FirstNet

Implementation of a Future Wireless Network for the First Responder

What's FirstNet?

The United States First Responders Network Authority (FirstNet) was created in 2012 as an Independent Authority within the US National Telecommunications and Information Association (NTIA) to provide First Responders with a nationwide broadband digital network dedicated to public safety.

Timeline -

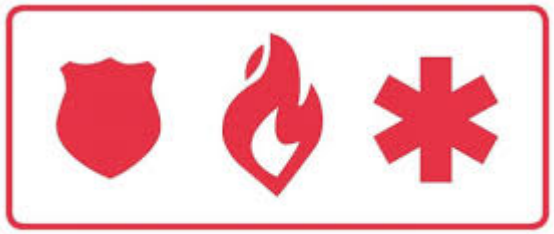
2012 – Created

2014 – Public Notice & Comment &
RFI (Request For Information)

2015 – 2018 – Rollout of Nationwide network

Who are First Responders?

Police, Fire, & Ambulance public safety personnel that provide the first reponse to accident & disaster scenes. Can also entail other governmental emergency response teams & military.



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1 http://www.legionbcyukon.ca/content/first-responders

2 http://www.keepcalm-o-matic.co.uk/p/keep-calm-i-m-a-first-responder/

What's their traditional communications medium?

Communications networks for First Responder have traditionally used Land Mobile Radio equipment

- base stations, repeaters & walkie talkies.
- dedicated single frequency operation – VHF, UHF, 700 & 800 MHz
- 25/12.5/6.25 kHz wide channels

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3 http://www.motorolasolutions.com/US-EN/Business+Product+and+Services/Two-way+Radios

Two system modes of operation:

- Conventional – users control single channel network access – collision avoidance
- Trunking – network control assigns channel resources to users – if no resources get busy signal

Historically Analog (300 Hz - 3 kHz) using FM[4]

Last 20 years Public Safety moved toward Digital

- North America: P25 (C4FM, 9600 bps, 12.5 kHz)[5]
- Europe: TETRA (4 slot TDMA, $\pi/4$ DQPSK, 25 kHz, 28.8 kbps*)[6]
- Others: Mix TETRA, P25 & proprietary

Typically only voice transmissions and limited packet data transmissions. Allowed use of:

- Encryption, Location info, short messaging

4 TIA 603D
5 TIA 102
6 ETSI EN 300 392-2 v3.2.1

FirstNet Intent

provide a US wide broadband data network that will enable First Responders access to high speed data for items such as:

