The Role of Standards and Progress Made

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E911 History

- The US FCC released a ‘Report and Order’ in 1996 (94–102) to provide:
  - a call-back number and cell/sector identification (‘Phase I’).
  - J-STD-034 “Wireless Enhanced Emergency Services PSAP Perspective”
  - more accurate location (‘Phase II’).
  - J-STD-036-B “Enhanced Wireless 9-1-1 Phase 2”
- This was revised in 1999 and allowed handset-based location technologies (i.e., GPS-based)
- FCC also had a schedule for handset replacement if using a handset-based solution
- FCC had service providers declare which type of location technology they were going to use (handset based or network based)
  - CDMA providers typically chose handset-based
  - GSM providers typically chose network-based
FCC Mandate Requirements

- **Wireless CDMA Handset Solution**
  - 9-1-1 call must
    - Route based on public safety instructions
    - Deliver the address of the originating cell sector
    - Callback number must be delivered regardless of subscriber network registration status or calling ID blocking settings. The callback number delivered to public safety include:
      - For registered callers, the Mobile Directory Number (MDN)
      - For non-registered callers, 911+the last 7 digits of the ESN or MEID
  - **E911 Phase II**
    - Deliver longitude and latitude (X-Y coordinates) of the mobile phone to the PSAP based upon a “re-bid” request
    - Accuracy Requirements for the handset solution:
      - 67% of the calls within 50 meters
      - 95% of the calls within 150 meters

3GPP2 LBS Specifications

  - CDMA air interface – supports 1x and HRPD
- **X.S0002-0 (TIA-881-1) MAP Location Services Enhancements**
  - Network standard to support control plane LBS
- **TSG-X X.S0009-0 (TIA-843) Wireless Intelligent Network Support for Location Based Services**
  - Defines several services using WIN (e.g., Location based routing)
  - Not deployed
- **X.S0024-0 (TIA-1020) IP-Based Location Services**
  - Similar to OMA Location (SUPL)
  - Not deployed
### 3GPP Standards for LTE Location

<table>
<thead>
<tr>
<th>Requirements</th>
<th>LTE Physical Layer (impacted by LCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.071 LCS Service Description</td>
<td>36.211 Physical Channels and Modulation</td>
</tr>
<tr>
<td>36.214 Physical Layer Measurements</td>
<td></td>
</tr>
<tr>
<td>Architecture and Feature Description</td>
<td>RAN Protocols (impacted by LCS)</td>
</tr>
<tr>
<td>23.271 Functional Description of LCS</td>
<td>36.331 RRC Protocol Specification</td>
</tr>
<tr>
<td>36.305 Functional Spec of UE Positioning</td>
<td></td>
</tr>
<tr>
<td>Core Network Interfaces and Services</td>
<td>RAN → Core Network Protocols</td>
</tr>
<tr>
<td>29.171 LCS-AP MME ↔ E-SMLC; SLs Interface</td>
<td>36.355 LTE Positioning Protocol (LPP)</td>
</tr>
<tr>
<td>29.172 ELP GMLC ↔ MME; SLg Interface</td>
<td>36.455 LTE Positioning Protocol A (LPPa)</td>
</tr>
<tr>
<td>29.173 Diameter-based SLh interface for CP LCS</td>
<td>24.301 NAS protocol for EPS</td>
</tr>
<tr>
<td>24.030 Supplementary Service Operations</td>
<td>24.413 S1-Application Protocol (S1-AP)</td>
</tr>
<tr>
<td>Operations and Maintenance</td>
<td>Performance Requirements</td>
</tr>
<tr>
<td>32.171 Telecom Mgt; Charging Mgt; LCS Charging</td>
<td>36.133 Requirements for support of RRM</td>
</tr>
<tr>
<td></td>
<td>36.171 Requirements for Support of A-GNSS</td>
</tr>
</tbody>
</table>

