

# RESEARCH AND ANALYSIS

The First Phase of our Work



**Craig Farrill**

Acting CTO

FirstNet Board Member

### This section is about...

- Concepts and analysis, **not** decisions
- Work we need to complete to move FirstNet forward
- Analysis that can't be completed until we get input from you
- What FirstNet will be and do for you

Here's our current thinking...



**FirstNet has researched many areas to get ready for state consultation.**

### **Network Analysis Areas**

- Architecture
- Coverage and Capacity
- Dynamic Priority and Control
- Security
- Resiliency and Reliability

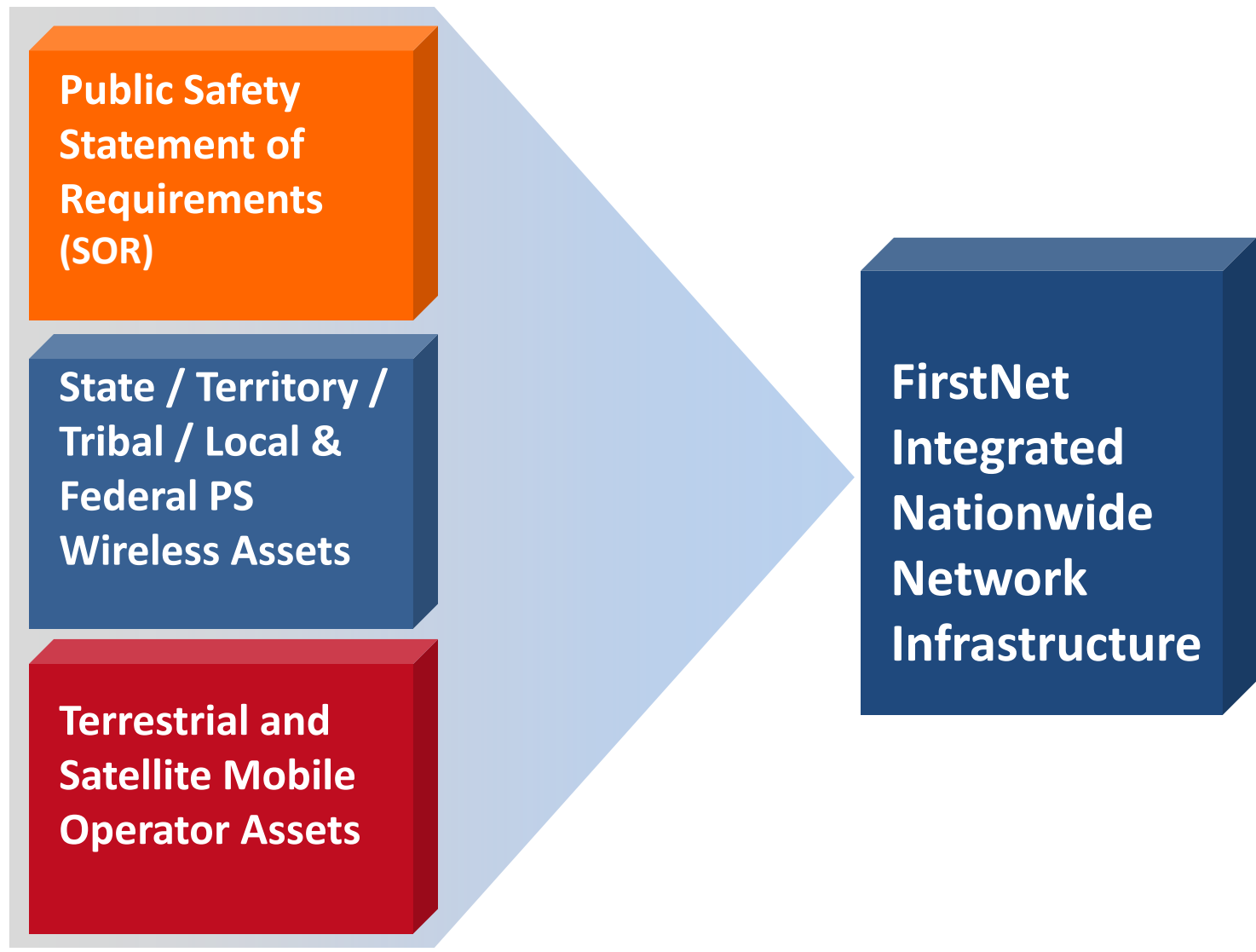
### **Radio Access Network Analysis Areas**

- Performance Optimization
- Cell Range
- Radio Planning Criteria

### **Core Network Analysis Areas**

- Core Architecture and Standards
- Distributed Hubs
- Data Centers

**FirstNet will integrate public safety requirements and assets.**



## What will FirstNet do for you?



### Communication

- Video: 1-to-many
- Messaging
- Images
- Group Text
- Voice: Non-Mission Critical

### Applications

- Your applications (Private, Selective sharing)
- FirstNet Applications
- Syndicated Applications



### Services

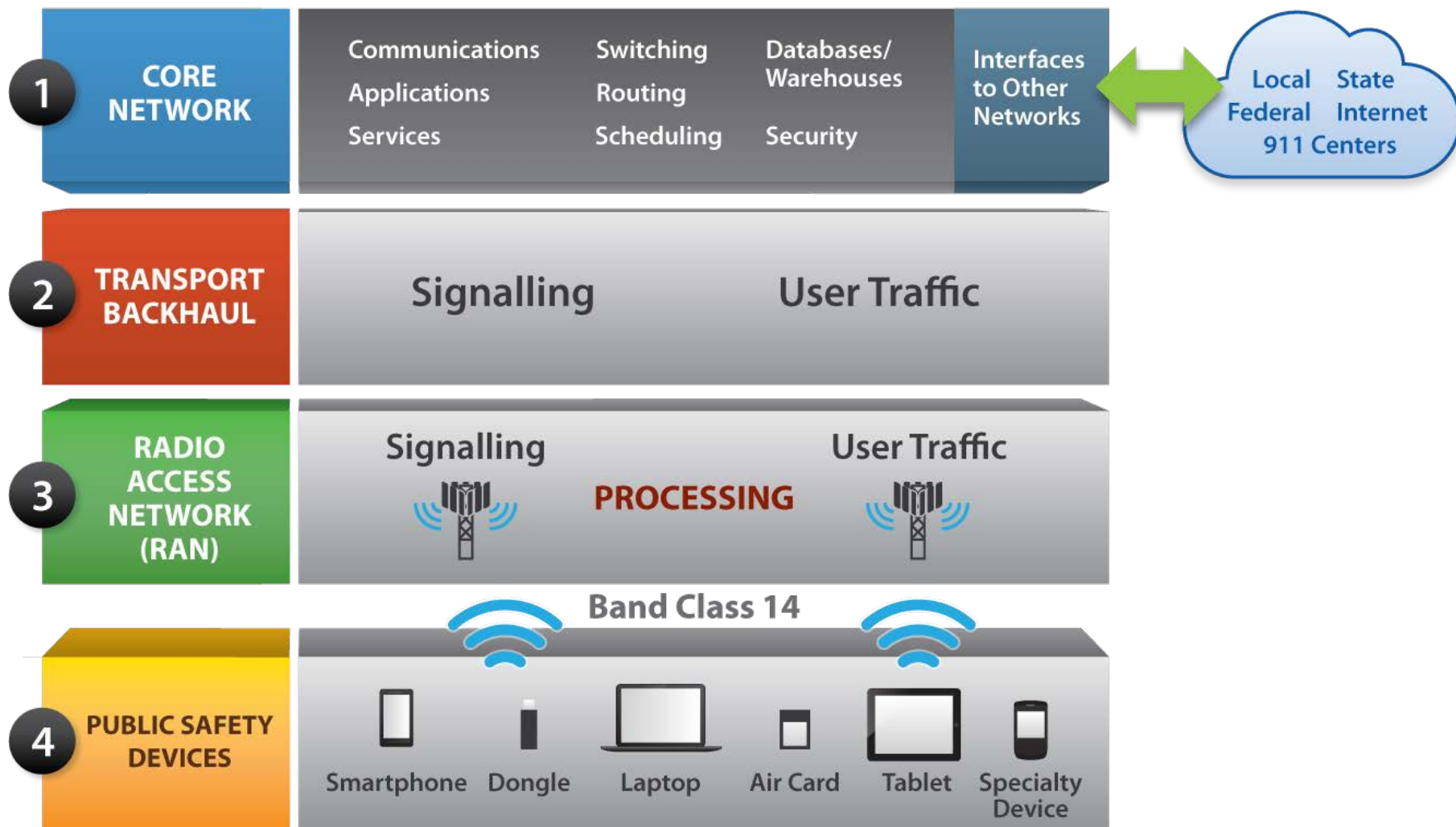
- Data Storage
- Recordkeeping
- Search
- Databases (CJIS, etc.)

