![IAFI ITU-APT Foundation of India]

PPDR

Bharat Bhatia
President, ITU-APT Foundation of India
Vice Chairman & Head of Asia Pacific, World Wireless Research Forum (WWRF)
Chair, ITU-R WP5D IMT Applications Group
Chair, APT Task group on WAS

Index

Definitions and Background

Examples of PPDR Network from Safe-net Korea

Examples of PPDR Network from Firstnet USA

Update on Public Safety 4G/5G Technology from 3GPP

PPDR Spectrum Summary and Conclusion

WHAT IS PPDR?
ITU term with same meaning as Public Safety or First Responders

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


IAFI
ITU-APT Foundation of India

Every year over $300 Billions are lost to disasters

Relevant natural catastrophe loss events worldwide 2021

Munich RE

Natural disasters caused overall losses of US$ 280bn

Hurricane Ida,
29 Aug – 2 Sep, United States
Overall losses: US$ 65bn
Insured losses: US$ 36bn

Flood,
12 – 19 Jul, Germany, Netherlands, Belgium
Overall losses: US$ 54bn
Insured losses: US$ 13bn

Tornado (series),
10 – 11 Dec, United States
Overall losses: US$ ~5.2bn
Insured losses: US$ ~4bn

Henan flood,
July, China
Overall losses: US$ 16.5bn
Insured losses: US$ 1.7bn

Winter storm Uri,
12 – 17 Feb, United States
Overall losses: US$ 30.1bn
Insured losses: US$ 15bn

Earthquake,
13 Feb, Japan
Overall losses: US$ 7.7bn
Insured losses: US$ 2.3bn

Earthquake,
14 Aug, Haiti
Overall losses: US$ 1.5bn
Insured losses: minor
Fatalities: 2,248

Volcano (Cumbre Vieja),
19 Sep – 25 Dec, Spain
Overall losses: US$ 0.9bn
Insured losses: minor

Typhoon Rai (Odette),
16 – 18 Dec, Philippines
Fatalities: 408

Cyclone Seroja,
3 – 12 Apr, Indonesia
Overall losses: US$ 0.8bn
Insured losses: US$ 0.3bn
Fatalities: 272

Geophysical events
Earthquake, tsunami, volcanic activity

Meteorological events
Tropical storm, extratropical storm, convective storm, local storm

Hydrological events
Flood, mass movement

Climatological events
Extreme temperature, drought, wildfire

○ Significant catastrophes
○ Small, medium and large loss events

Source: Munich Re, NatCatSERVICE, 2022

PPDR Wireless Solutions could help reduce Disaters losses by over $100 Bn Annualy

Legend: Average annual loss (multi-hazard, including extensive risk, indirect loss and agriculture)

Countries (top chart, scale 0–20): Malaysia, Viet Nam, Bangladesh, Thailand, Pakistan, Islamic Republic of Iran, Turkey, Philippines

Legend (bottom chart): Average additional investment required per year, 2016–2030; Average annual loss (multi-hazard, including extensive risk, indirect loss and agriculture)

Countries (bottom chart, scale 0–250): Indonesia, India, China

Source: Asia-Pacific Disaster Report 2019.

IAFI
ITU-APT Foundation of India

Country	Annual Losses (Billion USD)
China	245
Japan	118
India	88
Indonesia	29
South Korea	24
Philippines	20
Iran	16
Australia	15

PPDR AGENCIES CAN'T FUNCTION WITHOUT WIRELESS
TWO-WAY MISSION CRITICAL WIRELESS RADIO IS THEIR LIFELINE

In addition, they also need broadband wireless to complement their mission critical wireless radio.

IAFI
ITU APT Foundation of India

WHY DOES PPDR NEED TO TRANSFORM ?

1 **Incidents are increasing in volume & complexity**

Our world is becoming complex and dangerous
We live in an environment that is open to threats
It becomes more and more difficult to keep people safe

2 **Threat landscape is becoming more complex**

Incidents can be simultaneous and distributed
Our first responders face unpredictable conditions
Split-second decisions are needed

3 **Our responses should have the same impact**

Perfect collaboration in the workflow
Deep technology to augment the humans
Reliable mission critical networks

400++
NATURAL DISASTERS ANNUALLY

97% **GLOBAL PROTESTS (2011-2023)**

166% **GLOBAL TERROR ATTACKS (2011-2023)**
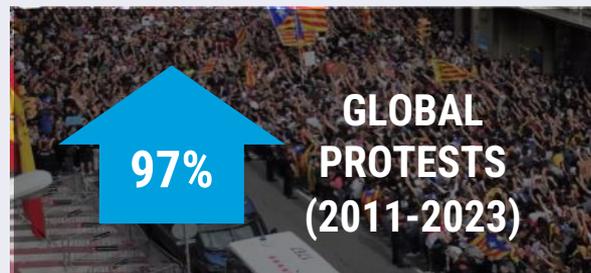
HOW CAN PUBLIC SAFETY SERVICES TRANSFORM ?

