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J. Arkko
Ericsson
C. Jennings
Cisco
Z. Shelby
Sensinode

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Uniform Resource Names for Device Identifiers
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Abstract

This memo describes a new Uniform Resource Name (URN) namespace for hardware device identifiers. A general representation of device identity can be useful in many applications, such as in sensor data streams and storage, or equipment inventories. A URN-based representation can be easily passed along in any application that needs the information.

Status of This Memo

This Internet-Draft will expire on May 3, 2018.

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1. Introduction

This memo describes a new Uniform Resource Name (URN) [RFC2141] [RFC3406] namespace for hardware device identifiers. A general representation of device identity can be useful in many applications, such as in sensor data streams and storage, or equipment inventories [RFC7252], [I-D.ietf-core-senml]. A URN-based representation can be easily passed along in any application that needs the information, as it fits in protocols mechanisms that are designed to carry URNs [RFC2616], [RFC3261], [RFC7252]. Finally, URNs can also be easily carried and stored in formats such as XML [W3C.REC-xml-19980210] or JSON [I-D.ietf-core-senml] [RFC4627]. Using URNs in these formats is often preferable as they are universally recognized, self-describing, and therefore avoid the need for agreeing to interpret an octet string as a specific form of a MAC address, for instance.

This memo defines identity URN types for situations where no such convenient type already exist. For instance, [RFC6920] defines cryptographic identifiers, [RFC7254] defines International Mobile station Equipment Identity (IMEI) identifiers for use with 3GPP cellular systems, and [I-D.atarius-dispatch-meid-urn] defines Mobile Equipment Identity (MEID) identifiers for use with 3GPP2 cellular systems. Those URN types should be employed when such identities are transported; this memo does not redefine these identifiers in any way.

Universally Unique IDentifier (UUID) URNs [RFC4122] are another alternative way for representing device identifiers, and already support MAC addresses as one of type of an identifier. However, UUIDs can be inconvenient in environments where it is important that the identifiers are as simple as possible and where additional requirements on stable storage, real-time clocks, and identifier length can be prohibitive. UUID-based identifiers are recommended for all general purpose uses when MAC addresses are available as identifiers. The device URN defined in this memo is recommended for constrained environments.

Future device identifier types can extend the device device URN type defined here, or define their own URNs.

Note that long-term stable unique identifiers are problematic for privacy reasons and should be used with care or avoided as described in [RFC7721].

The rest of this memo is organized as follows. Section 3 defines the "DEV" URN type, and Section 4 defines subtypes for IEEE MAC-48, EUI-48 and EUI-64 addresses and 1-wire device identifiers. Section 5 gives examples. Section 6 discusses the security considerations of the new URN type. Finally, Section 7 specifies the IANA registration for the new URN type and sets requirements for subtype allocations within this type.

2. Requirements language

In this document, the key words "MAY", "MUST, "MUST NOT", "OPTIONAL", "RECOMMENDED", "SHOULD", and "SHOULD NOT", are to be interpreted as described in [RFC2119].

3. DEV URN Definition

Namespace ID: "dev" requested

Registration Information: This is the first registration of this namespace, 2011-08-27.

Registration version number: 1

Registration date: 2011-08-27

Declared registrant of the namespace: IETF and the CORE working group. Should the working group cease to exist, discussion should be directed to the general IETF discussion forums or the IESG.

Declaration of syntactic structure: The identifier is expressed in ASCII (UTF-8) characters and has a hierarchical structure as follows:

```
devurn = "urn:dev:" body componentpart
body = macbody / owbody / orgbody / otherbody
macbody = "mac:" hexstring
owbody = "ow:" hexstring
orgbody = "dn:" number ":" identifier
otherbody = subtype ":" identifier
subtype = ALPHA *(DIGIT / ALPHA)
identifier = 1*unreservednout
unreservednout = ALPHA / DIGIT / "-" / "."
componentpart = [ "_" component [ componentpart ]]
component = *1(DIGIT / ALPHA)
hexstring = hexbyte /
            hexbyte hexstring
hexbyte = hexdigit hexdigit
hexdigit = DIGIT / hexletter
hexletter = "a" / "b" / "c" / "d" / "e" / "f"
number = *1DIGIT
```

The above Augmented Backus-Naur Form (ABNF) uses the DIGIT and ALPHA rules defined in [RFC5234], which are not repeated here. The rule for unreserved is defined in Section 2.3 of [RFC3986].