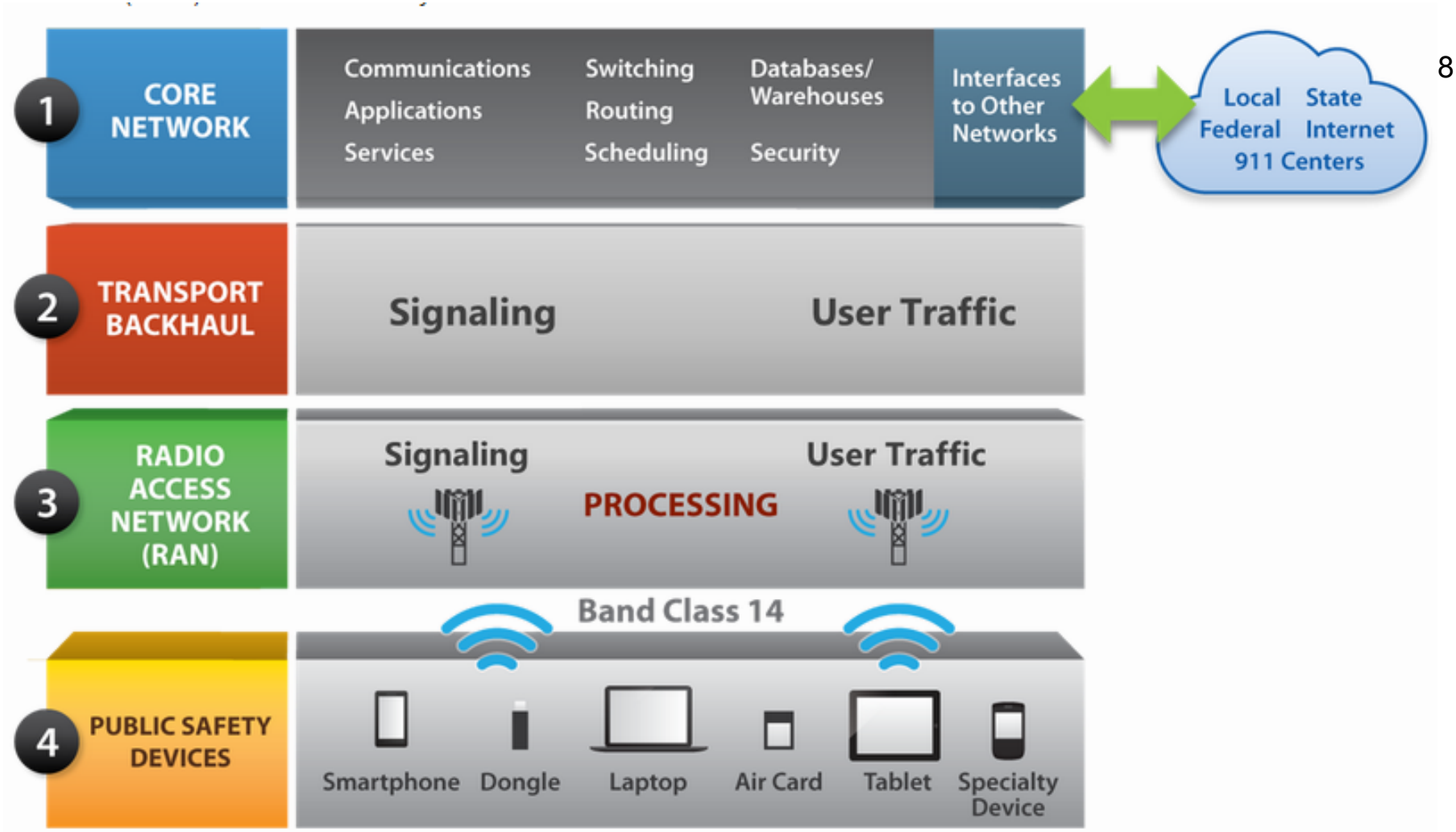
- video feeds
- detailed maps
- biometrics for First Responders & on scene victims
- access to virtual medical teams & other emergency response specialists
- detailed building & location blueprints
- access to full Material Safety Data sheets for appropriate chemical responses
- Full connectivity for Incident Command posts

FirstNet guidelines: [7]

- "...public safety users have priority access to the network"
- "...harden the network to assist with resiliency during natural disasters, incidents and man-made threats"
- "...network designed to provide mission-critical data and applications to augment the voice capabilities of today's land mobile radio (LMR) networks"
- "...enable local communications management and keep incident commanders in control"
- "...effective security controls that protect data and defend against Cyber Threats"
- "...backhaul that keeps the network up and running"
- "...leverage existing infrastructure where it makes sense"

7 http://firstnet.gov/about/guiding-principles

Four Distinct layers:



