Day 2
Tuesday, June 13

PSCR

2017
PUBLIC SAFETY BROADBAND STAKEHOLDER MEETING

#PSCR2017

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PSCR

Acronym Glossary

- APCO = Association of Public Safety Communications Officials
- API = Application Programming Interface
- AR = Augmented Reality
- AS = Authorization Server (term specific to the OAUTH spec)
- ATF = Alcohol, Tobacco, Firearms
- BCP = Best Current Practice
- C = Circa/Approximately
- CPSSP = Central Public Safety Service Provider
- CRC = Communications Research Centre
- CSS = Centre for Security Science
- DRDC = Defense Research and Development Canada
- EAS = Extended Area Service
- EMS = Emergency Medical Services
- EMT = Emergency Medical Technician
- ESN = Emergency Services Network
- FIDO = Fast Identity Online

- FOSS = Free and Open Source Software
- FRS = Fire and Rescue Service
- GIS = Geographic Information Science
- GPM = Gallons Per Minute
- HMI = Human-Machine Interaction
- HTTPS = Hypertext Transfer Protocol Secure
- ICAM = Identity, Credential, and Access Management
- ICS = Incident Command System
- IdP = Identity Provider
- IETF = Internet Engineering Task Force
- LDAP = Lightweight Directory Access Protocol
- LEO = Law Enforcement Officers
- LMR = Land Mobile Radio
- LTE = Long Term Evolution
- MCPTT = Mission Critical Push-to-Talk
- MFA = Multi-Factor Authentication
- NCCoE = National Cybersecurity Center of Excellence

- NFC = Near Field Communication
- NFPA = National Fire Protection Association
- NENA = National Emergency Number Association
- NPSTC = National Public Safety Telecommunications Council
- OAUTH = a rights delegation protocol
- OIDC = Open ID Connect
- PCP = Pre-commercial Procurement
- PKCE – Proof Key for Code Exchange
- PPDR = Public Protection & Disaster Relief
- PPI = Public Procurement of Innovative Solutions
- PS = Public Safety
- PSAP = Public Safety Answering Point
- PSBN = Public Safety Broadband Network
- PSFR = Public Safety First Responder
- RFC = Request for Comment
- RP = Relying Party
- SaaS = Software as a Service
- SAML = Security Assertion Markup Language

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Acronym Glossary

- SCBA = Self Contained Breathing Apparatus

- SDK = Software Development Kit

- SME = Subject Matter Expert

- SP = Special Publication

- SPOC – Single Point of Contact

- SSO = Single Sign On

- SWAT = Special Weapons and Tactics

- U2F = Universal Two Factor

- UAF = Universal Authentication Framework

- UAV = Unmanned Aerial Vehicle

- UICC = Universal Integrated Circuit Card

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MANAGING CHANGE

U.S. AIR FORCE

WHY IS IT IMPORTANT?

March 24, 1986 - May 18, 2017

Open Innovation

Accelerating Results & Engaging Diverse Communities

Heather Evans, NIST

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2017

PUBLIC SAFETY BROADBAND
STAKEHOLDER MEETING

#PSCR2017

Innovation Framework
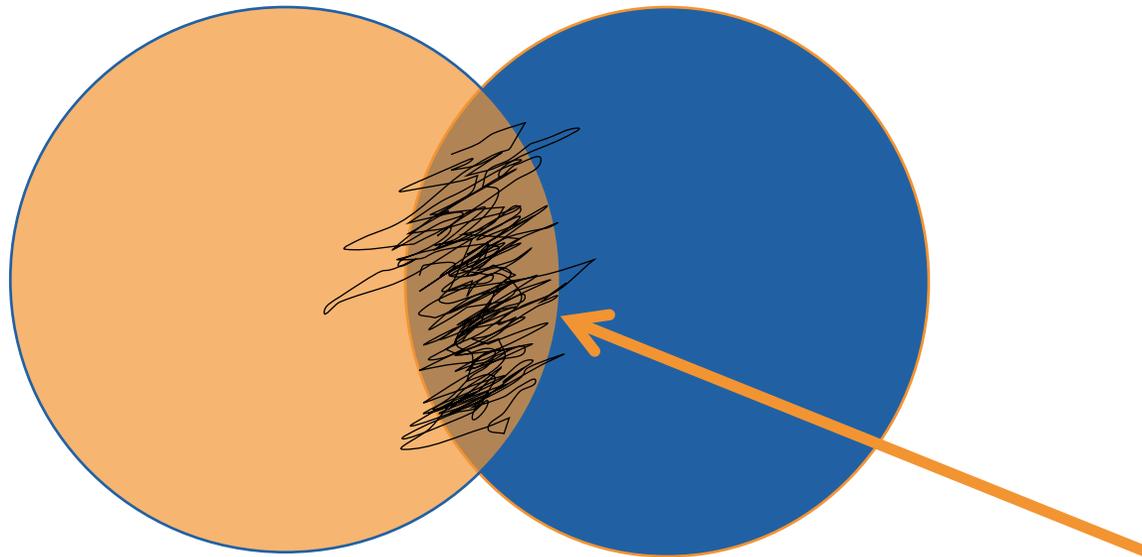
Mindset: Looking at the same things over and over and seeing new possibilities combined with the desire to take action

Process: The execution of new ideas that tend to occur at the **intersection of ideas**

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Joy's Law

"No matter who you are, most of the smartest people work for someone else."

-Bill Joy, co-founder Sun Microsystems

Picture source www.crunchbase.com

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Defining Open Innovation

- **Define a problem** to be solved or a goal to be reached.

- Participation is **open to anyone**, regardless of credentials, experience, connections, or past performance.

- The solver has flexibility to be **creative and innovative** in how they get to the solution.

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Methodologies for Open Innovation

- Crowdsourcing

- Citizen Science

- Hackathons

- Prize Competitions/ Challenges

Methodologies for Open Innovation

Crowdsourcing

Individuals or organizations solicit contributions from a large group of individuals, trusted individuals, or experts

Methodologies for Open Innovation

Crowdsourcing
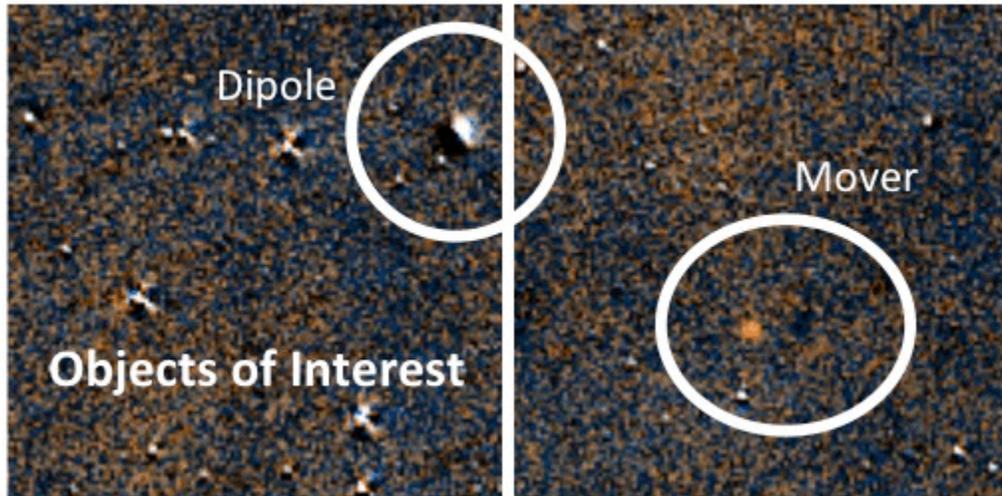
www.backyardworlds.org

Methodologies for Open Innovation

Citizen Science

Open collaboration in which members of the public participate in scientific research to meet real world goals.

Methodologies for Open Innovation

Citizen Science

Credit: Ushahidi Haiti Project

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Methodologies for Open Innovation

Hackathons
(hack day, codefest, data jam, etc.)

Sprints in which computer programmers and others involved in software development, including graphic designers, interface designers, project managers, and others collaborate intensively on projects

Methodologies for Open Innovation

Prize Competitions

Challenges that award a cash (or other) prize for the accomplishment of solving a distinct problem

Typically designed to extend the limits of human ability and technology

Methodologies for Open Innovation

Prize Competitions – some history

1700   1800   1900   2000

PSCR
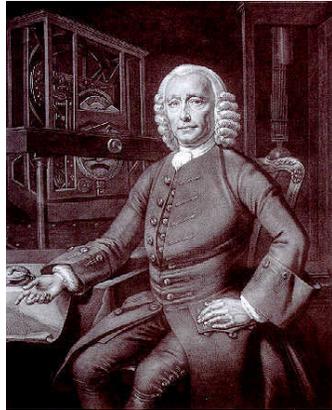
Open Innovation Track Record

7 years

775+ crowdsourcing & prize competitions

120+ agencies

$250 million in prizes

5 million+ site visits

Visitors from **every country**

Participants from **every state** in the USA

What This Means to You

Public Safety Innovation Accelerator

5 years

5 key categories

$100 million for external collaboration

Location-Based Services

Public Safety Mission Critical Voice

Public Safety Enhanced User Interface

Public Safety Analytics

Network & Device Security

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Virtual Public Safety Test Environment Challenge

Design a physical measurement environment that uses immersive virtual reality tools for testing new first responder technologies.

HeroX.com/NISTvr

Virtual Public Safety Test Environment Challenge

Results:

Open for **64 days**

703 community members

103 competitors

21 entries

793 votes cast

$45,000 in prizes

6 winners

Pay for Success

Diverse Skills

Accelerated Results

MultiVRse

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What's Next?

Open Innovation Opportunities

- Prototyping

- Ideation

- Data

- .....

Happening now:

PerfLoc Prize Competition

Using NIST test data from four buildings, develop an indoor localization and tracking app

$35,000 in prizes and trip to Japan for IPIN Conference

https://perfloc.nist.gov/

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A Grand Challenge for 2021:

Z-Axis & 3D Indoor Mapping

Get Involved

Open means that YOU are invited!

- Align with areas of interest
- Join working groups
- Submit solutions and solve problems

Follow & compete: Bit.ly/PSprizes

Sign up for the newsletter: PSCR.gov

Contact us: PSprizes@nist.gov

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Speakers

- **Moderator: Jason Kahn** – PSCR Research, Testing, & Evaluation Group

- **Joe Fournier** – Canada's Federal Government Centre for Security Science (CSS)

- **David Lund** – Public Safety Communication Europe (PSCE) Forum

- **Gordon Shipley** – UK Home Office Emergency Service Mobile Communications Programme (ESMCP)

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700 MHz Public Safety Broadband Network (PSBN)

- A transformational national capability

- Canada very active since 2010

- Key tenets – Interoperability, affordability, sustainability, efficient use of spectrum, 24/7 availability

- Band 14 (758-768 MHz D/L, 788-798 MHz D/L)

How Did We Get Here?

- <u>Nov 2010</u>: Industry Canada launches *"Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum"*

- <u>Mar 2012</u>: Minister of Industry announces setting aside 10 MHz of spectrum in the 700 MHz band, with a possible additional 10 MHz to follow

- <u>Aug 2012</u>: Industry Canada launches "Consultation on a Policy, Technical and Licensing Framework for Use of the Public Safety Broadband Spectrum in the D Block the PSBB Block."

- <u>April 2015</u>: Government of Canada identified an additional 10 MHz for public safety broadband - total of 20 MHz (Band 14)

- <u>May 2016</u>: Federal, provincial and territorial (FPT) ministers responsible for emergency management met in Toronto to discuss national priorities.

> *"Ministers agreed on the creation of a public-private advisory group to inform the way forward on this important, yet complex initiative."*

DRDC | RDDC

So What's Going on Now?

May 19, 2017: Public Safety Canada and Innovation, Science and Economic Development announce a commitment of Can$3 million in 2017-18 to engage diverse stakeholders and produce evidence-based analysis on implementation models for a potential Public Safety Broadband Network (PSBN).

Communications Interoperability Strategy for Canada

January 2011

Governance

| F/P/T Ministers |
| F/P/T Deputy Ministers |
PS	SOREM
ADM EMC	DG EMP Working Group	SOREM Response Working Group
CANUS Interoperability Working Group	F/P/T Interoperability Working Group *	CITIG & Associations

Work Groups ⟷ **PSBN Task Team**

Work Groups
➤ Deployment Options & Governance
➤ User Requirements

PSBN Task Team
➤ DRDC CSS / Innovation Science & Economic Development / Public Safety

* Expanded to include municipalities and tri-services

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Deployment Options & Governance

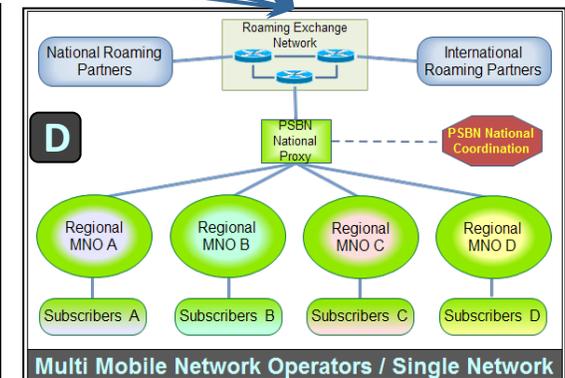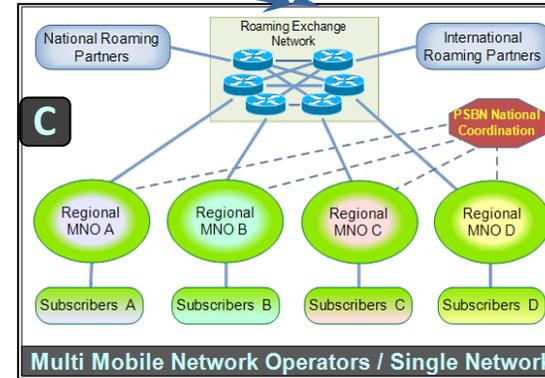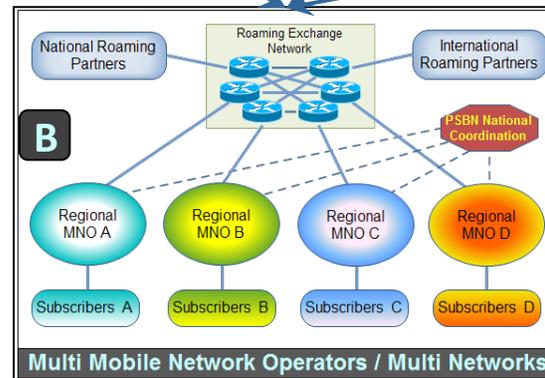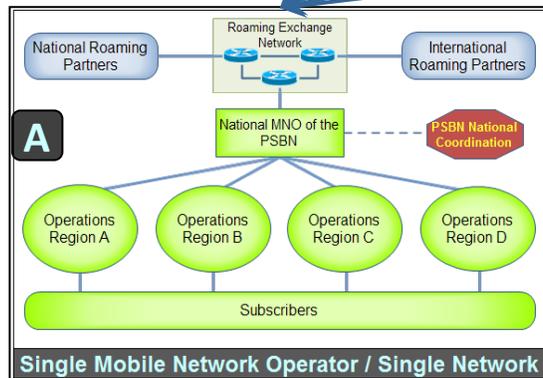| Dedicated Public Safety Broadband Network	Shared Public Safety – Commercial Network	Commercial Network
• Public safety use only • Dedicated public safety broadband spectrum	• Both public safety and commercial usage • Designated public safety broadband spectrum	• Public safety service on commercial networks • Spectrum obtained through auction

A — Single Mobile Network Operator / Single Network

National Roaming Partners · Roaming Exchange Network · International Roaming Partners · National MNO of the PSBN · PSBN National Coordination · Operations Region A · Operations Region B · Operations Region C · Operations Region D · Subscribers