The device identity namespace includes three subtypes, and more may be defined in the future as specified in Section 7.

The optional components following the hexstring are strings depicting individual aspects of a device. The specific strings and their semantics are up to the designers of the device, but could be used to refer to specific interfaces or functions within the device.

Relevant ancillary documentation: See Section 4.

Identifier uniqueness considerations: Device identifiers are generally expected to be unique, barring the accidental issue of multiple devices with the same identifiers.

Identifier persistence considerations: This URN type SHOULD only be used for persistent identifiers, such as hardware-based identifiers or cryptographic identifiers based on keys intended for long-term usage.

Process of identifier assignment: The process for identifier assignment is dependent on the used subtype, and documented in the specific subsection under Section 4.

Process for identifier resolution: The device identities are not expected to be globally resolvable. No identity resolution system is expected. Systems may perform local matching of identities to previously seen identities or configured information, however.

Rules for Lexical Equivalence: The lexical equivalence of the DEV URN is defined as an exact and case sensitive string match. Note that the two subtypes defined in this document use only lower case letters, however. Future types might use identifiers that require other encodings that require a more full-blown character set (such as BASE64), however.

Conformance with URN Syntax: The string representation of the device identity URN and of the MEID sub namespace is fully compatible with the URN syntax.

Validation Mechanism: Specific subtypes may be validated through mechanisms discussed in Section 4.

Scope: DEV URN is global in scope.

4. DEV URN Subtypes

4.1. MAC Addresses

DEV URNs of the "mac" subtype are based on the EUI-64 identifier [IEEE.EUI64] derived from a device with a built-in 64-bit EUI-64. The EUI-64 is formed from 24 or 36 bits of organization identifier followed by 40 or 28 bits of device-specific extension identifier assigned by that organization.

In the DEV URN "mac" subtype the hexstring is simply the full EUI-64 identifier represented as a hexadecimal string. It is always exactly 16 characters long.

MAC-48 and EUI-48 identifiers are also supported by the same DEV URN subtype. To convert a MAC-48 address to an EUI-64 identifier, The OUI of the Ethernet address (the first three octets) becomes the organization identifier of the EUI-64 (the first three octets). The fourth and fifth octets of the EUI are set to the fixed value FFFF hexadecimal. The last three octets of the Ethernet address become the last three octets of the EUI-64. The same process is used to convert an EUI-48 identifier, but the fixed value FFFE is used instead.

Identifier assignment for all of these identifiers rests within the IEEE.

4.2. 1-Wire Device Identifiers

The 1-Wire* system is a device communications bus system designed by Dallas Semiconductor Corporation. 1-Wire devices are identified by a 64-bit identifier that consists of 8 byte family code, 48 bit identifier unique within a family, and 8 bit CRC code [OW].

*) 1-Wire is a registered trademark.

In DEV URNs with the "ow" subtype the hexstring is a representation of the full 64 bit identifier as a hexadecimal string. It is always exactly 16 characters long. Note that the last two characters represent the 8-bit CRC code. Implementations MAY check the validity of this code.

Family code and identifier assignment for all 1-wire devices rests with the manufacturers.

4.3. Organization-Defined Identifiers

Device identifiers that have only a meaning within an organisation can also be used to represent vendor-specific or experimental identifiers or identifiers designed for use within the context of an organisation. Organisations are identified by the Private Enterprise Number [RFC2578].

5. Examples

The following three examples provide examples of MAC-based, 1-Wire, and Cryptographic identifiers:

```
   urn:dev:mac:0024befffe804ff1           # The MAC address of
                                          # Jari's laptop

   urn:dev:ow:10e2073a01080063            # The 1-Wire temperature
                                          # sensor in Jari's
                                          # kitchen

   urn:dev:ow:264437f5000000ed_humidity    # The laundry sensor's
                                          # humidity part

   urn:dev:ow:264437f5000000ed_temperature # The laundry sensor's
                                          # temperature part

   urn:dev:org:32473:123456               # Device 123456 in
                                          # the RFC 5612 example
                                          # organisation
```

6. Security Considerations

On most devices, the user can display device identifiers. Depending on circumstances, device identifiers may or may not be modified or tampered by the user. An implementation of the DEV URN MUST NOT change these properties from what they were intended. In particular, a device identifier that is intended to be immutable should not become mutable as a part of implementing the DEV URN type. More generally, nothing in this memo should be construed to override what the relevant device specifications have already said about the identifiers.

