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B. Carpenter
Univ. of Auckland
R. Hinden
Check Point
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Representing IPv6 Zone Identifiers in Uniform Resource Identifiers
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Abstract

This document describes how the Zone Identifier of an IPv6 scoped address can be represented in a Uniform Resource Identifier that includes a literal IPv6 address. It updates [RFC 3986](#) and [RFC 4007](#).

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Internet-Draft

IPv6 Zone ID in URI

May 2012

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1. Introduction

[RFC3986] defined how a literal IPv6 address can be represented in the "host" part of a Uniform Resource Identifier (URI). Subsequently, [RFC4007] extended the text representation of limited-scope IPv6 addresses such that a zone identifier may be concatenated to an address, for purposes described in that RFC. Zone identifiers are especially useful in contexts where literal addresses are typically used, for example during fault diagnosis, 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 host where they are defined, and they are completely meaningless for any other host. Today, they are only meaningful when attached to addresses with link local scope, but it is possible that other uses might be defined in the future.

[RFC 4007](#) does not specify how zone identifiers are to be represented in URIs. Practical experience has shown that this feature is useful, in particular when using a web browser for debugging with link local addresses, but as it is undefined, it is not implemented consistently in URI parsers or in browsers.

Some versions of some browsers accept the [RFC 4007](#) syntax for scoped IPv6 addresses embedded in URIs, i.e., they have been coded to interpret the "%" sign according to [RFC 4007](#) instead of [RFC 3986](#). Clearly this approach is very convenient for users, although it formally breaches the syntax rules of [RFC 3986](#). The present document defines an alternative approach that respects and extends the rules of URI syntax.

Thus, this document updates [\[RFC3986\]](#) by adding syntax to allow a zone identifier to be included in a literal IPv6 address within a URI. It also clarifies some statements in [\[RFC4007\]](#).

It should be noted that in other contexts than a user interface, a zone identifier is mapped into a numeric zone index or interface

number. The MIB textual convention [[RFC4001](#)] and the socket interface [[RFC3493](#)] define this as a 32 bit unsigned integer. 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.

Several alternative solutions were considered while this document was developed. The Appendix briefly describes the alternatives and their advantages and disadvantages.

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. Specification

According to [RFC 4007](#), a zone identifier is attached to the textual representation of an IPv6 address by concatenating "%" followed by <zone_id>, where <zone_id> is a string identifying the zone of the address. However, [RFC 4007](#) gives no precise definition of the character set allowed in <zone_id>. There are no rules or de facto standards for this. For example, the first Ethernet interface in a host might be called %0, %1, %en1, %eth0, or whatever the implementer happened to choose.

In a URI, a literal IPv6 address is always embedded between "[" and "]". This document specifies how a <zone_id> can be appended to the address. A <zone_id> SHOULD contain only ASCII characters classified in [RFC 3986](#) as "unreserved", which conveniently excludes "]" in order to simplify parsing.

Unfortunately "%" is always treated as an escape character in a URI, and according to [RFC 3986](#) it MUST therefore itself be escaped in a URI, in the form "%25". For this reason, "-" (hyphen) is used instead as the separator when a <zone_id> is included in a URI. Thus, the scoped address fe80::a%en1 would appear in a URI as http://[fe80::a-en1].

If an operating system uses any other characters in zone or interface

identifiers that are not in the "unreserved" character set, they MUST be escaped with a "%" sign according to [RFC 3986](#).

We now present the necessary formal syntax.

In [RFC 3986](#), the IPv6 literal format is formally defined in ABNF [[RFC5234](#)] by the following rule:

```
IP-literal = "[" ( IPv6address / IPvFuture ) "]"
```

To provide support for a zone identifier, the existing syntax of IPv6address is retained, and a zone identifier may be added optionally to any literal address. This allows flexibility for unknown future uses. The rule quoted above from [RFC 3986](#) is replaced by three rules:

```
IP-literal = "[" ( IPv6addrz / IPvFuture ) "]"
```

```
ZoneID = 1*( unreserved / pct-encoded )
```

```
IPv6addrz = IPv6address [ "-" ZoneID ]
```

The rules in [[RFC5952](#)] SHOULD be applied in producing URIs.

The 6man WG discussed and rejected an alternative in which the existing syntax of IPv6address would be extended by an option to add the ZoneID only for the case of link-local addresses. It was felt that the present solution offers more flexibility for future uses and is more straightforward to implement.

[RFC 4007](#) offers guidance on how the ZoneID affects interface/address selection inside the IPv6 stack. Note that the behaviour of an IPv6 stack if passed a non-zero zone index for an address other than link-local is undefined.

