The Mobile Equipment Identifier (MEID)

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Summary of Presentation
The Mobile Equipment Identifier (MEID)

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Summary
Purpose of MEID

- To identify cdma2000® terminals conforming to Release D or later.
- To allow special handling for stolen or malfunctioning devices.
- As a replacement for the ESN, which is quickly exhausting.
- Compatibility with 3GPP terminals, including multi-technology devices.

Stage I Requirements are defined in 3GPP2 S.R0048-A. This includes a detailed report from an April, 2002 Joint Experts Meeting (JEM).
Equipment vs. Subscription Identifiers

• An equipment identifier is a globally unique number for a physical piece of equipment. Equipment identifiers are 'burned' into a device, and should not be easily changed.

• A subscription identifier is a globally unique number that can be associated with (usually) a single device for the purpose of wireless communication. Examples are MIN and IMSI. The device associated with the subscription identifier may change (e.g. when a UIM is inserted into another phone).
Equipment Identifier Examples

- MAC Address is a 48 bit identifier for Ethernet and WiFi devices.
- ESN (Electronic Serial Number) is a 32 bit number invented for AMPS. Sometimes what is transmitted is not a true ESN (tESN), but a pseudo-ESN (pESN) or UIMID.
- UIMID is a 32 bit number that identifies a UIM for use on ANSI-41 networks. The UIMID may replace the ESN in ANSI-41 message.
- Pseudo-ESN (pESN) is a 32 bit hash of the MEID that will replace the true ESN in MEID-equipped terminals.
- IMEI is a 56 bit (14 decimal digit) identifier for GSM and UMTS terminals.
- MEID is an IMEI using hexadecimal digits (except for devices that also support GSM or UMTS modes).
ESN Issues

Many lessons were learned over 20 years of experience with ESN. Characteristics that will not be repeated with MEID are:

• ESN is tied to a single subscription, because of the need to match an MSID with a single ESN for HLR validation.

• ESN is used as an input to authentication.

• ESN is used to derive the Public Long Code Mask (PLCM) for CDMA phones.

• Only 256 distinct manufacturer assignment blocks existed.

• ESN codes are administered exclusively by the TIA rather than by a global assignment authority.
ESN Substitutes

It is sometimes necessary to use UIMID or pESN as a substitute for a true ESN (tESN) on radio interfaces and in the ANSI-41 networks:

- **UIMID** is stored on a UIM and used to maintain the static MSID/ ‘ESN’ association required by ANSI-41 validation and CAVE authentication. Each UIMID should be unique, not matching any other UIMID or tESN.

- **Pseudo ESN (pESN)** is derived from the MEID using the SHA-1 hash algorithm to reduce 56 bits to 24. pESN codes are not unique, but will not match any UIMID or tESN because they are prefixed with a distinct 8 bit manufacturer's code (decimal 128).

The first 8 bits of an ESN (manufacturer's code) distinguish a tESN from a UIMID or pESN.
MEID Format

MEID (14 Hexadecimal Digits)

<table>
<thead>
<tr>
<th>RR</th>
<th>Manufacturer Code</th>
<th>Serial Number</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
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<td>XXXXXX</td>
<td>1 0 1 1 1 2 1 3 1 4</td>
<td>15</td>
</tr>
</tbody>
</table>

Definitions of MEID Fields

Manufacturer Code.

RR - Regional Code. A0-FF are assigned by the Global Hexadecimal MEID Administrator (GHA). Other codes are reserved for use by as IMEI's. RR=99 is reserved for MEIDs that can also be used as IMEIs.

XXXXXX - 6 hexadecimal digit code assigned by the regional administrator to a manufacturer for a line of phones.

Serial Number - Assigned by manufacturer to identify an individual device.

CD - Checksum Digit. Not transmitted.
Comparison with IMEI

• MEID and IMEI are the same size (14 four-bit digits).

• MEID allows the use of hexadecimal digits (note: first digit must be “A” to “F” to distinguish MEID from IMEI).

