3GPP support for IP based Emergency Calls - April 2007 Status

2nd SDO Emergency Services Coordination Workshop (ESW07)
Library of Congress, Washington, DC, USA
April 10-12, 2007

Stephen Edge, Qualcomm, San Diego
(sedge@qualcomm.com)
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3GPP</td>
<td>3rd Generation Partnership Project</td>
</tr>
<tr>
<td>BGCF</td>
<td>Breakout Gateway Control Function</td>
</tr>
<tr>
<td>CS</td>
<td>Circuit Switched</td>
</tr>
<tr>
<td>CSCF</td>
<td>Call Session Control Function</td>
</tr>
<tr>
<td>CT1</td>
<td>3GPP Core Network and Terminals TSG Working Group 1</td>
</tr>
<tr>
<td>DOCSIS</td>
<td>Data Over Cable Service Interface Specification</td>
</tr>
<tr>
<td>E-CSC</td>
<td>Emergency-CSCF</td>
</tr>
<tr>
<td>EMC</td>
<td>Emergency Services Call</td>
</tr>
<tr>
<td>ESQK</td>
<td>Emergency Service Query Key</td>
</tr>
<tr>
<td>GMLC</td>
<td>Gateway Mobile Location Center</td>
</tr>
<tr>
<td>IBCF</td>
<td>Interconnection Border Control Function</td>
</tr>
<tr>
<td>I-CSCF</td>
<td>Interrogating CSCF</td>
</tr>
<tr>
<td>IMS</td>
<td>IP Multimedia Core Network Subsystem</td>
</tr>
<tr>
<td>IP-CAN</td>
<td>IP Connectivity Access Network</td>
</tr>
<tr>
<td>LRF</td>
<td>Location Retrieval Function</td>
</tr>
<tr>
<td>MGCF</td>
<td>Media Gateway Control Function</td>
</tr>
<tr>
<td>MGW</td>
<td>Media Gateway</td>
</tr>
<tr>
<td>P-CSCF</td>
<td>Proxy CSCF</td>
</tr>
<tr>
<td>PS</td>
<td>Packet Switched</td>
</tr>
<tr>
<td>RDF</td>
<td>Routing Determination Function</td>
</tr>
<tr>
<td>S-CSCF</td>
<td>Serving CSCF</td>
</tr>
<tr>
<td>SA2</td>
<td>3GPP Services and System Aspects TSG Working Group 2</td>
</tr>
<tr>
<td>TSG</td>
<td>Technical Specification Group</td>
</tr>
<tr>
<td>UE</td>
<td>User Equipment</td>
</tr>
<tr>
<td>xDSL</td>
<td>Digital Subscriber Line (all types)</td>
</tr>
</tbody>
</table>
Introduction

• Development of support for IP Based Emergency Calls has been ongoing in 3GPP since March 2003
• Development scope covers IP based emergency calls originated from 3GPP associated wireless networks and from ETSI TISPAN supported fixed broadband networks (xDSL and DOCSIS)
• Development started with a Technical Report (3GPP TR 23.867) in 3GPP TSG SA2 which evaluated requirements and different solutions
• Development has now progressed to a design specification (stage 2 – 3GPP TS 23.167) in SA2 that is almost 100% complete for Release 7 and associated IMS/SIP signaling enhancements in CT1 (stage 3 – 3GPP TS 24.229)
• This presentation focuses on the content of TS 23.167
• This specification (and others) are freely available at ftp.3gpp.org
• The presentation, though intended to be accurate, balanced and objective, contains the views of the author only and has not been seen or endorsed by 3GPP
• Changes to the first presentation at ESW06 (October 2006) are shown in red or (for a whole slide) with a pink background – these represent progress during the last 6 months and details missing earlier
Key Assumptions

