The Public Safety Broadband Wireless Network:

21st Century Communications for First Responders

Public Safety Homeland Security Bureau

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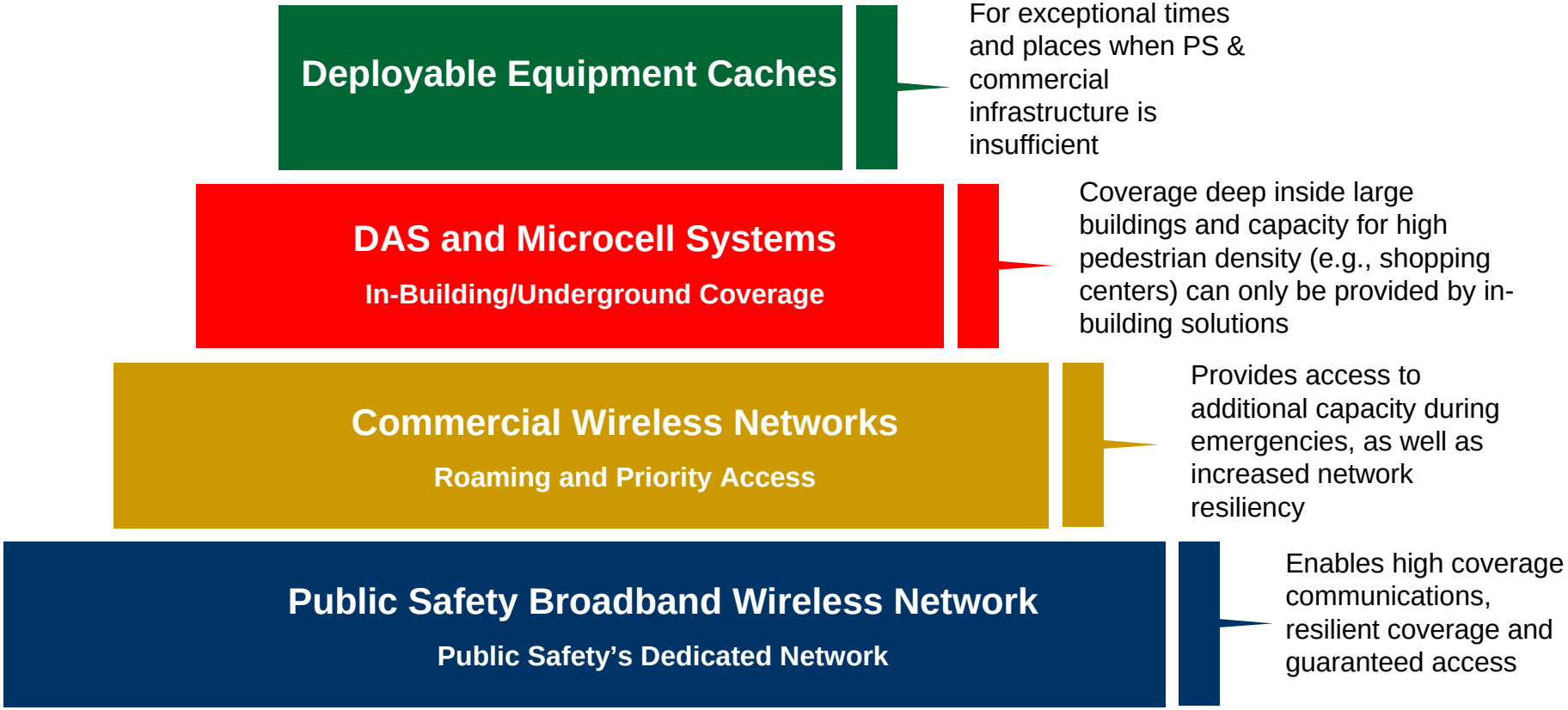
Federal Communications Commission

Public Safety Network and Solutions

Solution for **Reliable, High Coverage Mission Critical** Voice, Data, & Video 4G Services