PREDICT	PREVENT	RESPOND	RECOVER
Event prediction	Action to neutralise threat before it happens	Faster Incident response	Reduced impact Maximum support

Common Situational awareness fabric
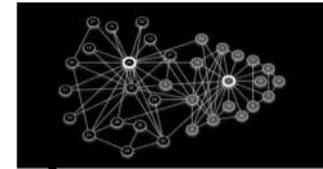
How Wireless Technologies Can help in this transformation

IAFI
ITU-APT Foundation of India

PS Needs	Technologies to meet the Needs
Mission Critical Voice - Eyes-up and hands-free VOICE	**LMR (TETRA/P25) Radios** providing Mission Critical Voice are the most important tool for PPDR responders enabling eyes-up and hands-free interaction and reducing cognitive load.
Enhanced situational awareness DATA	**Live group video calls** on LTE/5G help commanders and first responders to see what's happening in real-time for tactical decision making and resource identification.
Insights from the multitude of video sources DATA	**Video analytics** tools are needed to obtain critical insights from the video sources. In the future A.I tools can help us to make sense of all the data and move to the Predict and Prevent model
Artificial Intelligence and Augmented Reality- High velocity human factors DATA	**Artificial intelligence** can coordinate user interfaces and augment or automate tasks freeing up responders to focus on most important ones.

ITU and APT have been Studying Wireless Solutions for PPDR since 2000

➢ Considered by WRC in 2003 and 2015
➢ Many Reports and Recommnedations developed by ITU and APT

Resolution 646 adopted by WRC-03 & Revised by WRC-15	**Rec. M.2015 (PPDR FREQUENCY ARRANGEMENTS**	**Report M.2377 (PPDR REQUIREMENTS)**
Report. M.2415 (PPDR SPECTRUM REQIREMENTS)	**Rec. M.2009 (PPDR TECHNOLOGIES)**	**Report ITU-R M.2291 (LTE FOR PPDR)**
APT-AWG Rec. 01 4.9 GHz for PPDR	**APT-AWG Rec. 09 700-800 MHz for PPDR**	**APT-AWG Reports on PPDR**

PPDR DEPLOYMENT MODELS VARY BY REGIONS
ITU AND APT REPORTS PROVIDE GUIDANCE ON IMPLEMETING PPDR

IAFI
ITU-APT Foundation of India

DEDICATED/STANDALONE PS LTE NETWORK	HYBRID PUBLIC-PRIVATE	CARRIER LEVERAGED (ps & non ps)
Dedicated Spectrum	**Dedicated Spectrum**	**Shared Spectrum**
Dedicated Network	**Shared Network**	**Shared Network**
• Utilized only by Government agencies • Owned and Operated by Govt agency, usually as a CAPEX model	• 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	• Network shared with consumers, businesses, and PS agencies • Select enhancements and hardening to meet PS agency needs
Examples US Firstnet, Korea GRN, Singapore, Middle east	**Examples** Mexico MVNO	**Examples** UK ESN,
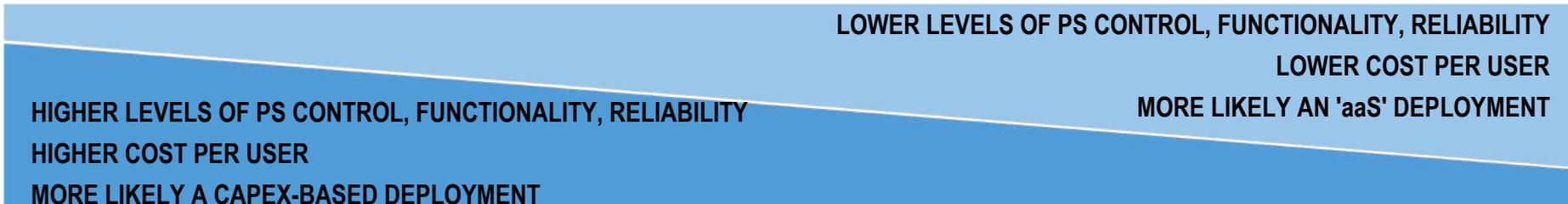
LOWER LEVELS OF PS CONTROL, FUNCTIONALITY, RELIABILITY