- Use the CS domain for EMC if not specifically guided to use the PS domain
- Solution mostly independent of the access network type
- Support cellular access, fixed broadband, WLAN, nomadic access
- Support a variety of emergency SIP/TEL URIs (as in 3GPP TS 22.101)
- Prioritize an EMC
- UE normally detects an EMC but network must be able to detect also
- Support an unregistered (unauthenticated) UE where regulations allow
- Support is mostly in the visited (serving) network
- PSAP can be IP capable or PSTN legacy
- Support callback to a registered UE
- Support location provision to a PSAP
- Support a location query key (e.g. ESQK in the US)
UE Impacts

• Should be able to detect an emergency session establishment request
• Select the CS or PS domain for the emergency session as follows
  – Use CS if the UE is CS attached but not PS attached
  – Use PS if the UE is PS attached but not CS and if the PS domain supports emergency calls
  – Give preference to CS if the UE is attached to both domains
  – Retry the call in the other domain if an attempt in one domain fails
• Must perform an emergency registration unless already IMS registered and in the home network
• Use a special emergency Public User Identifier (SIP URI) in the IMS emergency registration request.
• Handle redirection responses from the P-CSCF for emergency calls initially unrecognized by the UE
  – P-CSCF can redirect to either CS domain only or CS and PS domains
• Include the following in the SIP INVITE for an emergency call
  – Emergency session indication.
  – Emergency Public User Identifier and the associated Tel URI (if available) if an IMS emergency registration was performed
  – Any registered Public User Identifier if no emergency registration
  – Optionally, type of emergency service (or possibly implied in the emergency session indication)
  – UE location information if available
  – Optionally, UE Location capabilities
- Handle registration requests (with an emergency Public User Identifier) like any other registration request and forward the request to the IBCF or I-CSCF in the user’s home network.
- Detect an emergency session establishment request.
- Reject/allow emergency requests unmarked by the UE
- Reject/allow anonymous emergency requests
  - Note that an unregistered UE would include an “anonymous user” indication and an EMC indication in the SIP INVITE
- Disallow the assertion of an emergency Public User Identifier in non-emergency requests
- May query IP-CAN for a location identifier
- Select the E-CSCF in the same network to handle the EMC
- Prioritize the EMC (implementation dependent)
- Validate any Tel URI provided by the UE
- Provide the Tel URI if aware of the Tel URI associated with the UE’s emergency Public User Identifier (if the UE provides no Tel URI)
- Able to request the UE to retry the call:
  - In the PS domain following an initial emergency registration
  - In the CS domain only
  - In the CS or PS domain (e.g. emergency call not initially detected by the UE)
- Located in the visited network
- Performs specialized S-CSCF type functions
- Receive an EMC establishment request from a P-CSCF
- Can query an LRF to retrieve location and/or routing information and determine the correct PSAP
- Route EMC establishment requests to the correct PSAP including anonymous EMC requests (e.g. unregistered UE)
- Routing and/or location retrieval functionality could also be integrated in the E-CSCF
- May indicate Location Estimate source to the PSAP (e.g. positioning method)
- Could block caller ID and location delivery to the PSAP if requested by the user and allowed by local regulations
LRF

- Can support location retrieval and routing determination
- Can contain an RDF (routing determination function) and a location server (e.g. GMLC)
- The RDF provides the correct PSAP address to the E-CSCF (Tel URI or SIP URI)
- The RDF could also manage ESQK allocation in the US
- LRF may retrieve or use an interim location (for routing)
- LRF can be used for subsequent accurate location
  - LRF stores a record of the EMC
  - E-CSCF notifies the LRF when EMC is released
  - LRF provides correlation information to the E-CSCF for transfer to the PSAP in the EMC establishment request (e.g. an ESQK)
  - PSAP uses correlation information when requesting location directly from the LRF
• Step 6: Registration is in the home network – UE provides an Emergency Public User Identity
• Step 6 is skipped by a UE with insufficient credentials for authentication and may be skipped by a UE that is already IMS registered and served by the home network
• In step 7, the UE includes an emergency service indication and/or an emergency public user identity
EMC Establishment using the LRF