Cost Model Details

- CAPEX
  - Building Public Safety 700 MHz BB Spectrum Network
    - 95% POPS (dense urban to moderate rural) buildout
    - Hardening the 99% POPS network
    - Highly rural (95% to 99% of POPS)
  - Deployables
  - Excluded - devices
- OPEX
  - Cell site OA&M
  - Transport and IP Managed Services
  - Additional Rural Costs and Miscellaneous
  - Excluded – priority access and roaming, in-building

Broadband Network Strategy

- **Nationwide broadband network can be deployed for less than what we've spent on narrowband interop**
- Authorized network operators will deploy and operate a BB network designed for public safety in 10 MHz of spectrum
  - Perhaps in incentive-based partnerships with commercial entities, using their own infrastructure, or some combination
- PS can use commercial networks by roaming on priority basis
  - Improves redundancy and resiliency
- Funding for network construction, operation, and evolution
  - Grants for cap ex. Broadband fee to fund op ex
  - Makes nationwide build-out possible, including rural America
  - Supports hardening of existing infrastructure
- Requirements to create user devices that serve public safety
- Interoperability standards through ERIC

Diverse Services Available Nationwide

- Network will support diverse applications
  - Data and video services via IP transport in early years, forming a more reliable version of cutting-edge commercial offering.
  - Evolving to support mission-critical voice, data, and video
  - 256 kb/s or more per device, even at cell edge
- Dedicated public safety spectrum, supplemented with commercial spectrum
  - Network built to strict public safety standards in 10 MHz of public safety spectrum
  - Public safety can roam onto up to 70 MHz of spectrum licensed to commercial providers

Priority Access and Roaming

- **Public safety users would be able to roam with priority onto spectrum used by commercial systems.**
  - **Increased capacity**
  - **Improved dependability**
  - **Improved coverage**
- **Operators will recover costs at favorable commercial rates.**
- **Emerging technology supports flexible priority mechanism that can be configured to meet any public safety need.**
  - **Use of IP gives network operator ability to manage traffic such that important public safety traffic gets needed data rates and quality of service.**
  - **LTE standard defines mechanisms that use priority in determining which sessions can be established and which can be maintained.**
- **Reaching Agreement**
  - **FCC will work with public safety, commercial wireless carriers and vendors to determine precise needs, and how systems should be configured to meet those needs**

Complementary Strategies for Existing Network Footprint and Rural Areas

- Overlay the Commercial LTE Network to 95% of the Population
  - Commercial networks have built out infrastructure to reach 290 million Americans
  - Public safety can use and harden these same towers to achieve excellent coverage and signal reliability for a much smaller number of users
  - Public safety transceivers will be placed on up to 41 K commercial towers.
    - Providers will compete to provide this service
  - Public safety mobile devices will be hardened versions of commercial handheld devices to reduce costs and increase functionality
- For the most rural remaining 5% build a vehicular LTE network
  - Public safety will use and harden LMR or other towers where available, and will supplement with new towers where needed
  - To reduce number of rural towers needed, mobile devices in rural areas will have externally mounted antennas as is common today
  - In-door coverage improved through “relays” placed in emergency vehicles

More Technical Requirements

- Network will meet public safety requirements for coverage and signal reliability. Cost model assumes
  - In-building coverage from basestation is designed to meet stringent NPSTC and PSST path loss requirements.
    - Better coverage than many commercial systems.
  - For highly rural areas, in-building coverage requirements met in part through external antenna mounts and vehicular repeaters.

- Cost model assumes use of commercial technology for mobile devices, thereby reducing costs
  - 95% of population reached by handsets with 23 dBm transmit power and internal antenna
    - Same power assumed for highly rural areas, but vehicular external antenna mount

Benefits of Incentive-Based Partnerships

- Increased redundancy and reliability
- Improved capacity and performance for Public Safety
- Reduced costs for PS agencies and state and local governments
- Improves commercial infrastructure and reach
- Transition path to increased spectrum and operational efficiency
- Enable public safety to evolve with commercial technology, applications, and devices improvements (evergreen)

Model Assumed for Costing

Under contract with PS, commercial entity builds dedicated BB net Sharing of backhaul, core IP transport, tower.