Other devices in the same network may or may not be able to identify the device. For instance, on Ethernet network, the MAC address of a device is visible to all other devices.

The URNs generated according to the rules defined in this document result in long-term stable unique identifiers for the devices. Such identifiers may have privacy and security implications because they may enable correlating information about a specific device over a long period of time, location tracking, and device specific vulnerability exploitation [RFC7721]. Also, usually there is no easy way to change the identifier. Therefore these identifiers need to be used with care and especially care should be taken avoid leaking them outside of the system that is intended to use the identifiers.

7. IANA Considerations

This document requests the registration of a new URN namespace for "DEV", as described in Section 3.

Additional subtypes for DEV URNs can be defined through IETF Review or IESG Approval [RFC5226].

Such allocations are appropriate when there is a new namespace of some type of device identifiers, defined in stable fashion and with a publicly available specification that can be pointed to.

Note that the organisation (Section 4.3) device identifiers can also be used in some cases, at least as a temporary measure. It is preferrable, however, that long-term usage of a broadly employed device identifier be registered with IETF rather than used through the organisation device identifier type.

8. References

8.1. Normative References

[IEEE.EUI64]
IEEE, "Guidelines For 64-bit Global Identifier (EUI-64)", IEEE , unknown year, <http://standards.ieee.org/db/oui/tutorials/EUI64.html>.

[OW] IEEE, "Overview of 1-Wire(R) Technology and Its Use", MAXIM http://www.maxim-ic.com/app-notes/index.mvp/id/1796, June 2008, <http://www.maxim-ic.com/app-notes/index.mvp/id/1796>.

[RFC2119] 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>.

[RFC2141] Moats, R., "URN Syntax", RFC 2141, DOI 10.17487/RFC2141, May 1997, <https://www.rfc-editor.org/info/rfc2141>.

[RFC2578] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, DOI 10.17487/RFC2578, April 1999, <https://www.rfc-editor.org/info/rfc2578>.

[RFC3406] Daigle, L., van Gulik, D., Iannella, R., and P. Faltstrom, "Uniform Resource Names (URN) Namespace Definition Mechanisms", RFC 3406, DOI 10.17487/RFC3406, October 2002, <https://www.rfc-editor.org/info/rfc3406>.

[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>.

[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", RFC 5226, DOI 10.17487/RFC5226, May 2008, <https://www.rfc-editor.org/info/rfc5226>.

[RFC5234] Crocker, D., Ed. and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", STD 68, RFC 5234, DOI 10.17487/RFC5234, January 2008, <https://www.rfc-editor.org/info/rfc5234>.

8.2. Informative References

[I-D.atarius-dispatch-meid-urn] Atarius, R., "A Uniform Resource Name Namespace for the Device Identity and the Mobile Equipment Identity (MEID)", draft-atarius-dispatch-meid-urn-13 (work in progress), October 2017.

[I-D.ietf-core-senml] Jennings, C., Shelby, Z., Arkko, J., Keranen, A., and C. Bormann, "Media Types for Sensor Measurement Lists (SenML)", draft-ietf-core-senml-10 (work in progress), July 2017.

[RFC2616] Fielding, R., Gettys, J., Mogul, J., Frystyk, H., Masinter, L., Leach, P., and T. Berners-Lee, "Hypertext Transfer Protocol -- HTTP/1.1", RFC 2616, DOI 10.17487/RFC2616, June 1999, <https://www.rfc-editor.org/info/rfc2616>.

[RFC3261] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and E. Schooler, "SIP: Session Initiation Protocol", RFC 3261, DOI 10.17487/RFC3261, June 2002, <https://www.rfc-editor.org/info/rfc3261>.

[RFC3971] Arkko, J., Ed., Kempf, J., Zill, B., and P. Nikander, "SEcure Neighbor Discovery (SEND)", RFC 3971, DOI 10.17487/RFC3971, March 2005, <https://www.rfc-editor.org/info/rfc3971>.

[RFC3972] Aura, T., "Cryptographically Generated Addresses (CGA)", RFC 3972, DOI 10.17487/RFC3972, March 2005, <https://www.rfc-editor.org/info/rfc3972>.

[RFC4122] Leach, P., Mealling, M., and R. Salz, "A Universally Unique IDentifier (UUID) URN Namespace", RFC 4122, DOI 10.17487/RFC4122, July 2005, <https://www.rfc-editor.org/info/rfc4122>.

