

Status and Trends of Public Protection and Disaster Relief (PPDR) Communications

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AGENDA

- **What is PPDR**
- **What are the PPDR Technologies and how they are evolving**
- **What is ITU doing on PPDR**
- **What are PPDR implementation Strategies**
- **Summary and recommendations**



WHAT IS PPDR?



PUBLIC PROTECTION

MAINTAINING LAW AND ORDER,
PROTECTING LIFE AND PROPERTY,
RESPONDING TO EMERGENCIES

DISASTER RELIEF

RESPONDING TO SERIOUS DISRUPTIONS OF
THE FUNCTIONING OF SOCIETY THAT POSE
A SIGNIFICANT WIDESPREAD THREAT TO
HUMAN LIFE, HEALTH, PROPERTY, OR THE
ENVIRONMENT



**PPDR AGENCIES RELY ON WIRELESS COMMUNICATIONS.
TWO-WAY MISSION CRITICAL NARROWBAND RADIO IS THEIR LIFELINE.**



**TODAY, THEY ALSO NEED BROADBAND WIRELESS TO SUPPLEMENT
THEIR MISSION CRITICAL RADIO.**

PERFORMANCE IN A DISASTER



HURRICANE IRMA FLORIDA, SEP. 2017

“There was a **228 percent increase in push-to-talk communications** between county and local police from the day before Irma hit to the day of the hurricane. In that time, there were **no sites down, no outages and all [radio] communications worked flawlessly.**”

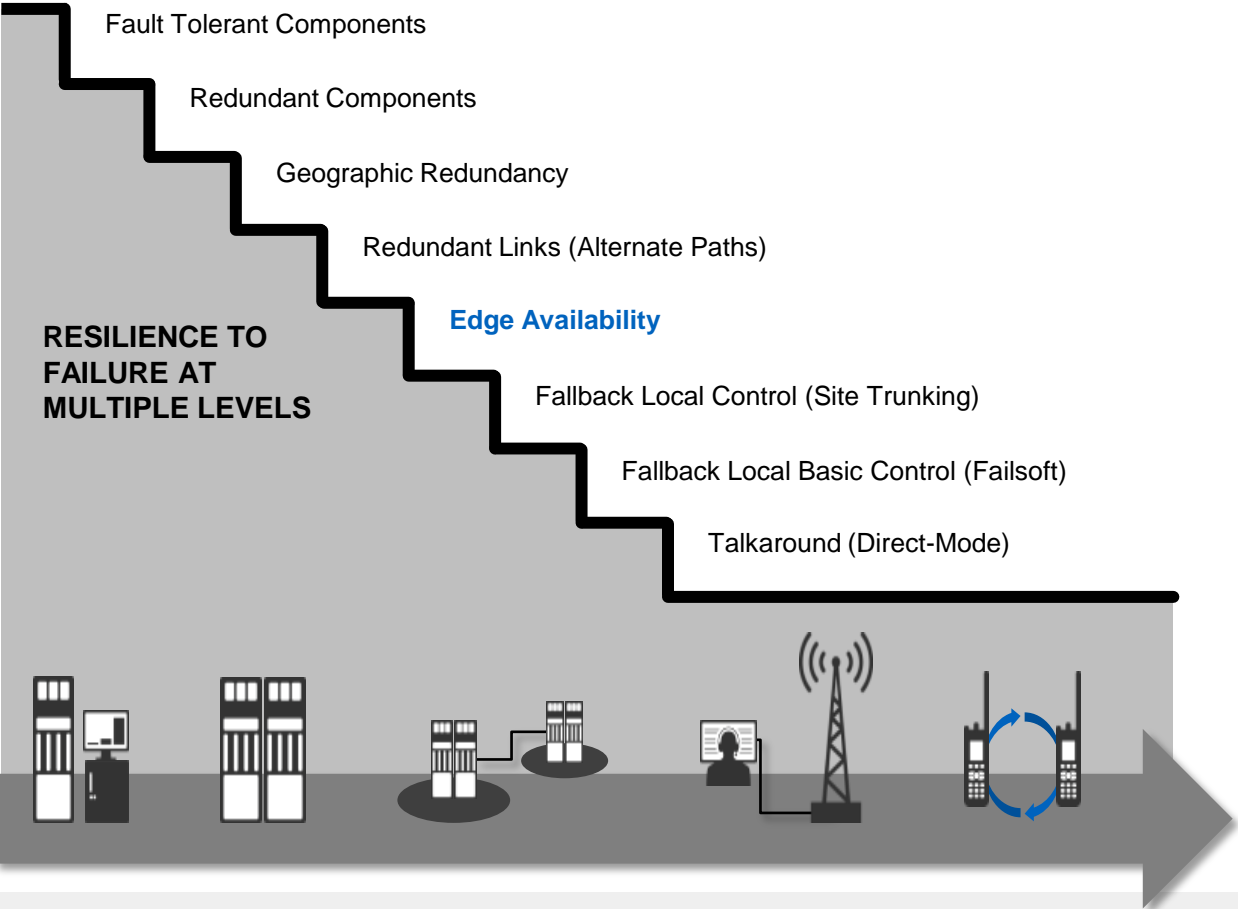
Greg Holcomb
Director of Public Safety Communications
Lake County, Florida
September 2017

“The radios were
crystal clear.”