### Capabilities

- NOC Status
- Activation
- Product Ordering
- Dynamic Priority Access

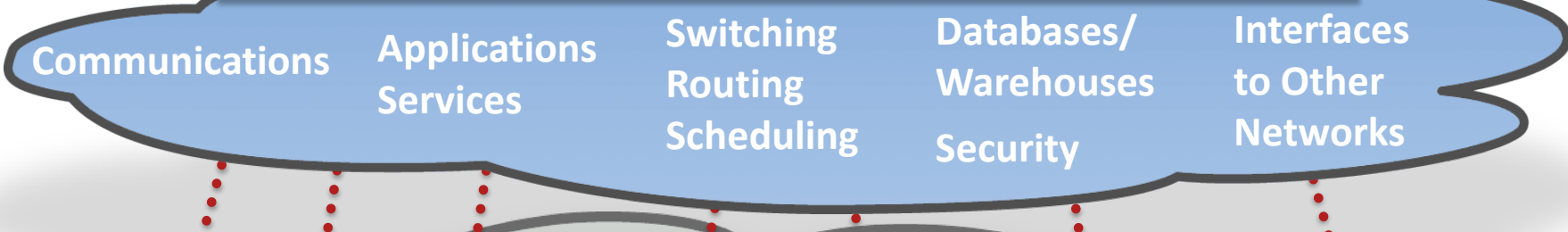


## Four fundamental building blocks that make up a network

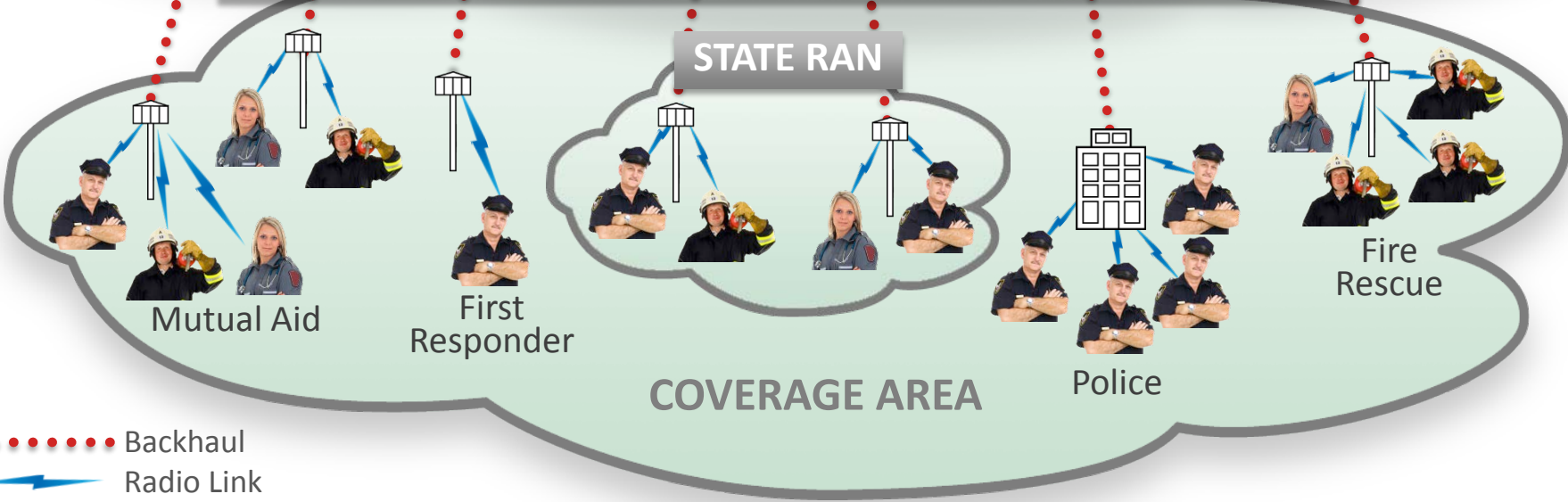


## FirstNet: Nationwide Core and Local Radio Access Networks

### FIRSTNET NATIONWIDE DISTRIBUTED CORE NETWORK



### FIRSTNET RADIO ACCESS NETWORK (RAN)



**Working with the public safety community, we will define what “public safety grade” means.**

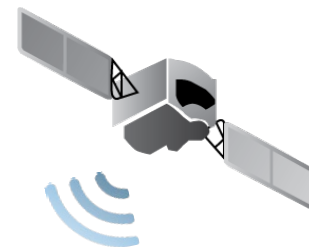
<b>FirstNet Attribute</b>	<b>Defining Public Safety Grade</b>
<b>Coverage</b>	<b>“Where public safety needs it”</b> (Geographic)
<b>Reliability</b>	<b>“You can bet your life on it”</b>
<b>Resiliency</b>	<b>“Multiple back-up options”</b>
<b>Emergency Communications</b>	<b>“Your trusted resource”</b>
<b>Group Communications</b>	<b>“Essential to teamwork”</b>



