Pan-European eCall: Standardization, Implementation, and Performance

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Marc Werner
Qualcomm Corporate R&D - Nuremberg, Germany
Outline

• eCall System Overview
• Qualcomm’s Role in eCall
• Standardization Status
• Implementation Guidelines
Introduction: eCall Procedures and Requirements

- In an accident, an E112 cellular voice call is automatically established (can also be triggered manually)
- Transmission of vehicle MSD (140 bytes) at the beginning of voice call
- Transmission must be fast and reliable (acknowledged)
- Pan-European operation without modifications to existing networks

- Data channels may not be available everywhere, usually not prioritized
- ‘Emergency SMS’ transmission may be delayed and not prioritized, or otherwise requires significant network changes
- eSafety initiative and GSM Europe decided that only a standardized in-band modem solution can meet the eCall requirements

GPS
eCall System Overview
eCall In-band Modem within the Cellular Architecture

- IVS or PSAP initiates MSD transmission within the 112 call (‘push’ / ‘pull’)
  - ‘push’ mode is standard for first MSD transmission
- Voice path is muted until MSD is correctly received
eCall Signaling Procedure (simplified)

**PSAP**
- PSAP operator
  - receives emergency call
  - identifies eCall (via flags or ‘push’ signal)
  - triggers MSD transmission
- PSAP modem continuously triggers MSD until it detects the incoming MSD signal
- PSAP modem detects MSD signal and continuously tries to decode MSD
- Upon correct reception, PSAP modem sends acknowledgement and then stops transmission
  - PSAP operator or application can confirm validity of MSD using higher-layer acknowledgement
- Downlink voice channel is un-muted

**IVS**
- In event of an accident, IVS automatically sets up a 112 voice call using eCall flags
- (IVS transmits eCall initiation ‘push’ signal)
- IVS modem listens for sync frames
- IVS starts transmitting MSD after detecting trigger from PSAP
- IVS continues to transmit MSD with incremental redundancy
- After reception of acknowledgement, IVS stops MSD transmissions
- Uplink voice channel is un-muted
Two Options of Indicating eCall to PSAP

- **Option 1: eCall flags for manual / automatic eCalls**
  - Telecom operator routing eCalls to an eCall-designated MSISDN

- **Option 2: IVS-initiated signalling (‘PUSH mode’)**
  - IVS initiation signalling should only start once PSAP has answered the call (i.e., indication via ISUP signalling)
  - Upon detecting the IVS-initiated signalling, the PSAP modem will request the MSD from the IVS
  - No delays for normal emergency calls
  - If PSAP is not eCall equipped, operator can still identify an eCall by the unique initiation signal

- **Options 1 and 2 will be used in parallel in first deployments**
  - IVS initiation signalling increases the overall transmission time by 0.8 – 2.0 s (1.2 s on average)
Qualcomm’s Role in eCall
Qualcomm’s Role in eCall

• **Standardization**
  – Qualcomm designed an eCall in-band modem solution for 3GPP
  – The Qualcomm modem was selected by 3GPP in a competition with two other candidates
  – Qualcomm is continues to be active in eCall-related standardization activities (3GPP, CEN, ETSI, …)

• **Products**
  – Qualcomm offers communication chipsets including eCall for IVS telematics modules
  – We do not offer eCall modules/products for PSAPs
  – PSAP demo implementation was done
    • on a laptop with ISDN card
    • on a wireless chip (QSC), with cellular modem on ARM-9 at 384 MHz
Qualcomm MDM6x00 – for Telematics applications

- **MDM6200/6600**: Qualcomm’s next generation data-centric devices
  - Selected for Telematics Program
- **Integrated baseband and RF in single package, with companion PMIC**
  - Multiband CDMA 1X, 1xEV-DO, including 1X-Advance & 1xEV-DO Rev B
  - Multiband WCDMA, including HSPA+ (Cat 9/10, Rel 7 protocol)
  - Quad-band GSM/GPRS/EDGE
- **Gen 8 GPSOne with GPS and GLONASS support**
- **Pin compatible between UMTS (MDM6200) and Multimode (MDM6600)**
- **45nm technology**
- **BMP M2M profile**
- **3GPP and 3GPP2 voice support using 3rd party audio codec**
- **Pan-European eCall support**
  - Best-in-class power consumption
  - Best-in-class board area
  - Best-in-class RF
The Junction of Car & Mobile