B — Multi Mobile Network Operators / Multi Networks

National Roaming Partners · Roaming Exchange Network · International Roaming Partners · PSBN National Coordination · Regional MNO A · Regional MNO B · Regional MNO C · Regional MNO D · Subscribers A · Subscribers B · Subscribers C · Subscribers D

C — Multi Mobile Network Operators / Single Network

National Roaming Partners · Roaming Exchange Network · International Roaming Partners · PSBN National Coordination · Regional MNO A · Regional MNO B · Regional MNO C · Regional MNO D · Subscribers A · Subscribers B · Subscribers C · Subscribers D

D — Multi Mobile Network Operators / Single Network

National Roaming Partners · Roaming Exchange Network · International Roaming Partners · PSBN National Proxy · PSBN National Coordination · Regional MNO A · Regional MNO B · Regional MNO C · Regional MNO D · Subscribers A · Subscribers B · Subscribers C · Subscribers D

24/7 Service Availability	Interoperability	Affordability	Sustainability

Efficient Use of Spectrum	Information Access and Sharing	Common User Experience

DRDC | RDDC

Use Cases & User Requirements

Use Case sources: Canada TAG, CSS, FirstNet, NPSTC

PSBN Task Team – Key Deliverables
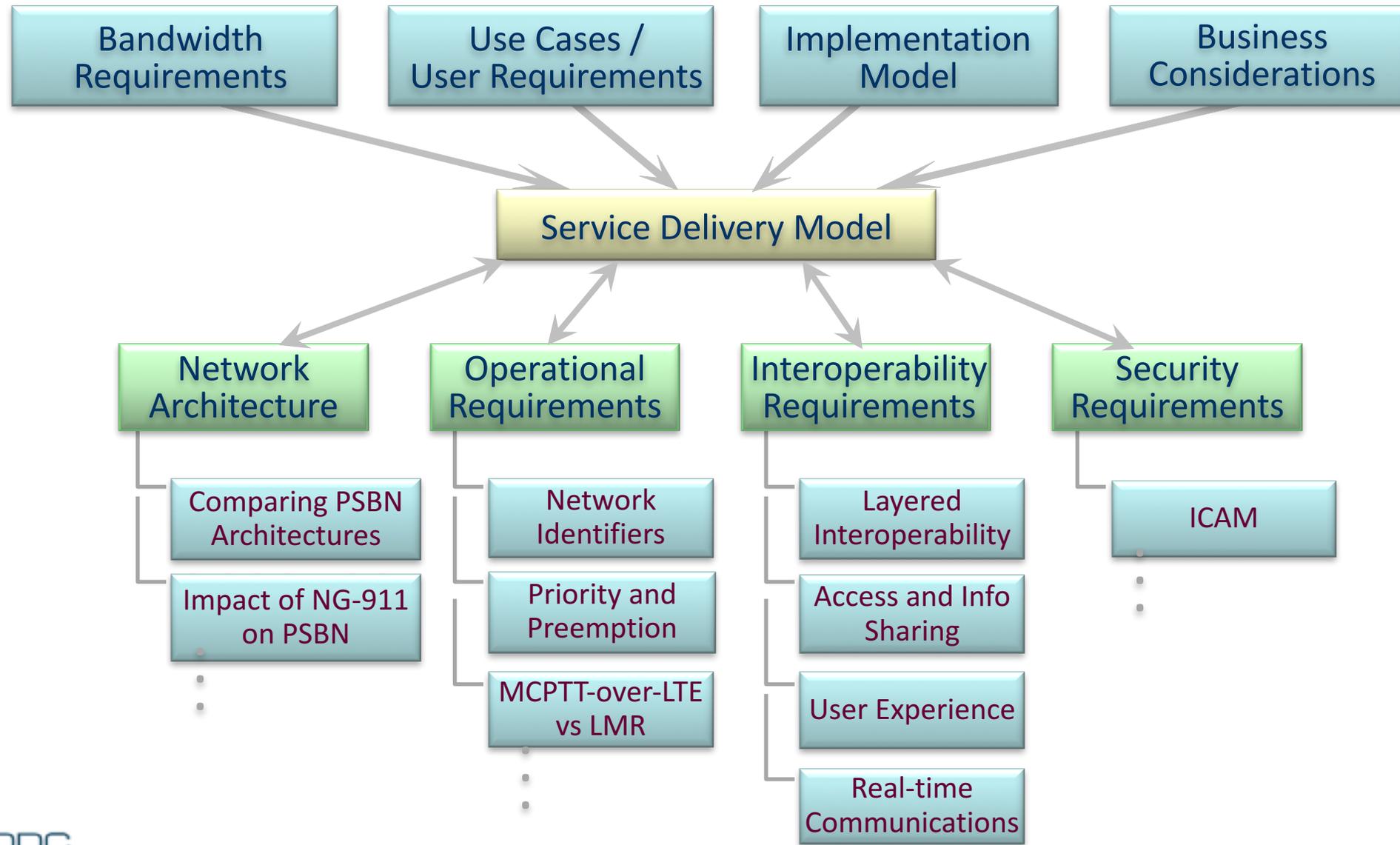
Leverage Extensive Work on PSBN since 2010

- Technology
  - 700 MHz Spectrum Requirements for Canadian Public Safety
  - Technical Advisory Group (technical reports, technical advice)

- Test and evaluation capabilities

- Experiments

- Collaboration with the US
  - Canada-US IWG
  - Technical Annex for CSS/CRC – PSCR collaboration
  - Chair the Deployable System Work Group
  - DHS S&T / FirstNet / NPSTC
  - Texas A&M

- Operational/governance initiatives
  - Industry Canada consultation 2012
  - Montreal Model
  - FPT IWG
  - IWG Governance Sub-committee
  - Economic Analysis

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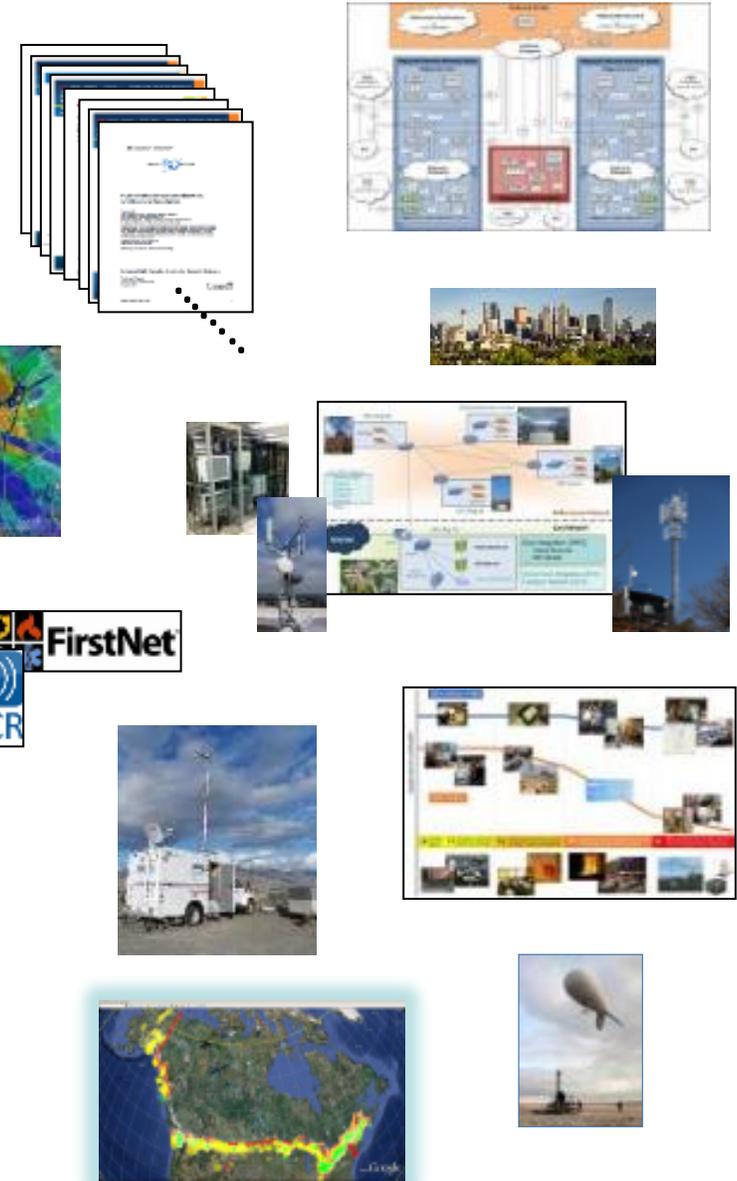
PSBN – Recent Supporting Initiatives

- Test and evaluation capabilities

- PSBN Pilots
  - Ottawa region PSBN pilot network
  - Calgary Police Pilot
  - Yukon / British Columbia deployable LTE Systems

- Experiments
  - Ottawa Fire Services
  - Regina Stadium
  - CAUSE Resilience

- Other Projects
  - Public safety broadband applications – University of Regina
  - Emerging wireless for public safety
  - In-building broadband wireless

DRDC | RDDC

Test and Evaluation Ecosystem

Communications Interoperability Research Test and Evaluation Centre

- **FirstNet - Boulder**
- **BRiC – Regina**
- **Deployable PSBN - Simon Fraser**
- **CIRTEC - Ottawa**
- **Public Safety Broadband Test and Evaluation Ecosystem**
- **PS Apps – Regina**
- **Advanced NPSBN research - PSCR Boulder**
- **PS LTE Testbed - Texas A&M**

DRDC | RDDC
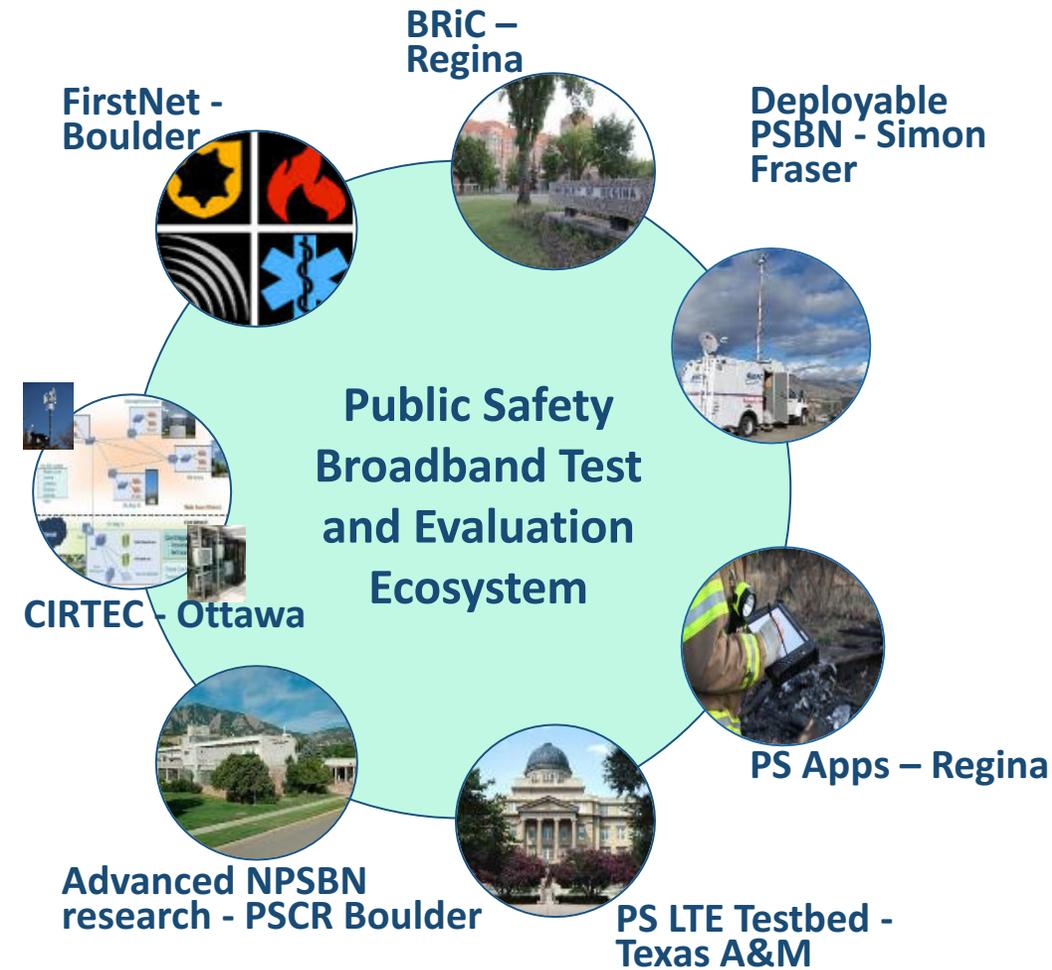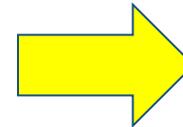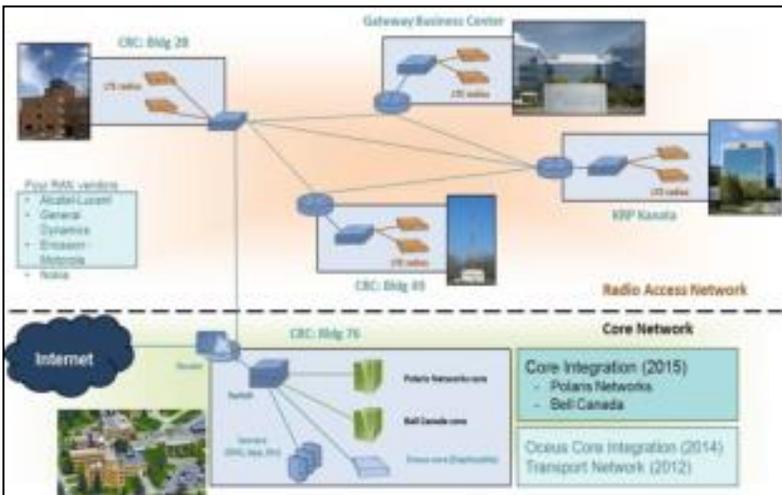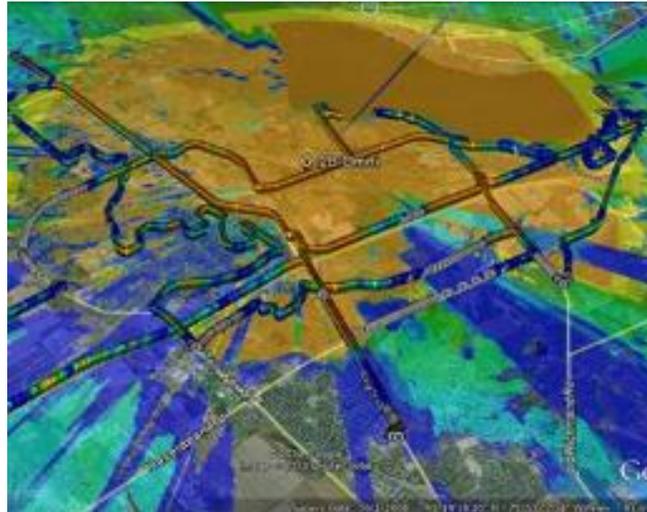
Canada-US Enhanced Resiliency Experiments
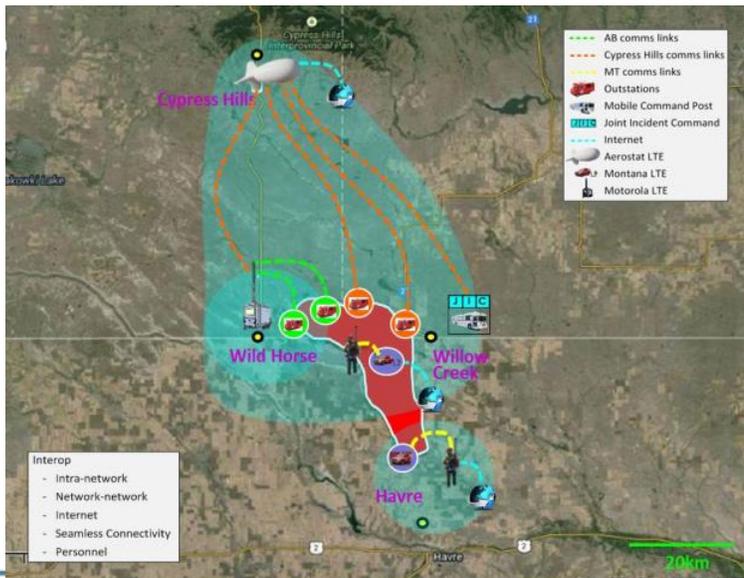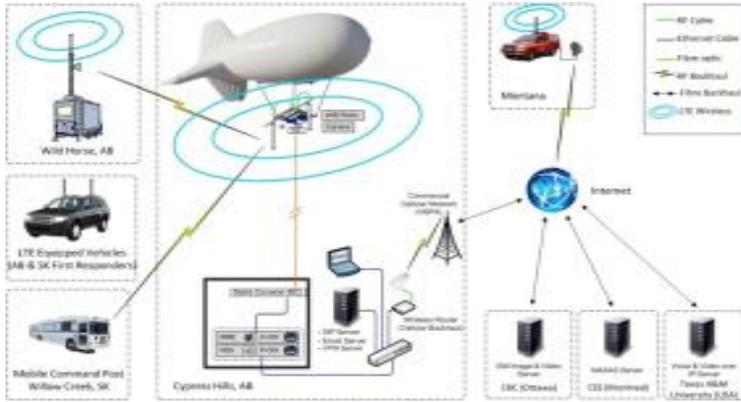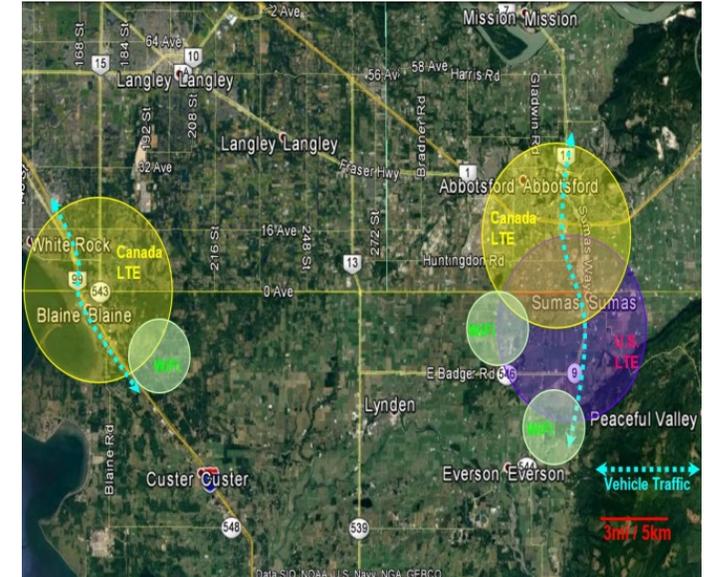
PSBN Pilot Projects