Broward County, Florida official
September 2017

BUILT FOR MISSION CRITICAL VOICE

LIMITING THE IMPACT OF SYSTEM FAILURES



**CONTINUED OPERATION,
EVEN IN A CATASTROPHE**

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PPDR COMMUNICATIONS ARE INCREASINGLY BEING COMPLEMENTED BY INTELLIGENCE

MISSION-CRITICAL COMMUNICATIONS

MISSION-CRITICAL INTELLIGENCE



CONNECTING PEOPLE
Voice-Centric



CONNECTED EVERYTHING
Data-Centric

SITUATIONAL AWARENESS
Command and Control



CONTEXTUAL AWARENESS
Intelligent Edge

PHYSICAL RESOURCES
Dedicated Network / Computing / Storage



VIRTUAL RESOURCES
Shared Networks / Cloud / Data

PRODUCTS/DEVICES
Hardware-Centric



INTELLIGENT ECOSYSTEMS
Multi-Modal / Cognitive

CRITICAL COMMUNICATIONS
React and Respond

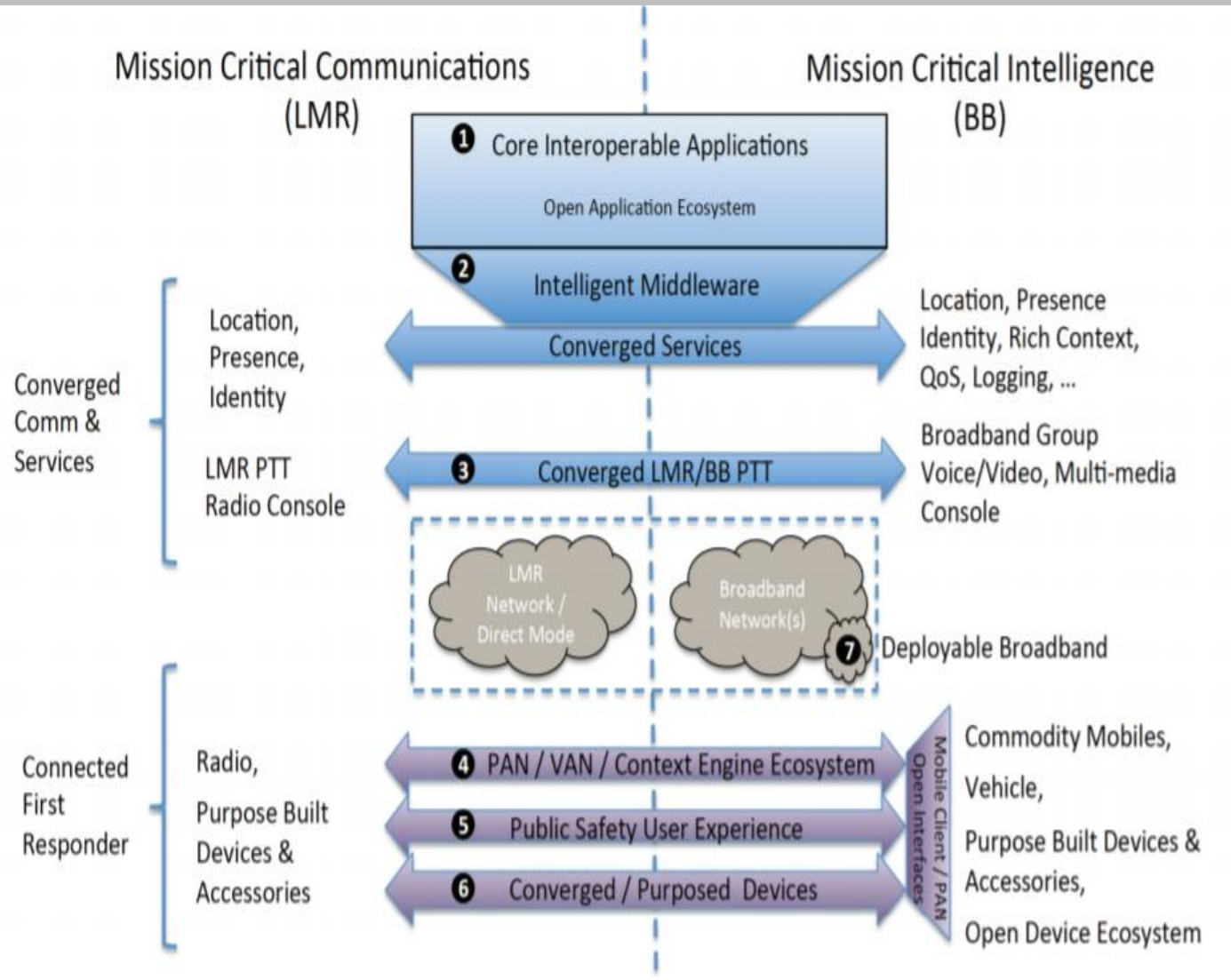


CRITICAL INTELLIGENCE
Predict and Prevent

THE ERA OF MISSION CRITICAL INTELLIGENCE



ozású és minden banki költségtől mentes, energiahatékó



MISSION CRITICAL PPDR TECHNOLOGIES

MISSION CRITICAL VOICE

