MCX Architecture and Interfaces

Agenda

- Why Mission critical services?
- How can they be implemented?
- What are the MC Services standards?
- QoS, Priority and Preemption – unpacked
- Mission critical video – example
- 4G, MC Standards and 5G - timelines
- Interoperability

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Next-gen Experience
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MCX Architecture and Interfaces

IDENTITY
SECURITY
LOCATIONING

UNIFIED EDGE SERVICES
CONTEXT-AWARE INFO MGT.
MULTIMEDIA WORKGROUP COMMS

INT INTEGRATED COMMAND & CONTROL

Situational Awareness

Edge Intelligence

- LMR NF DIRECT
- LTE INDOOR / OUTDOOR NETWORK
- 5G CAPACITY / COVERAGE NETWORK(S)
- DEPLOYABLE WIRELESS
- WIFI WIRELESS
Mission critical services

Incident detection
- Catalog
- Classify
- Notify

Incident handling
- Identity & dispatch resources
- Manage communications

Incident handling
- Voice call
- Sensor
- Location

Situational awareness
- Maps
- Plans
- Intelligence
- Video

Post-Incident
- Logging
- Analytics
- Evidence

COMMON MC SERVICES
- MC PTT
- MC VIDEO
- MC DATA
Mission critical services
Pipeline for all critical communications

Supporting the exchange of voice, video, text, images, location and other information

MCPTT/MCData/MCVideo connecting phones, radios, tablets cameras, and sensors…
Mission critical services
Consolidating information from disparate sources

MCPTT/MCData/MCVideo used to distribute it to multiple endpoints

Control Room
CALL TAKER
DISPATCH

Emergency Mgmt
ANALYSIS

Command Center
INTEL

Records & Evidence
RECORDS
Network topology

NETWORKS
- Wired & Wireless
- Multi-media
- Latency & Throughput
- Seamless & Secure

CLOUD
- Data & Video
- Metadata

FIXED AND WIRELESS

SENSORS & DEVICES
- Voice, Data, Video
- Mobile workers
- Vehicles
- Assets
- Drones

EDGE
- Aggregation points
- Sensor fusion

COMMAND POST
- Context sensitive
- Real time intelligence

COMMAND CENTRE
- Situational awareness
User services and network services

Ground Responder
- Connected responder
- Connected vehicles
- Automated responder

Network Services
- MCPTT
- IoT
- Data
- Video
- Location
- Edge Intel

User Services
- Situational awareness
- Augmented reality
- A.I. augmented workflows
- Automated dispatch

Networks
- Loc. tracking
- Cloud Access
- Edge Compute
- LP WAN
- NB IOT
- 4G LTE Adv Pro
- WiFi / WiFi 6
- Private LTE
- C-V2X
- 5G
- MCPTT
- IoT
- Data
- Video
- Location
- Edge Intel
Mission critical services

MC Services (PT-X)

GCSE (Multicast)

PSLTE

BROADBAND
4G / 5G

Identity
Groups
Location

MCPTT
MCDATA
MCVideo

Enhanced collaboration
End user options
Extended reach

Multiple media
Device flexibility
Extended service area

Hardened network
QoS, Priority & Preemption
Fast call setup
NW Slices

Extended service area
MC Services standards

- 2011: OMA PoC v2.0
- 2015: OMA PCPS and Licensed to 3GPP
- 2016: 3GPP MCPTT LTE Release 13
- 2018: 3GPP MCVideo & MCData LTE Release 14
- 2020: 3GPP MC Enhancements & LMR IWF LTE Release 15 LTE Release 16

Future:
- Mission Critical Services
- Railway
- Maritime
# 3GPP Specifications
## Introducing MC PTT

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<th>Technical Specification</th>
<th>Specification Title</th>
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<tr>
<td>TS 22.280</td>
<td>Mission Critical Services Common Requirements</td>
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<td>TS 23.280</td>
<td>Common Functional Architecture to Support Critical Services; Stage 2</td>
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<td>Minimum requirements for support of Mission Critical Push To Talk (MCPTT) service over the Gm reference point</td>
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<td>TR 26.179</td>
<td>Mission Critical Push To Talk (MCPTT); Codecs and media handling</td>
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## 3GPP Specifications Introducing MC Video and MC Data

### Technical Specification | Specification Title
---|---
TS 22.281 | Mission Critical Video (MCVideo) over LTE; Stage 1
TS 23.281 | Functional Architecture and Information Flows to Support Mission Critical Video (MCVideo); Stage 2
TS 24.281 | Mission Critical Video (MCVideo) Signalling Control; Protocol Specification

### Technical Specification | Specification Title
---|---
TS 22.282 | Mission Critical Data (MCData) over LTE; Stage 1
TS 23.282 | Functional Architecture and Information Flows to Support Mission Critical Data (MCData); Stage 2
TS 24.282 | Mission Critical Data (MCData) Signalling Control; Protocol Specification
TS 24.582 | Mission Critical Data (MCData) Media Plane Control; Protocol Specification
MCPTT Feature details

Common functions
User Creation / Authentication / Authorisation /
UE Configuration / User Profile / Key Generation
Group Creation / Group Regroup Creation / Teardown
Group Affiliation / Remote change / De-affiliation
Pre-established Session Establishment / Modification / Release

Group call features
Automatic / Manual Commencement Mode
Floor Control
Upgrade to / Cancel Emergency Group Call
Upgrade to / Cancel Imminent Peril Group Call
Client Originated (CO) / Client Terminated (CT)

Call types
Pre-arranged
Group call
Broadcast call
Emergency call
Imminent peril call
Emergency alert
On demand chat
Group call
Broadcast call
Emergency call
Imminent peril call
On-network Private call

Others
Location
MBMS bearers

Source: 3GPP
Each item contains several sub-group calls
In network and off network calls included
How is MC PTT implemented?