Ottawa
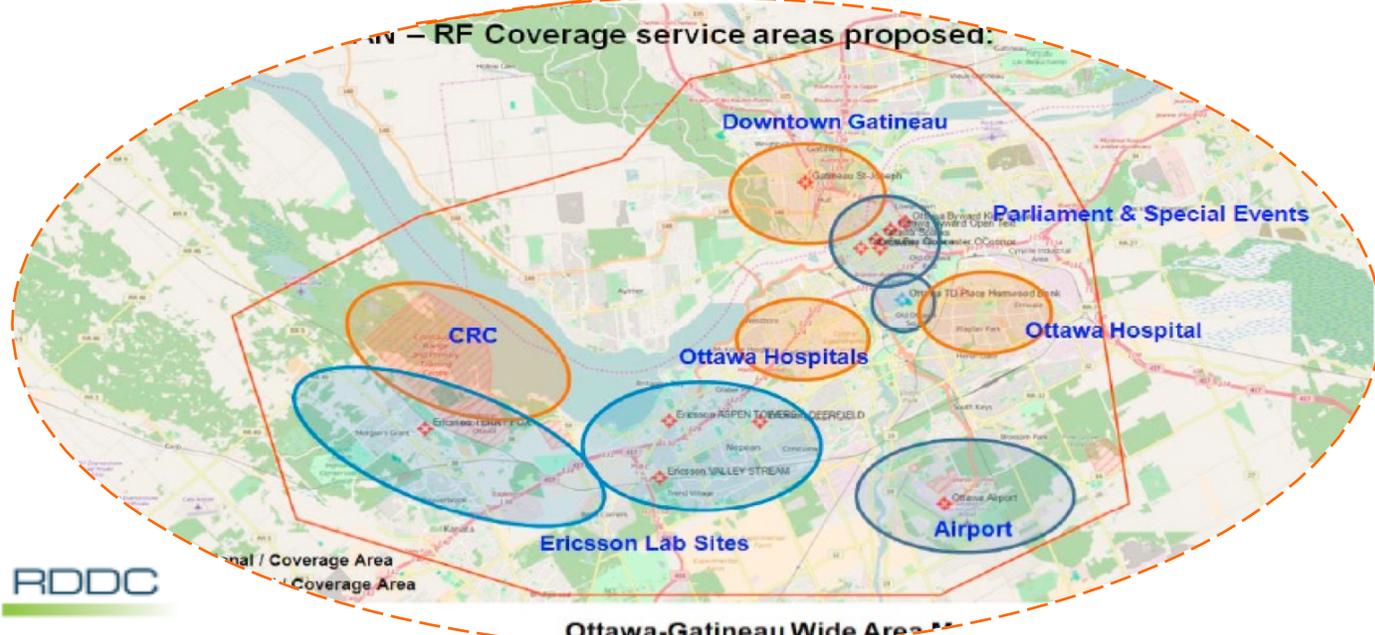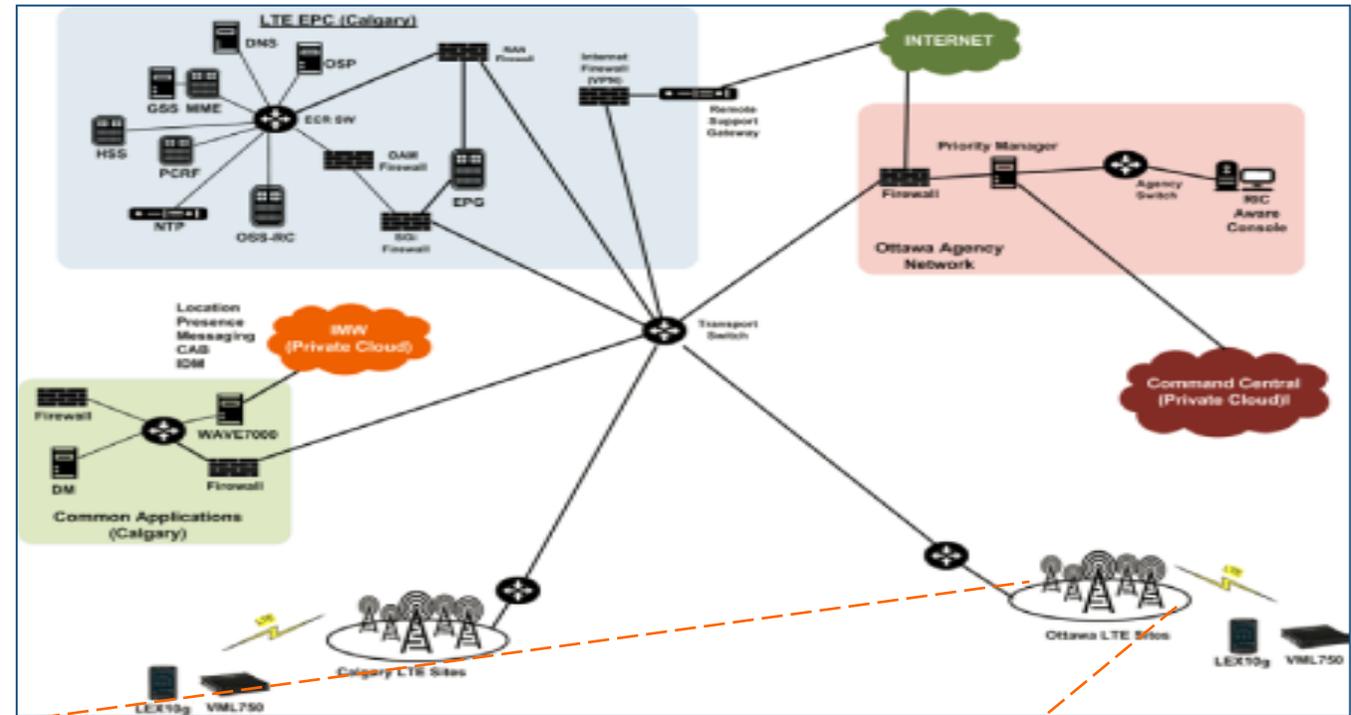
PSBN Pilot Projects

Calgary
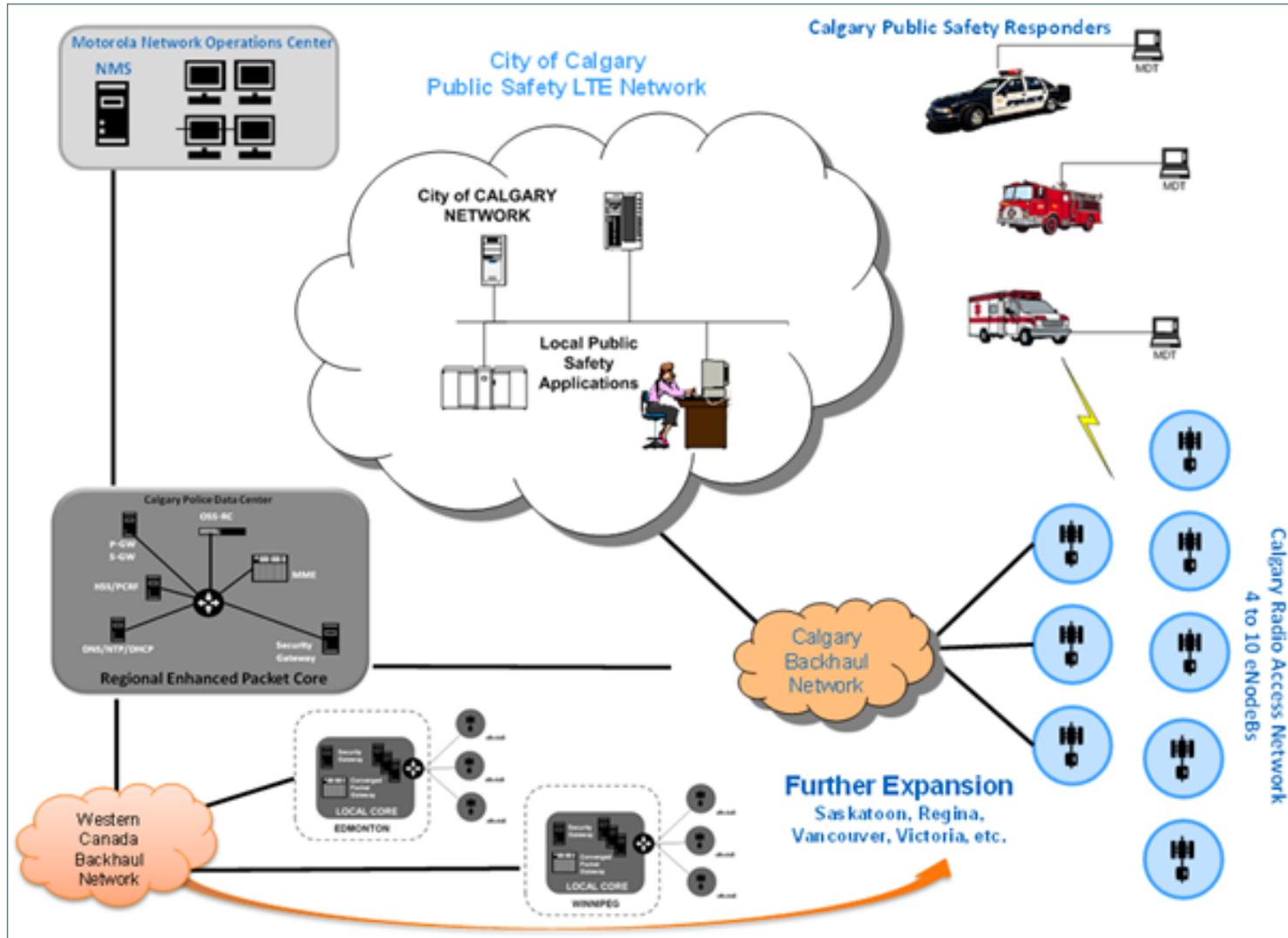
Broadband LTE Experiments

Ottawa Fire (HazMat)
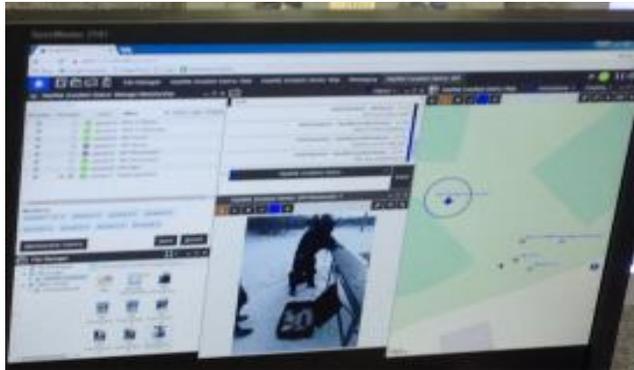
Deployable Systems

Regina Stadium

LTE Coverage

Ottawa Paramedics

DRDC | RDDC

Thanks!!

European Interoperable Broadband for PPDR

PSCR Public Safety Broadband Stakeholder Meeting
13 June 2017

David Lund, PSCE Forum

www.broadmap.eu   **@BroadMap_H2020**

Public Safety Communications Europe Forum - PSCE

- Established as a result of a European Commission funded project in 2008. Evolved into a sustainable independent forum,

- Public safety user organisations, industry and research institutes

- Discuss and exchange ideas and best practices, develop roadmaps and improve the future of public safety communications.

Public Safety End Users

Saving Lives!

Managing Strategy, Tactical Planning & Operations
Running, Managing & improving the effectiveness
of Public Safety Communication
Processes

Would this new idea
work for you?

We have this problem
or limitation,
can you find a solution?

New and improved
Communication
Applications,
Services, Devices
and Networks

Collaboration to develop new
Applications, Services, Devices
and Networks

Researchers

Research and Development of novel
improvements for Public Safety
Communication -Legal, social,
Process and Technology

Industry

Development and Supply
of Communication Applications,
Services, Devices and
Networks

We want to improve our
products and services

Networks

EC's Horizon 2020 Project Call

H2020-DRS-2014-2015

Topic: **DRS-18-2015:Communication technologies and interoperability topic 1: interoperable next generation of broadband radio communication system for public safety and security** `Closed`

Publication date: 11 December 2013

Types of action: CSA Coordination and support action
DeadlineModel: single-stage
date: 25 M...

`- Less`

Topic Description

Scope:

Specific challenge:

The users/potential buyers participating in the action should agree on specifications, and set standards for the next generation of an EU interoperable radio communication system considering at least three markets: one for broadband network system technology/setup/operation, one for end-user devices and one for applications, taking into account previously EU funded R&D project on the same issues.

