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A Uniform Resource Name Namespace for the Global System for Mobile Communications Association (GSMA) and the International Mobile station Equipment Identity (IMEI)

Abstract

This specification defines a Uniform Resource Name (URN) namespace for the Global System for Mobile Communications Association (GSMA) and a Namespace Specific String (NSS) for the International Mobile station Equipment Identity (IMEI), as well as an associated parameter for the International Mobile station Equipment Identity and Software Version number (IMEISV). The IMEI and IMEISV were introduced as part of the specification for the GSM and are also now incorporated by the 3rd Generation Partnership Project (3GPP) as part of the 3GPP specification for GSM, Universal Mobile Telecommunications System (UMTS), and 3GPP Long Term Evolution (LTE) networks. The IMEI and IMEISV are used to uniquely identify Mobile Equipment within these systems and are managed by the GSMA. URNs from this namespace almost always contain personally identifiable information and need to be treated accordingly.

Status of This Memo

This document is not an Internet Standards Track specification; it is published for informational purposes.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Not all documents approved by the IESG are a candidate for any level of Internet Standard; see Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7254.

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1. Introduction

This specification defines a Uniform Resource Name (URN) namespace for the Global System for Mobile Communications Association (GSMA) and a Namespace Specific String (NSS) for the International Mobile station Equipment Identity (IMEI), as well as an associated parameter for the International Mobile station Equipment Identity and Software Version number (IMEISV) as per the namespace registration requirement found in RFC 3406 [1]. The Namespace Identifier (NID) 'gsma' is for identities used in GSM, Universal Mobile Telecommunications System (UMTS), and Long Term Evolution (LTE) networks. The IMEI and the IMEISV are managed by the GSMA, so this NID is managed by the GSMA. While this specification currently defines only the 'imei' NSS under the 'gsma' NID, additional NSS under the 'gsma' NID may be specified in the future by the GSMA, using the procedure for URN NSS changes and additions (currently through the publication of future Informational RFCs approved by IETF consensus).

The IMEI is 15 decimal digits long and includes a Type Allocation Code (TAC) of 8 decimal digits and a Serial Number (SNR) of 6 decimal digits plus a Spare decimal digit. The TAC identifies the type of the Mobile Equipment and is chosen from a range of values allocated to the Mobile Equipment manufacturer in order to uniquely identify the model of the Mobile Equipment. The SNR is an individual serial number that uniquely identifies each Mobile Equipment device within the TAC. The Spare digit is used as a Check digit to validate the IMEI and is always set to the value 0 when transmitted by the Mobile Equipment.

The IMEISV is 16 decimal digits long and includes the TAC and SNR, same as for the IMEI, but also includes a 2 decimal digit Software Version Number (SVN), which is allocated by the Mobile Equipment manufacturer to identify the software version of the Mobile Equipment.

The information here is meant to be a concise guide for those wishing to use the IMEI and IMEISV as URNs. Nothing in this document should be construed to override 3GPP Technical Specification (TS) 23.003 [2], which specifies the IMEI and IMEISV.

The GSMA is a global trade association representing nearly 800 mobile phone operators across 220 territories and countries of the world. The primary goals of the GSMA are to ensure that mobile phones and wireless services work globally and are easily accessible. Further details about the GSMA's role in allocating the IMEI and the IMEISV, as well as the IMEI and IMEISV allocation guidelines, can be found in GSMA Permanent Reference Document (PRD) TS.06 [3].

2. Terminology

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 RFC 2119 [4].

3. Namespace Registration Template

Namespace ID: 'gsma'

Registration Information:

Registration version number: 1

Registration date: 2014-01-12

Declared registrant of the namespace:

Registering organization:

Name: GSM Association

Address: 1st Floor, Mid City Place,

71 High Holborn, London, England

Designated contact person:

Name: Paul Gosden

Coordinates: pgosden@gsma.com

Declaration of syntactic structure:

The identifier is expressed in American Standard Code for Information Interchange (ASCII) characters and has a hierarchical structure expressed using the Augmented Backus-Naur Form (ABNF) defined in RFC 5234 [5], as follows:

```
gsma-urn              = "urn:" gsma-NID ":" gsma-NSS
gsma-NID              = "gsma"
gsma-NSS              = imei-specifier / future-gsma-specifier
imei-specifier        = "imei:" ( imeival / ext-imei )
                                    [ ";" sw-version-param ]
                                    [ ";" imei-version-param ]
ext-imei = gsma-defined-nonempty ;GSMA defined and
                                 ;IETF consensus
                                 ;required
sw-version-param      = "svn=" software-version
imei-version-param    = "vers=" imei-version-val
software-version      = 2DIGIT
imei-version-val      = DIGIT
future-gsma-specifier = future-specifier
                              *( ";" future-param )
future-specifier      = gsma-defined-nonempty ;GSMA defined

future-param          = par-name [ EQUAL par-value ]
par-name              = gsma-defined-nonempty
par-value             = gsma-defined-nonempty
EQUAL                 = "="
gsma-defined-nonempty = 1*gsma-urn-char
gsma-urn-char         = ALPHA / DIGIT
                        / "-" / "." / "_" / "%" / ":"
```

An NSS for the IMEI is defined under the 'gsma' NID.

An IMEI is an identifier under the 'gsma' NID that uniquely identifies the mobile devices used in the GSM, UMTS, and LTE networks.

The representation of the IMEI is defined in 3GPP TS 23.003 [2]. To accurately represent an IMEI received in a cellular signaling message (see 3GPP TS 24.008 [6]) as a URN, it is necessary to convert the received binary (Binary Coded Decimal (BCD)) encoded bit sequence to a decimal digit string representation. Each field has its representation for humans as a decimal digit string with the most significant digit first.

The following ABNF includes the set of core rules in RFC 5234 [5]; the core rules are not repeated here.

A URN with the 'imei' NSS contains one 'imeival', and its formal definition is provided by the following ABNF (RFC 5234) [5]:

```
imeival  =  tac "-" snr "-" spare

tac      = 8DIGIT

snr      = 6DIGIT

spare    = DIGIT
```

<future-gsma-specifier> and <gsma-defined-nonempty> can comprise any ASCII characters compliant with the above ABNF.

The GSMA will take responsibility for the 'gsma' namespace, including the 'imei' NSS.

Additional NSS may be added for future identifiers needed by the GSMA, at their discretion. Only URNs with the 'imei' NSS are considered to be "GSMA IMEI URNs", and use in IETF protocols of other NSS that might be defined in the future will require IETF consensus.

Relevant ancillary documentation:

See IMEI Allocation and Approval Guidelines (GSMA PRD TS.06) [3] and 3GPP TS 23.003 [2].

Identifier uniqueness considerations:

Identifiers under the 'gsma' NID are defined and assigned by the GSMA after ensuring that the URNs to be assigned are unique. Uniqueness is achieved by checking against the IANA registry of previously assigned names.

Procedures are in place to ensure that each IMEI is uniquely assigned by the Mobile Equipment manufacturer so that it is guaranteed to uniquely identify that particular Mobile Equipment device.

Procedures are in place to ensure that each IMEISV is uniquely assigned by the Mobile Equipment manufacturer so that it is guaranteed to uniquely identify that particular Mobile Equipment device and the specific software version installed.

Identifier persistence considerations:

The GSMA is committed to maintaining uniqueness and persistence of all resources identified by assigned URNs.

As the NID sought is 'gsma' and "GSMA" is the long-standing acronym for the trade association that represents the mobile phone operators, the URN should also persist indefinitely (at least as long as there is a need for its use). The assignment process guarantees that names are not reassigned. The binding between the name and its resource is permanent.

The TAC and SNR portions of the IMEI and IMEISV are permanently stored in the Mobile Equipment, so they remain persistent as long as the Mobile Equipment exists. The process for TAC and SNR assignment is documented in GSMA PRD TS.06 [3], and once assigned, the TAC and SNR values are not reassigned to other Mobile Equipment devices. The SVN portion of the IMEISV may be modified by software when new versions are installed but should be persistent for the duration of the installation of that specific version of software.

Process of identifier assignment:

The GSMA will manage the <NSS> (including 'imei') and <future-gsma-specifier> identifier resources to maintain uniqueness.

The process for IMEI and IMEISV assignment is documented in GSMA PRD TS.06 [3].

Process for identifier resolution:

Since the 'gsma' NSS is not currently globally resolvable, this is not applicable.

Rules for Lexical Equivalence:

Two GSMA IMEI URNs are equivalent if they have the same 'imeival' value, and the same parameter values in the same sequential order, with the exception that the 'vers=0' parameter is to be ignored for the purposes of comparison. All of these comparisons are to be case insensitive.