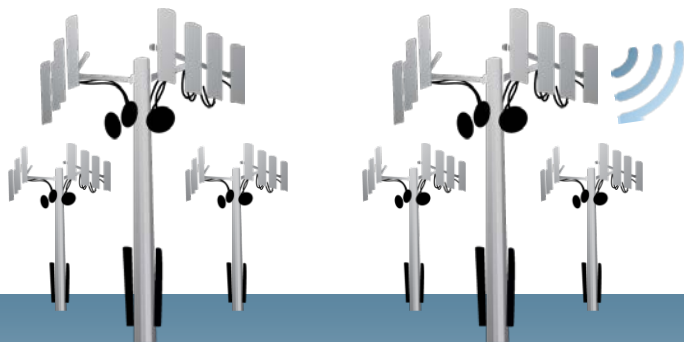
# Diverse Coverage Architecture: considering a “3-in-1” Approach: Terrestrial + Satellite + Deployable



**#2:  
Mobile Satellite Systems**



**#1:  
Multiple Terrestrial Mobile Systems**

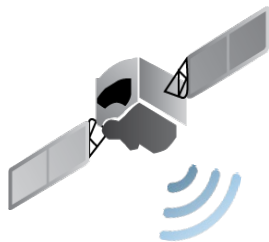


**#3:  
Deployable Systems**

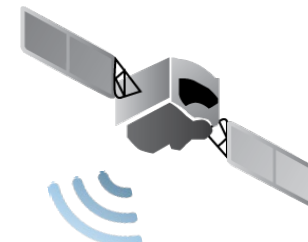


**Public Safety User**

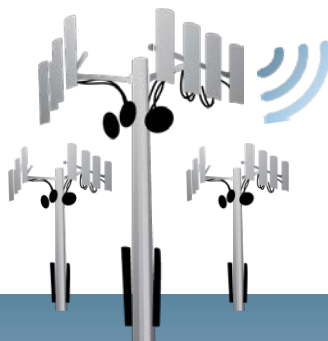
# Diverse Coverage Architecture: considering a “3-in-1” Approach: Terrestrial + Satellite + Deployable



**#2:  
Mobile Satellite Systems**



**#1:  
Terrestrial Mobile System**

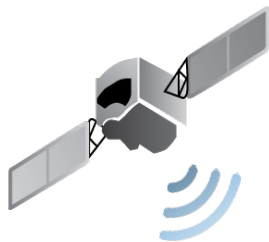


**#3:  
Deployable Systems**



**Public Safety User**

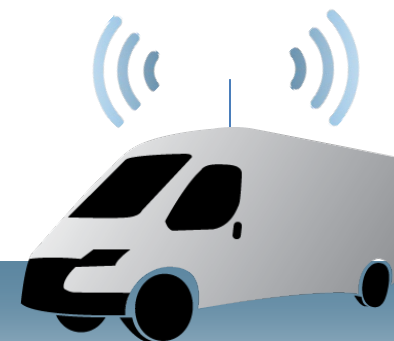
# Diverse Coverage Architecture: considering a “3-in-1” Approach: Terrestrial + Satellite + Deployable