Scope:

Different organisation schemes, such as a dedicated EU Mobile Virtual Network Operator for law enforcement agencies, a European Economic Interest Group, national interoperable networks, or any other way will have to be studied.

The participants will propose the best suitable architecture/solution in order to establish the desired EU-interoperable system.

The action will develop the core set of specifications, roadmap for research or tender documents to be used as a basis for national procurements, or the legal setting of alternate organisational solutions taking into account the above-mentioned requirements for interoperable next generation PPDR broadband

A Cornerstone for European Critical Mobile Broadband Comms

BroadMap

Co-ordination and Support Action (CSA)

BROADMAP will inform Horizon 2020's co-funded procurement process which will likely use the PCP and PPI instruments of H2020 and/or other instruments

BROADWAY

BROADNET

Applied R&D / Pre-commercial Procurement (PCP)

Public Procurement of Innovative Solutions (PPI)

Phase 0
Requirements
Solutions
Transition
Roadmapping

Phase 1
Solution design

Phase 2
Prototype
development

Phase 3
Original development
of limited volume
of first test products /
services

Phase 4
Deployment of commercial
volumes of end-products
Wide diffusion of newly developed
solutions

Supplier A

Supplier B

Supplier B

Supplier B

Supplier C

Supplier C

Supplier D

Supplier(s)
A,B,C,D
and/or X

Supplier D

Also normally multiple sourcing here
to keep competition going

2016   **2018**

Circa 2020-2022

2025

2025 – Commercially Deployed Interoperable Broadband Applications, Services, Networks, Devices for PPDR

Approach

- **Collect, assess and validate** the PPDR's wireless broadband communication requirements

May 2016

BroadMap

April 2017

May 2018

Circa 2025

Study 1

Study X

Study N

Policy and Standards Liaison

Collect Requirements

Validate Requirements

Establish a core set of Specifications

Define Transition Roadmaps

Final Definition of Transition Roadmaps and PCP Specification

National Workshop 1

National Workshop X

National Workshop 15

May-August 2016

End User Stakeholder event

October 2016

Final Stakeholder event

April 2017

SEC-04-DRS 2017 Broadband Communication System Pre-Commercial Procurement

EU Interoperable Broadband Applications, Services, Networks and Devices for PPDR

Approach

- **Collect**, **assess and validate** the PPDR's wireless broadband communication requirements

- **Establish a core set of specifications** to fulfil the requirements

Approach

- **Collect, assess and validate** the PPDR's wireless broadband communication requirements

- **Establish a core set of specifications** to fulfil the requirements

- **Define transition roadmaps** for research and standardisation for future evolution of European interoperable radio communication solutions, within legal procurement constraints

May 2016

BroadMap

April 2017

May 2018

Circa 2025
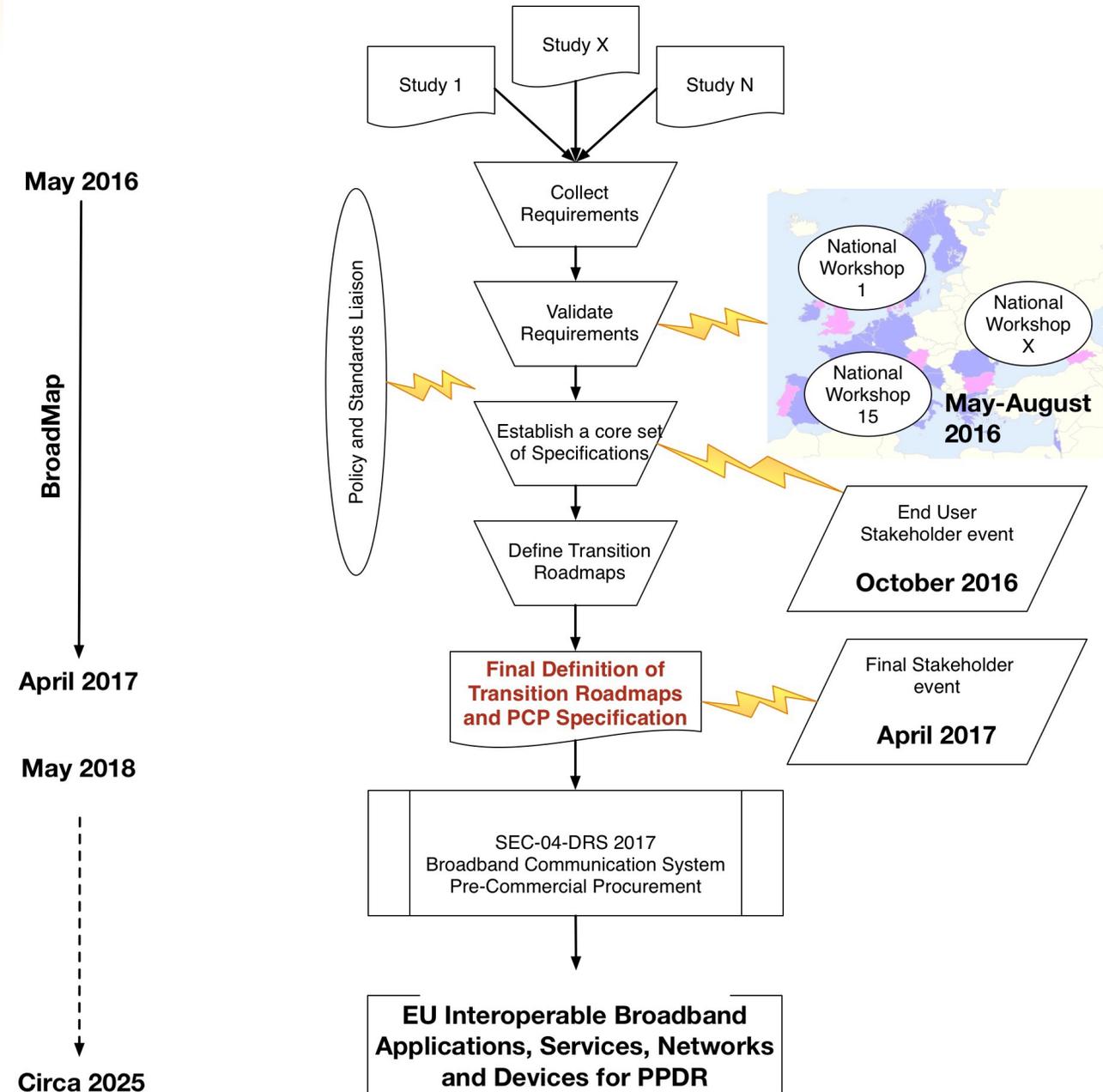
Approach

- Collect, **assess and validate** the PPDR's wireless broadband communication requirements

- **Establish a core set of specifications** to fulfil the requirements

- **Define** transition roadmaps for research and standardisation for future evolution of European interoperable radio communication solutions, within legal procurement constraints

- **Prepare the ground for a new eco-system** to catalyse new applications, services and processes making use of broadband capabilities for Public Safety and Security

A Broad Map

Legend:
- Involved partners (blue)
- Supporting partners (magenta)
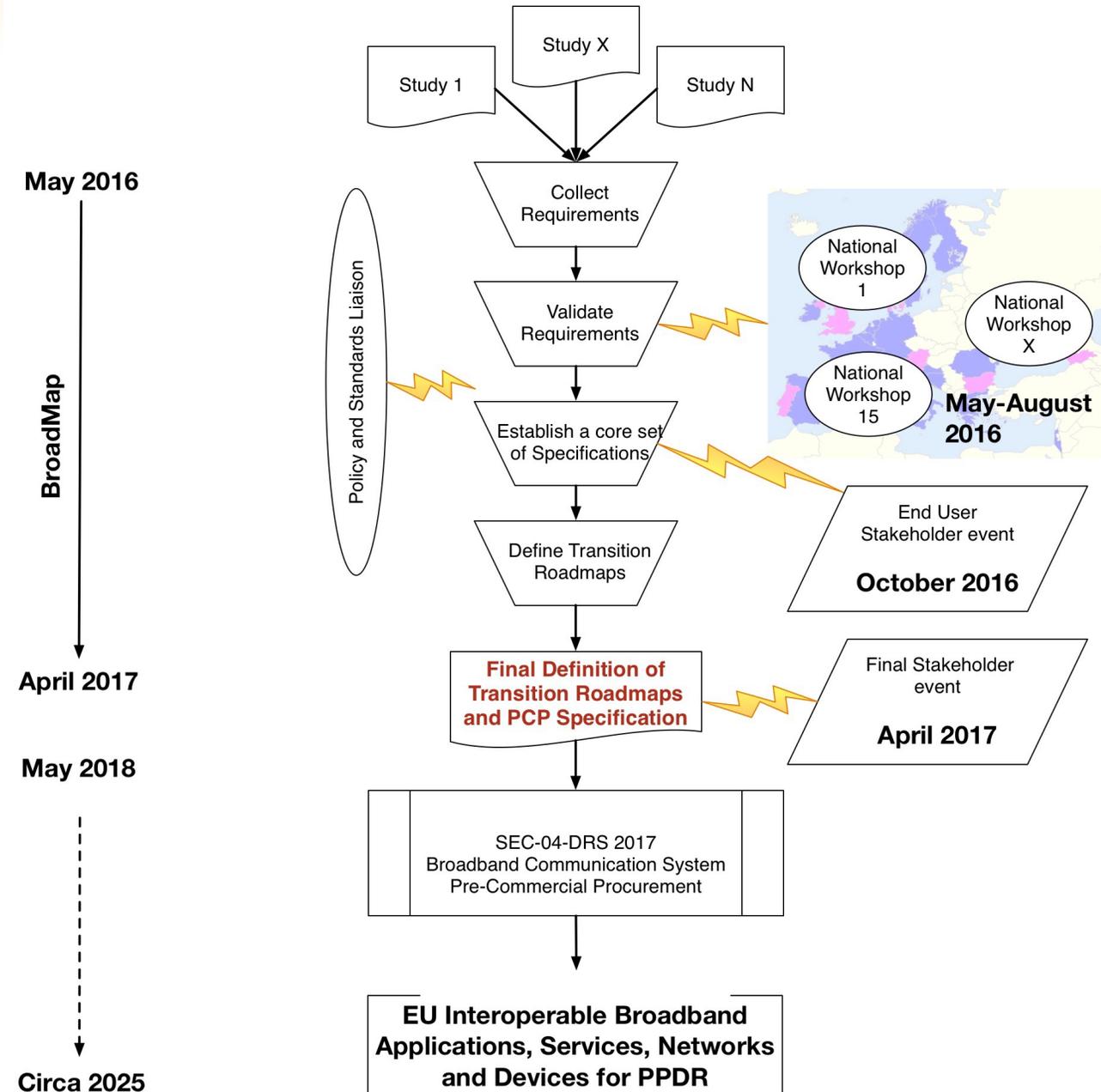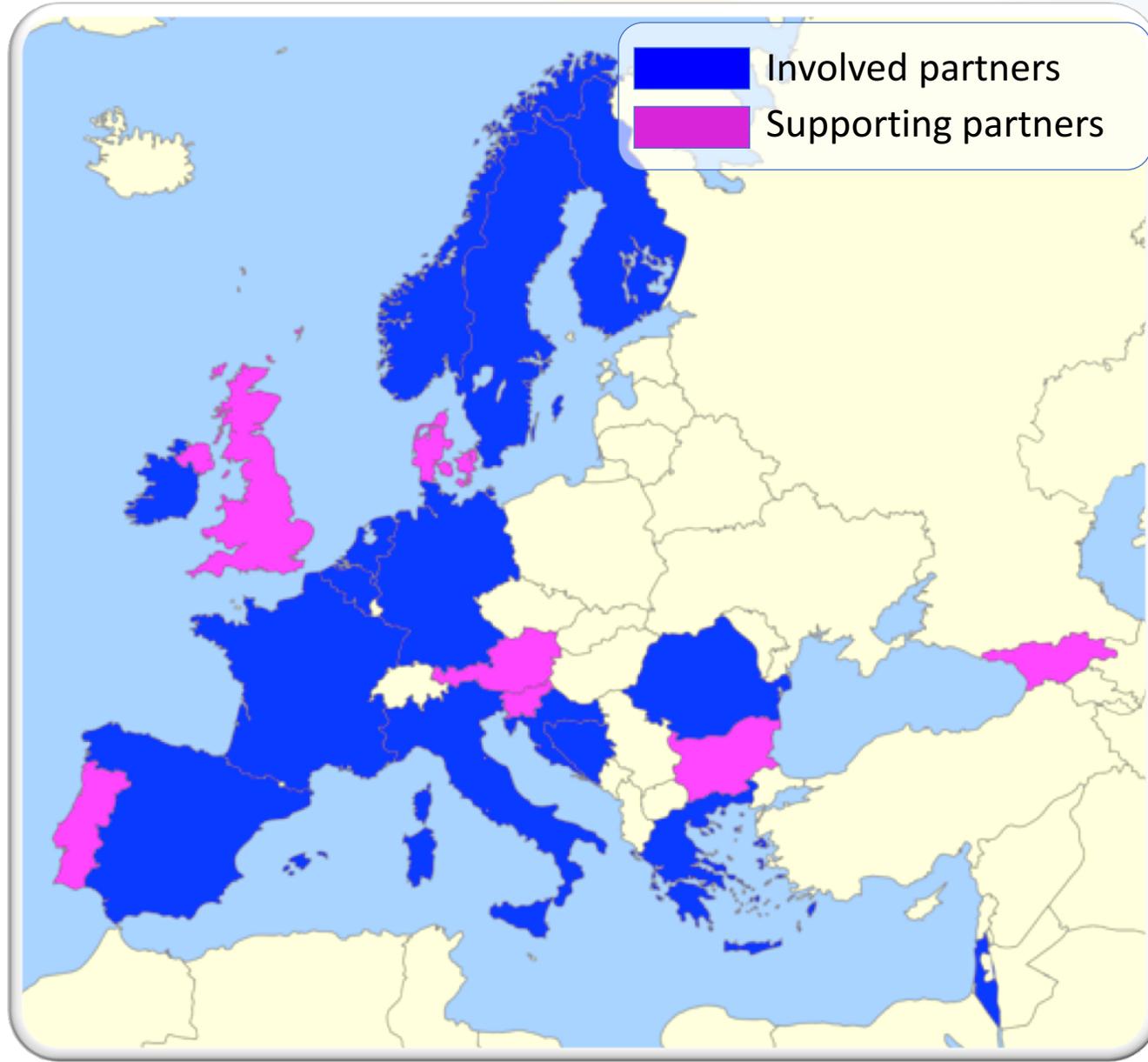
PSCE providing project coordination and support, *Consortium Leader: Dr. David Lund, PSCE*

15 potential buyers/end users, of which
- 12 represent EU Member States
- 3 represent Associated Countries
- 8 represent the responsible Ministry within their country
- 7 represent end user organizations and/or operators of emergency service networks