Terrestrial Trunked Radio (TETRA)

- Formerly known as Trans-European Trunked Radio
- European standard for a trunked radio system
- Specifically designed for PPDR
- Provides Mission critical voice, SMS and low speed data

APCO P25

- Developed by Association of Public safety officials in USA (APCO)
- American standard for a trunked radio system
- Specifically designed for PPDR
- Provides Mission critical voice, sms and low speed data

DMR

- Digital mobile radio (DMR) is an open digital mobile radio standard defined in the European Telecommunications Standards Institute (ETSI)
- Being used by many PPDR agencies due to lower cost

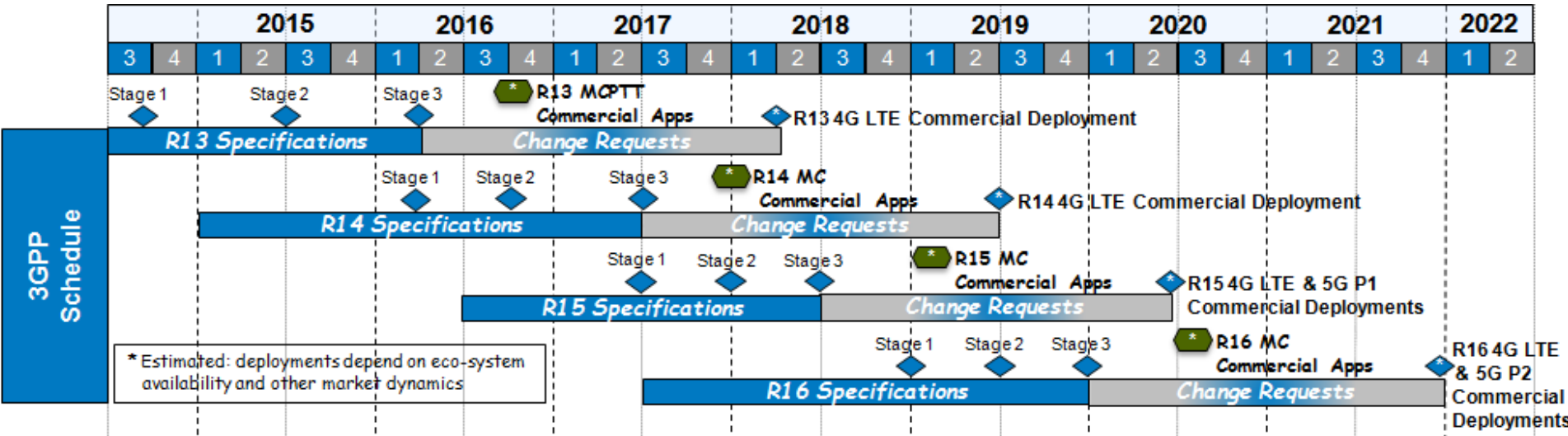
MISSION CRITICAL INTELLIGENCE

LTE (ADVANCED) and 5G

- LTE-Advanced systems (Release 13 onwards) have attractive capabilities of meeting the needs of broadband PPDR
- LTE-advanced can meet the needs of mission critical intelligence by supporting Mission critical voice, data and video services as an IMT radio interface.