[RFC4627] Crockford, D., "The application/json Media Type for JavaScript Object Notation (JSON)", RFC 4627, DOI 10.17487/RFC4627, July 2006, <https://www.rfc-editor.org/info/rfc4627>.

[RFC5612] Eronen, P. and D. Harrington, "Enterprise Number for Documentation Use", RFC 5612, DOI 10.17487/RFC5612, August 2009, <https://www.rfc-editor.org/info/rfc5612>.

[RFC6920] Farrell, S., Kutscher, D., Dannewitz, C., Ohlman, B., Keranen, A., and P. Hallam-Baker, "Naming Things with Hashes", RFC 6920, DOI 10.17487/RFC6920, April 2013, <https://www.rfc-editor.org/info/rfc6920>.

[RFC7252] Shelby, Z., Hartke, K., and C. Bormann, "The Constrained Application Protocol (CoAP)", RFC 7252, DOI 10.17487/RFC7252, June 2014, <https://www.rfc-editor.org/info/rfc7252>.

[RFC7254] Montemurro, M., Ed., Allen, A., McDonald, D., and P. Gosden, "A Uniform Resource Name Namespace for the Global System for Mobile Communications Association (GSMA) and the International Mobile station Equipment Identity (IMEI)", RFC 7254, DOI 10.17487/RFC7254, May 2014, <https://www.rfc-editor.org/info/rfc7254>.

[RFC7721] Cooper, A., Gont, F., and D. Thaler, "Security and Privacy Considerations for IPv6 Address Generation Mechanisms", RFC 7721, DOI 10.17487/RFC7721, March 2016, <https://www.rfc-editor.org/info/rfc7721>.

[W3C.REC-xml-19980210]
Sperberg-McQueen, C., Bray, T., and J. Paoli, "XML 1.0 Recommendation", World Wide Web Consortium FirstEdition REC-xml-19980210, February 1998, <http://www.w3.org/TR/1998/REC-xml-19980210>.

Appendix A. Changes from Previous Version

Version -05 made a change to the delimiter for parameters within a DEV URN. Given discussions on allowed character sets in SenML [I-D.ietf-core-senml], we would like to suggest that the "_" character be used instead of ";", to avoid the need to translate DEV URNs in SenML-formatted communications or files. However, this reverses the earlier decision to not use unreserved characters. This also means that device IDs cannot use "_" characters, and have to employ other characters instead. Feedback on this decision is sought.

Version -05 also introduced local or organisation-specific device identifiers. Organisations are identified by their PEN number (although we considered FQDNs as a potential alternative. The authors belive an organisation-specific device identifier type will make experiments and local use easier, but feedback on this point and the choice of PEN numbers vs. other possible organisation identifiers would be very welcome.

Version -05 also added some discussion of privacy concerns around long-term stable identifiers.

Finally, version -05 clarified the situations when new allocations within the registry of possible device identifier subtypes is appropriate.

Version -04 is a refresh, as the need and interest for this specification has re-emerged. And the editing author has emerged back to actual engineering from the depths of IETF administration.

Version -02 introduced several changes. The biggest change is that with the NI URNs [RFC6920], it was no longer necessary to define cryptographic identifiers in this specification. Another change was that we incorporated a more generic syntax for future extensions; non-hexstring identifiers can now also be supported, if some future device identifiers for some reason would, for instance, use BASE64. As a part of this change, we also changed the component part separator character from '-' to ';' so that the general format of the rest of the URN can employ the unreserved characters [RFC3986].

Appendix B. Acknowledgments

The authors would like to thank Ari Keranen, Stephen Farrell, Christer Holmberg, Peter Saint-Andre, Wouter Cloetens, and Ahmad Muhanna for interesting discussions in this problem space. We would also like to note prior documents that focused on specific device identifiers, such as [RFC7254] or [I-D.atarius-dispatch-meid-urn].

Authors' Addresses

Jari Arkko
Ericsson
Jorvas 02420
Finland

Email: jari.arkko@piuha.net

Cullen Jennings
Cisco
170 West Tasman Drive
San Jose, CA 95134
USA

Phone: +1 408 421-9990
Email: fluffy@cisco.com

Zach Shelby
Sensinode
Kidekuja 2
Vuokatti 88600
FINLAND

Phone: +358407796297
Email: zach@sensinode.com