48 external supporters
- 7 extra countries

DGFLA providing legal expertise

National Workshop 1

National Workshop X

National Workshop 15

May-August 2016

15 project partner countries

25 workshops - validate user requirements

276 PPDR organisations from 18 countries

600+ practitioners (users) involved

Largest Study ever carried out across Europe regarding Broadband for PPDR

September to November 2016

Translation of Requirements => Specifications
Definition of Candidate Solutions

December 2016 to February 2017

Transition Roadmaps

SpiceNet Reference Architecture

SpiceNet Reference–
Standardised PPDR Interoperable Communication Service for Europe
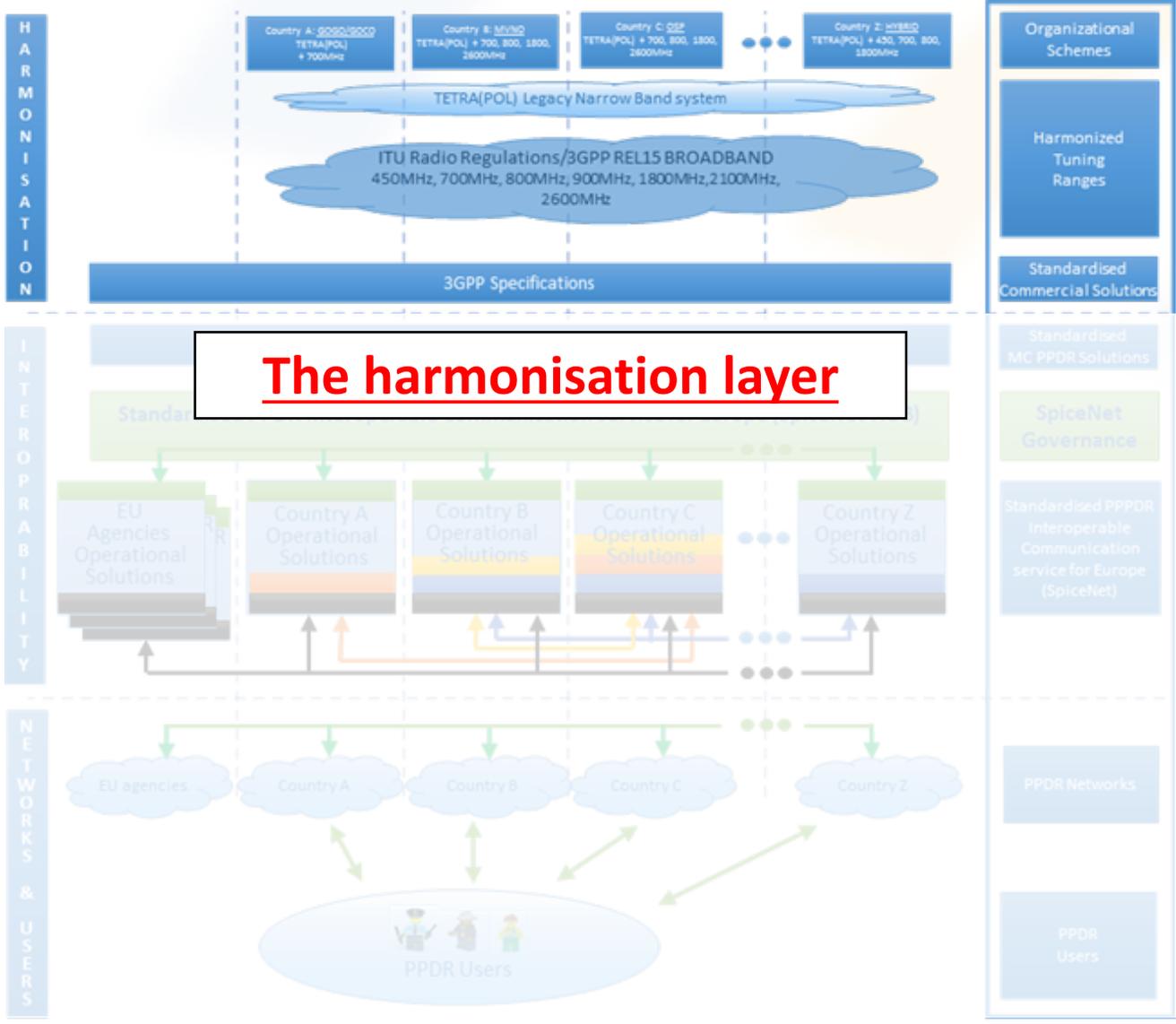
Three layers:

- **The harmonisation layer** enables own organisation schemes to provide PPDR services.
  - Flexible harmonisation is achieved by using 3GPP and other standardised technologies and commonly agreed harmonized tuning ranges.

SpiceNet Reference–
Standardised PPDR Interoperable Communication Service for Europe

The Interoperability Layer

Three layers:

- The harmonisation layer enables own organisation schemes to provide PPDR services.
  - Flexible harmonisation is achieved by using 3GPP and other standardised technologies and commonly agreed harmonized tuning ranges .

- **The interoperability layer** defines **SpiceNet** (Standardised PPDR Interoperable Communication for Europe) as **a common PPDR Pan European cross-border interoperability solution.**
  - This enables each country to use a set of common services for pan-European interoperability.
  - For national interoperability countries have freedom to use their own operational solutions.

SpiceNet Reference–
Standardised PPDR Interoperable Communication Service for Europe

Three layers:

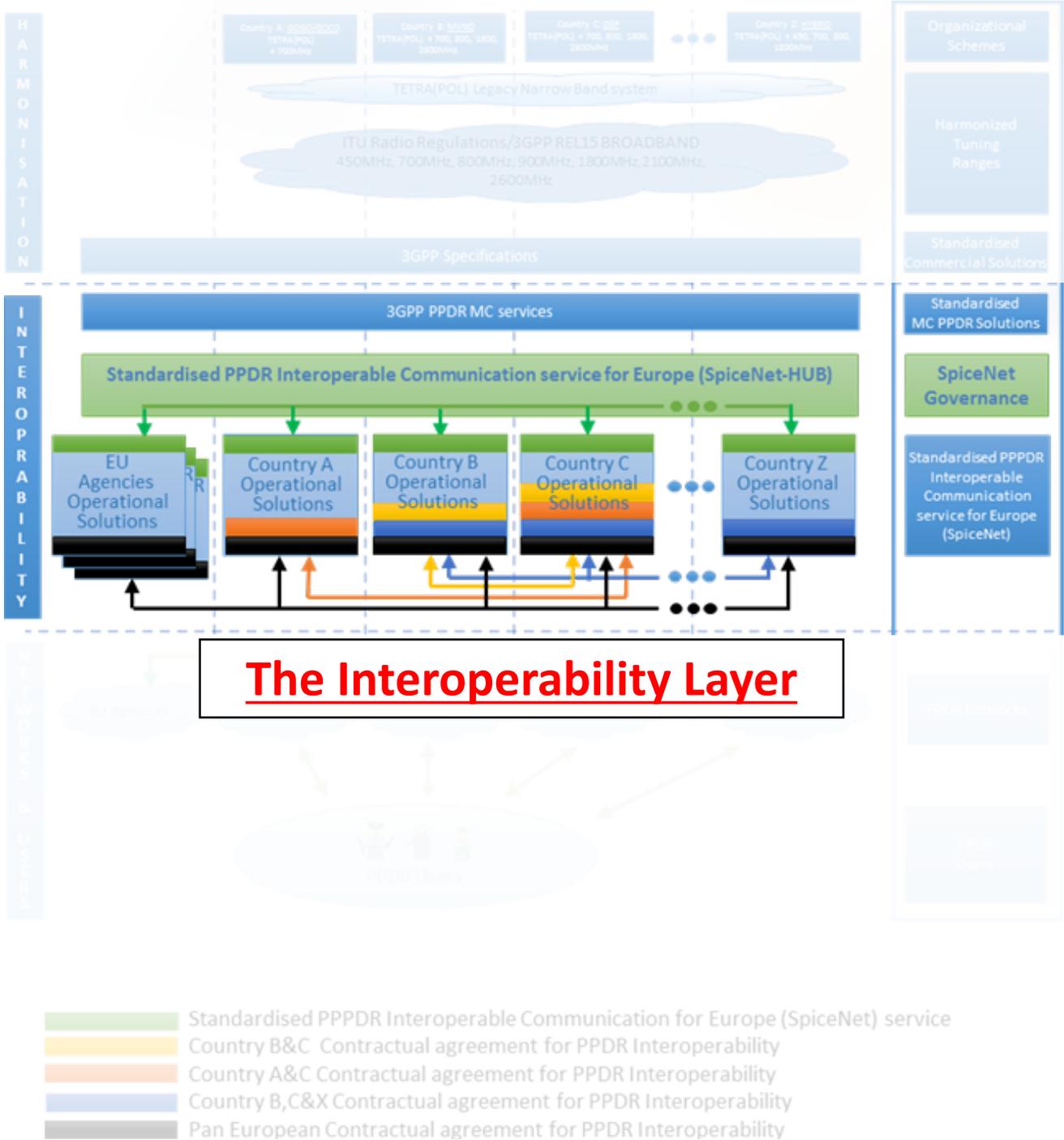- **The harmonisation layer** enables own organisation schemes to provide PPDR services.
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  - This enables each country to use a set of common services for pan-European interoperability.
  - For national interoperability countries have freedom to use their own operational solutions.

- **The network and user layer** enables common services provided by **SpiceNet** to be used in all participating countries. These common services can be further extended via agreements between nations.
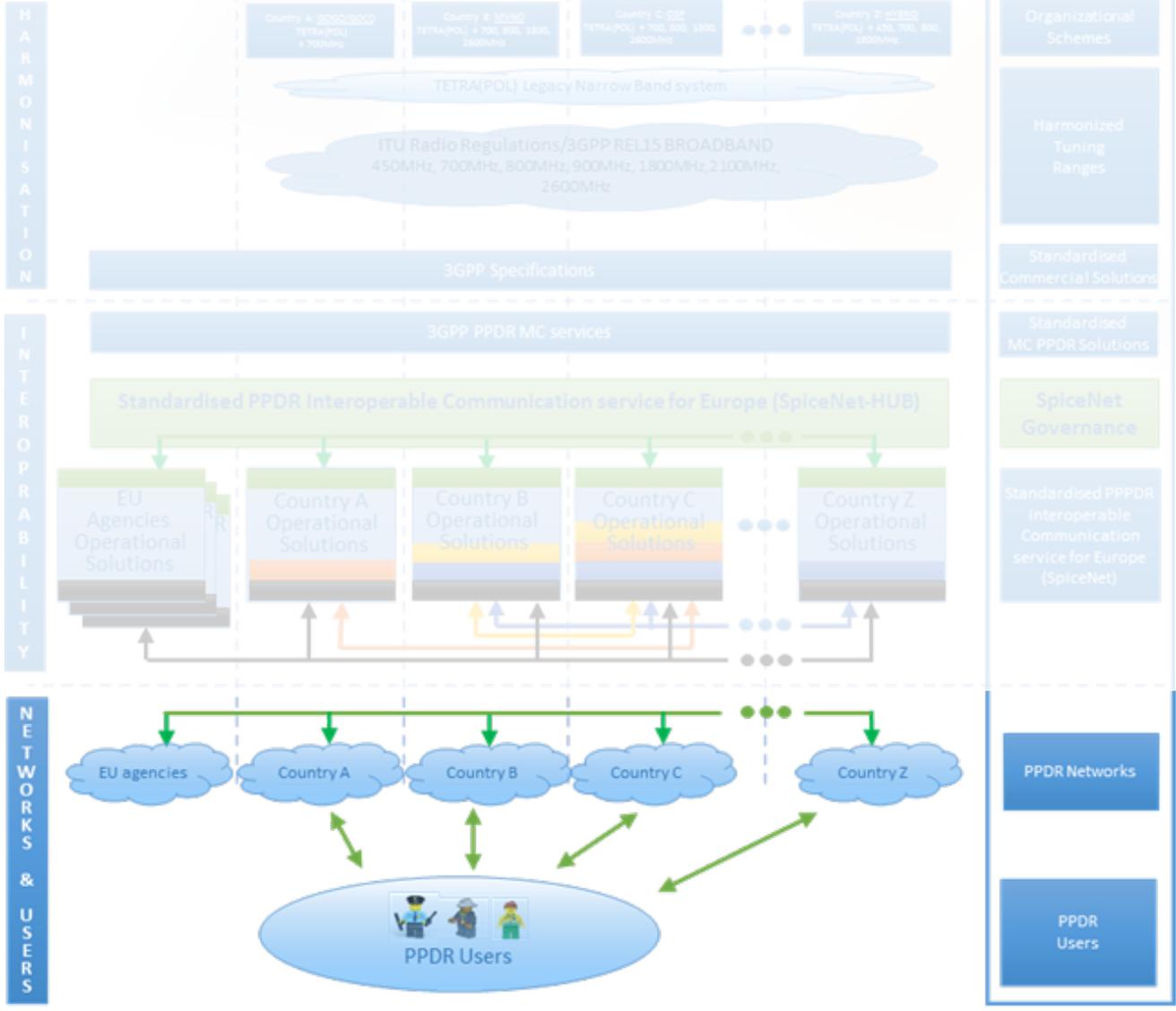
The network and user layer

Standardised PPPDR Interoperable Communication for Europe (SpiceNet) service
Country B&C Contractual agreement for PPDR Interoperability
Country A&C Contractual agreement for PPDR Interoperability
Country B,C&X Contractual agreement for PPDR Interoperability
Pan European Contractual agreement for PPDR Interoperability

Next Steps

Pre-Commercial Procurement
2018 – 2021/22
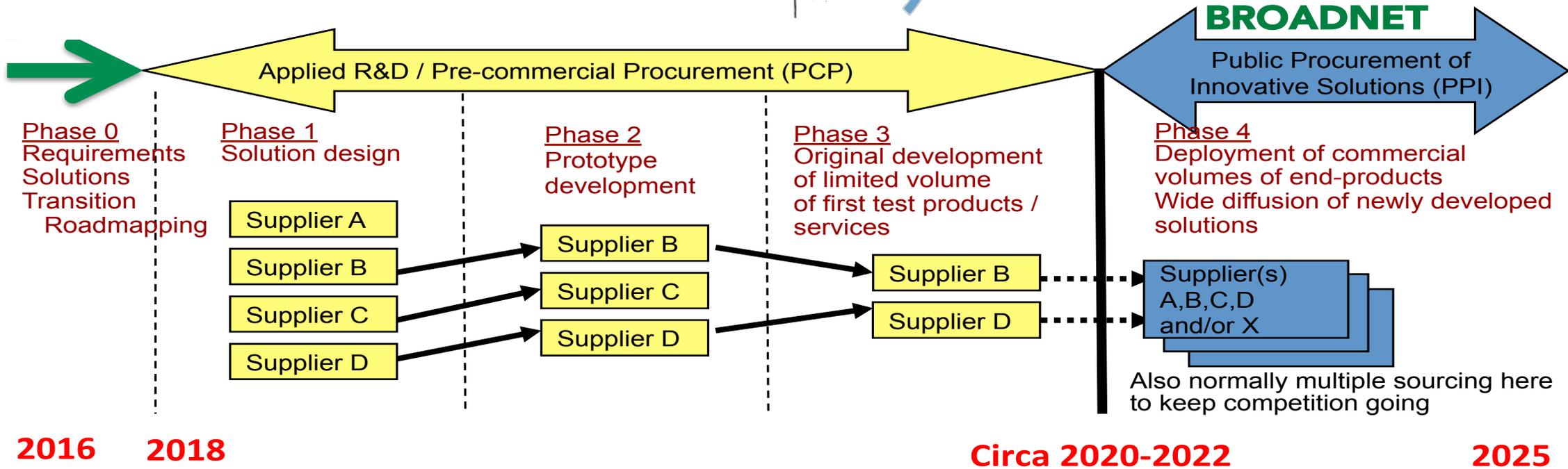
BROADNET

Applied R&D / Pre-commercial Procurement (PCP)

Public Procurement of
Innovative Solutions (PPI)

Phase 0
Requirements
Solutions
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Roadmapping

Phase 1
Solution design

Supplier A
Supplier B
Supplier C
Supplier D

Phase 2
Prototype
development

Supplier B
Supplier C
Supplier D

Phase 3
Original development
of limited volume
of first test products /
services

Supplier B
Supplier D

Phase 4
Deployment of commercial
volumes of end-products
Wide diffusion of newly developed
solutions

