

Distributed Mobility Management [dmm]
Internet-Draft
Intended status: Standards Track
Expires: July 21, 2017

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January 17, 2017

**MN Identifier Types for [RFC 4283](#) Mobile Node Identifier Option
draft-ietf-dmm-4283mnids-04.txt**

Abstract

Additional Identifier Types are proposed for use with the Mobile Node Identifier Option for MIPv6 ([RFC 4283](#)).

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[1.](#) Introduction

The Mobile Node Identifier Option for MIPv6 [[RFC4283](#)] has proved to be a popular design tool for providing identifiers for mobile nodes during authentication procedures with AAA protocols such as Diameter [[RFC3588](#)]. To date, only a single type of identifier has been specified, namely the MN NAI. Other types of identifiers are in common use, and even referenced in [RFC 4283](#). In this document, we propose adding some basic types that are defined in various telecommunications standards, including types for IMSI [[ThreeGPP-IDS](#)], P-TMSI [[ThreeGPP-IDS](#)], IMEI [[ThreeGPP-IDS](#)], and GUTI [[ThreeGPP-IDS](#)]. In addition, we specify the IPv6 address itself and

IEEE MAC-layer addresses as mobile node identifiers. Defining identifiers that are tied to the physical elements of the device (RFID, MAC address etc.) help in deployment of Mobile IP because in many cases such identifiers are the most natural means for uniquely identifying the device, and will avoid additional look-up steps that might be needed if other identifiers were used.

2. 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 [\[RFC2119\]](#).

3. New Mobile Node Identifier Types

The following types of identifiers are commonly used to identify mobile nodes. For each type, references are provided with full details on the format of the type of identifier.

The Tag Data standard promoted by Electronic Product Code(TM) (abbreviated EPC) supports several encoding systems or schemes including

- o RFID-GID (Global Identifier),
- o RFID-SGTIN (Serialized Global Trade Item Number),
- o RFID-SSCC (Serial Shipping Container),
- o RFID-SGLN (Global Location Number),
- o RFID-GRAI (Global Returnable Asset Identifier),
- o RFID-DOD (Department of Defense ID), and
- o RFID-GIAI (Global Individual Asset Identifier).

For each RFID scheme except GID, there are two variations: a 64-bit scheme (for example, SGLN-64) and a 96-bit scheme (SGLN-96). GID has only a 96-bit scheme. Within each scheme, an EPC identifier can be represented in a binary form or other forms such as URI.

The following list includes the above RFID types as well as various other common identifiers and several different types of DUIDs.

Mobile Node Identifier Description

Identifier Type	Description	Reference
IPv6 Address		[RFC4291]
IMSI	International Mobile	[ThreeGPP-IDS]

	Subscriber Identity	
P-TMSI	Packet-Temporary Mobile Subscriber Identity	[ThreeGPP-IDS]
GUTI	Globally Unique Temporary ID	[ThreeGPP-IDS]
EUI-48 address	48-bit Extended Unique Identifier	[IEEE802]
EUI-64 address	64-bit Extended Unique Identifier-64 bit	[IEEE802]
DUID-LLT	DHCPv6 Unique Identifier: Link-Layer address plus timestamp	[RFC3315]
DUID-EN	DHCPv6 Unique Identifier: Enterprise Number plus add'l data	[RFC3315]
DUID-LL	DHCPv6 Unique Identifier: Link-Layer address	[RFC3315]
DUID-UUID	DHCPv6 Unique Identifier: other conformant format	[RFC6355]
RFID-SGTIN-64	64-bit Serialized Global Trade Item Number	[EPC-Tag-Data]
RFID-SSCC-64	64-bit Serial Shipping Container	[EPC-Tag-Data]
RFID-SGLN-64	64-bit Serialized Global Location Number	[EPC-Tag-Data]
RFID-GRAI-64	64-bit Global Returnable Asset Identifier	[EPC-Tag-Data]
RFID-DOD-64	64-bit Department of Defense ID	[RFID-DoD-spec]
RFID-GIAI-64	64-bit Global Individual Asset Identifier	[EPC-Tag-Data]
RFID-GID-96	96-bit Global Identifier	[EPC-Tag-Data]
RFID-SGTIN-96	96-bit Serialized Global Trade Item Number	[EPC-Tag-Data]
RFID-SSCC-96	96-bit Serial Shipping Container	[EPC-Tag-Data]
RFID-SGLN-96	96-bit Serialized Global Location Number	[EPC-Tag-Data]
RFID-GRAI-96	96-bit Global Returnable Asset Identifier	[EPC-Tag-Data]
RFID-DOD-96	96-bit Department of Defense ID	[RFID-DoD-spec]
RFID-GIAI-96	96-bit Global Individual Asset Identifier	[EPC-Tag-Data]
RFID-GID-URI	Global Identifier represented as URI	[EPC-Tag-Data]
RFID-SGTIN-URI	Serialized Global Trade Item Number represented as URI	[EPC-Tag-Data]
RFID-SSCC-URI	Serial Shipping Container	[EPC-Tag-Data]