**#2:  
Mobile Satellite Systems**



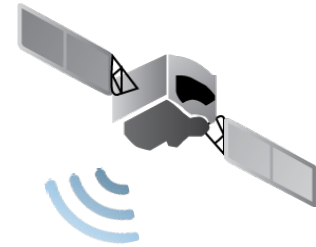
**#3:  
Deployable Systems**



**Public Safety User**

# Diverse Coverage Architecture: considering a “3-in-1” Approach: Terrestrial + Satellite + Deployable

**#2:  
Mobile Satellite System**



**#3:  
Deployable Systems**



**Public Safety User**

# Diverse Coverage Architecture: considering a “3-in-1” Approach: Terrestrial + Satellite + Deployable

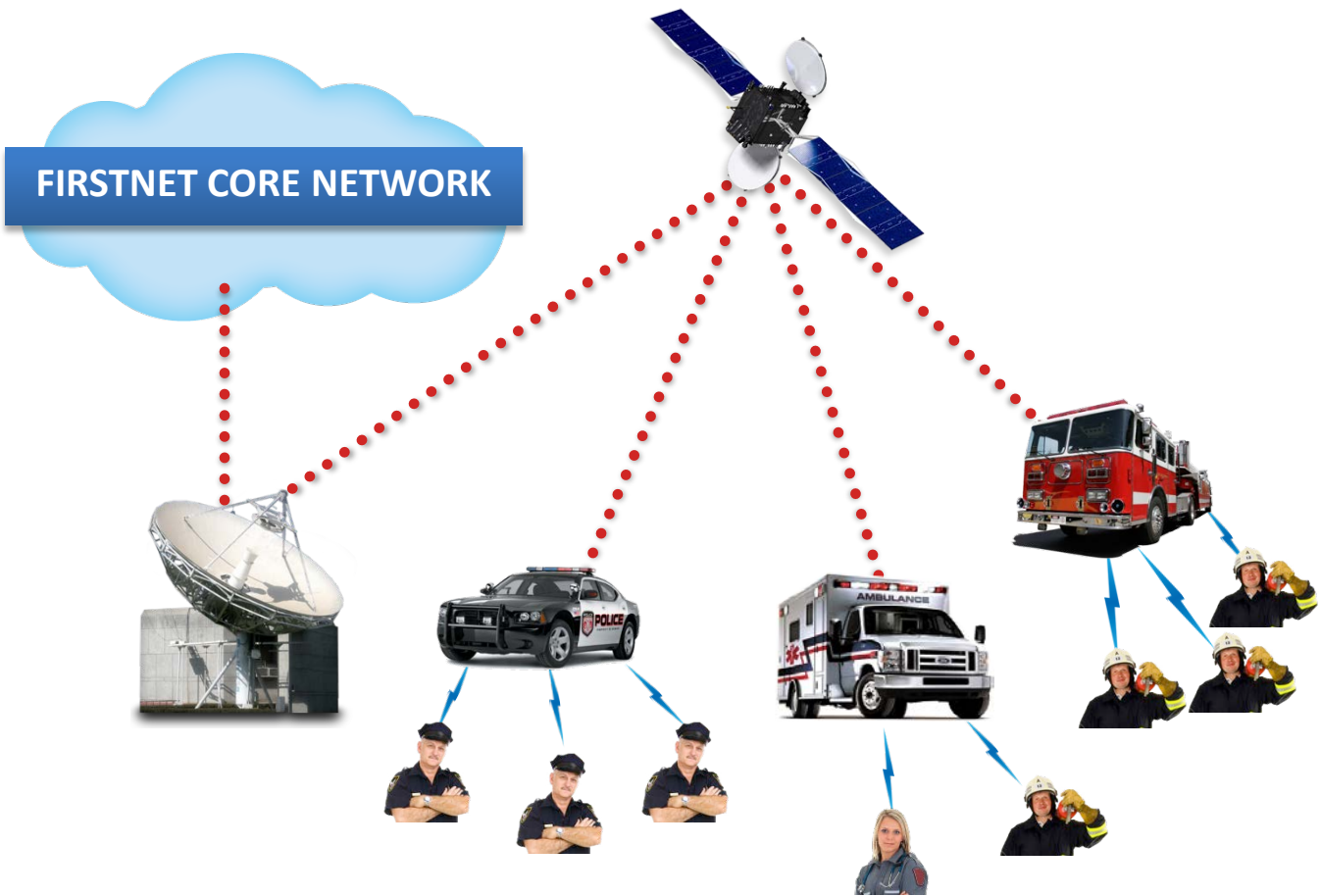
**#3:  
Deployable Systems**



**Public Safety User**



# SkyBridge: Using satellite to connect to FirstNet Core services and applications.



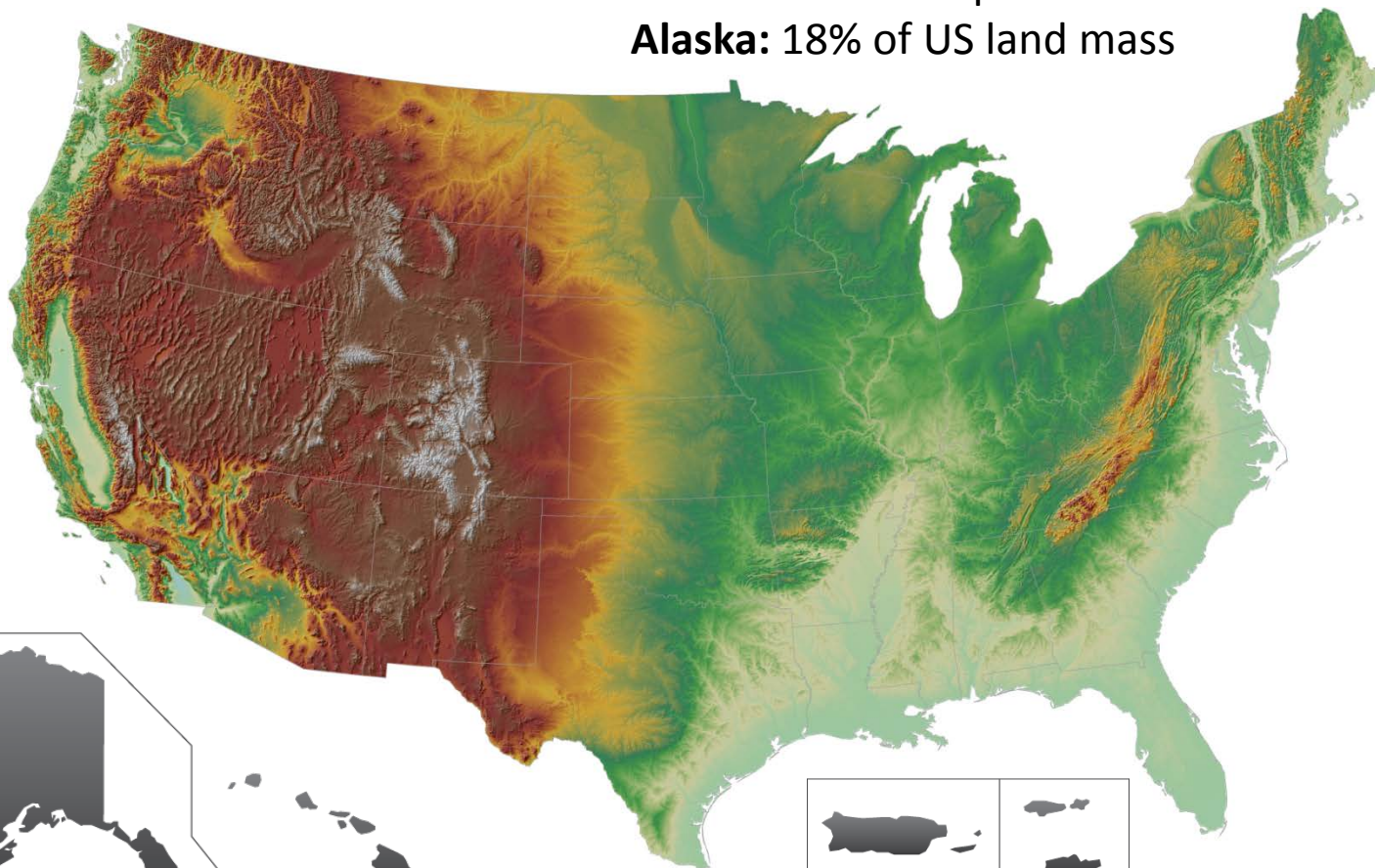
## SKYBRIDGE BENEFITS

- A vehicle-mounted and powered FirstNet BC14 PicoCell
- Local coverage in and around vehicle
- Works wherever satellite data links can be established
- Can serve:
  - Rural areas
  - Tribal lands
  - Wilderness
  - Parks and federal lands

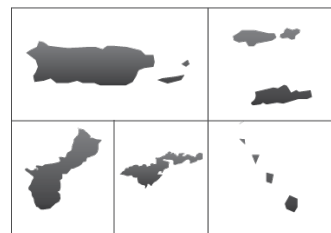
# Terrain Ruggedness: a major impact on radio propagation