LOWER COST PER USER

MORE LIKELY AN 'aaS' DEPLOYMENT

HIGHER LEVELS OF PS CONTROL, FUNCTIONALITY, RELIABILITY

HIGHER COST PER USER

MORE LIKELY A CAPEX-BASED DEPLOYMENT

Index

Definitions and Background

Examples of PPDR Network from Safe-net Korea

Examples of PPDR Network from Firstnet USA

Update on Public Safety 4G/5G Technology from 3GPP

PPDR Spectrum Summary and Conclusion

IAFI
ITU-APT Foundation of India

Concept of Korea Safe-Net

Integrated Dedicated 4G-5G network in 700 MHz (10+10 MHz) for

- PPDR

- Railways

- Maritime

# Timelines of Korea Safe-Net (Budget US$ 1.4 Billion)

Classification	Overall	Phase 1 (2018.10~2019.9)	Phase 2 (2019.10~2020.9)	Phase 3 (~2021.3)
District	KT (District A), KT (District B), SKT (District C)	1st CORE	2nd CORE, 3rd CORE	
CORE & OP Center	1st and 2nd CORE & OP/ 3rd OP Center	Upgrade of 1st CORE & OP Center	2nd and 3rd CORE & OP Center	1st and 2nd CORE & OP Center Inter-backup
Fixed Base Stations	Over 15000	3519	6936	4992
Timelines	2014-2025	2018-2019	2019-2020	2020-2025

IAFI
ITU-APT Foundation of India

Korea Safe-Net Project Vs. Commercial Mobile Networks
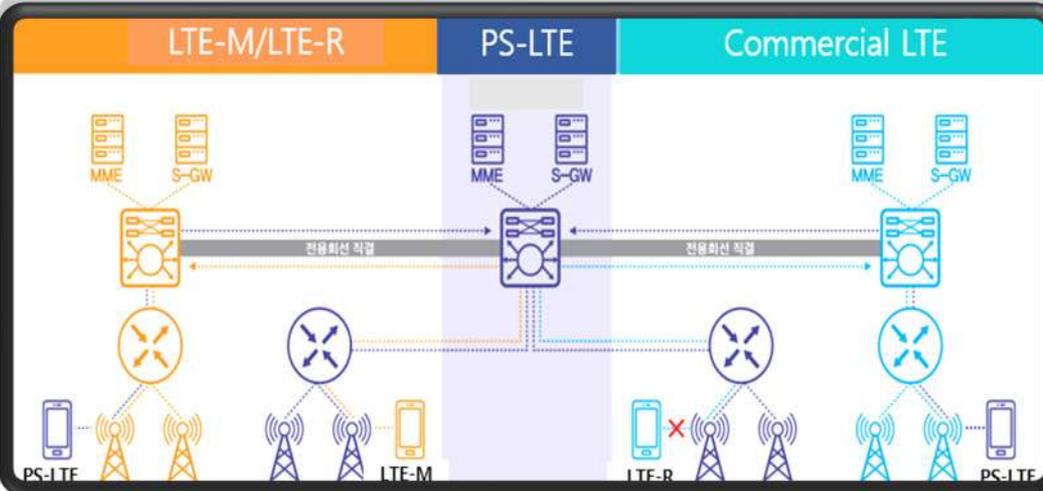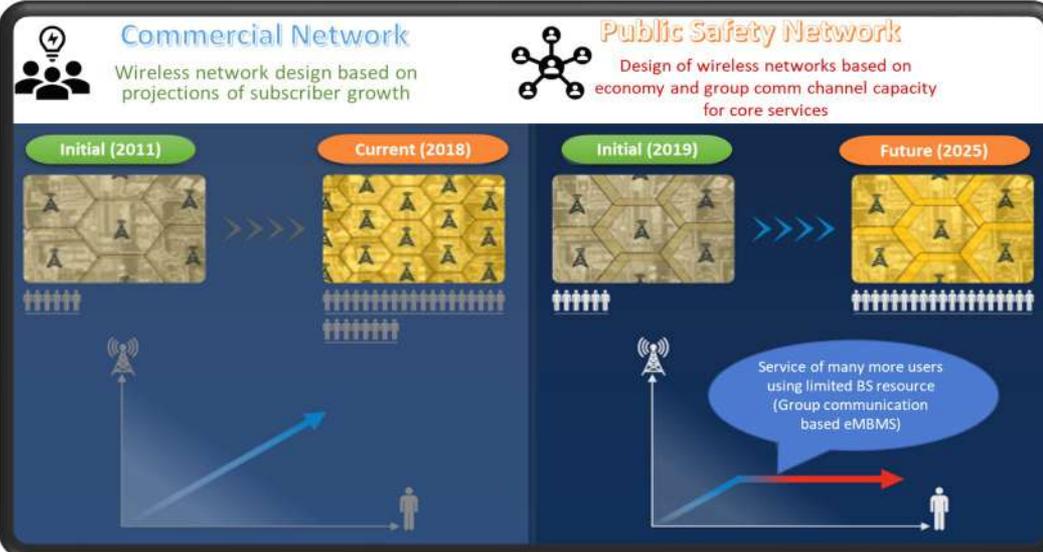
Korea Safe-Net - Overview