		represented as URI		
	RFID-SGLN-URI	Global Location Number		[EPC-Tag-Data]
		represented as URI		
	RFID-GRAI-URI	Global Returnable Asset		[EPC-Tag-Data]
		Identifier represented as URI		
	RFID-DOD-URI	Department of Defense ID		[RFID-DoD-spec]
		represented as URI		
	RFID-GIAI-URI	Global Individual Asset		[EPC-Tag-Data]
		Identifier represented as URI		
+-----+	+-----+			+-----+

Table 1

4. Descriptions of MNID types

In this section descriptions for the various MNID types are provided.

4.1. Description of the IPv6 address type

The IPv6 address [[RFC4291](#)] is encoded as a 16 octet string containing the full IPv6 address. The IPv6 address MUST be a unicast routable IPv6 address. Multicast addresses, link-local addresses, and the unspecified IPv6 address MUST NOT be used. IPv6 Unique Local Addresses (ULAs) MAY be used, as long as any security operations making use of the ULA also take into account the domain in which the ULA is guaranteed to be unique.

4.2. Description of the IMSI MNID type

The International Mobile Subscriber Identity (IMSI) [[ThreeGPP-IDS](#)] is at most 15 decimal digits (i.e., digits from 0 through 9). The IMSI MUST be encoded as a string of octets in network order, where each digit occupies 4 bits. The last digit MUST be zero padded, if needed, for full octet size. For example an example IMSI 123456123456789 would be encoded as follows:

0x12, 0x34, 0x56, 0x12, 0x34, 0x56, 0x78, 0x90

4.3. Description of the EUI-48 address type

The IEEE EUI-48 address [[IEEE802-eui48](#)] is encoded as a 6 octet string containing the IEEE EUI-48 address.

4.4. Description of the EUI-64 address type

The IEEE EUI-64 address [[IEEE802-eui64](#)] is encoded as a 8 octet string containing the full IEEE EUI-64 address.

[4.5.](#) Description of the DUID-LLT type

The DUID-LLT is the DHCPv6 Unique Identifier (DUID) formulated by concatenating the link-layer address plus a timestamp [[RFC3315](#)]. This type of DUID consists of a two octet type field containing the value 1, a two octet hardware type code, four octets containing a time value, followed by link-layer address of any one network interface that is connected to the DHCP device at the time that the DUID is generated. The time value is the time that the DUID is generated represented in seconds since midnight (UTC), January 1, 2000, modulo 2^{32} . Since the link-layer address can be of variable length the DUID-LLT is of variable length.

[4.6.](#) Description of the DUID-EN type

The DUID-EN is the DHCPv6 Unique Identifier (DUID) formulated by concatenating the Enterprise Number plus some additional data [[RFC3315](#)]. This form of DUID is assigned by the vendor to the device. It consists of a two octet type field containing the value 2, the vendor's registered Private Enterprise Number as maintained by IANA, followed by a unique identifier assigned by the vendor. Since the vendor's unique identifier can be of variable length, the DUID-EN is of variable length.

[4.7.](#) Description of the DUID-LL type

The DUID-LL is the DHCPv6 Unique Identifier (DUID) formulated by concatenating the network hardware type code and the link-layer address [[RFC3315](#)]. This type of DUID consists of two octets containing the DUID type 3, a two octet network hardware type code, followed by the link-layer address of any one network interface that is permanently connected to the client or server device. For example, a host that has a network interface implemented in a chip that is unlikely to be removed and used elsewhere could use a DUID-LL. Since the link-layer address can be of variable length, the DUID-LL is of variable length.

[4.8.](#) Description of the DUID-UUID type

The DUID-UUID [[RFC6355](#)] is the DHCPv6 Unique Identifier based on the Universally Unique Identifier (UUID) [[RFC4122](#)]. This type of DUID consists of two octets containing the DUID type 4, followed by 128-bit UUID.