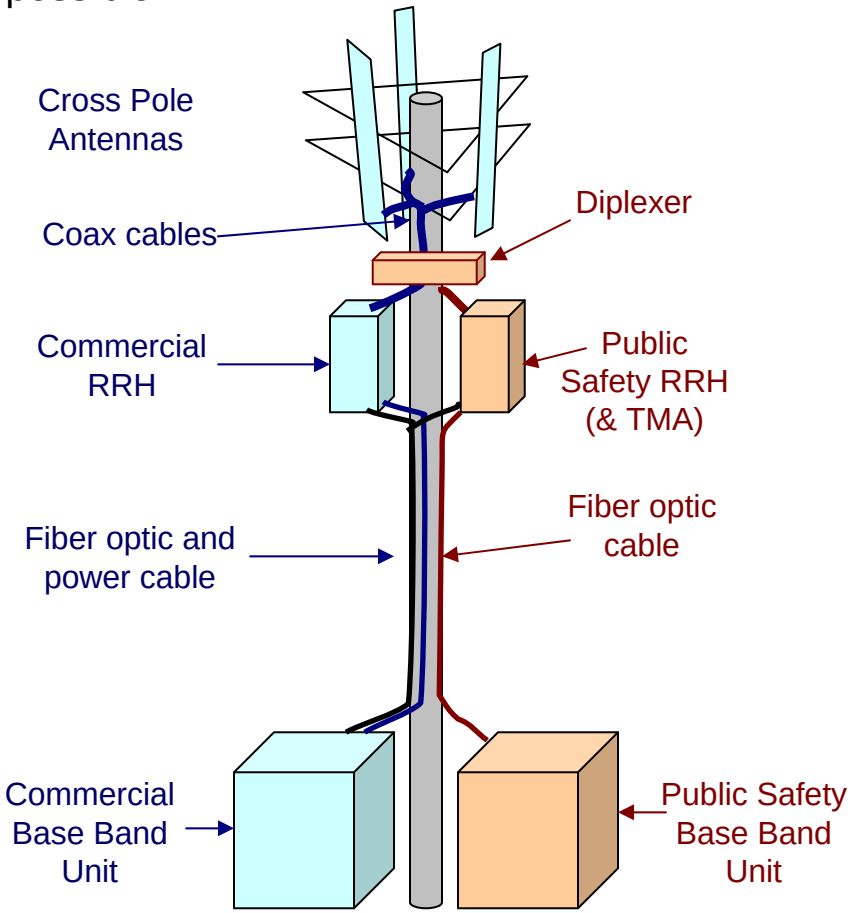
Infrastructure Oriented ⟷ ***Service Oriented***