Index

Definitions and Background

Examples of PPDR Network from Safe-net Korea

Examples of PPDR Network from Firstnet USA

Update on Public Safety 4G/5G Technology from 3GPP

PPDR Spectrum Summary and Conclusion

IAFI
ITU-APT Foundation of India
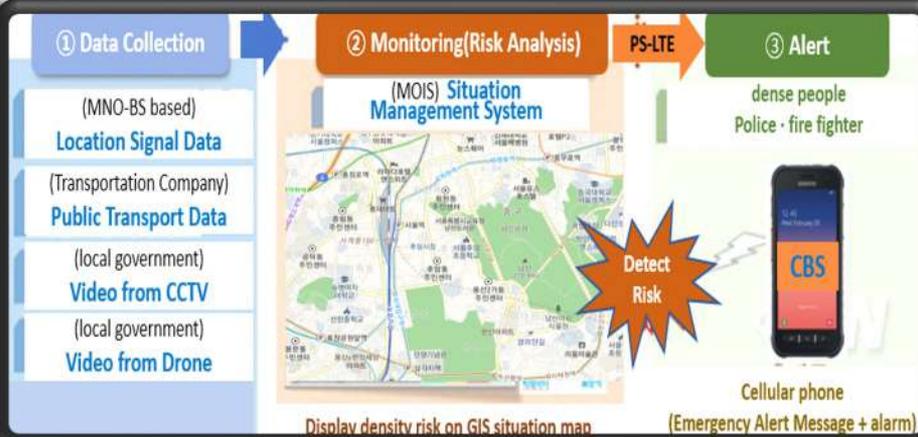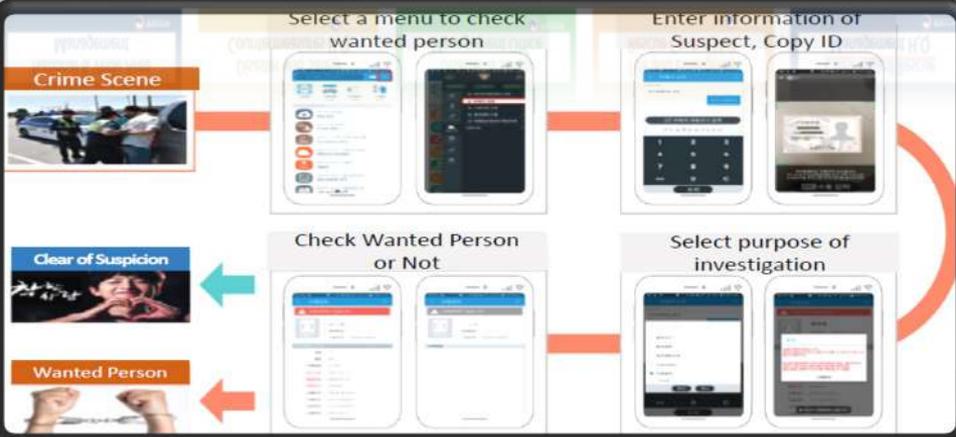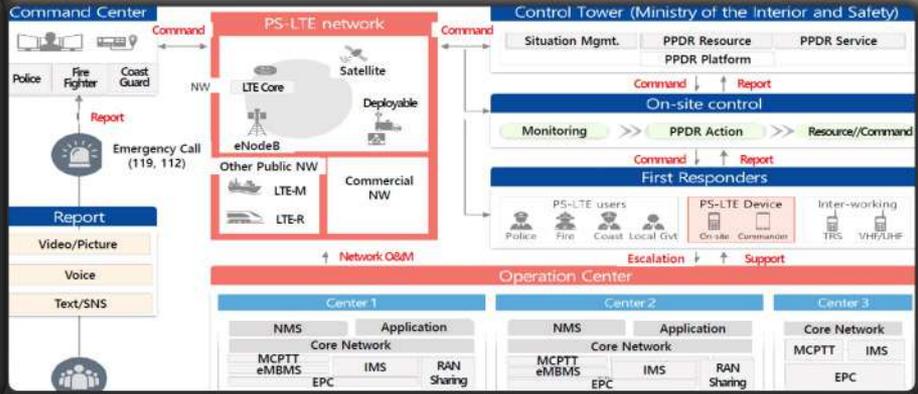
FirstNet Network Timelines