1. UE initiates the emergency session

2. if required, retrieve UE location

3. if required, retrieve PSAP routing information

4. E-CSCF routes the emergency session based on routing destination from LRF

- Step 1 – SIP INVITE sent from UE to the P-CSCF and then E-CSCF
- Step 2 – E-CSCF may query LRF for location information
- Step 3 – LRF can invoke RDF to determine PSAP
- Step 4 – LRF returned information used to route the EMC
Emergency Services Registration

- Similar to but distinct from normal registration (e.g. both may occur)
- Required if the UE has sufficient credentials to authenticate with the IMS network and is not served by the home network or not yet IMS registered
- UE inserts an emergency Public User Identifier in the registration request
  - Format is sip:user@sos.domain if the normal SIP URI is sip:user@domain
- The Registration is sent to the Visited Network P-CSCF and then Home Network (e.g. S-CSCF)
- The P-CSCF may override the normal registration duration – e.g. to comply with local regulations on call back time
- The main purposes are:
  - Authenticate the UE identity at the IMS level in the visited network
  - Obtain a verified callback address (SIP URI and Tel URI)
  - Ensure that callback via the home network will succeed
  - Enable the home network to suppress supplementary services on callback (e.g. call waiting)
  - Enable provision of EMC service to roaming users (including authentication and callback) where no normal roaming agreement exists between the visited and home networks
- But there are some issues
  - Must be completed before call origination can start (hence adds delay)
  - Tel URI still needs to be resolved
Location Retrieval

1. Init. Emerg. Call

2. Acquire location

3. INVITE (emergency)

4. Retrieve Location-routing information

5. Procedure to obtain the UE's location

6. Return Location-routing information

7a. INVITE (emergency)

7b. IAM

7c. INVITE (emergency)

8. Complete Emergency Call Establishment

9. Retrieve location

10. Procedure to obtain the initial or updated location

11. Return location

12. Release Emergency Call

13. Release call record
Other Impacts

- Additional Impacts are being defined to support EMCs in different 3GPP Access Networks
- The impacts mainly concern obtaining IP connectivity and support for unregistered UEs
- The impacted access networks comprise:
  - General Packet Radio Service (GPRS) – 3GPP TS 23.060
  - Interworking WLAN (I-WLAN) – 3GPP TS 23.234
  - Fixed Broadband Access in the EU (TISPAN)
- Compatibility with the NENA i2 solution is also considered
Some Remaining Issues

- Definition of Tel URI associated with a UE’s emergency SIP URI
  - Using an existing Tel URI (e.g. MSISDN) may cause problems if the same Tel URI also needs to be normally registered and available for normal originating and terminating calls
  - Don’t want to assign additional permanent E.164 numbers to UEs
  - Temporary E.164 number assignment by home network is problematic (though a possible solution)
  - Current opinion is that a normal Tel URI (containing normal MSISDN) should be possible – maybe using SIP Outbound and possibly with new call back and registration impacts
  - One alternative would be a Tel URI containing the normal MSISDN and with an extra optional Tel URI parameter signifying emergency usage which avoids reusing an existing Tel URI

- Emergency registration is now fixed in Release 7 but might be improved in Release 8 to reduce delay
- Protocol for E-CSCF to LRF interface not specified in Release 7
- Support of Voice Call Continuity (VCC) is being studied for Release 8
- Possibility of supporting other access types in Release 8
Summary

- Support of IP based emergency calls is now almost complete in 3GPP Release 7
- There are a few lingering issues in Release 7 that should be resolved by June 2007
- There may be some further enhancements in Release 8
  - A work item to support VCC is already ongoing
  - Some other potential issues might also be tackled if there is a consensus – e.g. improved registration, support of other access types, E-CSCF to LRF protocol definition