Any identifier in the 'gsma' NSS can be compared using the normal mechanisms for percent-encoded UTF-8 strings (see RFC 3629 [7]).

Conformance with URN Syntax:

The string representation of the 'gsma' NID and of the 'imei' NSS is fully compatible with the URN syntax (see RFC 2141 [8]).

Validation mechanism:

The IMEI can be validated using the mechanism defined in Annex B of 3GPP TS 23.003 [2]. There is no mechanism defined to validate the SVN field of the IMEISV.

Scope: The GSMA URN is global in scope.

4. Specification

4.1. IMEI Parameters

The optional 'vers' parameter and the 'ext-imei' field in the ABNF are included for extensibility of the 'imei' NSS -- for example, if the IMEI format is extended in the future (such as with additional digits or using hex digits). In this case, the 'vers' parameter would contain a non-zero value and the 'ext-imei' would be further defined to represent the syntax of the extended IMEI format. A value of the 'vers' parameter equal to 0 or the absence of the 'vers' parameter means the URN format is compliant with the format specified here.

Any change to the format of the 'imei' NSS requires the use of the procedure for URN NSS changes and additions (currently through the publication of future Informational RFCs approved by IETF consensus). The use of the 'vers' parameter was chosen for extensibility instead of defining a new NSS (e.g., 'imei2') because it is likely that many

applications will only need to perform string compares of the 'imeival'. So, even if the format or length of the 'imeival' changes in the future, such applications should continue to work without having to be updated to understand a new NSS.

RFC 7255 [10] specifies how the GSMA IMEI URN can be used as an instance ID as specified in RFC 5626 [11]. Any future value of the 'vers' parameter other than 0, or the definition of additional parameters that are intended to be used as part of an instance ID, will require an update to RFC 7255 [10].

For example:

urn:gsma:imei:90420156-025763-0;vers=0

The IMEISV is an identifier that uniquely identifies mobile devices and their associated software versions used in the GSM, UMTS, and LTE networks. The representation of the IMEISV is defined in 3GPP TS 23.003 [2].

To represent the IMEISV, the URN parameter 'svn' is appended to the GSMA IMEI URN and set equal to the decimal string representation of the two software version number (svn) digits in the IMEISV, and the Spare digit in the IMEI 'imeival' is set to zero.

For example:

urn:gsma:imei:90420156-025763-0;svn=42

4.2. IMEI Format

4.2.1. Type Allocation Code (TAC)

The TAC is an 8 decimal digit value. The TAC identifies the type of the Mobile Equipment and is chosen from a range of values allocated to the Mobile Equipment manufacturer in order to uniquely identify the model of the Mobile Equipment.

4.2.2. Serial Number (SNR)

The SNR is a 6 decimal digit value. The SNR is an individual serial number that uniquely identifies each Mobile Equipment device within the TAC.

4.2.3. Spare

The Spare is a single decimal digit. When the IMEI is stored on the Mobile Equipment and network equipment, it contains a value that is used as a Check digit and is intended to avoid manual reporting errors (e.g., when customers register stolen mobiles at the operator's customer care desk) and also to help guard against the possibility of incorrect entries being provisioned in the network equipment. The Spare is always set to zero when transmitted by the Mobile Equipment (including when in the IMEI URN format). Annex B of 3GPP TS 23.003 [2] specifies a mechanism for computing the actual Check digit in order to validate the TAC and SNR.

4.2.4. Binary Encoding

When included in a cellular signaling message, the IMEI format is 15 decimal digits encoded in 8 octets, using BCD as defined in 3GPP TS 24.008 [6]. Figure 1 is an abstract representation of a BCD-encoded IMEI stored in memory (the actual storage format in memory is implementation specific). In Figure 1, the most significant digit of the TAC is coded in the least significant bits of octet 1. The most significant digit of the SNR is coded in the least significant bits of octet 5. The Spare digit is coded in the least significant bits of octet 8. When included in an identity element in a cellular signaling message, the most significant digit of the TAC is included in digit 1 of the identity element in Figure 10.5.4 of 3GPP TS 24.008 [6].