3GPP Releases for PPDR



Release 12
(4G standards)

- ProSe
- GCSE_LTE

Release 13
(4G standards)

- MCPTT
- eProSe-Ext
- MCPTT codec
- MBMS-enh
- IOPS
- SC_PTM

Release 14
(4G standards)

- MCPTT Enhancements, MC Video, MC Data, MC Arch
- MC Video codec
- ProSe Enhancements (REAR: UE-Network Relay)
- MCPTT-MCPTT Interconnect Enh.*
- MCPTT-LMR Interworking*
- MBMS for MC services*
- 5G: SMARTER*, 5G Arch*, 5G RAN*
- C/NB-IoT, MTC, V2X, EnTV

Release 15
(4G standards)

- MCPTT, MCVideo, MCData, MC Arch Enhancements
- MONASTERY Railway PTT, Video, Data
- R13 MCPTT Conformance Test
- MCPTT – MCPTT Interconnect Enh.
- MCPTT – LMR Interworking
- High Power UE (B3, B20, B28)
- ProSe Enh. (REAR2, WLAN Discovery)
- Maritime PTT, Video, Data*
- License Assisted Access (LAA) for CBRS 3.5GHz band in US
- Common API Framework*
- NAPS – Northbound APIs for SCEF

Release 16 (estimated)
(4G standards)

- MCPTT, MCVideo, MCData, MC Arch Enhancements
- Railway (Phase 2) & Maritime PTT, Video, Data
- MCPTT – MCPTT Interconnect Enh.
- MCPTT – LMR Interworking Enh.
- Common API Framework
- Common API MC Middleware APIs(?)
- IMS RTC Enhancements
- Virtual Reality media services
- Efficient Delivery of Streaming Service*

* Study Items: produce only proposals; then standards may be defined based upon the proposals

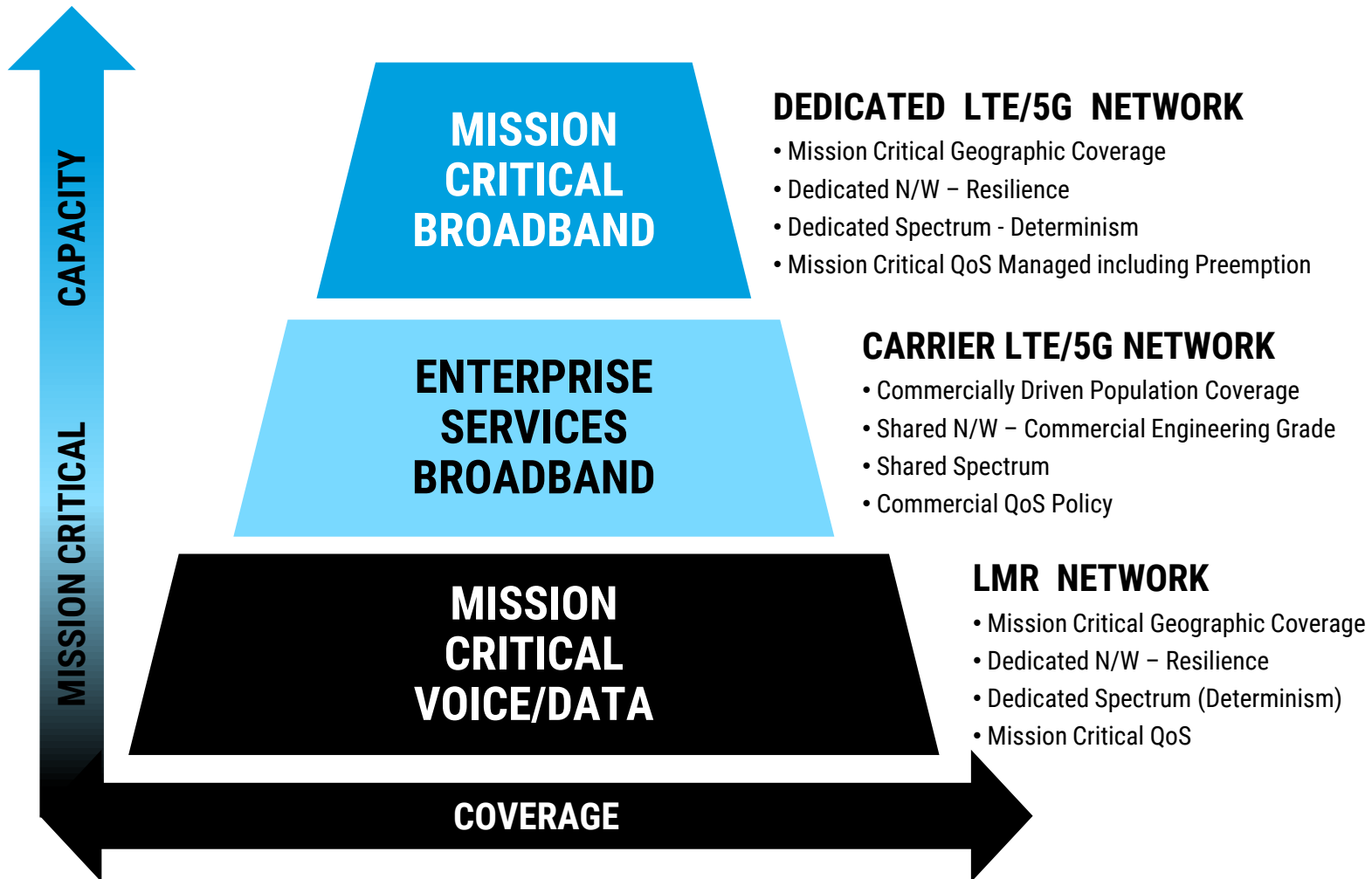
Release 15
(5G standards)