Expanding Vehicle Capabilities …

…Embedded Connectivity

Automotive use cases
- Emergency Assistance
- Advanced Driver Assistance Systems (ADAS)
- Navigation
- Energy management
- Electric vehicle use cases
- Entertainment
- Phone Integration

Continuity of life - built into the vehicle HMI

“Build in”

Mobile Life Use Cases

Life & Productivity
- Email
- Scheduling / Planning
- Messaging
- Following your Interests
- Social Network Participation

Bringing Life into the Vehicle…

…Phone to Car Integration

Automotive Use Cases

Bringing Life into the Vehicle…

“Bring in”
Trends for In-Vehicle Systems

Cloud-based

- FM / AM Radio, RDS
- Entertainment (A+V)
- Traffic & Energy Efficiency
- Navigation & Maps

In-Vehicle

- Navigation w/ Media Player
- Proprietary closed Arch.
- Navigation (Map Data)
- Semi-open Architecture
- Smart Caching
- Open HLOS Architecture

Increased Need for Connectivity and Processing Capabilities
Our focus: the connected car …

For passenger:
• Entertainment, Audio / Video
• Internet, Sync to mobile devices

For driver:
• Navigation, Information
• Safety, Communication

Connectivity
WWAN, WiFi, Bluetooth, USB
Wireless charging

Information & Entertainment
Navigation
Media
Audio
Video

Telematics
Connectivity, Safety, eCall

... enabled by Qualcomm
Standardization Status
eCall Standardization: 3GPP and CEN

- 3GPP eCall general description [TS 26.267](#) and Reference C-code [TS 26.268](#) (v8.0.0) first released March 2009
- Conformance testing [TS 26.269](#) first released in April 2009
- Characterization test report [TR 26.969](#) first released September 2009

- Extensive real-world testing resulted in several modem upgrades in 2010
- eCall compliance test specs were developed in 3GPP RAN5 and GERAN3 in cooperation with ETSI MSG December, 2010
Recent 3GPP Spec Upgrades

• v8.0.0: Initial release
• v8.5.0: Last major spec update, December 2010
  – Synchronization in the presence of sample slips
• v8.6.0: Minor adaptations, published March 2011
  – Contains the last set of updates based on field testing and feedback received from other vendors
  – Fully backward compatible with 8.5.0, not critical for interoperability
  – Stable version to be used in the EU’s HeERO field trials

(version numbers refer to TS 26.268 Rel-8; Rel-9 specs are derived automatically)
CEN TC 278 Specifications – about to be published

• EN 16062 Intelligent transport systems — ESafety — ECall high level application requirements (HLAP)

• EN 15722 Road transport and traffic telematics — ESafety — eCall minimum set of data

• EN 16072 Intelligent transport systems — ESafety — Pan European eCall- Operating requirements

• EN 16102 Intelligent transport systems — ECall — Operating requirements for third party support

• Status: Drafts revised and submitted for affirmation vote
Implementation Guidelines
Implementation Recommendations / Lessons Learned

• Requirements of the eCall PSAP modem:
  – Telephone interface: Jitter-free lossless PCM interface to ISDN or analog line
  – Application interface: MSD output, control input (e.g., manual Pull signal)
  – Minimization of clock drift / sample slips
    • eCall modem can handle sample slips, but slips decrease performance
  – Computing equipment / processor to run PSAP modem (ARM, PC, ...)
    • Low complexity and memory requirements
    • Implementation using offline decoding / multithreading can be used to further reduce peak processor load
    • Real-time transmit signal generation must be maintained
  – Network echo cancellers can degrade performance
    • Use of 2.1 kHz tone recommended in case of such degradation in PSAP network
    • In general, all speech processing functions should be deactivated

• Similar requirements exist for the eCall IVS modem

*Recommendations are derived from field test results and early vendor implementations*
2G/3G Connectivity for eCall IVS devices

- GSM Directive and EU Commission decision on harmonization of the 900 MHz band
  - Expect migration of GSM networks to UMTS
- By 2014, less than 15% of mobile subscriptions in the 12 largest European markets will be non-3G+
- Lifespan of private vehicles (12-15 years)

→ Careful assessment of 2G/3G support is necessary

- GSMA recommends dual-mode (2G&3G) devices for eCall
- Additional benefits of a connected in-vehicle platform
  - Provides high speed mobile connectivity for ITS services
  - Enables telematics business models
Thank you
Licensing
Licensing

PSAP Equipment

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For further information on licensing terms in relation to eCall, please contact Daniel Hermele at dhermele@qualcomm.com.