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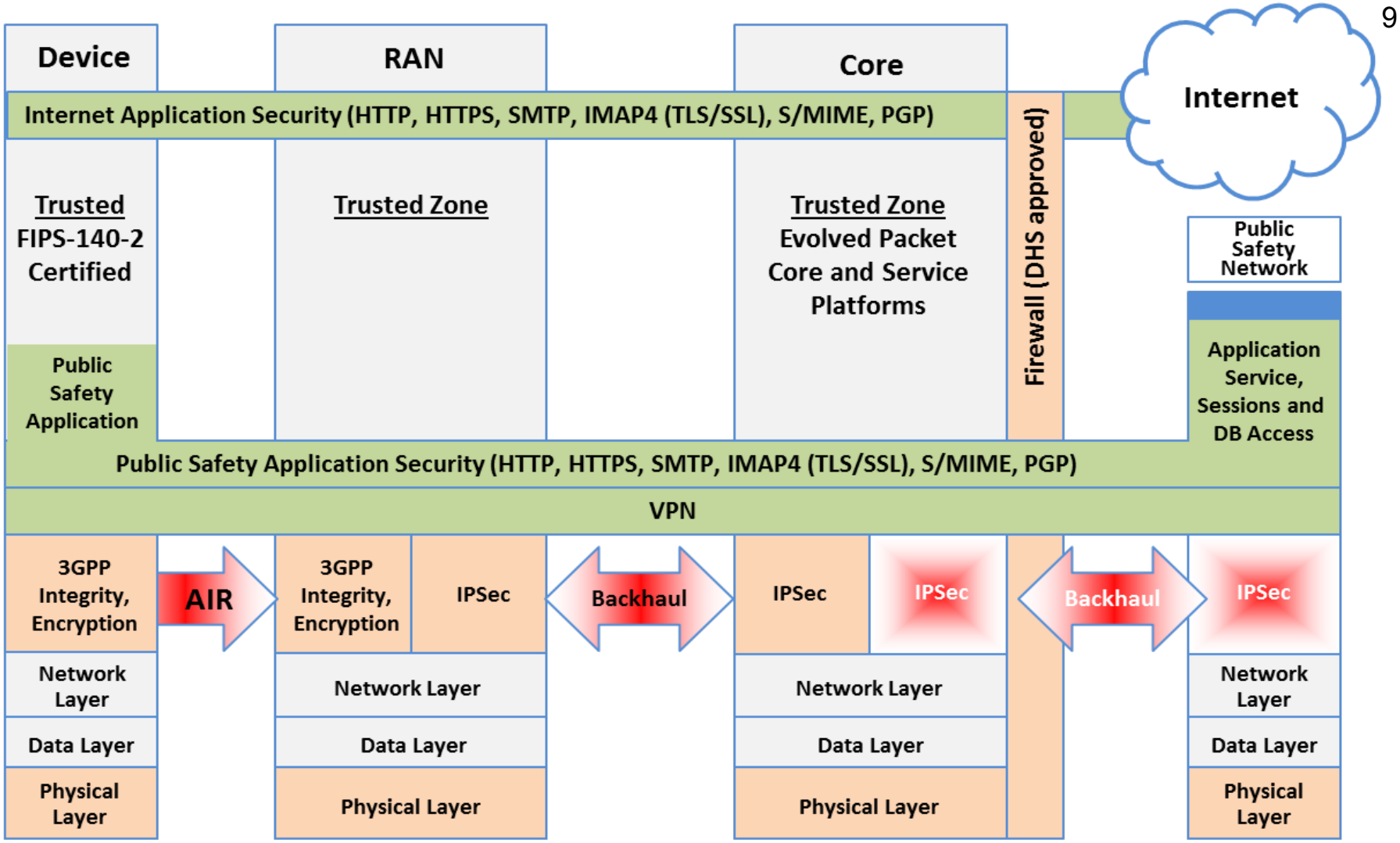
8 http://firstnet.gov/network

Security Overlay on Network Layers critical requirement -



9 http://firstnet.gov/about/guiding-principles

Radio Access Network & Backhaul

- Based on 4G LTE evolving standard
- Requirement to cover 99 percent of population and National Highway System.
  - Tens of thousands of base stations required.
- Sites & Network hardened to provide resiliency and redundancy against Earthquakes, Hurricanes, Tornados and Terrorism
- 4G LTE Band Class 14

	Uplink (UL) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	
	F_{UL_low} – F_{UL_high}	F_{DL_low} – F_{DL_high}	
12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD
14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD
15	Reserved	Reserved	FDD