4.9. Description of the RFID types

The General Identifier (GID) that is used with RFID is composed of three fields - the General Manager Number, Object Class and Serial Number. The General Manager Number identifies an organizational entity that is responsible for maintaining the numbers in subsequent fields. GID encodings include a fourth field, the header, to guarantee uniqueness in the namespace defined by EPC.

Some of the RFID types depend on the Global Trade Item Number (GTIN) code defined in the General EAN.UCC Specifications [[EANUCCGS](#)]. A GTIN identifies a particular class of object, such as a particular kind of product or SKU.

The EPC encoding scheme for SGTIN permits the direct embedding of EAN.UCC System standard GTIN and Serial Number codes on EPC tags. In all cases, the check digit is not encoded. Two encoding schemes are specified, SGTIN-64 (64 bits) and SGTIN-96 (96 bits).

The Serial Shipping Container Code (SSCC) is defined by the EAN.UCC Specifications. Unlike the GTIN, the SSCC is already intended for assignment to individual objects and therefore does not require additional fields to serve as an EPC pure identity. Two encoding schemes are specified, SSCC-64 (64 bits) and SSCC-96 (96 bits).

The Global Location Number (GLN) is defined by the EAN.UCC Specifications. A GLN can represent either a discrete, unique physical location such as a warehouse slot, or an aggregate physical location such as an entire warehouse. In addition, a GLN can represent a logical entity that performs a business function such as placing an order. The Serialized Global Location Number (SGLN) includes the Company Prefix, Location Reference, and Serial Number.

The Global Returnable Asset Identifier (GRAI) is defined by the General EAN.UCC Specifications. Unlike the GTIN, the GRAI is already intended for assignment to individual objects and therefore does not require any additional fields to serve as an EPC pure identity. The GRAI includes the Company Prefix, Asset Type, and Serial Number.

The Global Individual Asset Identifier (GIAI) is defined by the General EAN.UCC Specifications. Unlike the GTIN, the GIAI is already intended for assignment to individual objects and therefore does not require any additional fields to serve as an EPC pure identity. The GRAI includes the Company Prefix, and Individual Asset Reference.

The DoD Construct identifier is defined by the United States Department of Defense (DoD). This tag data construct may be used to

encode tags for shipping goods to the DoD by a supplier who has already been assigned a CAGE (Commercial and Government Entity) code.

[4.9.1.](#) Description of the RFID-SGTIN-64 type

The RFID-SGTIN-64 is encoded as specified in [[EPC-Tag-Data](#)]. The SGTIN-64 includes five fields: Header, Filter Value (additional data that is used for fast filtering and pre-selection), Company Prefix Index, Item Reference, and Serial Number. Only a limited number of Company Prefixes can be represented in the 64-bit tag.

[4.9.2.](#) Description of the RFID-SGTIN-96 type

The RFID-SGTIN-96 is encoded as specified in [[EPC-Tag-Data](#)]. The SGTIN-96 includes six fields: Header, Filter Value, Partition (an indication of where the subsequent Company Prefix and Item Reference numbers are divided), Company Prefix Index, Item Reference, and Serial Number.

[4.9.3.](#) Description of the RFID-SSCC-64 type

The RFID-SSCC-64 is encoded as specified in [[EPC-Tag-Data](#)]. The SSCC-64 includes four fields: Header, Filter Value, Company Prefix Index, and Serial Reference. Only a limited number of Company Prefixes can be represented in the 64-bit tag.

[4.9.4.](#) Description of the RFID-SSCC-96 type

The RFID-SSCC-96 is encoded as specified in [[EPC-Tag-Data](#)]. The SSCC-96 includes six fields: Header, Filter Value, Partition, Company Prefix, and Serial Reference, as well as 24 bits that remain Unallocated and must be zero.

[4.9.5.](#) Description of the RFID-SGLN-64 type

The RFID-SGLN-64 type is encoded as specified in [[EPC-Tag-Data](#)]. The SGLN-64 includes five fields: Header, Filter Value, Company Prefix Index, Location Reference, and Serial Number.

[4.9.6.](#) Description of the RFID-SGLN-96 type

The RFID-SGLN-96 type is encoded as specified in [[EPC-Tag-Data](#)]. The SGLN-96 includes six fields: Header, Filter Value, Partition, Company Prefix, Location Reference, and Serial Number.

