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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)

draft-montemurro-gsma-imei-urn-18

Abstract

This specification specifies a Uniform Resource Name namespace for the GSMA (Global System for Mobile communications Association) and a Namespace Specific String (NSS) for the IMEI (International Mobile station Equipment Identity), and an associated parameter for the IMEISV (International Mobile station Equipment Identity and Software Version number). The IMEI is 15 decimal digits long and the IMEISV is 16 decimal digits long and both are encoded using Binary Encoded Decimal (BCD). The IMEI and IMEISV were introduced as part of the specification for Global System for Mobile communications (GSM) and are also now incorporated by the 3rd Generation Partnership Project (3GPP) as part of the 3GPP specification for GSM, the Universal Mobile Telecommunications System (UMTS) and 3GPP LTE (Long Term Evolution). The IMEI and IMEISV are used to uniquely identify Mobile Equipment within these systems and are managed by the GSMA.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on May 24, 2014.

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1. Introduction

This specification specifies a Uniform Resource Name (URN) namespace for the GSMA (GSM Association) and a NSS for the IMEI (International Mobile station Equipment Identity), and associated parameter for the Software Version number from the IMEISV (International Mobile station Equipment Identity and Software Version number) as per the namespace registration requirement found in RFC 3406 [1]. The NID (Namespace Identifier) 'gsma' is for identities used in GSM, UMTS and LTE networks. The IMEI and the IMEISV are managed by the GSMA, so this NID is managed by the GSMA. Whilst this specification currently specifies 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 conensus).

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 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 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] that specifies the IMEI and IMEISV.

The GSM Association (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 mobile phones and wireless services work globally and are easily accessible. Further details about the GSMA role in allocating the IMEI and the IMEISV and 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' requested

Registration Information:

Registration version number: 1

Registration date: 2013-10-18

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-string ;GSMA defined
                                        ;and IETF
                                        ;consensus
                                        ;required
sw-version-param = "svn=" software-version-string
imei-version-param = "vers=" imei-version-val
software-version-string = 2DIGIT
imei-version-val = DIGIT
future-gsma-specifier = gsma-defined-nonempty-string ;GSMA
                                                     ;defined
                                                     ;and IETF
                                                     ;consensus
                                                     ;required
gsma-defined-nonempty-string = 1*gsma-urn-char
gsma-urn-char  = ALPHA / DIGIT
               / "-" / "." / "_" / "%"/":"/";"/"="
```

A 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 augmented Backus-Naur Form (ABNF) includes the set of core rules in RFC 5234 [5], and 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
```

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

The GSMA will take responsibility for the NSS 'imei'.

Additional NSS may be added for future identifiers needed by the GSMA using the procedure for URN NSS changes and additions (currently through the publication of future Informational RFCs approved by IETF consensus).

Relevant ancillary documentation:

See IMEI Allocation and Approval Guidelines [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. 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 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 IMEISVs 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 the TAC and SNR values once assigned are not re-assigned to other Mobile Equipment. 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:
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 'gsma' NSS can be compared using the normal mechanisms for percent-encoded UTF-8 strings (see RFC 3629 [10]) .

Conformance with URN Syntax:
The string representation of the 'gsma' NID and of the IMEI NSS is fully compatible with the URN syntax.

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: 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 specified here requires the use of the procedure for URN NSS changes and additions (currently the publication of a future Informational RFCs approved by IETF consensus). The reason why use of the 'vers' parameter was chosen for extensibility instead of defining a new NSS (e.g. 'imei2') is that 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.

draft-allen-dispatch-imei-urn-as-instanceid-12 [11] specifies how the GSMA IMEI URN can be used as an instance ID as specified in RFC 5626 [12]. Any future value of the 'vers' parameter other than equal to 0 or the definition of additional parameters that are intended to be used as part of an instance ID will require an update to draft-allen-dispatch-imei-urn-as-instanceid-12 [11].

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 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].

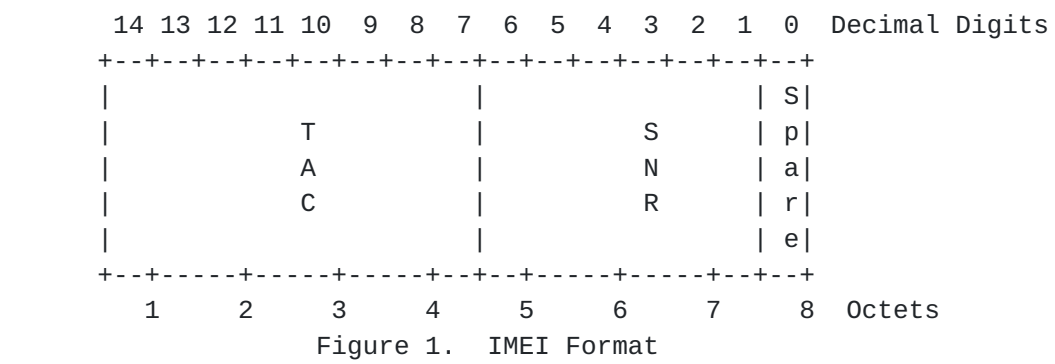

Figure 1. IMEI Format

4.3. IMEISV Format

4.3.1. Type Allocation Code (TAC)

The TAC is the same as the TAC in the IMEI in Section 4.2.1.

4.3.2. Serial Number (SNR)

The SNR is the same as the SNR in the IMEI in 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 URN's 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 needs 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 [10]. 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 is asked to register the Formal URN Namespace 'gsma' in the Registry of URN Namespaces, using the registration template presented in Section 3 of this document.

8. Security 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). Unfortuantely there are currently examples of some applications which are using the IMEI for authorisation. 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.

Whilst 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 there is still a possibility that the software version could identify software that is vulnerable to attacks or is known to contain security holes. Therfore care SHOULD be taken regarding use of the IMEISV 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 is a similar concern to the use of the User-Agent header in SIP (Session Initiation Protocol) 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. Further, because IMEIs can be loosely correlated to a user, they need to be treated as any other personally identifiable information. 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 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 surveillence and call data mining if sent in the clear.

Additional security considerations are specified in 3GPP TS 22.016 [7]. Specifically the IMEI is to be incorporated in a module which 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 [10]. 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 and John Klensin for their help and comments.

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