- Phase 1 5G

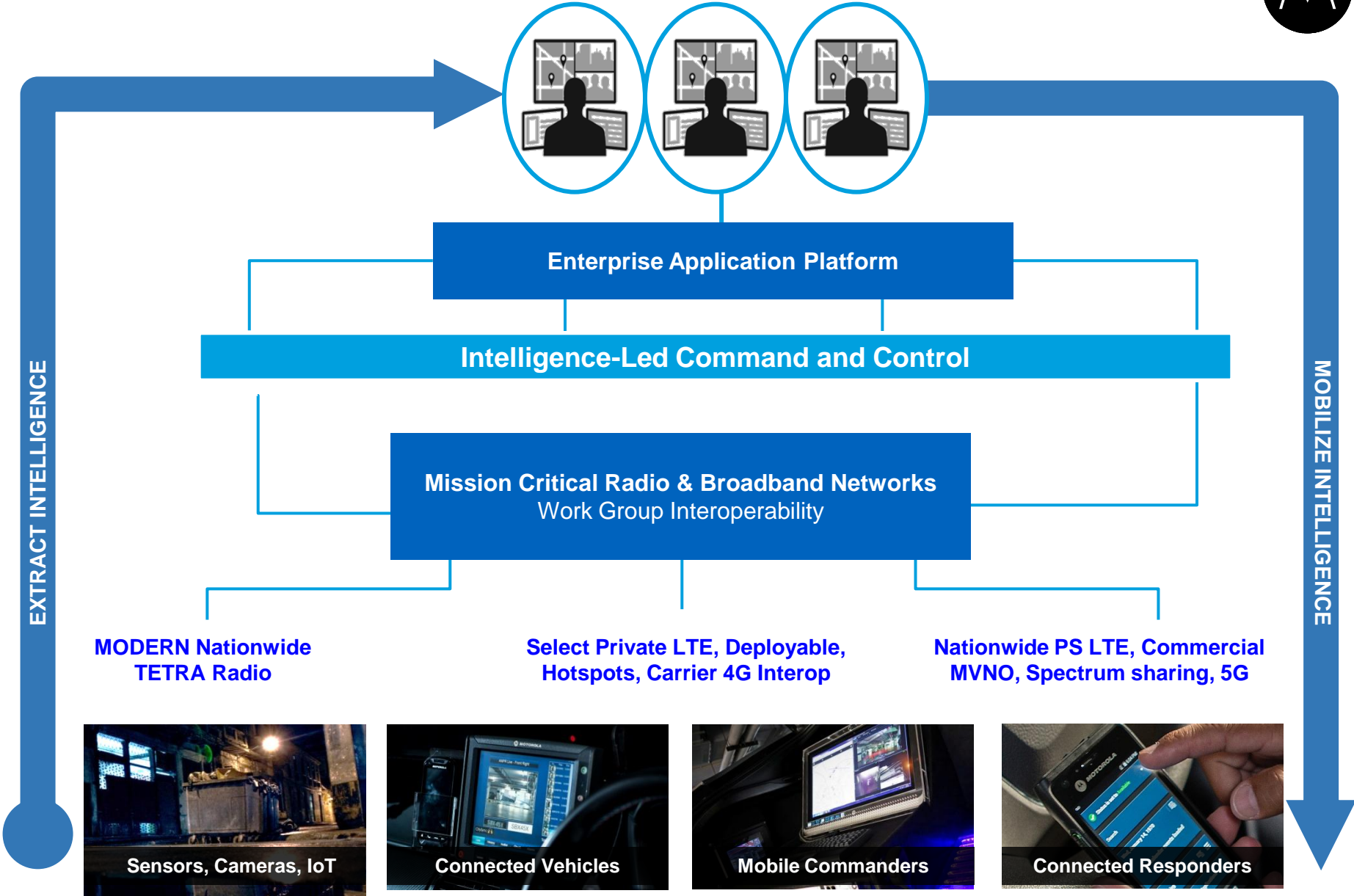
Release 16 (estimated)
(5G standards)

- Phase 2 5G
- MPS/MCService Priority & QoS

MISSION CRITICAL PPDR COMMUNICATIONS



PPDR NEEDS A COMPLETE SOLUTION



Next generation devices, personal and vehicle area networks

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NARROWBAND SPECTRUM HARMONIZATION

Resolution 646 adopted by WRC-2003 recognized regionally harmonized frequency bands for narrowband PPDR.