USA: 3.8 million square miles

Alaska: 18% of US land mass

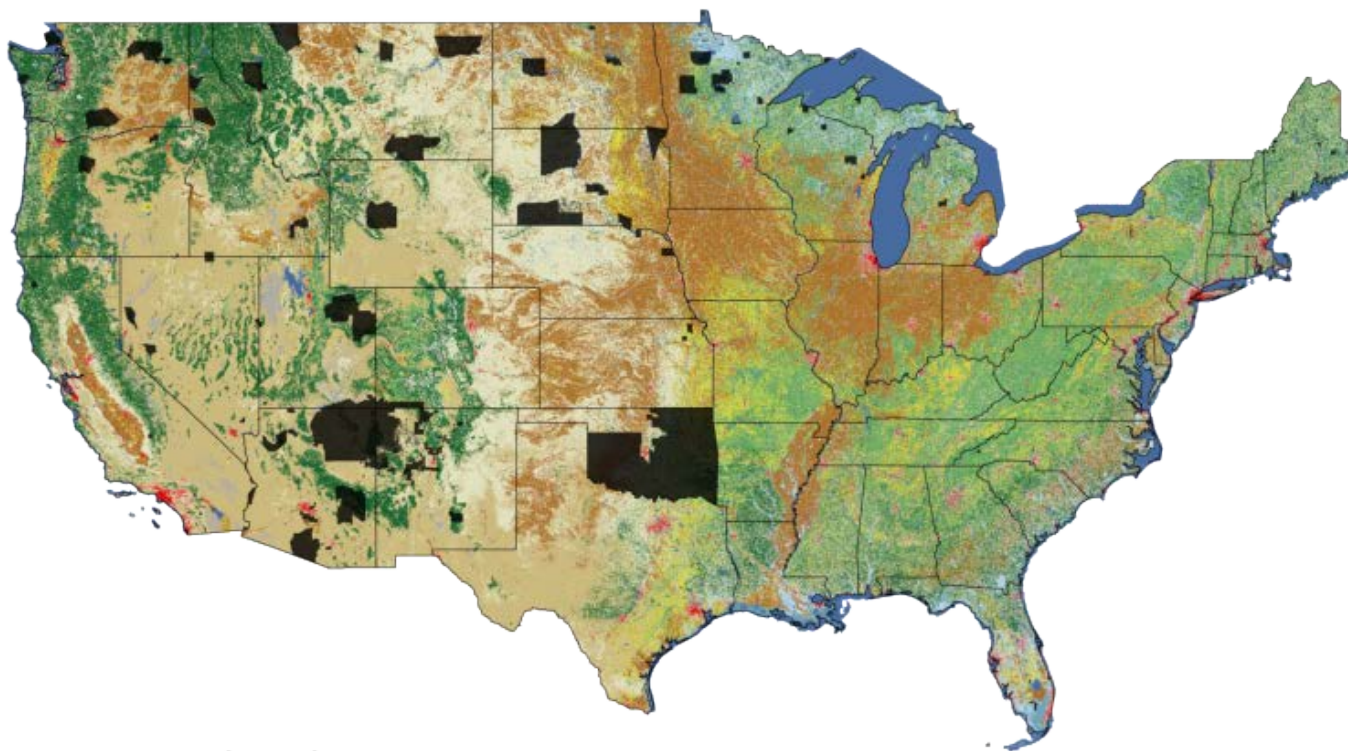


Terrain data for Alaska and Hawaii not immediately available



Terrain data for U.S. territories not immediately available

# Land use is significant to coverage planning.



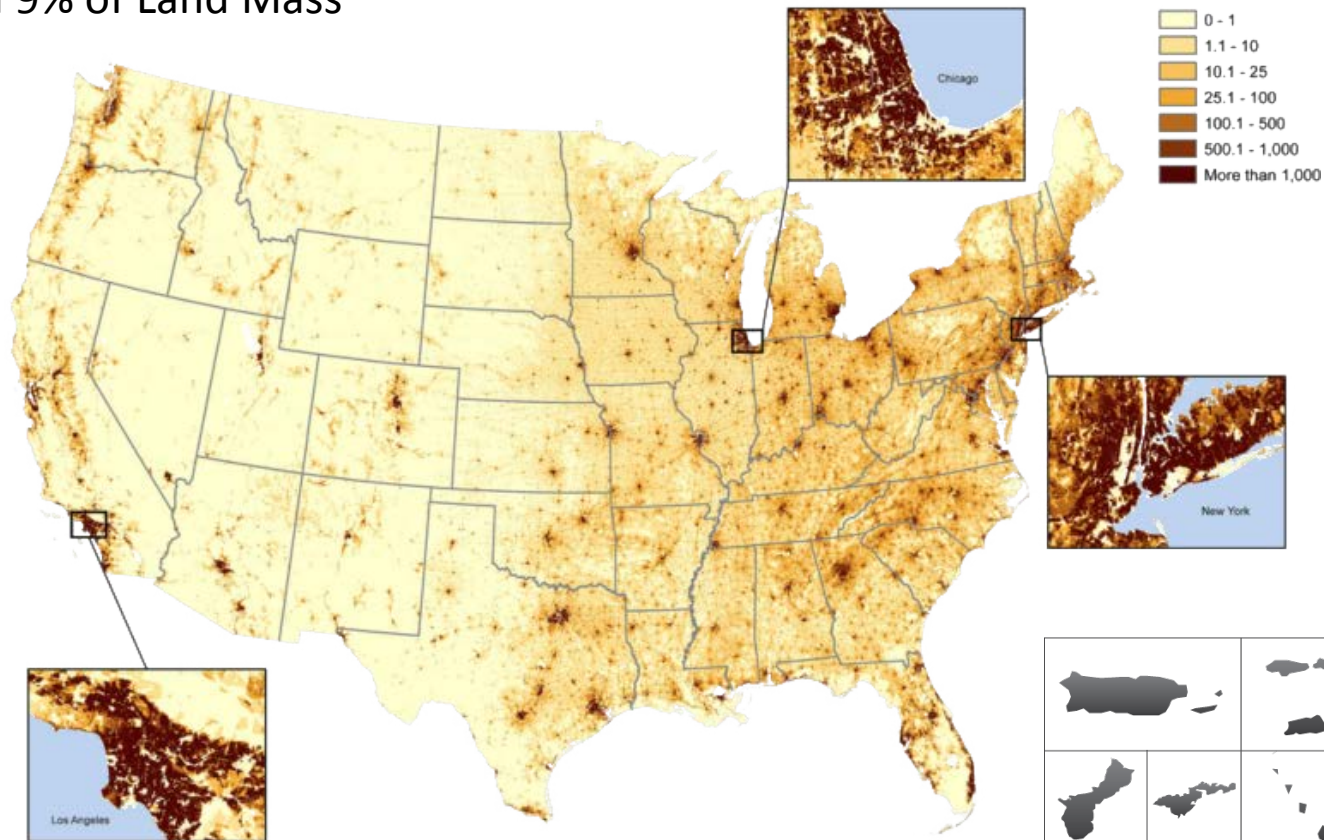
**Legend**

Open Water	Deciduous Forest	Moss
Perennial Ice/Snow	Evergreen Forest	Pasture Hay
Developed, Open Space	Mixed Forest	Cultivated Crops
Developed, Low Intensity	Dwarf Scrub	Woody Wetlands
Developed, Medium Intensity	Shrub/Scrub	Emergent Herbaceous Wetlands
Developed, High Intensity	Grassland	Tribal Land
Barren Land	Sedge	