Supplier(s)
A,B,C,D
and/or X

Also normally multiple sourcing here
to keep competition going

2016   **2018**

Circa 2020-2022   **2025**

2025 – Commercially Deployed Interoperable
Broadband Applications, Services, Networks, Devices
for PPDR

Emergency Services Mobile Communications Programme

PSCR General Update
17 June 2017

Background

Airwave:

- Was the first national public safety (PS) network
- Is used by all UK Emergency Services and agencies
- Is a private TETRA network with loaned spectrum
- Has c3,800 sites to provide full national coverage
- Includes underground and air-to-ground coverage
- Provides functionality, coverage, availability, security
- National shut down is 31 Dec 2019 with extensions
- Is expensive and cannot support broadband data
- Was bought by Motorola in 2016

Programme objectives

- To replace Airwave with the Emergency Services Network (ESN) by enhancing a commercial mobile network (a carrier) to provide:
  - Integrated broadband data services
  - Public Safety functionality
  - National full coverage (97%/geography; 98%/population)
  - Improved availability through greater resilience
  - End-to-end security
  - Priority access over the general public
  - Greater choice in device types
  - A much cheaper service
- Available in 2018 with transition complete in 2020
- Meet user requirements but not necessarily in the same way

HM Government

NPCC
National Police Chiefs' Council

CFOA
Chief Fire Officers
Association

ASSOCIATION OF
AMBULANCE
CHIEF EXECUTIVES

Programme costs

Financial Measure	15 year costs/savings Programme
	£m
Net Cost (inc/less Income exc NonCash)	5,010
Total Saving (Base Case less Net Cost i.e. inc Income, exc Non-Cash)	2,895
Total Investment	1,060
Return on Investment	2.7
First Year of Saving/Benefit	2,020
Payback Year	2,023
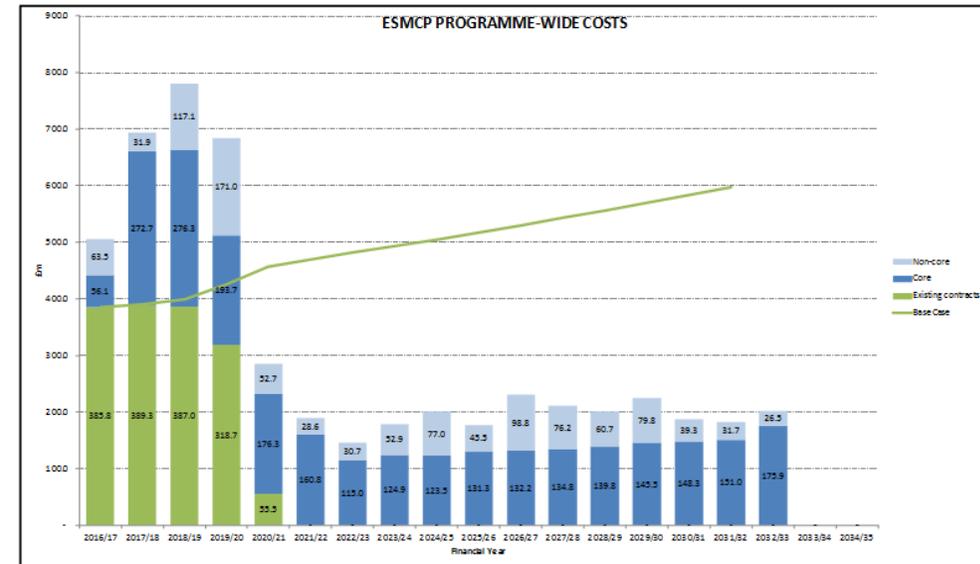
FBC Forecast (V7.40) reported to ESN Finance Group March 2017

Programme costs

Total ESMCP Costs 2015/16 – 2031/32

Lot 1 (Delivery Partner) 0.7%
Lot 2 (User Services) 15.7%
Existing contracts 27.4%
Lot 3 (Mobile Services) 22.9%
Optimism Bias/QRA 4.7%
Device Installation 1.8%
Control Rooms 1.1%
Devices 7.4%
Local Users 1.9%
Data and connections 6.3%
Wave 7000 0.7%
Extended Area Services 3.8%
Air to Ground 1.6%
ESN Management Team 2.6%
London Underground 1.4%
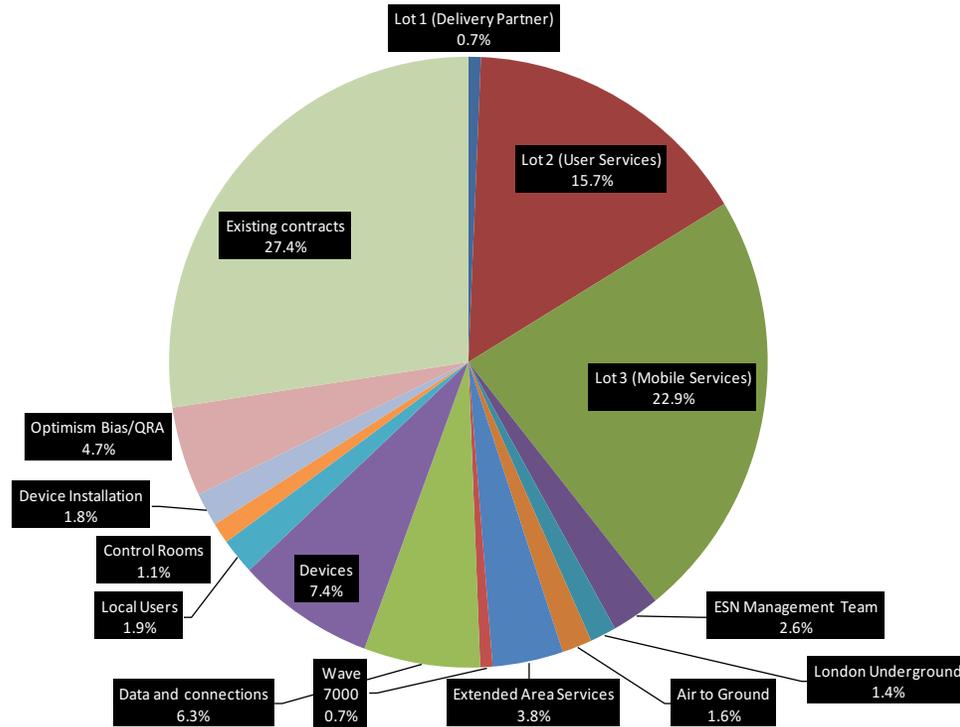
Total ESN "Steady State" Costs 2021/22 – 2031/32

Optimism Bias/QRA 6.4%
Device Installation 2.1%
Devices 10.2%
Lot 2 (User Services) 26.0%
Data and connections 11.9%
Extended Area Services 4.7%
Air to Ground 2.8%
ESN Management Team 3.1%
Lot 3 (Mobile Services) 32.9%

HM Government
NPCC National Police Chiefs' Council
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ASSOCIATION OF AMBULANCE CHIEF EXECUTIVES
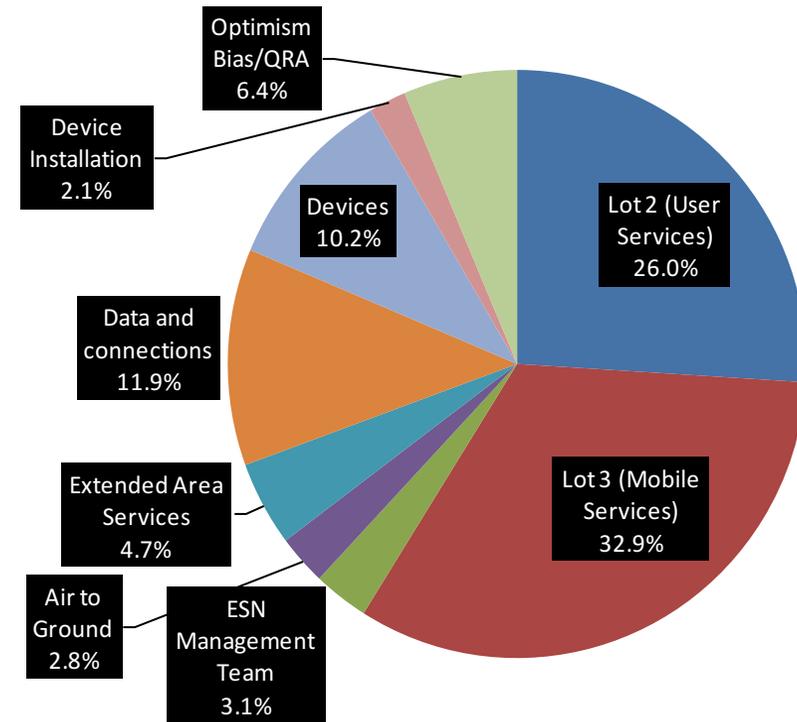
Key dates

Milestone	Date
Contract awards	2015
Motorola acquires Airwave	Feb 16
Detailed design	May 16
Reference system	Aug 16
Test and functional trials	Aug 16 to Feb 18
Major operational trials	Q2 2018
Transition commences	Q3 2018
Transition completes	2020

HM Government

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National Police Chiefs' Council