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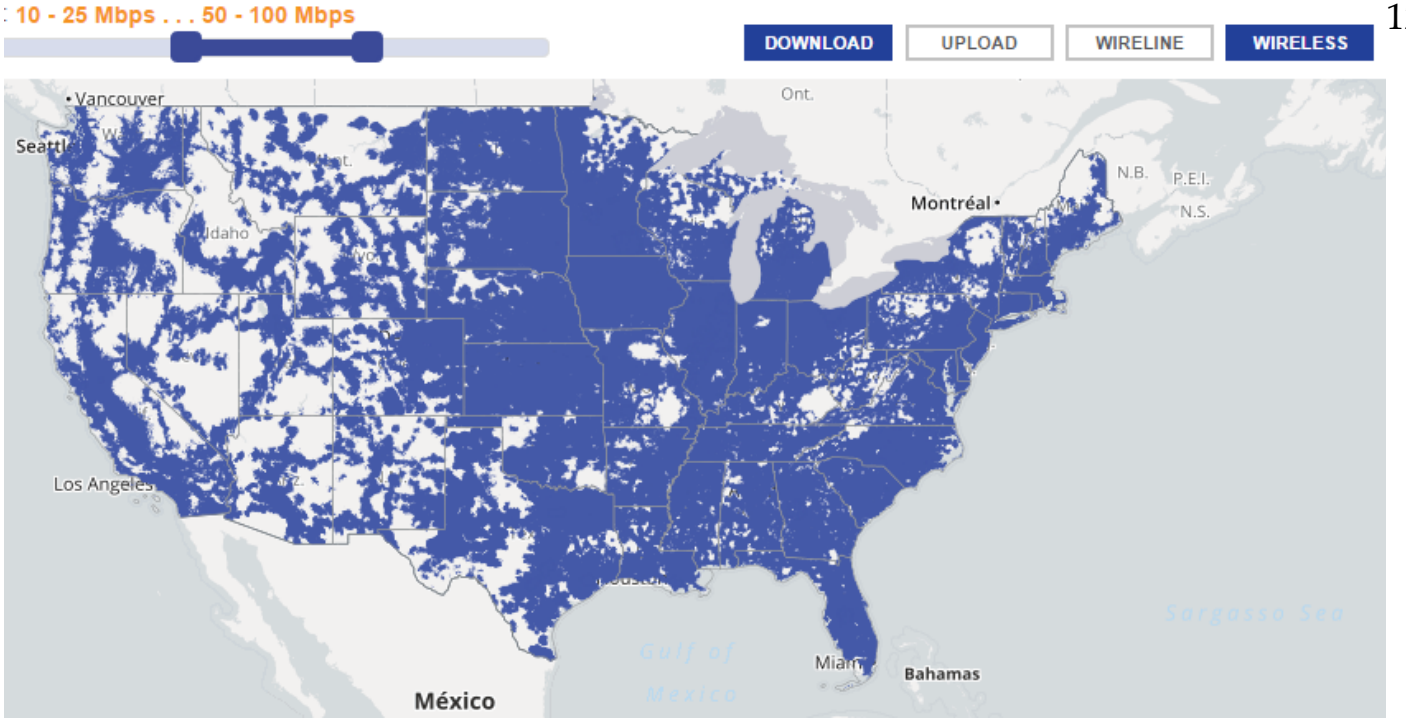
10 **3GPP TS 36.101 V12.5.0 (2014-09)**

– 2 x 5 or 1 x10 MHz channels
– Downlink data rates up to 50/100 Mbps respectively depending on modulation used and antenna (MIMO)[11]

- RAN (Radio Access Network) is one of the most challenging aspects of FirstNet. Below is current commercial coverage with similar data rates:



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11 http://www.lte-bullets.com/LTE%20in%20Bullets%20-%20DL%20Bit%20Rates.pdf
12 http://www.broadbandmap.gov/speed

Devices & Applications:

- Devices are required to operate on both FirstNet & Commercial networks[13]
  - Smartphones, Tablets, Cellular modems required
  - Must be multi user capable
- Applications will make use of the broadband nature of network
  - Multimedia conferencing
  - Situational Awareness (maps, blueprints, video feeds)
  - Personal Biometrics
  - PTT apps
  - Video & Data logging
  - Killer App will help with buy-in

13 Public Safety Broadband High-Level Launch Requirements Statement of Requirements for FirstNet Consideration - http://www.npstc.org/download.jsp?tableId=37&column=217&id=2609&file=BBWG_SoR_Launch_12112012.pdf