Region 1 (EMEA)

380-470 MHz – Harmonized Band for PPDR (P25 and TETRA)

380-385/390-395 preferred core harmonized band for permanent PPDR

Noted Current PPDR bands as 3-30, 68-88, 138-144, 148-174, 380-400 MHz (including CEPT designation of 380-385/390-395 MHz), 400-430, 440-470, 764-776, 794-806 and 806-869 MHz.

**Resolution 646
adopted by WRC-03**

ITU-R Technical Studies

**Report M.2033
(PPDR REQUIREMENTS)**

**Rec. M.2015
(PPDR FREQUENCY ARRANGEMENTS)**

**Rec. M.2009
(PPDR TECHNOLOGIES)**

**Report ITU-R M.2291
(LTE FOR PPDR)**

Since 2010, Studies have been carried out around the world on the need and value of Broadband to Public safety Wireless Communications

Phoenix Study in USA to find the value of 10+10 MHz spectrum in 700 MHz band

EU study on the amount of spectrum needed for broadband Public Safety LTE

Study by Hong Kong university on the Value of 10+10 MHz spectrum in key asian countries

Report ITU-R [M.2014](#) – Digital land mobile systems for dispatch traffic.

Report ITU-R [M.2291](#) – The use of International Mobile Telecommunications (IMT) for broadband public protection and disaster relief (PPDR) applications.

Recommendation ITU-R [M.2015](#) – Frequency arrangements for public protection and disaster relief radiocommunication systems in UHF bands in accordance with Resolution **646 (Rev.WRC-12)**.

Recommendation ITU-R [M.2009](#) – Radio interface standards for use by public protection and disaster relief operations in some parts of the UHF band in accordance with Resolution **646 (WRC-03)**.

APT, Report 38 on technical requirements for mission critical broadband PPDR communications. http://www.apr.int/sites/default/files/Upload-files/AWG/APT-AWG-REP-38-APT_Report_on_PPDR.docx

CEPT, ECC Report 199 – User requirements and spectrum needs for future European broadband PPDR systems (Wide Area Networks).

<http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP199.PDF>

ETSI TR 102 022-1 V1.1.1 (2012-08) - User Requirement Specification; Mission Critical Broadband Communication Requirements

http://www.etsi.org/deliver/etsi_tr/102000_102099/10202201/01.01.01_60/tr_10202201v010101p.pdf

CEPT ECC WG FM PT 49 Radio Spectrum for Public Protection and Disaster Relief (PPDR),

Report from FM Project Team 49 (2nd and 3rd meetings)

<http://www.cept.org/ecc/groups/ecc/wg-fm/fm-49>.

Public Safety Broadband High-Level Statement of Requirements for FirstNet Consideration, 700 MHz Spectrum Requirements for Canadian Public Safety Interoperable Mobile Broadband Data Communications [http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapi/smse-018-10-public-safety-sub2.pdf/\\$FILE/smse-018-10-public-safety-sub2.pdf](http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapi/smse-018-10-public-safety-sub2.pdf/$FILE/smse-018-10-public-safety-sub2.pdf)

PUBLIC PROTECTION AND DISASTER RELIEF SPECTRUM REQUIREMENTS . , Helsinki, January 2007, ECC REPORT 102

BROADBAND SPECTRUM HARMONIZATION

Revised [Resolution 646](#) adopted by ITU WRC -2015 recognized 694-894 MHz (700-800) as the globally harmonized frequency range for **broadband** PPDR

RESOLUTION 646 (Rev. WRC-15) GLOBAL PPDR SPECTRUM

694-894 is the global harmonized frequency range for Public Safety Broadband

This includes:

- **700MHz LTE bands (Band 28, Band 14 & Band 68)**
- **800 MHz LTE bands (Band 20 and Band 26)**