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ASSOCIATION OF
AMBULANCE
CHIEF EXECUTIVES

Programme structure

SCS structure
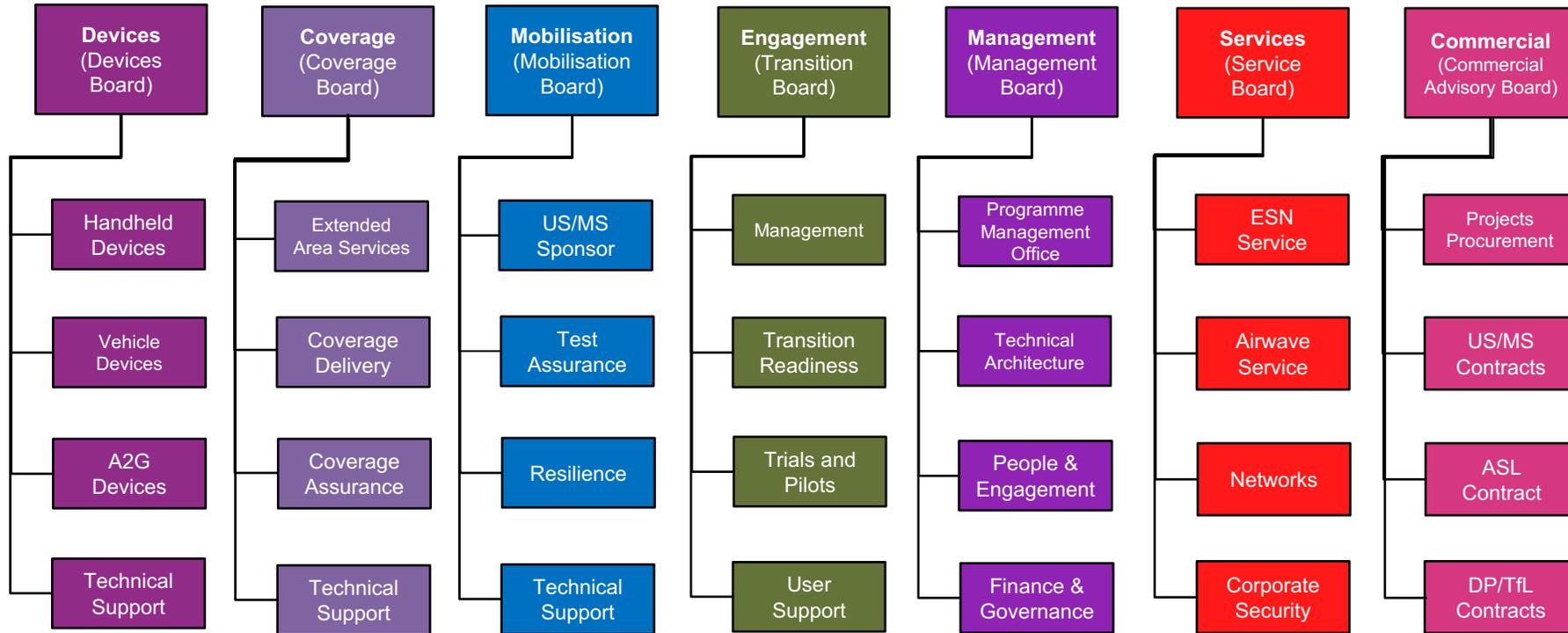

```
                    Programme
                     Director
                        |
         +--------------+--------------+
         |                        Transition
         |                         Director
         |                            |
       DD Devices              DD Management
         |                            |
       DD Coverage             DD Engagement
         |                            |
       DD Mobilisation         DD Services
         |                            :
       DD Commercial           Senior Users
                               (Police, Fire,
                                Ambulance)
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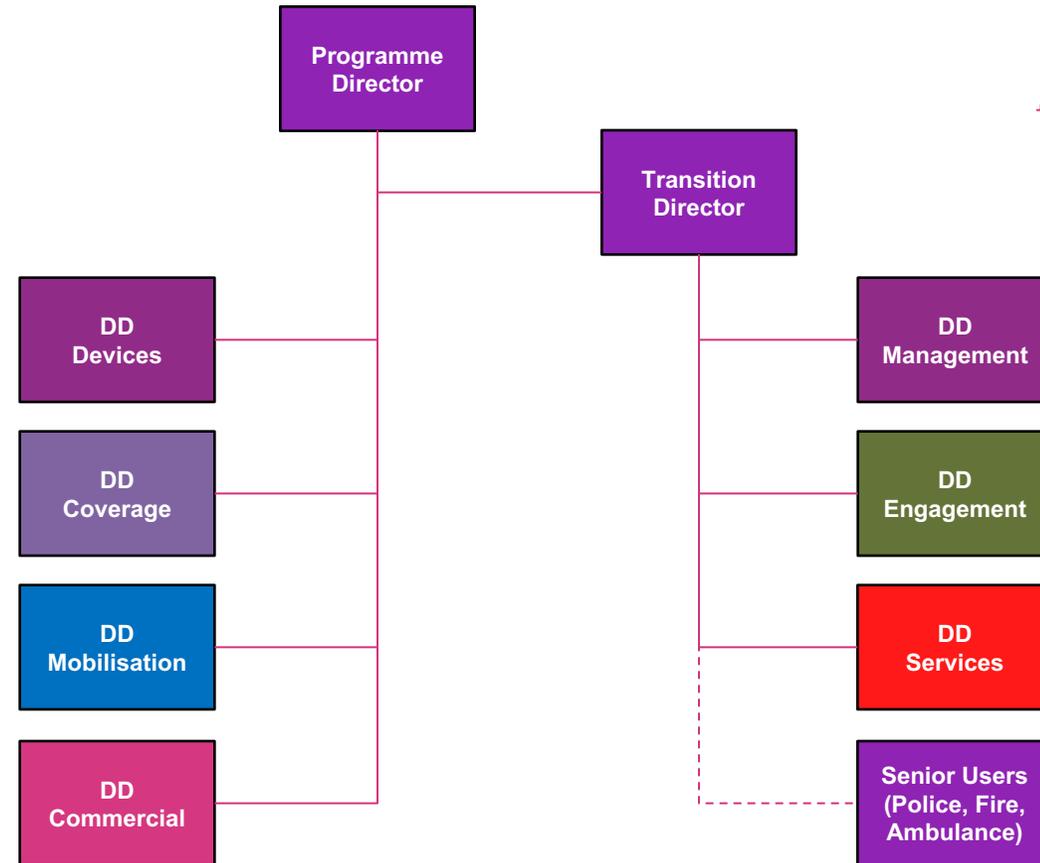
Programme scope

- **Emergency Services** User Organisations:
  - 44 Police forces
  - 50 FRS
  - 13 Ambulance Trusts
- **Other** User Organisations:
  - non-Home Office police forces
  - other government departments
  - local authorities
  - Transport agencies and utility companies
- **Control rooms**: c200
- **Vehicles**: c50,000
- **Aircraft**: c115
- **Users**: c300,000

Main procurement lots

- **Lot 1 (Delivery Partner) - KBR**
  - A Delivery Partner to support the Authority oversee the build out of the network; manage transition; training support services; vehicle installation design and assurance, and delivery support

- **Lot 2 (User Services) - Motorola**
  - A service provider to provide end-to-end systems integration; public safety functionality; account management; network and IT infrastructure; technical interfaces to all other lots and services user device management; application hosting; customer support; and service management

- **Lot 3 (Mobile Services) - EE**
  - A mobile network operator to provide an enhanced radio access service with highly available full national coverage using the Extended Area Services; and technical interface to Lot 2

Other procurements

- **Devices:** handheld, vehicle and aircraft (and their installations), and NSS
- **Coverage:** EAS, LUS, General and Special coverage
- **Networks:** Control Rooms, Connections and Interworking
- **Related activities:**
  - Coverage assurance
  - Resilience assurance
  - Security architecture
  - Testing
  - Trials
  - Live Services
  - Transition readiness and assurance

- **Dependent projects:**
  - Crossrail
  - HS2
  - Network Rail (Telecoms)
  - New venues

Commercial approach

User Organisations (UO)

ESN Management Team (EMT)

Core ESN services centrally procured

Non-core ESN services centrally procured

Non-core ESN services locally procured

Lot I: Delivery Partner

Lot 2: User Services

Lot 3: Mobile Services
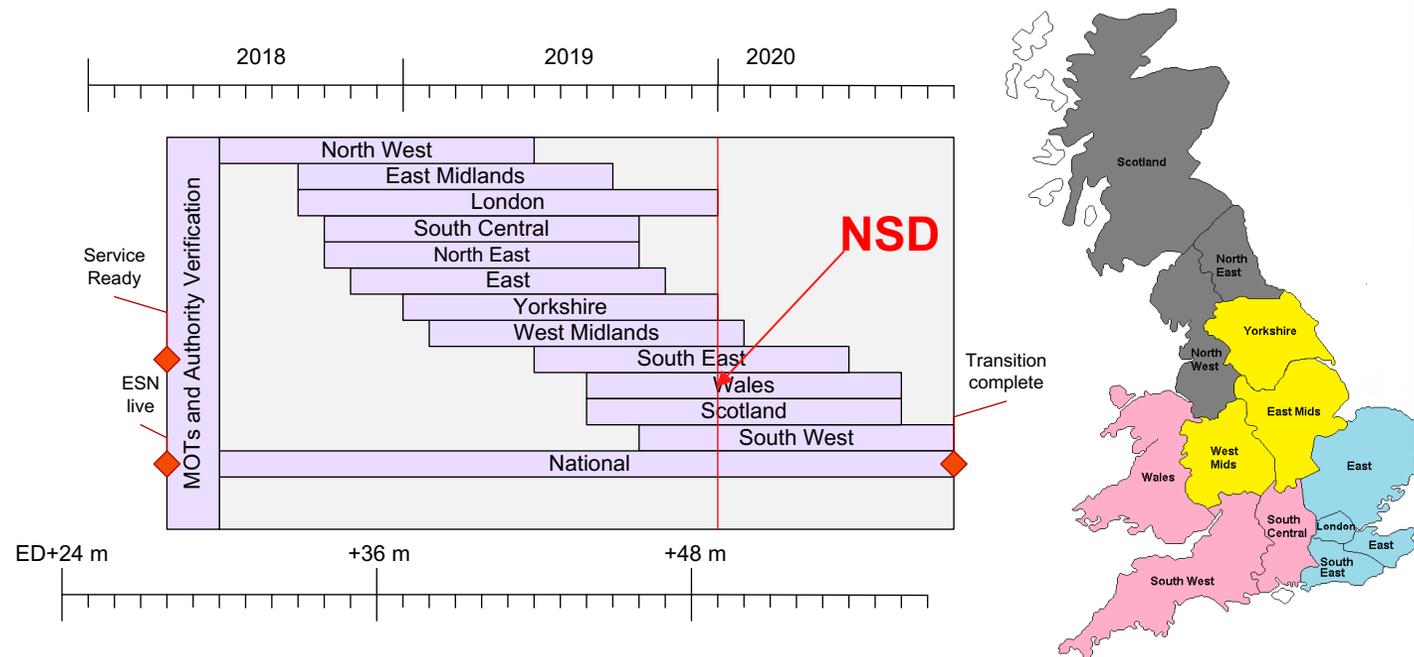
Lot 3: Non-core network airtime

Extended Area Services (EAS)

Air to ground device and network

Devices frameworks

Apps Store

Vehicle installation framework

Local vehicle installation

Local training delivery

Local project management

Control room upgrades sub-programme

Lot 2 provides user access via self-service portal

Lot 1 provides delivery assurance role in support

Control room upgrades is a sub-programme, centrally coordinated with the overall Programme and interfaces with Lot 2 User Services

Contract management
Centrally procured contracts and frameworks managed by EMT

Central ESN Procurement
Provides core ESN functionality, work connectivity plus programme management of the support for Transition to ESN

Other ESN central procurements
Provides additional ESN functionality largely in response to needs and demands that vary between user organisations and that complement the core ESN service;

Local ESN procurements
Provide additional support for user organisations in the Transition to the new ESN service; there may or may not be a need for individual organisations to procure support services depending on their existing capabilities and/or support arrangements

Transition

- Transition is assumed to take 27 months:

- There will be 12 Regional Transition Groups and one National Transition Group

Progress Updates
(Tuesday after Conference in Conference Room 14)

- Mobilisation
- General Coverage
- Extended Area Coverage
- Air to Ground
- London Underground
- Devices
- Transition
- Control Room Upgrades
- Control Room Connections
- Network Interworking
- Special Coverage

Thank you!

FirstNet Update

Jeff Bratcher

**FirstNet Chief Technology Officer**

June 13, 2017

Middle Class Tax Relief and Job Creation Act of 2012

Public Law 112-96 signed February 22, 2012

*"The First Responder Network Authority
shall hold the single public safety wireless license
and take all actions necessary to
<u>ensure the building, deployment, and operation
of the nationwide public safety broadband network</u>"*

FirstNet Assets
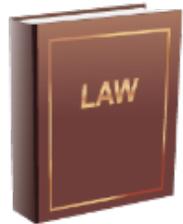
THE LAW
2.22.12

FirstNet becomes law
(Public Law 112-96)

FUNDING

$7B authorized to build the FirstNet network – funded via spectrum auctions through 2022.
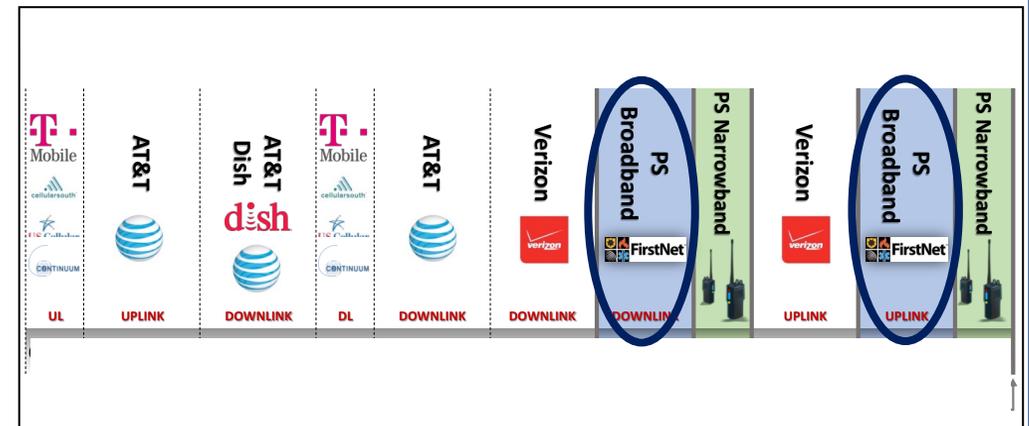
GOVERNANCE

FirstNet **Board** has **15 members** that possess telecommunications and public safety backgrounds.

Each Governor appoints **1 Single Point of Contact (SPOC)** and a governing body to represent the State's interests to FirstNet.
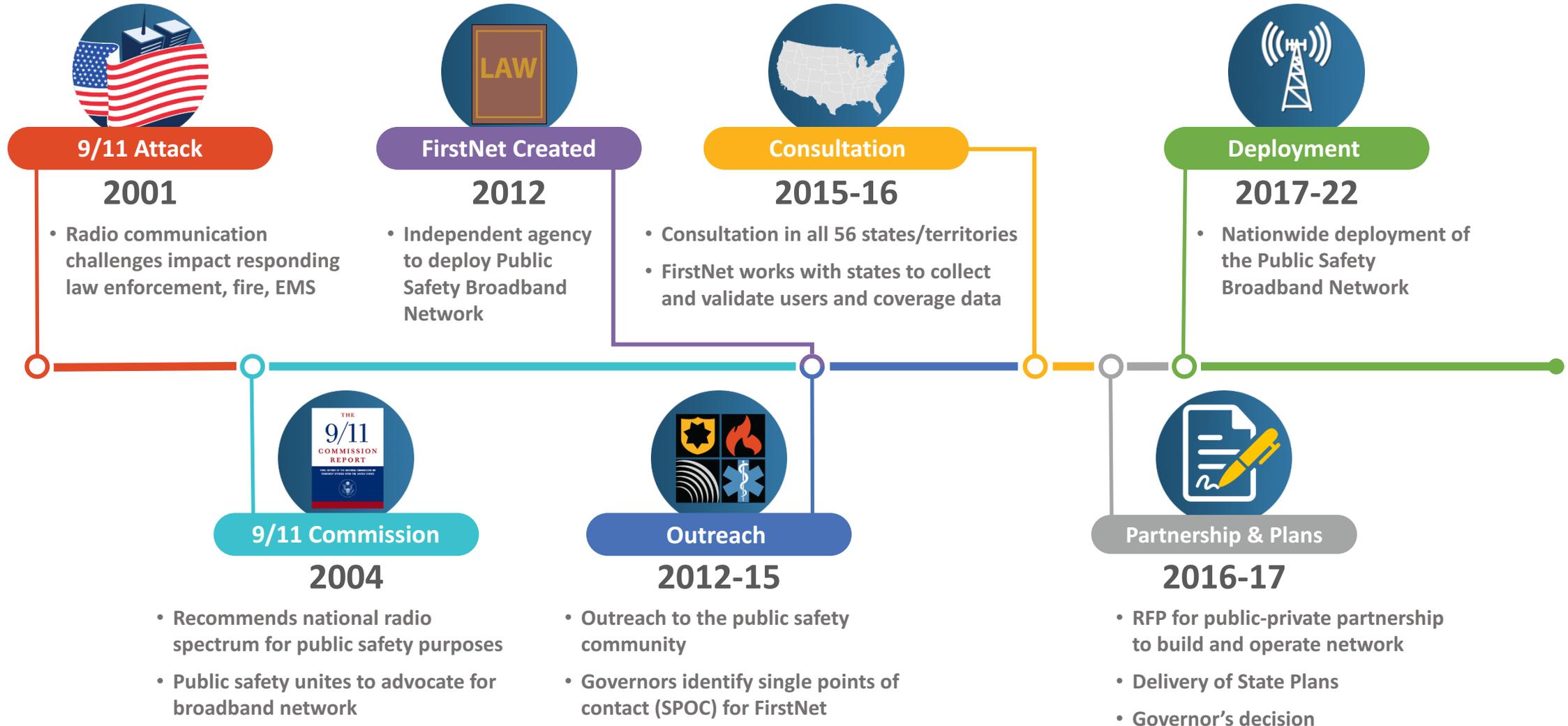
43 member **Public Safety Advisory Committee (PSAC)** advises FirstNet on public safety intergovernmental matters.

NATIONWIDE SPECTRUM

20MHz of bandwidth dedicated to public safety in prime **700MHz** frequency range (**BAND 14**).

FirstNet's Journey

9/11 Attack
2001
- Radio communication challenges impact responding law enforcement, fire, EMS

FirstNet Created
2012
- Independent agency to deploy Public Safety Broadband Network

Consultation
2015-16
- Consultation in all 56 states/territories
- FirstNet works with states to collect and validate users and coverage data

Deployment
2017-22
- Nationwide deployment of the Public Safety Broadband Network

9/11 Commission
2004
- Recommends national radio spectrum for public safety purposes
- Public safety unites to advocate for broadband network

Outreach
2012-15
- Outreach to the public safety community
- Governors identify single points of contact (SPOC) for FirstNet

Partnership & Plans
2016-17
- RFP for public-private partnership to build and operate network
- Delivery of State Plans
- Governor's decision

June 13, 2017

RFP Statement of Objectives (16)

Building, Deployment, Operation & Maintenance of the NPSBN

Financial Sustainability

First Responder User Adoption

Device Ecosystem

Applications Ecosystem

Accelerated Speed to Market

User Service Availability

Service Capacity

Cyber Security

Priority Services

Integration Of Opt-out State RANs

Integration of Existing Commercial/ Federal/ State/Tribal/Local Infrastructure To Support NPSBN Services

Life-cycle Innovation

Program and Business Management

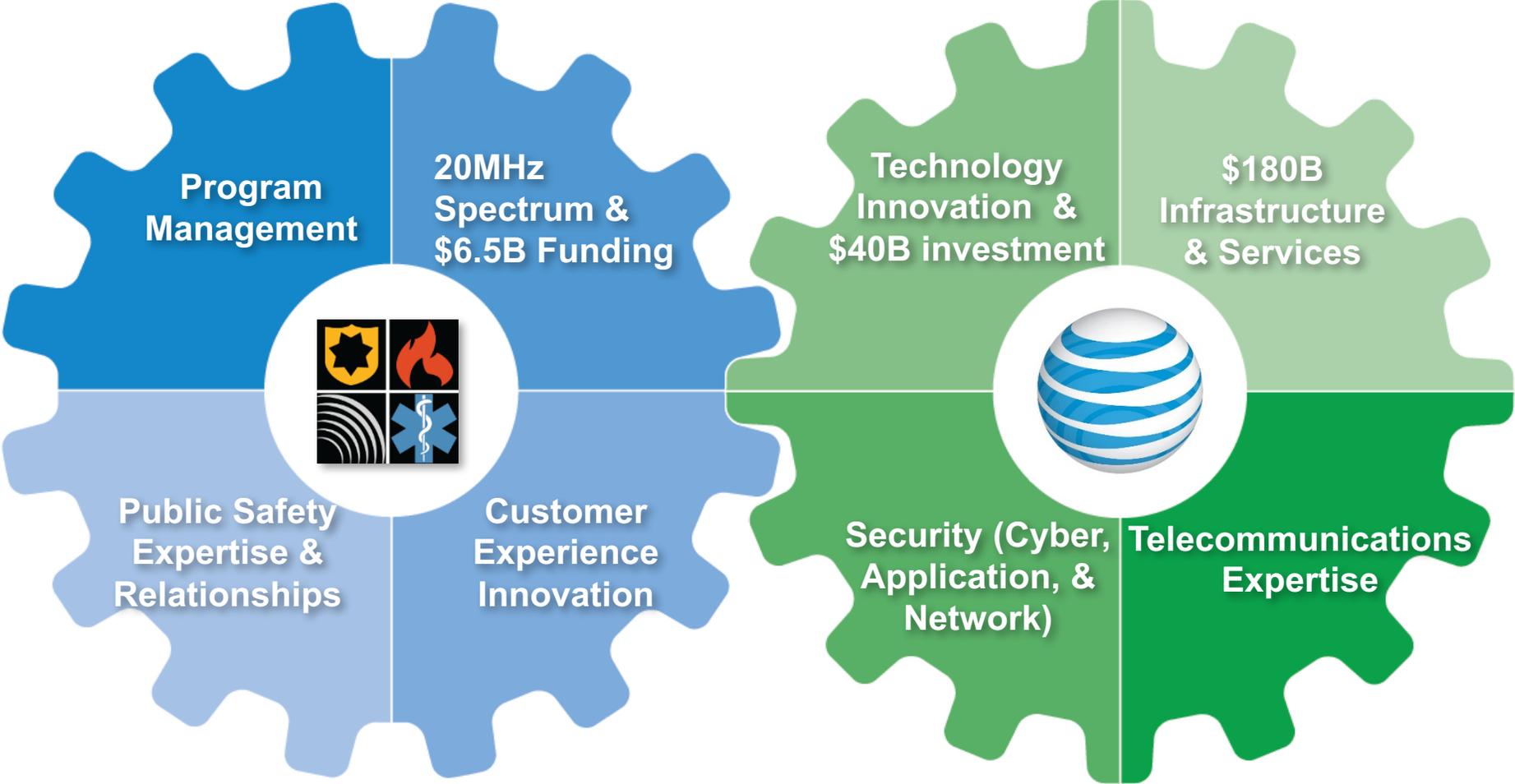Customer Care and Marketing