2001
9/11 attacks

- Radio communication challenges affect first responders
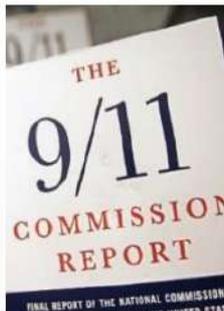
2004
9/11 Commission

- Recommends national radio spectrum for public safety purposes

- Public safety unites to advocate for nationwide broadband network

2012
The FirstNet Authority Established

- Independent agency to deploy Nationwide Public Safety Broadband Network

2012–16
Initial Outreach and Consultation

- Governors identify FirstNet single points of contact

- Consultation in all 56 states and territories

- FirstNet works with states to collect and validate users and coverage data

2016–17
Partnership and State Plans Created

- Network RFP released

- Award to AT&T

- Delivery of 56 state/territory plans

- 56 Governors Opt-In decisions

2018–19
Network Deployment Begins

- FirstNet core launched

- Band 14 buildout nationwide

- Roadmap released to advance FirstNet, guide future investments

2020 and beyond
Roadmap and Investment

- Engage and collaborate with public safety and industry

- Execute the FirstNet Authority Roadmap

- Invest in the network

- Continue Band 14 buildout

FirstNet Network Plan

ENGAGE public safety entities and associations, PSAC, industry, and government to understand their trends, drivers, and priorities

DEVELOP and promote public safety broadband communications roadmaps that reflect the voice of public safety

COLLABORATE with public safety to realize the operational benefit of the FirstNet Experience

INVEST in the network to further a differentiated FirstNet Experience

FIRST RESPONDER NETWORK AUTHORITY
Oversees, influences and complements the FirstNet Solution with value-adding activities and investment

PARTNERSHIP
Identify and collaborate on opportunities that enhance the FirstNet Solution

FIRSTNET
Built with AT&T

AT&T (FIRSTNET SOLUTION)
Designs, delivers and supports the FirstNet Solution based on public safety's needs

FirstNet

FirstNet Network Design

Core

- EPC
- IMS Core
- Services Platforms
- App Servers
- Service Enablers

Coverage & Capacity

- Macro Coverage
- Capacity
- In-building Solutions
- Temporary/On-Demand Coverage
- Range Extension
- Device-to-Device
- Air-to-Ground
- Maritime Operations
- Availability/Reliability/ Resiliency/Hardening

Situational Awareness

- Location Services
- Sensors
- Wearables
- Cameras/Video
- Mapping/Geographic Information System (GIS)
- Data Analytics/Artificial Intelligence

Voice Communications

- Mission Critical Push-to-talk (MCPTT)
- PTT Interconnection

Secure Information Exchange

- Data Access
- Data Sharing
- Cybersecurity
- Identity, Credential and Access Management (ICAM)/Single Sign-On

User Experience

- Priority Services
- Applications
- Devices
- Accessories
- Hands Free Operations
- Augmented Virtual Reality
- Heads-Up Display

FirstNet

FirstNet Network Benefits

Cell sites on UAV (Drones)

Network Status Tool

Priority, Pre-Emption on All AT&T LTE Spectrum Band 14 – 20 Mhz Spectrum

72 Dedicated Deployables (SatCOLTs) 14 hour response

App Catalog Curated Apps

App Developer Ecosystem

Local Control Uplift Tool

End-to-End Encryption of Network Traffic

Expanding network coverage (adding 45 sites in Oregon)

Dedicated Customer Service 24x7 for FirstNet Users

Dedicated FirstNet 24x7 Security Operations Center (SOC)

Contract oversight by FirstNet Authority, a federal agency

Index

Definitions and Background

Examples of PPDR Network from Safe-net Korea

Examples of PPDR Network from Firstnet USA

Update on Public Safety 4G/5G Technology from 3GPP

PPDR Spectrum Summary and Conclusion

IAFI
ITU-APT Foundation of India

What is 3GPP?