**Resolution 646
Revised by WRC-15**

ITU-R Technical Studies

**Report M.2368
(UPDATED FROM 2033)**

**Rec. M.2015
Updated freq. arrngmt**

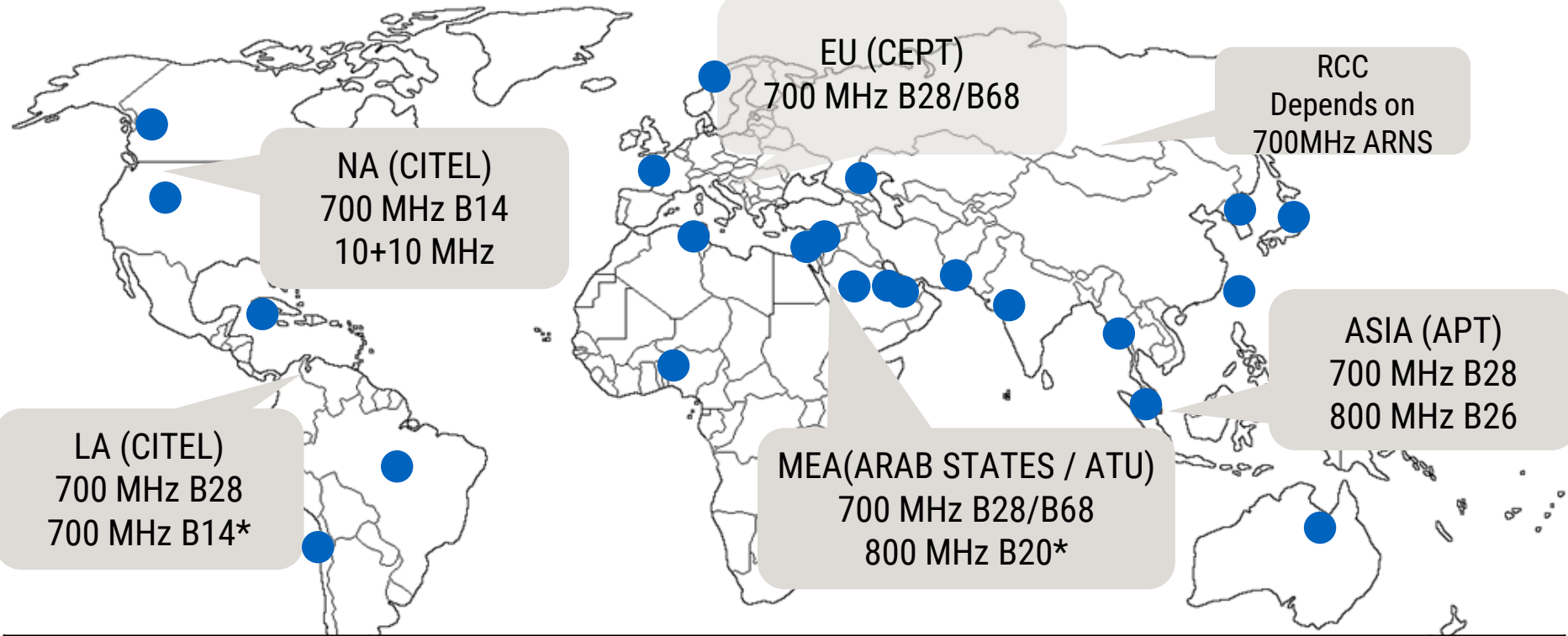
**Rec. M.2009
PPDR Technologies**

**Report ITU-R M.2291
IMT-advanced for PPDR
Proposal for IMT-2020 PPDR**

BROADBAND SPECTRUM HARMONIZATION: WHAT WE KNOW TODAY



38+ countries, >2.6 Billion population: dedicated B_PPDR spectrum in 700/800MHz



US 700 Band Plan /Canada	3GPP Band 14 (special band)	788-798/758-768 MHz
APT 700 Band plan (LATM, ASIA, ME)	3GPP Band 28	703-748/758-803 MHz
Arab/Europe. Africa R1* 700 Band plan (MEA)	3GPP Band 68 (New band) Or Band 28 2x(30+3)MHz	698-728/753-788 MHz 703-736/758-791MHz
Asia 800 Band Plan (ASIA)	3GPP Band 26	814-834/859-879 MHz
EU 800 Band Plan (R1*)	3GPP Band 20	791-821/832-862 MHz

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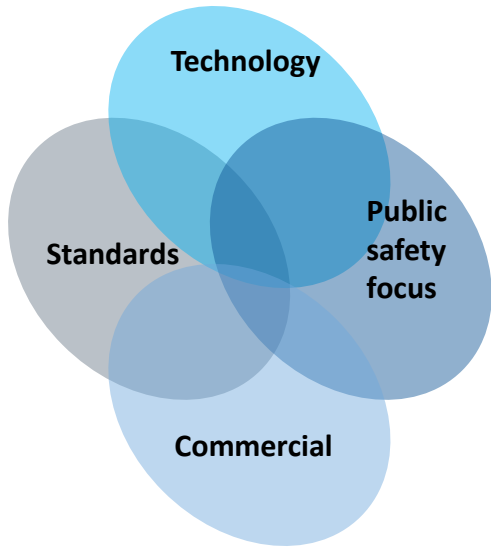
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CRITICAL SUCCESS FACTORS FOR MISSION-CRITICAL PPDR NETWORKS