• IMEI must be used by phones with GSM/UMTS capabilities (i.e. all 3GPP/3GPP2 multimode phones).

• The meanings of some digits within the MEID and IMEI differ slightly.

• 3GPP does not support regular transmission of the IMEI, so tracking stolen phones is difficult.

• MEID provides more unique codes (>27 x 10^{15} codes) than IMEI because of the use of hex digits and because digits are less constrained (e.g. the first two digits of IMEI are the country code of the manufacturer).
Administration & Standardization

Support for the MEID will require a number of administrative and standardization activities:

- Defining the requirements for the MEID.
- Defining the process for assigning MEID codes to manufacturers.
- Modifying radio interface and network protocols to support MEID.
- (Optional) Supporting an Equipment Identity Register to validate MEIDs.
Administration

3GPP2 is developing MEID Administrative Procedures in S.P0088 and Assignment Guidelines in S.P0089.

• A Global Hexadecimal Administrator (GHA) will assign MEID code prefixes.
• The entity to act as GHA has not yet been identified.
• Phones that also operate in GSM or UMTS modes will need to acquire an IMEI instead or use a decimal MEID from the GHA using RR=99.
MEID Support in Standards

Support for MEID in standards is still being defined. A Stage 1 description is being revised as 3GPP2 S.R0048-A. Protocol changes that are being examined are:

- Transmission of MEID from ME over Release D air interface upon request (Status Request message).
- Transmission of MEID from ME in accesses (e.g. all registrations) instead of ESN.
- Addition of MEID to IOS.
- New ANSI-41 VLR/EIR interface messages to obtain the status of an MEID.
- Addition of MEID to ANSI-41 messaging between VLR and MSC.
EIR – Equipment Identity Register

Standards for MEID will support an EIR, but the use of an EIR is a carrier option.

The EIR maintains three different lists of MEIDs, and can be queried using ANSI-41 messages (being defined):

• **White list** – A list of assigned MEID code ranges (*not* a list of individual MEID codes).

• **Black list** – A list of MEIDs that should be denied service (e.g. because they represent stolen phones or those with service-impacting hardware issues).

• **Grey list** – A list of MEIDs to be tracked (but not denied service).

EIR’s need to be globally linked or centralized to maximize their ability to track mobile equipment.
Information Flows

Basic ESN Usage
ESN with R-UIM
MEID in Backwards Compatibility Mode
MEID with R-UIM in Backwards Compatibility Mode
MEID Usage
MEID with R-UIM
Basic ESN Usage

Systems cooperate to perform validation (MIN matches ESN) and Authentication

- Serving System (MSC, VLR, BS)
  tESN, MIN

- Home System (HLR/AC)
  tESN, MIN
ESN with R-UIM

† Using the True ESN instead of the UIMID will cause problems if the UIM is moved between phones while roaming.
MEID in Backwards Compatibility Mode

Systems cooperate to perform validation (MSID matches pESN) and Authentication
MEID with R-UIM in Backwards Compatibility Mode

Systems cooperate to perform validation (MSID matches pESN† or UIMID) and Authentication

† Using the Pseudo ESN instead of the UIMID will cause problems if the UIM is moved between phones while roaming.
MEID Usage

MEID validation is a serving system responsibility. Status may be 'black', 'white' or 'grey'.

AKA authentication does not require ESN. pESN still needs to be sent to satisfy ANSI-41 requirements.
MEID with R-UIM

AKA authentication does not require ESN. pESN still needs to be sent to satisfy ANSI-41 requirements.
Summary

- MEID is the equipment identifier of the future.
- MEID provides operators with capabilities to track stolen or malfunctioning mobiles that are superior to those available with ESN or IMEI.
- It solves many of the problems with ESN, including code exhaustion.
- MEID can be tracked more reliably than GSM or UMTS can track IMEI.
- Implementation of support of MEID by carriers can be phased in as the need arises.