The 3rd Generation Partnership Project (3GPP) unites telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as "Organizational Partners", and provides their members with a stable environment to produce Technical Reports (informative information) and Technical Specifications (normative standards) that define 3GPP technologies.
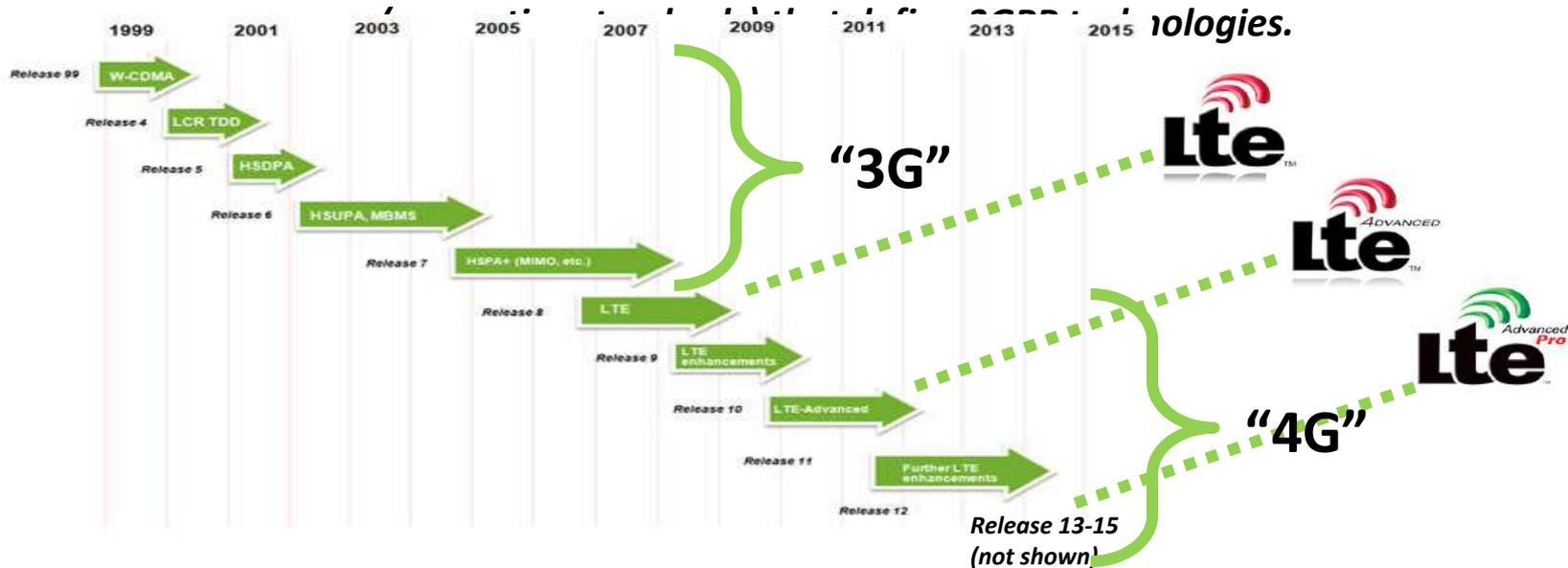
PPDR 3GPP journey from LTE to 5G
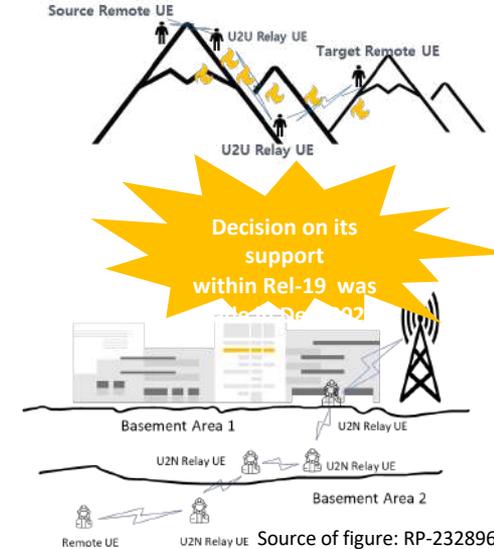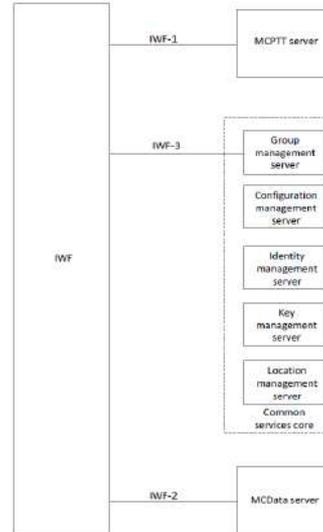
Increase participation of Governments in 5GPP Public safety standards

2023

2015

FirstNet (FirstNet)	UNITED STATES
U.S. Department of Commerce (U.S. Department of Commerce)	
NTIA (National Telecommunications and Information Administration)	
HOME OFFICE (HOME OFFICE)	UNITED KINGDOM
BMWK (Bundesministerium für Wirtschaft und Klimaschutz)	GERMANY
MINISTERE DE L'INTERIEUR (MINISTERE DE L'INTERIEUR)	FRANCE
Netherlands Police (Netherlands Police, Division MDC)	NETHERLANDS

