6man-zone-ui-06, 2025-01-17:
 - Removed erroneous reference to ASCII.
 - Zone ID REQUIRED if o/s provides no default.
 - Noted that the cited hack is no longer maintained.
- * draft-ietf-6man-zone-ui-07, 2025-01-24:
 - Noted that non-browser use of URIs is not affected.
- * draft-ietf-6man-zone-ui-08, 2025-02-26:
 - Reworded example of RFC1918 address.
 - Refined scope of statement about web browsers.
 - Noted that implementations should make character set checks.

Appendix B. Acknowledgements

This document owes a lot to the previous discussions that led to RFC 6874 and to the abandoned ~~draft-Internet-Draft~~ [I-D.ietf-6man-rfc6874bis].

Useful comments were received from Erik Auerswald, Nick Buraglio, Martin J. Dürst, Toerless Eckert, David Farmer, Brian Haberman, Nate Karstens, Tero Kivinen, Erik Kline, Jen Linkova, Eduard Metz, Gyan Mishra, Ole Troan, David Schinazi, Jürgen Schönwälder, Michael Sweet, Martin Thomson, Éric Vyncke, Magnus Westerlund, and other participants in the 6MAN WG.

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