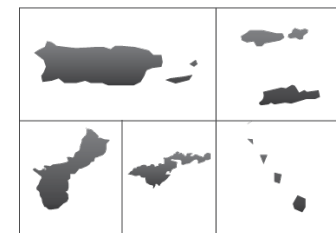


# Population is a starting point, but public safety events don't always happen where people live.

Population Density: 85% of US Population Lives Within 9% of Land Mass



Population data for Alaska and Hawaii not immediately available



Population data for U.S. territories not immediately available

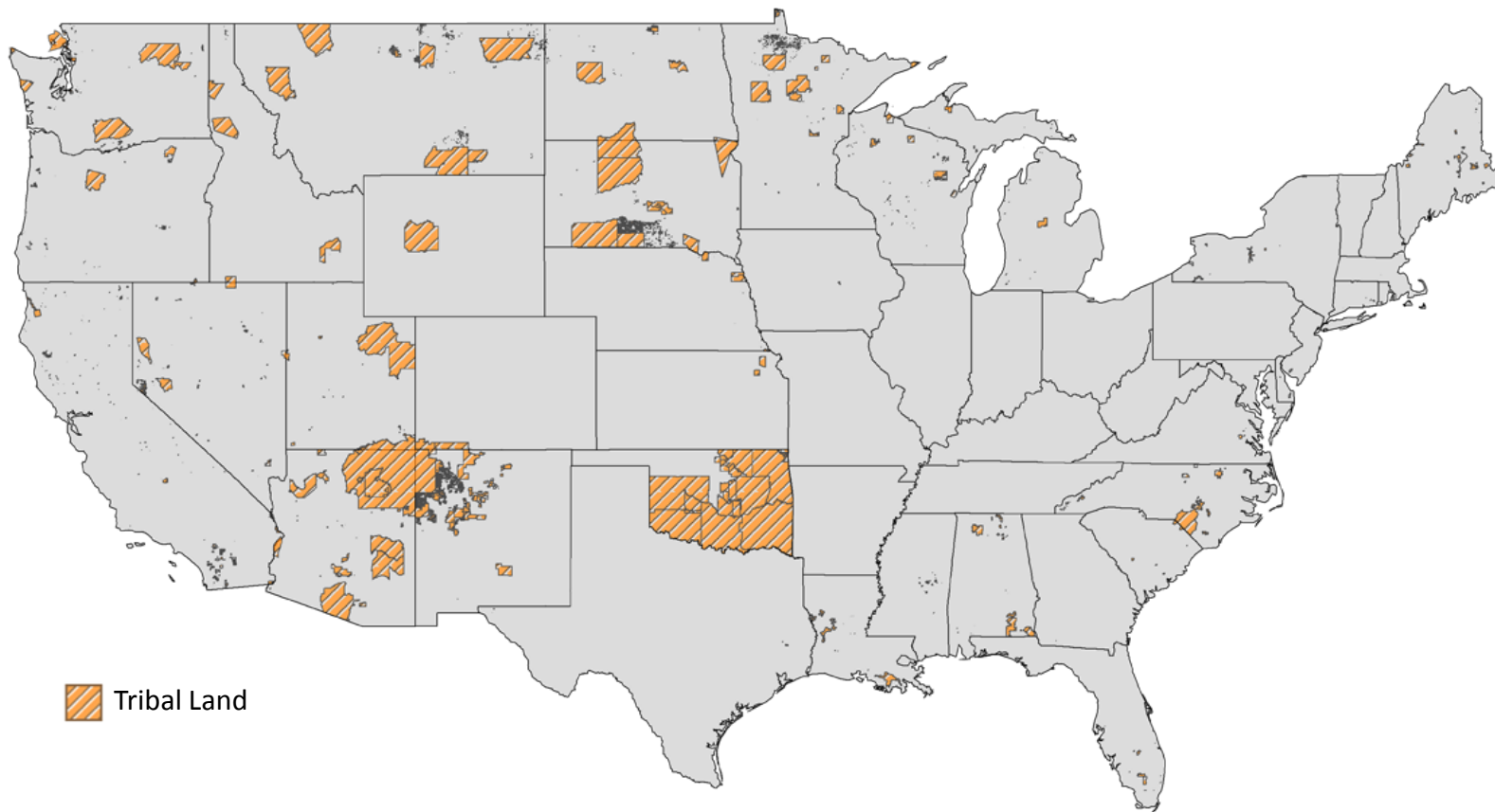
Our nation's roads and highways are used extensively by first responders.



Highway data for U.S. territories not immediately available

National Highway System: as Defined by the Federal Highway Administration

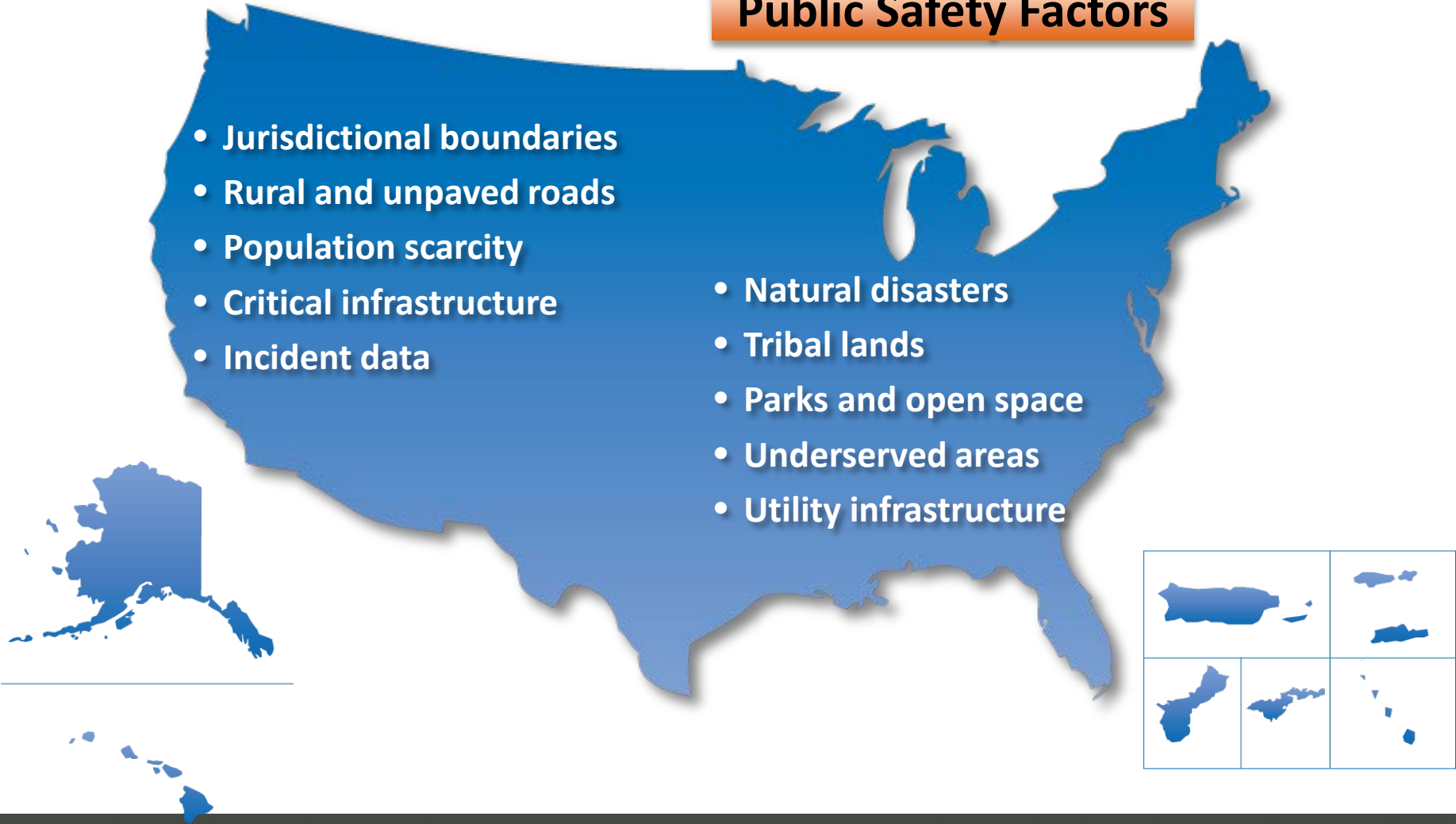
FirstNet has a mandate to provide rural coverage which includes tribal lands.