### 3GPP Standards Impacted for IMS Emergency Call Support in LTE

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Core Network Interfaces and Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.101 Service Aspects; Service Principles</td>
<td>23.003 Numbering, Addressing and Identification</td>
</tr>
<tr>
<td>Architecture and Feature Description</td>
<td>24.301 NAS protocol for Evolved Packet System</td>
</tr>
<tr>
<td>23.167 IMS Emergency Service Architecture</td>
<td>24.229 IMS Call Control protocol based on SIP and SDP Protocol spec for MI interface between E-CSCF and LRF</td>
</tr>
<tr>
<td>23.228 Functional Description of IMS</td>
<td>29.212 PCC over Gx Reference point</td>
</tr>
<tr>
<td>23.203 Policy and Charging Control Architecture</td>
<td>29.213 PCC Signaling Flows and QoS parameter Mapping</td>
</tr>
<tr>
<td>23.401 Evolved Packet Core for E-UTRAN Access</td>
<td>29.214 PCC over Rx Reference point</td>
</tr>
<tr>
<td>33.401 SAE: Security Architecture</td>
<td>29.272 Diameter interface between MME and HSS; S6a</td>
</tr>
<tr>
<td></td>
<td>29.274 EPC: Evolved GPRS Tunneling Protocol (GTPv2-C)</td>
</tr>
</tbody>
</table>
OMA Location Specifications

- **OMA SUPL 2.0 – Secure User Plane for Location**
  - Defines a user plane transport to support variety of access technologies and geolocation mechanisms
    - E.g., CDMA, GSM, UMTS, LTE, WiMAX
    - MS-based, Network-based, A-GPS, AFLT, EOTD...
  - Version 2.0 added Emergency Call support

  - An LTE capable SET and SLP shall support RRLP and/or TIA-801 if A-GPS or A-Galileo positioning is supported.
  - New "LTE cell info" and "LTE areaID" were added, and "LTE" was added to the list of network types that could be supported.
  - A reference to 3GPP 36.331 "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification
Glossary and Acronyms

- **Callback Number (CBN)** - Providing the telephone number of the emergency caller allows calls to be made back after the emergency call (e.g., to obtain more information)
  - A pseudo-call-back number is provided for non-subscribers, based on the ESN, IMEI or MEID. It allows identification of the caller, but not call-back.
  - Call-back uses standard inter-system call delivery (e.g., based on ANSI/TIA-41)
- **Public Safety Answering Point (PSAP)** - the ability to support 9-1-1 service depends on the establishment of “Public Safety Answering Points” which vary in size and structure from locality-to-locality; notably, the geographic territory served by these PSAPs range from a single municipality, to a large city, to a county-wide or regional district, to an entire state.
- **Automatic Number Identification (ANI)** - technology used to capture the calling number by the switching equipment in the central office; relayed to the PSAP along with the emergency call to provide the call taker with the callback number
- **Pseudo ANIs (pANIs)** - a set of non-dialable telephone numbers assigned to each cell site/antenna sector to facilitate routing
- **Selective Routing Database (SRDB)** - contains information to determine what particular PSAP relates to the pANI (and to its associated cell site/sector)
- **Master Street and Address Guide (MSAG)** - links the street address associated with the telephone number to a particular PSAP and provides information about the different emergency service agencies that respond to that location
- **Automatic Location Identification (ALI) Database** - contains the necessary association between the telephone number and the name and address information; usually situated at a central location in the network and serves numerous PSAPs
- **“nomadic”** - scenario where a VoIP subscriber can take her phone with her and use it around the world, making the provision of information difficult at times
- **Position Determining Equipment (PDE)** - estimates the position of a wireless subscriber placing the 9-1-1 call both at the start of the call and, if needed, during the progress of the call
- **Mobile Switching Center (MSC)**
- **Mobile Positioning Center (MPC)** - services provided by a third-party (TCS, Intrato), in the case of VZW
Acronyms

- A-GPS – Assisted GPS
- AFLT – Advanced Forward Link Trilateration
- E-SMLC – Evolved Serving Mobile Location Center
- GMLC – Gateway Mobile Location Center
- SGW – Serving Gateway
- PGW – PDN Gateway
- MME – Mobility Management Entity
- E-CID – Enhanced Cell ID
- OTDOA – Observed Time Difference of Arrival
- LPP – LTE Positioning Protocol
- LRF – Location Retrieval Function
- RDF – Routing Determination Function
- SUPL – Secure User Plane
- OMA – Open Mobile Alliance
- MLP – Mobile Location Protocol
- CSCF – Call Session Control Function
- ENUM – Electronic Number Mapping
- DNS – Domain Name Server
- TrFO – Transcoding Free Operation
- NNI – Network-to-network Interface