[4.9.7.](#) Description of the RFID-GRAI-64 type

The RFID-GRAI-64 type is encoded as specified in [[EPC-Tag-Data](#)]. The GRAI-64 includes five fields: Header, Filter Value, Company Prefix Index, Asset Type, and Serial Number.

[4.9.8.](#) Description of the RFID-GRAI-96 type

The RFID-GRAI-96 type is encoded as specified in [[EPC-Tag-Data](#)]. The GRAI-96 includes six fields: Header, Filter Value, Partition, Company Prefix, Asset Type, and Serial Number.

[4.9.9.](#) Description of the RFID-GIAI-64 type

The RFID-GIAI-64 type is encoded as specified in [[EPC-Tag-Data](#)]. The GIAI-64 includes four fields: Header, Filter Value, Company Prefix Index, and Individual Asset Reference.

[4.9.10.](#) Description of the RFID-GIAI-96 type

The RFID-GIAI-96 type is encoded as specified in [[EPC-Tag-Data](#)]. The GIAI-96 includes five fields: Header, Filter Value, Partition, Company Prefix, and Individual Asset Reference.

[4.9.11.](#) Description of the RFID-DoD-64 type

The RFID-DoD-64 type is encoded as specified in [[RFID-DoD-spec](#)]. The DoD-64 type includes four fields: Header, Filter Value, Government Managed Identifier, and Serial Number.

[4.9.12.](#) Description of the RFID-DoD-96 type

The RFID-DoD-96 type is encoded as specified in [[RFID-DoD-spec](#)]. The DoD-96 type includes four fields: Header, Filter Value, Government Managed Identifier, and Serial Number.

[4.9.13.](#) Description of the RFID URI types

In some cases, it is desirable to encode in URI form a specific encoding of an RFID tag. For example, an application may prefer a URI representation for report preparation. Applications that wish to manipulate any additional data fields on tags may need some representation other than the pure identity forms.

For this purpose, the fields as represented the previous sections are associated with specified fields in the various URI types. For instance, the URI may have fields such as CompanyPrefix,

ItemReference, or SerialNumber. For details and encoding specifics, consult [[EPC-Tag-Data](#)].

5. Security Considerations

This document does not introduce any security mechanisms, and does not have any impact on existing security mechanisms. Insofar as the selection of a security association may be dependent on the exact form of a mobile node identifier, additional specification may be necessary when the new identifier types are employed with the general AAA mechanisms for mobile node authorizations.

Some identifiers (e.g., IMSI) are considered to be private information. If used in the MNID extension as defined in this document, the packet including the MNID extension should be encrypted so that personal information or trackable identifiers would not be inadvertently disclosed to passive observers. Operators can potentially apply IPsec Encapsulating Security Payload (ESP) [[RFC4303](#)], with confidentiality and integrity protection for protecting the location information.

Moreover, MNIDs containing sensitive identifiers might only be used for signaling during initial network entry. Subsequent binding update exchanges might then rely on a temporary identifier allocated during the initial network entry, perhaps using mechanisms not standardized within the IETF. Managing the association between long-lived and temporary identifiers is outside the scope of this document.

6. IANA Considerations

The new mobile node identifier types defined in the document should be assigned values from the "Mobile Node Identifier Option Subtypes" registry. The following values should be assigned.

New Mobile Node Identifier Types

Identifier Type	Identifier Type Number
IPv6 Address	2
IMSI	3
P-TMSI	4
EUI-48 address	5
EUI-64 address	6
GUTI	7
DUID-LLT	8
DUID-EN	9
DUID-LL	10
DUID-UUID	11
	12-15 reserved
	16 reserved
RFID-SGTIN-64	17
RFID-SSCC-64	18
RFID-SGLN-64	19
RFID-GRAI-64	20
RFID-DOD-64	21
RFID-GIAI-64	22
	23 reserved
RFID-GID-96	24
RFID-SGTIN-96	25
RFID-SSCC-96	26
RFID-SGLN-96	27
RFID-GRAI-96	28
RFID-DOD-96	29
RFID-GIAI-96	30
	31 reserved
RFID-GID-URI	32
RFID-SGTIN-URI	33
RFID-SSCC-URI	34
RFID-SGLN-URI	35
RFID-GRAI-URI	36
RFID-DOD-URI	37
RFID-GIAI-URI	38
	39-255 reserved

Table 2

See [Section 4](#) for additional information about the identifier types.

7. Acknowledgements

The authors wish to acknowledge Hakima Chaouchi, Tatuya Jinmei, Jouni Korhonen and Sri Gundavelli for their helpful comments.

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