# FirstNet coverage considerations go far beyond those of commercial networks.

## Public Safety Factors

- Jurisdictional boundaries
- Rural and unpaved roads
- Population scarcity
- Critical infrastructure
- Incident data
- Natural disasters
- Tribal lands
- Parks and open space
- Underserved areas
- Utility infrastructure



# RELIABILITY



The majority of cell site outages are due to loss of power and data links.



Public safety-grade design includes:

- Extended battery life
- Back-up power systems
- Diverse cell site links
- Diverse cell site link technology (fiber, coax, microwave, telco)

**A redundant and diverse network is essential for reliability.**



## REDUNDANCY

### PHYSICAL

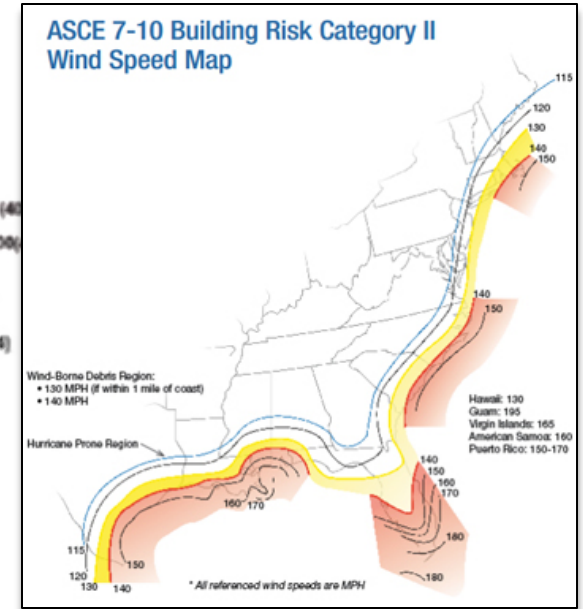
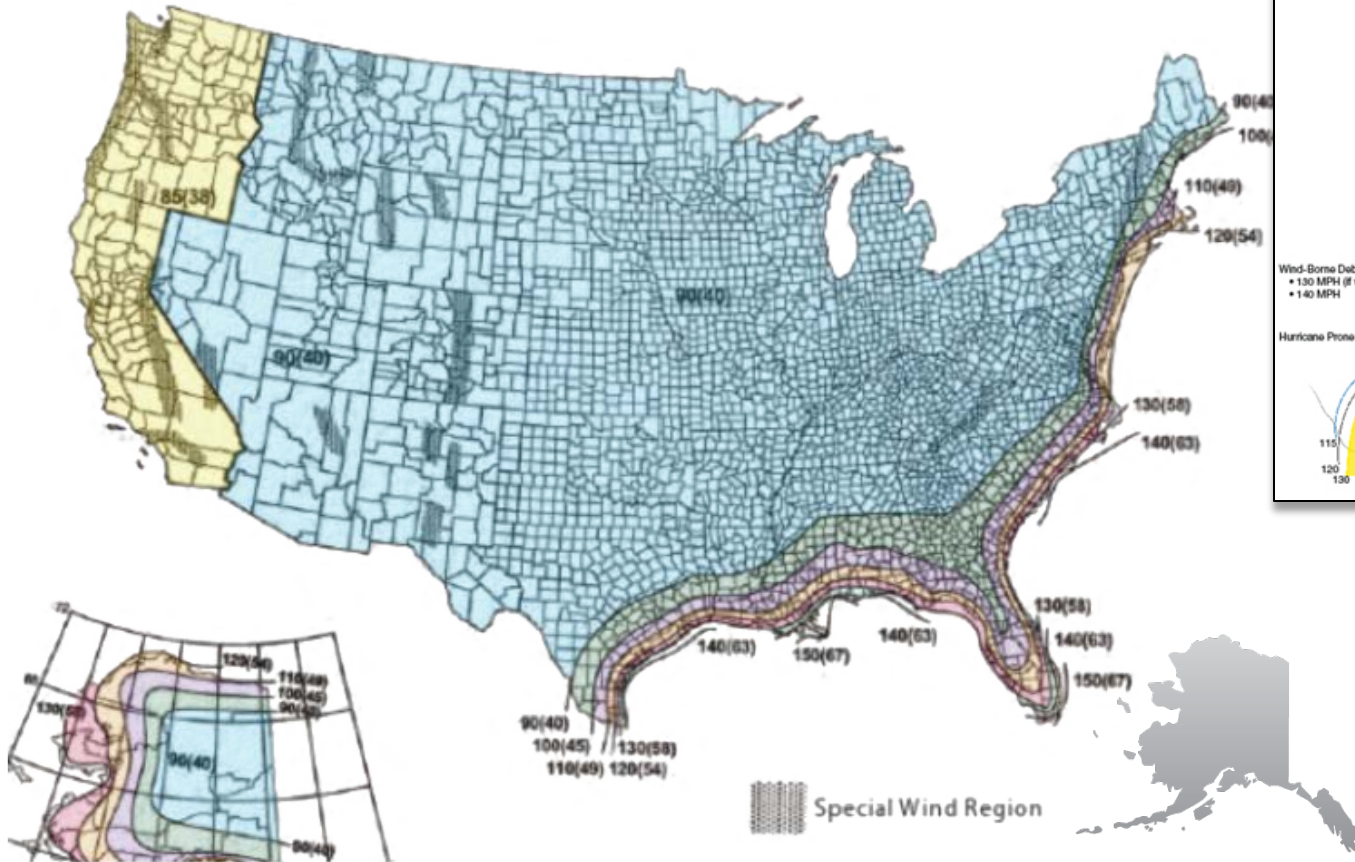
Avoiding single points of failure across the network (power, backhaul, sites, coverage)