More than two times

**INDIA
MINISTRY OF
ELECTRONICS & IT**

FirstNet (FirstNet)	UNITED STATES
U.S. Department of Defense (U.S. Department of Defense)	
U.S. Department of Transport. (U.S. Department of Transportation)	
U.S. National Security Agency (US National Security Agency)	
NTIA (National Telecommunications and Information Administration)	
HOME OFFICE (HOME OFFICE)	UNITED KINGDOM
NCSC (National Cyber Security Centre)	
BMWK (Bundesministerium für Wirtschaft und Klimaschutz)	GERMANY
BDBOS (Federal Agency for Public Safety Digital Radio)	
MINISTERE DE L'INTERIEUR (MINISTERE DE L'INTERIEUR)	FRANCE
Ministère Economie et Finances (Ministère de l'Economie et des Finances)	
Netherlands Police (Netherlands Police, Division MDC)	NETHERLANDS
MinEA (Ministry of Economic Affairs and Climate Policy)	
TRAFICOM (The Finnish Transport and Communications Agency)	FINLAND
MINECO (MINISTRY OF ECONOMIC AFFAIRS AND DIGITAL TRANSFORMATION)	SPAIN
BMF (Austrian Federal Ministry of Finance)	AUSTRIA
Ministry of Transport and Cons (Ministry of Transport and Construction of the Slovak Republic)	SLOVAKIA
MeitY (Ministry of Electronics & Information Technology)	INDIA

*IM: Individual Member

PPDR Communications in 3GPP

|	
Authorities → Authorities communication - Communications among authorities	**Individuals → Authorities communication** - Rescue request from the public to government (e.g. 112 or 100 Call
Authorities → Individuals communications - Alerting from authority to the public (CBS-based Public Warning Service)	**Individuals → Individuals communication** - Communication among the public regarding PPDR events

PPDR Services implemented in 3GPP LTE/5G

MCPTT

MCData

MCVideo

Interworking with Two Way LMR Radio
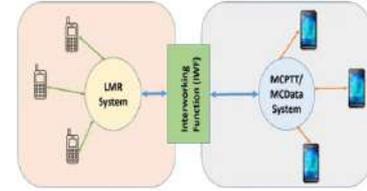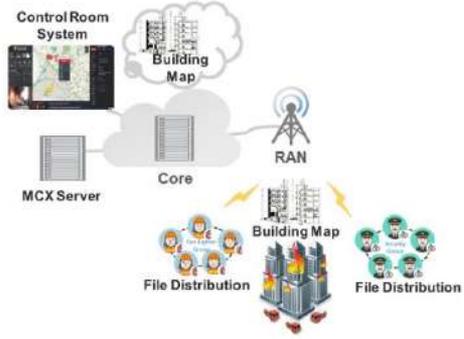
Enabling Technologies

- Group Communication System Enablers for Proximity Service
- Proximity Service Enhancements
- Mission Critical Common Services
- MC system integration and interconnection
- MBMS usage for MC communication services

Index

700 MHZ BAND IS THE PREFERRED GLOBAL BAND FOR 4G/5G PS Coverage
GAINING GOBAL ADOPTION AND ECO-SYSTME SUITED FOR Public Safety
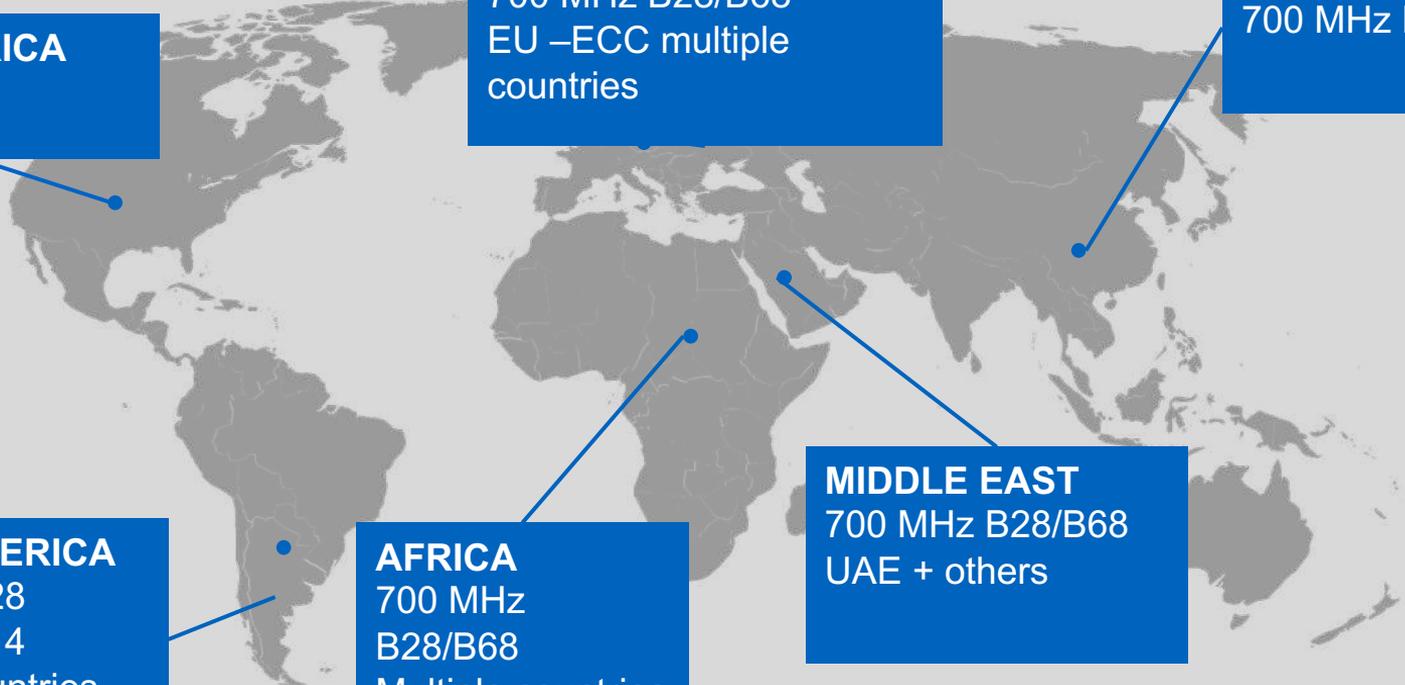
NORTH AMERICA
700 MHz B14
USA + Canada