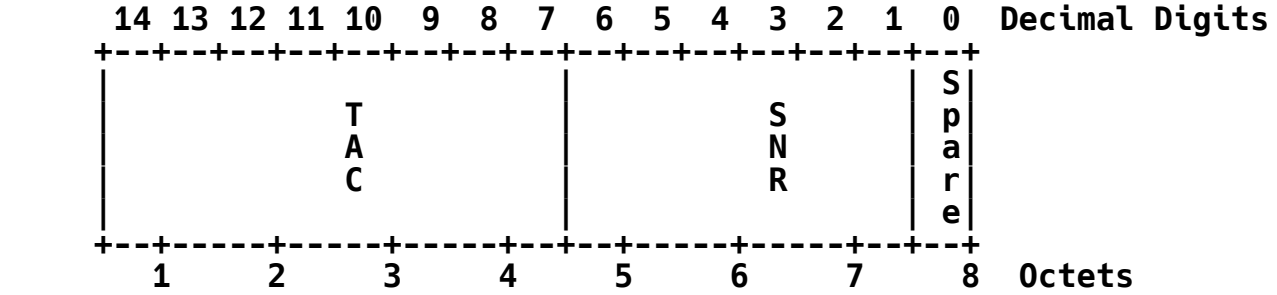

Figure 1: IMEI Format

4.3. IMEISV Format

4.3.1. Type Allocation Code (TAC)

The TAC is the same as the TAC in the IMEI (see Section 4.2.1).

4.3.2. Serial Number (SNR)

The SNR is the same as the SNR in the IMEI (see Section 4.2.2).

4.3.3. Software Version Number (SVN)

The Software Version Number is allocated by the mobile device manufacturer to identify the software version of the mobile device.

4.3.4. Binary Encoding

When included in a cellular signaling message, the IMEISV format is 16 decimal digits encoded in 8 octets using BCD as defined in 3GPP TS 24.008 [6]. Figure 2 is an abstract representation of a BCD-encoded IMEISV stored in memory (the actual storage format in memory is implementation specific). In Figure 2, the most significant digit of the TAC is coded in the most significant bits of octet 1. The most significant digit of the SNR is coded in the most significant bits of octet 5. The most significant digit of the SVN is coded in the most significant bits of octet 8. When included in an identity element in a cellular signaling message, the most significant digit of the TAC is included in digit 1 of the identity element in Figure 10.5.4 of 3GPP TS 24.008 [6].

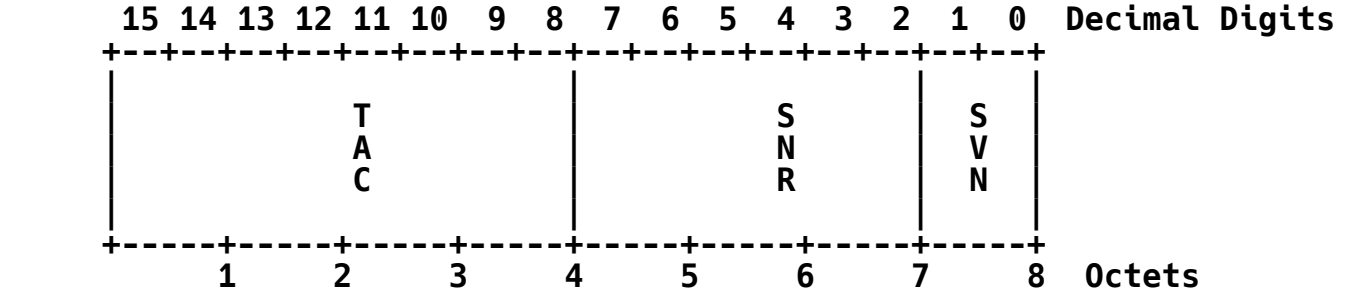

Figure 2: IMEISV Format

5. Community Considerations

GSM, UMTS, and LTE mobile devices will be interoperating with Internet devices for a variety of voice and data services. To do this, they need to make use of Internet protocols that will operate end to end between devices in GSM/UMTS/LTE networks and those in the general Internet. Some of these protocols require the use of URNs as identifiers. Within the GSM/UMTS/LTE networks, mobile devices are identified by their IMEI or IMEISV. Internet users will need to be able to receive and include the GSMA URN in various Internet protocol elements to facilitate communication between pure Internet-based devices and GSM/UMTS/LTE mobile devices. Thus, the existence and

syntax of these namespaces need to be available to the general Internet community, and the namespace needs to be reserved with IANA in order to guarantee uniqueness and prevent potential namespace conflicts both within the Internet and within GSM/UMTS/LTE networks. Conversely, Internet implementations will not generally possess IMEI identifiers. The identifiers generated by such implementations will typically be URNs within namespaces other than 'gsma' and may, depending on context, even be non-URN URIs. Implementations are advised to be ready to process URIs other than 'gsma' namespaced URNs, so as to aid in interoperability.