### OPERATIONAL

- Backup equipment
- Deployables
- Commercial carrier roaming/direct mode

# Wind zones will require more robust hardening...

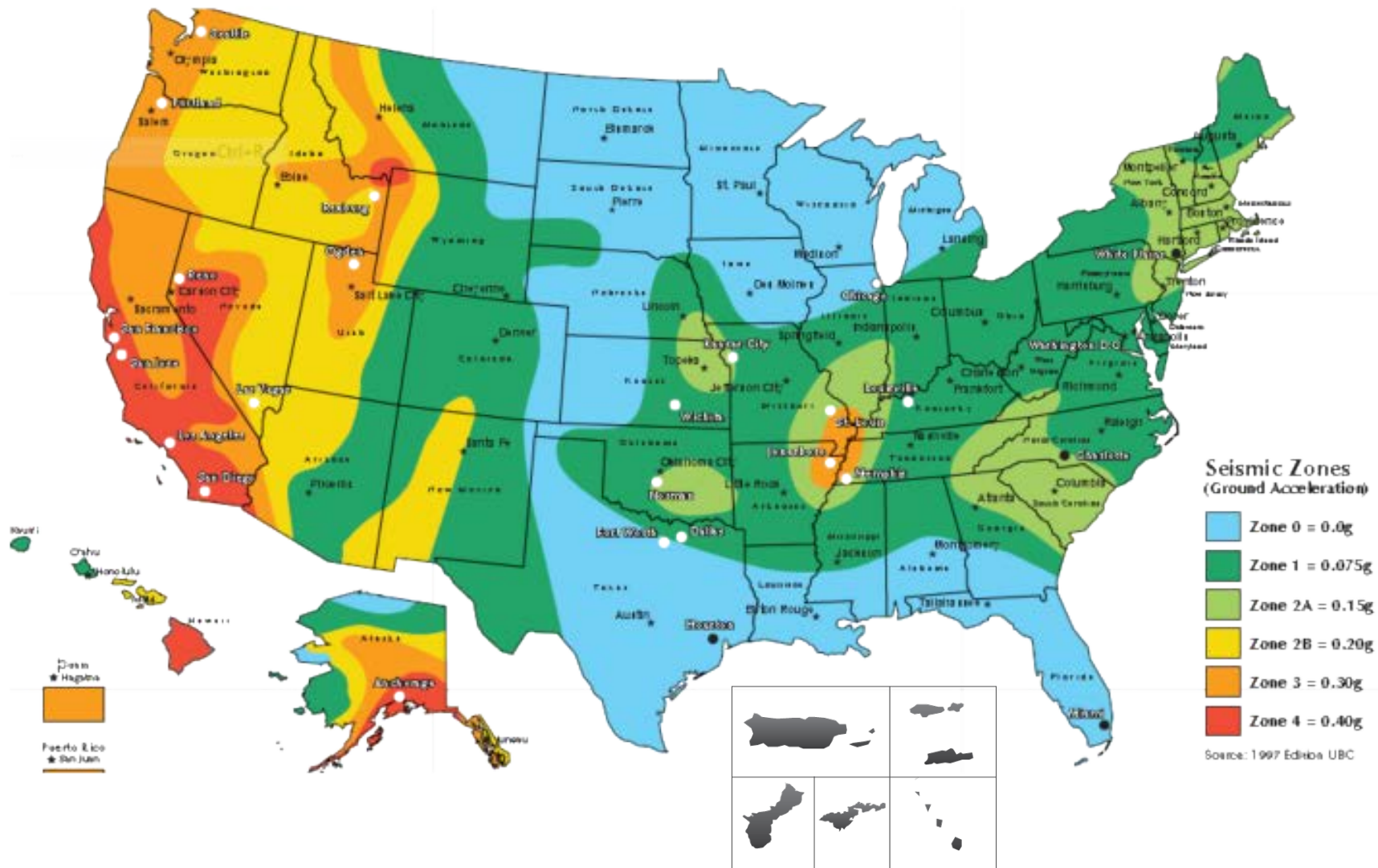
REV G 3-SECOND BASIC WIND SPEED MAP



Wind speed data for Alaska, Hawaii, and U.S. territories not immediately available



...as will seismic zones. Hardening is not one size fits all.



Seismic data for U.S. territories not immediately available

# RESILIENCY



Recovering quickly after an network incident is imperative.

## RESILIENCY

### PHYSICAL

- Diverse Routing- Switching and Backhaul
- Mirrored Databases
- Geographically Distributed Processing

### OPERATIONAL

- Deployables
  - Cells on Wheels
  - Systems on Wheels
- Capacity Management/Load Shifting
- Spares Management



# DEVICES

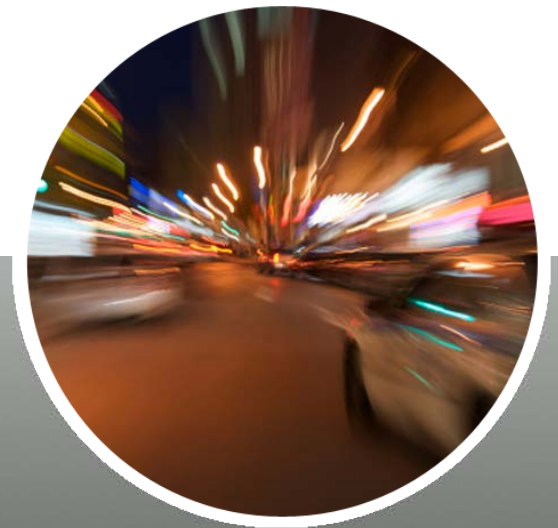


**FirstNet devices will be designed to meet public safety requirements and support critical application and service needs.**



An RFI was issued for devices on April 15, 2013.  
These are device type examples for illustration only.

# PROJECT PHASES



## Phase I

Requirements  
Planning

## Phase II

Stakeholder  
Decisions

## Phase III

Contracts &  
Core Network  
Completion

## Phase IV

Deployment  
& Operations

**Phase I**

**Requirements  
Planning**

**Phase II**

**Stakeholder  
Decisions**

**SLIGP Phase 1 – Requirements Gathering**



**SLIGP Phase 2 - Data Collection**

**User and Network Requirements**



**Core and RAN specifications**

**Network RFIs issued**



**Network RFPs issued**

**BTOP Spectrum Leases**



**Pilot Project integration and device  
planning**

**Initial design concepts documented**



**FirstNet business model**



**State RAN plan build-out documents  
issued**



## Phase III

Requirements  
Planning

Stakeholder  
Decisions

Contracts &  
Core Network  
Completion

Deployment  
& Operations

- **Contracts and contractors (operating partners, core, RAN, site development, user support services)**
- **Core network deployment/integration**
- **Device original equipment manufacturer (OEM) agreements**
- **Data center integration**
- **Initial pilot project (BTOP) integrations**

## Phase IV

Requirements  
Planning

Stakeholder  
Decisions

Contracts &  
Core Network  
Completion

Deployment  
& Operations

- **Spectrum clearing**
- **Network deployment**
- **Network testing/interworking**
- **Billing/user support services**
- **Device testing and field deployments**
- **Operational process trials**

# FIRSTNET IS COMMITTED TO...

- **Creating a nationwide architecture and standards with local management and adaptation.**
- **Optimizing the use of existing wireless facilities to reduce network spend.**
- **Building relationships with all 56 states and territories.**
- **Working together based on your requirements**
- **Deploying a fully-integrated public safety-grade nationwide wireless broadband network serving first responders and public safety for decades to come.**

**Please join us in this mission.**



**FirstNet will build a network for millions of public safety users who need to be able to send data and talk to one another to meet their mission.**

Creating FirstNet will require an unprecedented level of public-private partnership, collaboration and shared commitment to the well-being of all Americans.



# Q & A