[3.](#) Web Browsers

In recent years, web browsers have evolved considerably and now accept and parse many forms of input that are not a formal URI. Examples of this include host names, search items, bookmarks, search history, etc. For example the Google Chrome browser now calls the "address bar" the "omnibox" [[chrome](#)]. The authors believe it is feasible, and very convenient for users, if browsers also allow (in addition to the formal URI syntax defined in this document) a syntax that will enable cut and paste. For example:

```
http://[fe80::a%en1]
```

It seems that modern browsers can be adapted to parse this because it is inside of the "[" "]"'s. This would permit the output of commands like `ping6 -w ff02::1%en1` to be "cut and pasted" into a browser address bar. Consequently this document recommends that browsers support this syntax in addition to the formal URI syntax defined above.

4. Security Considerations

The security considerations of [[RFC3986](#)] and [[RFC4007](#)] apply. In particular, this URI format creates a specific pathway by which a deceitful zone index might be communicated, as mentioned in the final security consideration of [RFC 4007](#). It is emphasised that the format is intended only for debugging purposes, but of course this intention

does not prevent misuse.

To limit this risk, implementations SHOULD NOT allow use of this format except for well-defined usages such as sending to link local addresses under prefix `fe80::/10`.

An HTTP server or proxy MUST ignore any ZoneID attached to an incoming URI, as it only has local significance at the sending host.

5. IANA Considerations

This document requests no action by IANA.

6. Acknowledgements

The lack of this format was first pointed out by Margaret Wasserman some years ago, and more recently by Kerry Lynn. A previous draft document by Martin Duerst and Bill Fenner [[I-D.fenner-literal-zone](#)] discussed this topic but was not finalised.

Valuable comments and contributions were made by Karl Auer, Carsten Bormann, Brian Haberman, Tatuya Jinmei, Tom Petch, Tomoyuki Sahara, Juergen Schoenwaelder, and Ole Troan.

Brian Carpenter was a visitor at the Computer Laboratory, Cambridge University during part of this work.

This document was produced using the xml2rfc tool [[RFC2629](#)].

7. Change log [RFC Editor: Please remove]

[draft-ietf-6man-uri-zoneid-01](#): use "-" instead of %25, listed alternatives in Appendix, according to WG debate, added suggestion for browser developers, 2012-05-29.

[draft-ietf-6man-uri-zoneid-00](#): adopted by WG, fixed syntax to allow for % encoded characters, 2012-02-17.

[draft-carpenter-6man-uri-zoneid-01](#): chose Option 2, removed 15 character limit, added explanation of ID/number mapping and other clarifications, 2012-02-08.

[draft-carpenter-6man-uri-zoneid-00](#): original version, 2011-12-07.

8. References

8.1. Normative References

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[8.2.](#) Informative References

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- [RFC2629] Rose, M., "Writing I-Ds and RFCs using XML", [RFC 2629](#), June 1999.
- [RFC3493] Gilligan, R., Thomson, S., Bound, J., McCann, J., and W. Stevens, "Basic Socket Interface Extensions for IPv6", [RFC 3493](#), February 2003.
- [RFC4001] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", [RFC 4001](#), February 2005.
- [chrome] Google, "Use the address bar (omnibox)", 2012, <<http://support.google.com/chrome/bin/answer.py?answer=95440>>.

[Appendix A.](#) Alternatives Considered

1. Leave the problem unsolved.

This would mean that per-interface diagnostics would still have to be performed using ping or ping6:

```
ping fe80::a%en1
```

Advantage: works today.

Disadvantage: less convenient than using a browser.

2. Simply using the percent character.

```
http://[fe80::a%en1]
```

Advantage: allows use of browser, allows cut and paste.

Disadvantage: invalid syntax under [RFC 3986](#); not acceptable to URI community.

3. Escaping the escape character as allowed by [RFC 3986](#):

```
http://[fe80::a%25en1]
```

Advantage: allows use of browser.

Disadvantage: ugly and confusing, doesn't allow simple cut and paste.

4. Alternative separator

```
http://[fe80::a-en1]
```

Advantage: allows use of browser, simple syntax

Disadvantage: doesn't allow simple cut and paste.

Note: the initial proposal for this choice was to use an underscore as the separator, but it was noted that this becomes effectively invisible when a user interface automatically underlines URLs.

5. With the "IPvFuture" syntax left open in [RFC 3986](#):

```
http://[v6.fe80::a_en1]
```

Advantage: allows use of browser.

Disadvantage: ugly and redundant, doesn't allow simple cut and paste.

Authors' Addresses

Brian Carpenter
Department of Computer Science
University of Auckland
PB 92019
Auckland, 1142
New Zealand

Email: brian.e.carpenter@gmail.com

Robert M. Hinden
Check Point Software Technologies, Inc.
800 Bridge Parkway
Redwood City, CA 94065
US

Email: bob.hinden@gmail.com