6. Namespace Considerations

A URN was considered the most appropriate URI to represent the IMEI and IMEISV, as these identifiers may be used and transported similarly to the Universally Unique Identifier (UUID), which is defined as a URN in RFC 4122 [12]. Since specifications for protocols that are used to transport device identifiers often require the device identifier to be globally unique and in the URN format, it is necessary that the URN formats are defined to represent the IMEI and IMEISV.

7. IANA Considerations

In accordance with BCP 66 (RFC 3406) [1], IANA has registered the Formal URN Namespace 'gsma' in the "Uniform Resource Names (URN) Namespaces" registry, using the registration template presented in Section 3 of this document.

8. Security and Privacy Considerations

IMEIs (but with the Spare value set to the value of the Check digit) are displayable on most mobile devices and in many cases are printed on the case within the battery compartment. Anyone with brief physical access to the mobile device can therefore easily obtain the IMEI. Therefore, IMEIs MUST NOT be used as security capabilities (identifiers whose mere possession grants access). Unfortunately, there are currently examples of some applications that are using the IMEI for authorization. Also, some service provider's customer service departments have been known to use knowledge of the IMEI as "proof" that the caller is the legitimate owner of the mobile device. Both of these are inappropriate uses of the IMEI.

While the specific software version of the mobile device only identifies the lower-layer software that has undergone and passed certification testing, and not the operating system or application software, the software version could identify software that is vulnerable to attacks or is known to contain security holes.

Therefore, the IMEISV MUST only be delivered to trusted entities within carrier networks and not provided to the Internet at large, as it could help a malicious device identify that the mobile device is running software that is known to be vulnerable to certain attacks. This concern is similar to concerns regarding the use of the User-Agent header in the Session Initiation Protocol (SIP) as specified in RFC 3261 [13]. Therefore, the IMEISV (that is, the IMEI URN with a 'svn' parameter) MUST NOT be delivered to devices that are not trusted. IMEIs are almost always personally identifiable information, and so these URNs MUST be treated as personally identifiable information in all cases. In order to prevent violating a user's privacy, the IMEI URN MUST NOT be included in messages intended to convey any level of anonymity.

Since the IMEI is permanently assigned to the mobile device and is not modified when the ownership of the mobile device changes (even upon a complete software reload of the device), the IMEI URN MUST NOT be used as a user identifier or user address by an application. Using the IMEI to identify a user or as a user address could result in communications destined for a previous owner of a device being received by the new device owner or could allow the new device owner to access information or services owned by the previous device owner.

Additionally, since the IMEI identifies the mobile device, it potentially could be used to identify and track users for the purposes of surveillance and call data mining if sent in the clear.

Since the IMEI is personally identifiable information, uses of the IMEI URN with IETF protocols require a specification and IETF Expert Review [14] in order to ensure that privacy concerns are appropriately addressed. Protocols carrying the IMEI URN SHOULD at a minimum use channels that are strongly hop-by-hop encrypted, and it is RECOMMENDED that end-to-end encryption be used.

Additional security considerations are specified in 3GPP TS 22.016 [9]. Specifically, the IMEI is to be incorporated in a module that is contained within the terminal. The IMEI SHALL NOT be changed after the terminal's production process. It SHALL resist tampering, i.e., manipulation and change, by any means (e.g., physical, electrical, and software).

9. Acknowledgements

This document draws heavily on the 3GPP work on Numbering, Addressing, and Identification in 3GPP TS 23.003 [2] and also on the style and structure used in RFC 4122 [12]. The authors would like to thank Cullen Jennings, Lisa Dusseault, Dale Worley, Ivo Sedlacek, Atle Monrad, James Yu, Mary Barnes, Tim Bray, S. Moonesamy, Alexey Melnikov, Martin Duerst, John Klensin, Paul Kyzivat, Christer Holmberg, Barry Leiba, and Stephen Farrell for their help and comments.

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