Concerns:

Cost of system due to coverage & hardening requirements

- Hardening of sites can leverage commercial operations but go beyond typical cell site requirements
- More stringent tower requirements, backup power requirements and security requirements
- Coverage for 700 MHz will be an issue.
  - Rural density in Western/Central US will require substantial # of sites to reach population
  - In building coverage will be a challenge in urban environment
- 2 Million Public Safety users vs 300 Million commercial cellular users in 2010 could reduce cost if commercial technology could be leveraged[14]

14 http://www.ntia.doc.gov/files/ntia/publications/firstnet_story-_cca_april17-2013.pdf

Interference with existing PS NB channels

- Public Safety Narrow-Band frequencies are adjacent to FirstNet frequencies
- NB networks use highpower basestations (100W) and mobiles (30W)
- NB & WB devices now expected to work simultaneously

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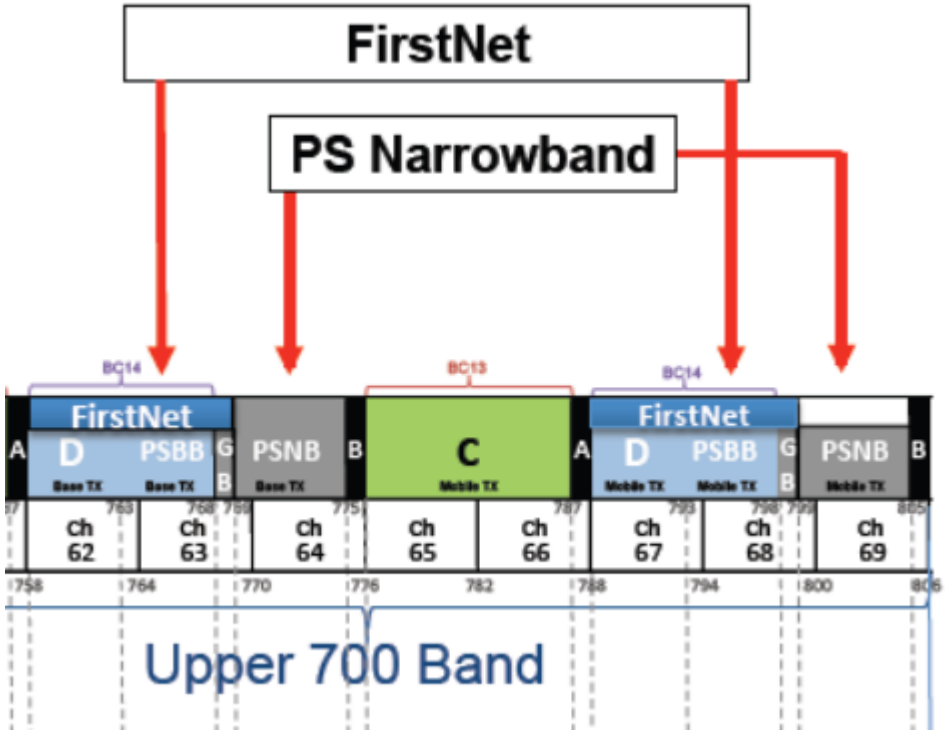

15 http://competitivecarriers.org/wp-content/uploads/2012/10/Presentation-Public-Safety-LTE-Opportunities-2.pdf

Buy-in by Public Safety community

- Community prefers independent networks for each type of organization – Police vs Fire vs EMT
- Need system to work – must be Reliable, Robust, Secure
  - Seen cellular networks knocked out in past
- Issues with current Digital networks with vocoders and concerns of reliability
  - Analog only radios on Fireground
  - Many Police & Fire systems still analog

Future of FirstNet

- RFI and comments period closed Oct 27, 2014.
- ~ 200 responses received from industry, government, & public safety organizations.
- FirstNet is reviewing and will issue updates in the coming year to push network forward.
- Politics & Marketing will play an important role in the technology that is deployed
- "Best is the enemy of good enough " but who decides what is "good enough"