EUROPE
700 MHz B28/B68
EU –ECC multiple countries

ASIA
700 MHz B28

SOUTH AMERICA
700 MHz B28
700 MHz B14
Multiple Countries

AFRICA
700 MHz
B28/B68
Multiple countries

MIDDLE EAST
700 MHz B28/B68
UAE + others

In summary....

1 **Mission Critical Voice complemented by situational awareness will remain the Key to future of Public safety**

Public safety operations can incorporate specific devices and analytics into their operations with LTE and 5G. 5G is being designed to be a sustainable and scalable technology.

2 **LTE extending to 5G in the future, can provide capacity for situational awareness, and Intelligence ,complementing LMR Voice**
5G will provide a significant improvement in user experience compared to 4G in peak data and latency.
LTE will need to extend to 5G to support Gbps capacities, to be able to provide an effective data and Video Layer

3 **Public safety providers need to establish prioritised 5G and LTE access either through dedicated networks, collaboration / partnerships.**

5G will deliver an ecosystem for sustainable technical and business innovation, and will require different regulatory models.
5G will support multi tenancy and network resource slicing models based on software defined architectures.

- LMR for Mission critical Voice providing nation-wide and deep indoor coverage (VHF/400 MHz)
- 4G/5G 700-800 MHz for data and video coverage , supplemented with mobile operator networks
- LTE-U/5G for Highspeed Data for hotspots /incidents (4.9 GHz/26-28 GHz)

Dedicated LMR network — Dedicated 4G/5G network — Commercial Mobile Operator networks — 5G/LTE-U High Band Incident Area. Axes: Coverage (vertical), Capacity (horizontal).
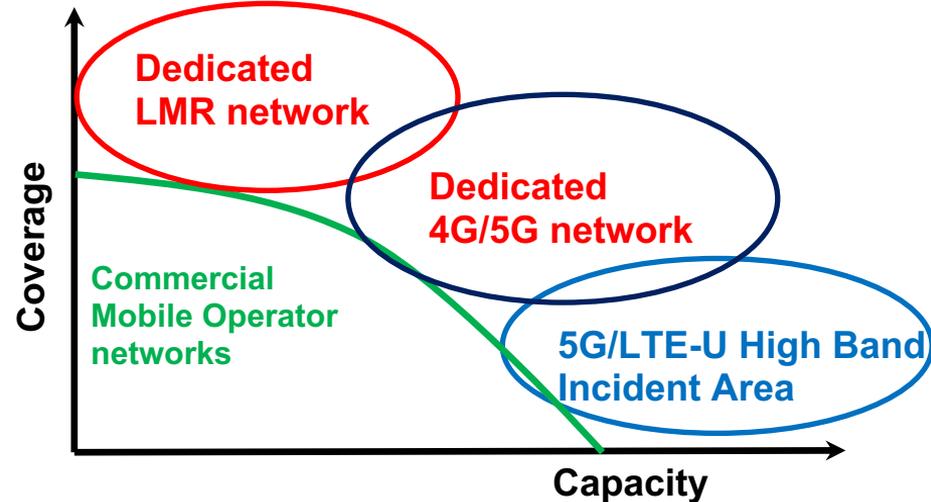
THANK YOU

Bharat.Bhatia@iafi.in

PPDR saves lives