- PPDR Spectrum**
 - PPDR Spectrum allocation for Public Safety Provider, that is available for the PSP to use when and where it is needed
 - Regulation that allows PSP to share spectrum and network builds with MNOs for commercial viability
- Governance model**
 - Appropriate governance model and vehicles for administration of the model to ensure end to end service levels are met
 - Governance authority must include user reps.
- Technology model**
 - Network sharing models are more efficient and good long term models
 - Governance models can be extended from LTE technology now to 5G in the future



MULTIPLE LTE DEPLOYMENT MODELS

VALUE PROPOSITIONS FOR ALL MODELS

PRIVATE/STANDALONE PS LTE NETWORK

Dedicated Spectrum

Dedicated Network

- Utilized only by Government agencies
- Owned and Operated by Govt agency, usually as a CAPEX model

Examples

US Firstnet, Korea GRN, Singapore, Middle east

HYBRID PUBLIC-PRIVATE

Dedicated Spectrum

Shared Network

- PS-LTE network shared with other entities (e.g., utilities, carriers, military)
- Requires unique governance and operating model to accommodate PS demands and reduce costs

Examples

Mexico MVNO

CARRIER LEVERAGED (ps & non ps)

Shared Spectrum

Shared Network

- Network shared with consumers, businesses, and PS agencies
- Select enhancements and hardening to meet PS agency needs

Examples

UK ESN,

HIGHER LEVELS OF PS CONTROL, FUNCTIONALITY, RELIABILITY
HIGHER COST PER USER
MORE LIKELY A CAPEX-BASED DEPLOYMENT

LOWER LEVELS OF PS CONTROL, FUNCTIONALITY, RELIABILITY
LOWER COST PER USER
MORE LIKELY AN 'aaS' DEPLOYMENT

PUBLIC-SAFETY LTE NETWORK vs CARRIER LTE NETWORK

Public safety LTE network

Geographical coverage

Maximum capacity for incident handling, supported by deployables

Serving small customer base with the service needed for emergency handling

User / Role based device provisioning

Dynamic prioritisation based on situation of user

Security across users, devices, network and applications, including encryption of voice calls

Redundancy 2x normal load, business continuity process critical. Maintenance personnel are critical to operation

Services are based on Public Safety User requirements

Carrier LTE network

Population coverage

Busy-hour capacity, catering to hot-spots for additional capacity (but not a single hour anymore)

Serving large customer base with best possible service ssible service

IMSI based device provisioning

Prioritisation only for specific service like VoLTE

Security not a critical issue, therefore end to end encryption and security is left to applications

Redundancy not 2x normal load. Heavily focused on User experience and can recognise conditions leading to failures

New features are implemented for new revenue-generating services

EARLY PPDR LTE DEPLOYMENTS

LA-RICS
Los Angeles County, USA
Population: 10 million

Dedicated Network
Dedicated Spectrum

HALTON, ONT.
Regional Municipal Police
Network

Dedicated Network
Dedicated Spectrum

ESN
UK nationwide network

Shared Network
Shared Spectrum

HARRIS COUNTY
Houston metro area, USA
Population: 4.4 million

Dedicated Network
Dedicated Spectrum

FIRSTNET
USA Nationwide Network

Shared Network
Dedicated Spectrum

MIDDLE EAST 1
National defense agency
network

Dedicated Network
Dedicated Spectrum

MIDDLE EAST 2
National public safety
network

Dedicated Network
Dedicated Spectrum

MIDDLE EAST 3 (UAE)
National defense agency
network

Dedicated Network
Dedicated Spectrum

Korea LTE
National public safety
network

Dedicated Network
Dedicated Spectrum

SINGAPORE LTE
National public safety
network

Dedicated Network
Dedicated Spectrum
Currently Trial only

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In Summary

- PPDR agencies depend on their mission critical TETRA/P25 radios to save lives and will continue to do so
- Mission critical intelligence and data is becoming just as important as voice. LTE-advanced and 5G networks will provide ultra reliable, low latency and high mobility designed to meet high demands of mission critical video and data by the PPDR agencies
- 700 MHz(3GPP Band 14, 28,68) and 800 MHz (3GPP Band 20, 26) has already harmonized for PPDR by WRC-15
- PPDR LMR networks are typically dedicated systems owned and operated by PPDR agencies. LTE and 5G systems could be dedicated, shared or commercial depending on the economic considerations. Report ITU-R M.2291 provides details of the options and choices
- Many countries are already implementing 4G LTE advanced networks to support PPDR, complementing their LMR networks



**Spectrum saves lives
Harmonisation saves Public money.**

THANK YOU



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