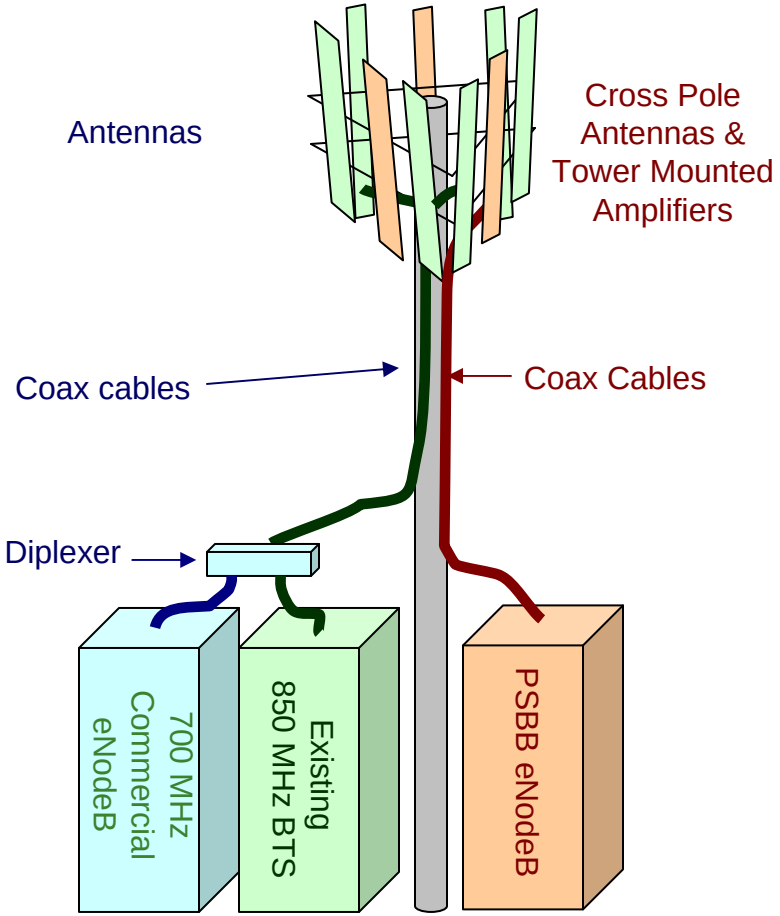
	Dedicated Network	Dedicated Radio Access Network	Dedicated Channel	Fully Shared, Enterprise	Fully Shared, Retail
Description	• PS has separate base stations, backhaul and core network	• PS has separate base stations, uses carrier core network	• PS uses carrier RAN and core, with line card for PS spectrum	• PS uses carrier network for data transport, adds service layer	• PS relies on carrier network for data transport and services
Business Model	• Contract to build and manage network	• Contract for RAN OA&M • Tonnage fees for core services	• Install subsidy for channel card • Tonnage fees for core services	• Tonnage fees	• User / service fees
Advantages	• Maximum PS control, flexibility, and dedicated capacity	• PS can specify RAN req's, dedicated RAN capacity	• Dedicated RAN capacity, cost-efficient	• High cost efficiency, service level flexibility	• High cost efficiency, operational simplicity
Disadvantages	• High PS cost and complexity	• RAN cost redundancies	• Some limits on feature flexibility	• No dedicated capacity	• No dedicated capacity, less service flexibility, higher user fees

= Assumed Model

Example Public Safety / Commercial Base Station Configurations

- Depending on Public Safety / Commercial agreements, more active sharing than shown may be possible





Other bands supported by commercial operator not shown

Device Ecosystem

- There is a great opportunity with LTE to leverage commercial economies of scale on those parts that add the most cost to devices
- Therefore public safety devices will be close to the cost of unsubsidized commercial devices

Component ==>	*Hardware*	*Software/ Middleware*	*Operating System*	*Baseband Chipset*	*RF Chipset*	*RF Front End*
Degree of commonality to commercial devices	Medium	Medium	100%	100%	100%	Low
Effect of customization on cost	Low	Medium	High	High	High	Low

Cost of customizing the highest cost components will NOT be incurred because they are 100% leveraged

Deployables

- **$200 M program to provide development and initial deployment to support two use cases**

- **Fleets for Mobile Cell Site Deployment**
  - **Provides for PS BB Spectrum coverage where no cell sites**
    - **Remote areas such as wilderness**
    - **Replacement of cell site(s) destroyed by disaster**
  - **Supplemental coverage for long-term major incidents**
  - **Fleets on regional/state basis to provide coverage w/in a few hours**

- **Vehicular Area Networks**
  - **Equips vehicles with “relay capability” so first responders can leave vehicle with handheld and use vehicle to communicate to PS BB network**
    - **Enhance coverage into buildings**
    - **Extends coverage from vehicle to surrounding area**

Summary

- Ensures that broadband wireless communications for public safety will be fully interoperable across all geographies and jurisdictions
- Ensures nationwide coverage
- Provides for funding for the construction, operation and evolution of the public safety network
- Provides for reserve capacity and needed redundancy and reliability through roaming and priority access on commercial broadband networks
- Ensures that public safety will have handsets available at consumer electronic prices