Source: GSMA, 3GPP, ETSI
QoS, Priority and Preemption

**Static**
- Fixed commitment of resources when device powers on - user’s provisioned level of service

**Dynamic**
- Dynamic resource assignment as calls are established – through signaling on the Rx interface

**Policy-based**
- Dynamic resource assignment based on pre-defined policies: User, App type, Service level

- Quality of Service (QoS) - guaranteed level of service based on parameters such as packet priority, delay budget, packet error loss
- Priority - manage which users get access to the network resources during times of congestion
- Preemption - remove active sessions of lower priority users and allocate resources to higher priority users when network resources are scarce or fully occupied
QoS – an analogy

Preemption

For gates, terminals and flight status, please check with us at aa.com/gates or call 1-800-433-7300.

Doors close 10 minutes before departure.
QoS, Priority and Preemption – in action

PTT
User role / Location / Application based priority and preemption
Handshaking to configure GBR creation - Admission control

Rx (Diameter)
QCI & ARP
GBR requested per call leg
User role, location, Application priority & preemption

PCRF
QCI and ARP
As per Rx request

Gx
Bearer requested for every leg of PTT

PGW
QCI and ARP enforced

NO CONGESTION
Good quality for all calls

SGi
Bearer

SGW
GBR created

eNodeB
QCI and ARP enforced

PTT has higher priority than VoLTE
User role, Location, Application based priority/preemption
Mission critical video

Responder Initiated or Command Centre requested Live video stream

Stream a video to other officers and command center.

By selecting a group of people in the map and clicking on the “Stream” button. All team members will be notified about incoming video.

From the command center you can request or force video and you can also monitor, join or end any video session that is happening.
Mission critical video
Push from ground

Dispatcher

Mobile Streamer
Stream video to a single contact, talkgroup, or Quick Group

Mobile Receiver
Incoming video stream is notified or barged (app setting) with tone.
Video streamer’s ID provided.
PTT call audio & Video audio are mixed or PTT call audio has priority (app setting)
Past streams show in history.

Dispatch
Monitored talkgroups show active video streams.
Dispatcher can switch between active video streams.
Past streams shown in history.
Mission critical video
Request from dispatch

Dispatcher
Dispatcher requests video from mobile user
*If Confirmed* – request is sent to mobile, user accepts and starts video
*If Unconfirmed* – request is sent to mobile, device starts video automatically

Mobile Streamer
Monitored talkgroups show active video streams.
*If Confirmed* – accepts request, sends video
*If Unconfirmed* – video sends automatically without user input
4G, MC Standards and 5G

**3 CAPACITY – THROUGHPUT, DEVICES**
- LOW LATENCY & RELIABILITY
- NEW VERTICALS
  - Enablers: IoT, Slicing, Automation, Orchestration

**2 COLLABORATION**
- COMMUNICATION
- AWARENESS
  - Enablers: GCSE, eMBMS

**1 COVERAGE**
- CAPACITY
  - IOT
  - Enabler: LTE Bearer

**MISSION CRITICAL SERVICES OVER BROADBAND**

**LTE**
- R8 (2008)
- R9
- R10

**LTE ADVANCED**
- R11 (2011)
- R12

**LTE ADVANCED PRO**
- R13 MC (2016)
- R14 (2017)
- R15 (2018)
- R16 (2019)

**4G, MC Standards and 5G**

**5G PHASE 1**
- R15 (2018)
- 5G PHASE 1

**5G PHASE 2**
- R16 (2019)
- Migration options
- Positioning
- Satellite Conn.

**5G R17**
- 5G Non-standalone
- Standalone

**5G R16 Freeze**
- Asset tracking
- UAV
- Maritime
- Extended Reality
- High precision position
- Critical Medical Apps

**5G RAN**
- Non-standalone
- Standalone

**Stage 2/3 specs**
- 5G Core
- MCPTT - enh
- MC Video
- MC data
- IOPS

**Enablers:**
- GCSE, eMBMS, MCPTT

**NEW VERTICALS**
- Enablers:
  - IoT, Slicing, Automation, Orchestration

** larvae**
- 1G
- 2G
- 3G
- 4G
- 5G

**R8 (2008)**
- LTE OFDMA
- IP EPC
- Carrier Aggregation
- WiFi Offload
- Sparse Hetnets

**R9**
- MBMS
- VoLTE

**R10**
- Dense HetNets
- MTC / LTE-M
- 256 QAM

**R11 (2011)**
- HetNets
- Unlicensed LTE
- NB-IOT

**R12**
- C-V2X
- eLAA

**R13 MC (2016)**
- LTE-M CAT-M

**R14 (2017)**
- eMBMS APIs

**R15 (2018)**
- Drones
- uLLC
Interoperability

Plug tests
Conformance testing
Interoperability testing
Certification.

A group within TCCA / CCBG is working out
  What is actually needed?
  What are the use cases?
  What can we learn from the latest plug test?
  What IOP testing should be done in TCCA?
  What testing needs to be done by individual operators?
Thank You