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-17

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.

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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
   concensus).

   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 [";" sw-version-param]
                                       [";" imei-version-param]
      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 concensus).

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 is 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). 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
concensus). 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-11 [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-11 [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].

```
    14 13 12 11 10  9  8  7  6  5  4  3  2  1  0  Decimal Digits
    +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
    |                    |                 | S|
    |           T        |           S     | p|
    |           A        |           N     | a|
    |           C        |           R     | r|
    |                    |                 | e|
    +--+-----+-----+-----+--+--+-----+-----+--+--+
     1     2     3     4     5     6     7     8  Octets
                  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
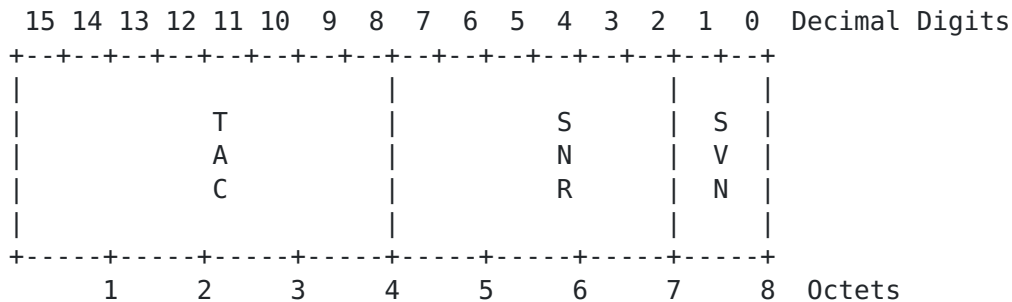included in digit 1 of the identity element in Figure 10.5.4 of 3GPP
TS 24.008 [6].

```
   15 14 13 12 11 10  9  8  7  6  5  4  3  2  1  0  Decimal Digits
   +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
   |                    |              |      |     |
   |          T         |        S     |   S  |
   |          A         |        N     |   V  |
   |          C         |        R     |   N  |
   |                    |              |      |     |
   +-----+-----+-----+-----+-----+-----+-----+-----+
      1     2     3     4     5     6     7     8  Octets
              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 survellience 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
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Authors' Addresses

   Michael Montemurro (editor)
   Blackberry
   4701 Tahoe Dr
   Mississauga, Ontario L4W 0B4
   Canada

   Email: mmontemurro@blackberry.com

   Andrew Allen
   Blackberry
   1200 Sawgrass Corporate Parkway
   Sunrise, Florida 33323
   USA

   Email: aallen@blackberry.com

   David McDonald
   Eircom

   Email: David.McDonald@meteor.ie

   Paul Gosden
   GSM Association
   1st Floor, Mid City Place, 71 High Holborn,
   London
   England

   Email: pgosden@gsma.com