Facilitation of FirstNet's Compliance With The Act & Other Laws

FirstNet & AT&T: An Innovative Public-Private Partnership To Build Public Safety's Network

Program Management

20MHz Spectrum & $6.5B Funding

Public Safety Expertise & Relationships

Customer Experience Innovation

Technology Innovation & $40B investment

$180B Infrastructure & Services

Security (Cyber, Application, & Network)

Telecommunications Expertise

June 13, 2017

3GPP Standards for Mission Critical Services

Release 12 (March 2015) & Release 13 (March 2016)

Release 14 (March-June 2017)

Release 15 (Nov. 2018) & Release 16 (March 2020)

Release 12:

- Proximity Services (ProSe)
- Group Communications System Enablers for LTE (GCSE_LTE)

Release 13:

- Mission Critical Push To Talk over LTE (MCPTT)
- Isolated E-UTRAN Operations (IOPS)
- enhancements of prior features (D2D and group)

Mission Critical Video (MCVideo)

Mission Critical Data (MCData)

Mission Critical Services Common Requirements (MCCoRe)

Mission Critical Push To Talk over LTE - Realignment (MCPTT-R)

enhancements of prior features (D2D, IOPS, and group)

MCVideo Enhancements

MCData Enhancements

MCPTT Enhancements

MCCoRe Enhancements

5G support for Quality of Service (QoS), Priority, and Preemption

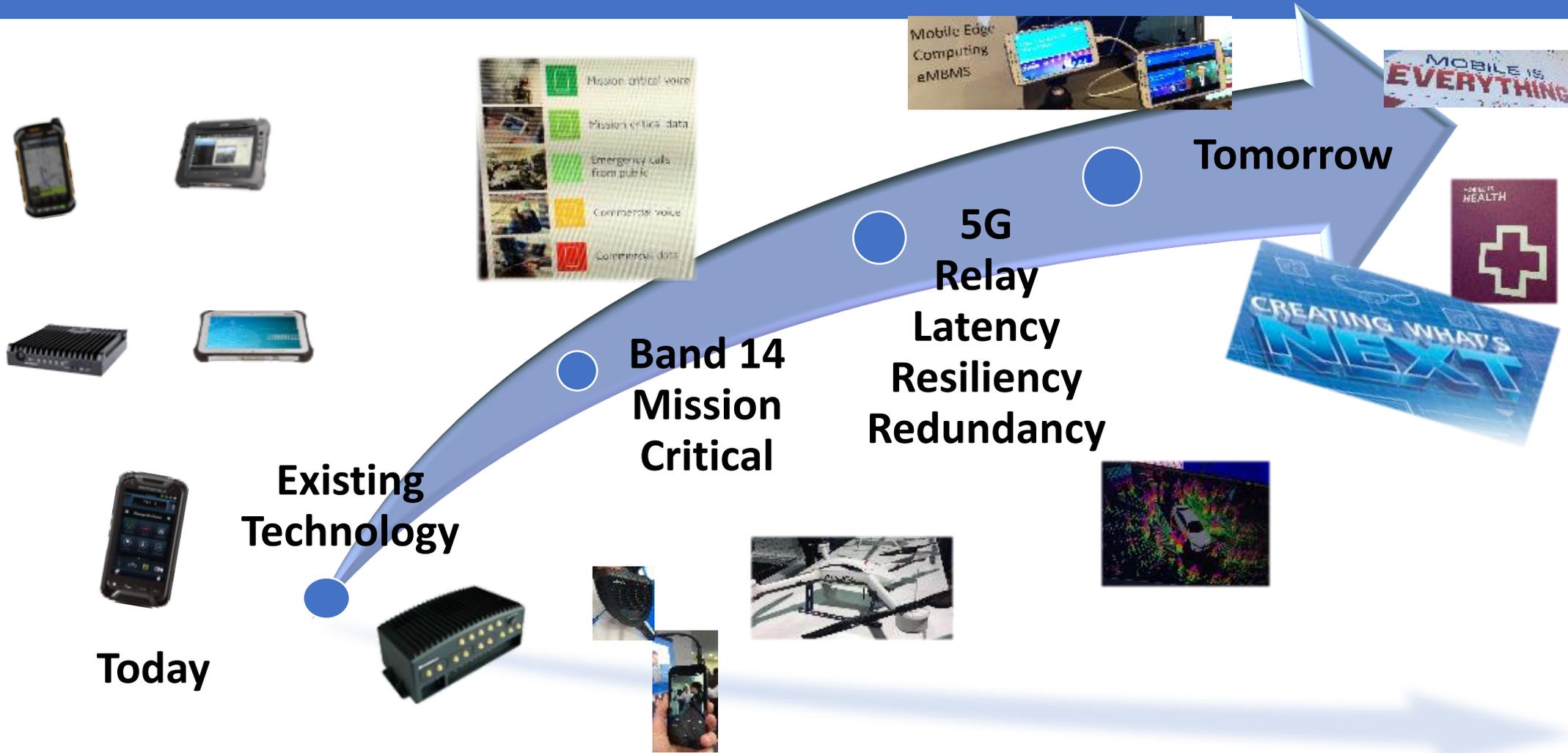5G support for Dynamic Controller

Improvement of Direct Mode capabilities

June 13, 2017

Public Safety Device Ecosystem Vision

Types	Smartphones • Tablets • Feature phones • Ruggedized • All operating systems	In Vehicle Routers (IVR) • Hotspots / Mobile Data Terminals (MDT) • Modems • Vehicle Network System (VNS) • Range extension / High Power UE • Satellite fallback	Hybrid • Wearables • Hands free • Gloved usage
Types	• Smartphones • Tablets • Feature phones • Ruggedized • All operating systems	• In Vehicle Routers (IVR) • Hotspots / Mobile Data Terminals (MDT) • Modems • Vehicle Network System (VNS) • Range extension / High Power UE • Satellite fallback	• Hybrid • Wearables • Hands free • Gloved usage
Connectivity	• LTE, 3G, Satellite, 5G • Wi-Fi, Wi-Gig • NFC • Bluetooth • Tethering • Direct Mode	• LTE, 3G, Satellite, 5G • Wi-Fi, Wi-Gig • Ethernet • USB • Direct Mode	• LTE, 3G, Satellite, 5G • Wi-Fi, Wi-Gig • NFC • Bluetooth

All inclusive vision building on economies of scale to target COTS pricing and availability

Public Safety Devices Roadmap Vision

Today

Existing Technology

Band 14
Mission
Critical

Mobile Edge Computing eMBMS

5G
Relay
Latency
Resiliency
Redundancy

Tomorrow

MOBILE IS EVERYTHING

CREATING WHAT'S NEXT

Applications

Strategy

- • Create apps that enable public safety user adoption
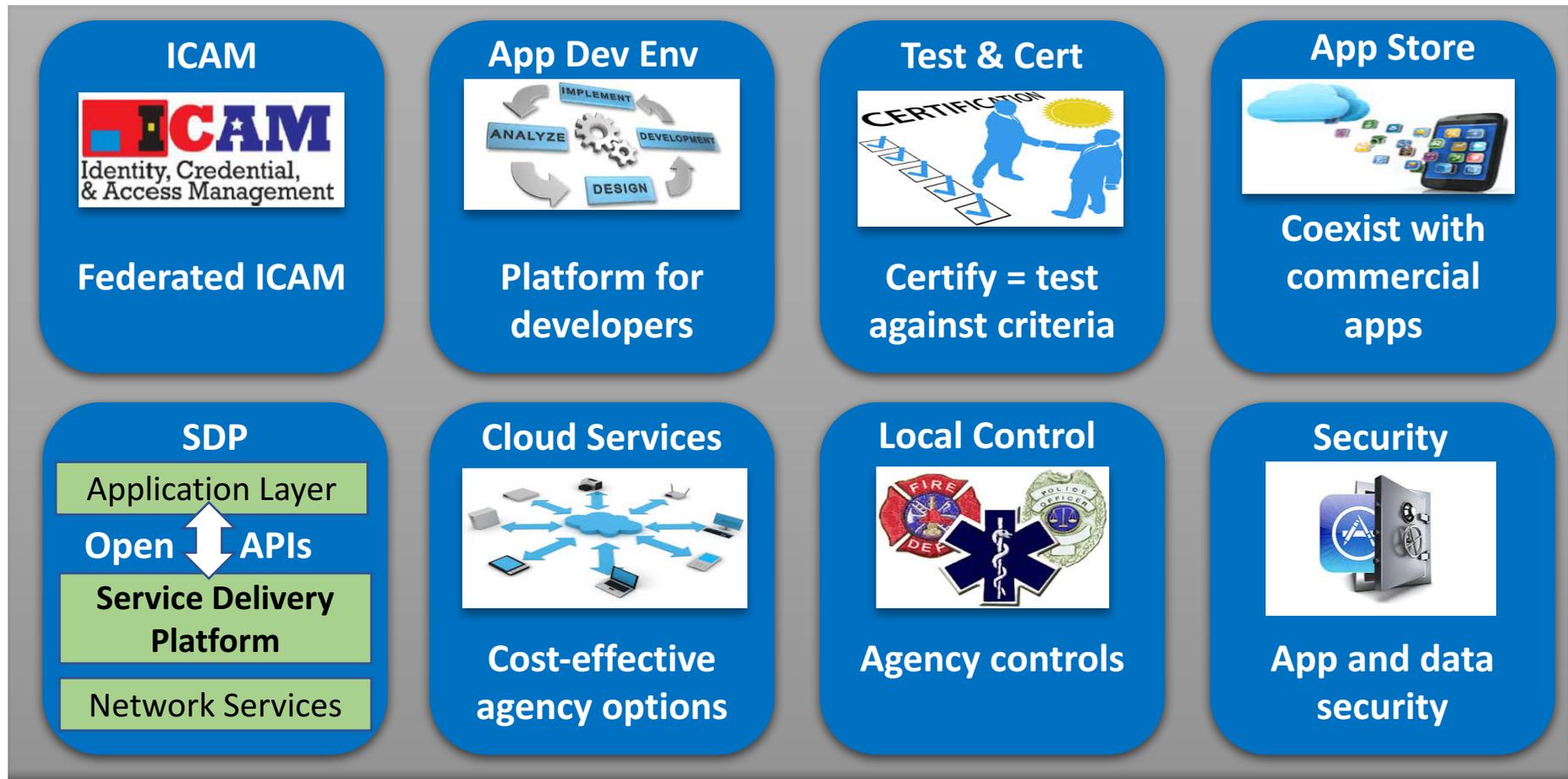- • Leverage scale and technologies of the commercial market

Vision

- • Innovate continuously to meet the needs of public safety
- • Support a vibrant public safety developer community
- • Enable development of a growing portfolio of public safety apps

Ecosystem

- • Facilitate the secure coexistence of FirstNet and commercial apps on devices
- • Offer best-of-breed solutions

Applications Ecosystem Vision

ICAM

Federated ICAM

App Dev Env

Platform for developers

Test & Cert

Certify = test against criteria

App Store

Coexist with commercial apps

SDP

Application Layer

Open ↕ APIs

Service Delivery Platform

Network Services

Cloud Services

Cost-effective agency options

Local Control

Agency controls

Security

App and data security

High Priority Applications for Public Safety

June 13, 2017

Internet of Things (IOT) Vision for Public Safety

Human Telemetry

Sensors

Variety of
Drones and Robots

Temporary
Cameras

Connected
Vehicles

Temporary Event Installations

FirstNet Innovation and Test Lab – Boulder

- State-of-the-art telecommunications laboratory for FirstNet and current/future vendors to validate and test NPSBN public safety specific features and functionality
- Ribbon Cutting held Nov. 9th, 2016

Focus areas:
- Quality of service
- Priority
- Preemption
- Mission-critical services, devices, and applications
- R&D efforts with PSCR

FirstNet State Plans

Rich Reed | FirstNet Chief Customer Officer

June 13, 2017

Transforming Public Safety Communications

PUBLIC SAFETY

Police, Fire, EMS, 911, others

IN

COMMUNITIES

Counties, Cities, Tribal, Rural

ACROSS

THE NATION

50 states
5 territories & DC

FirstNet - Dedicated to Excellent Customer Experience (CX)

MODERNIZED

Innovative **apps and large devices ecosystem**

Network **improvements and upgrades over 25 years**

Multi-layered, proven, **cybersecurity and network security solutions**

PRIORITIZED

Emergency communications receive highest **Quality Priority & Preemption**

Rapid deployment of network

Instant nationwide **coverage** leveraging existing infrastructure

SPECIALIZED

Nationwide coverage with access to **deployables**

Aggressive pricing for public safety

Dedicated 24/7/365 public safety helpdesk

June 13, 2017

FirstNet Priorities

State Plans

Core Network

June 2017 SPOC Meeting

All 50 states, 5 territories and the District of Columbia met in Addison, TX.

June 13, 2017

Content of the State Plan Portal

FirstNet Overview

Background and mission of FirstNet, including recap of the acquisition process

Products & Services

Information on the features, applications, devices, and services (including pricing plans) that will be available on the FirstNet network

Network Architecture

Technical and operational information on the reliable, scalable, secure infrastructure that will be made available through FirstNet

Consultation & Outreach

Recap of the consultation and outreach efforts within the State / Territory that informed the acquisition and State Plan

Coverage

Interactive map of coverage, including phased buildout in the State /Territory

Governor's Decision

Detailed information on the process for opting-in, as well as all information required to make an informed opt-out decision

June 13, 2017

State Plans Timeline

National State Plan Kickoff Meeting	FirstNet State Plan Release	State Reviews and Provides Any Comments on State Plan	FirstNet Reviews Any Comments	Official Notice to Governor
June 7-8	Mid-June	Up to 45 days	No later than Aug-Sept	No later than Late Sept

FirstNet Engagement with States

For Public Safety, By Public Safety

FirstNet™

FirstNet Quality of Service, Priority and Preemption

PSCR Conference

June 2017

What Is QPP?

- Quality of Service (QoS): Establishes service quality parameters
- Priority: Gives users preferred access to network resources
- Preemption: Terminates or relocates lower priority users to provide access for high priority user

Quality of Service, Priority and Preemption

FirstNet QPP

- Standards based solution

- Supported on multiple bands

- Supports
  - Load control mechanism with access priority
  - Traffic management capabilities
  - Admission control priority with pre-emption
  - Scheduling priority

FirstNet QPP Capabilities in a Nutshell

- **Access Class Barring (ACB)**
  - Public safety users will have special Access Class and will be exempt from throttling/barring
- **High Priority Access (HPA)**
  - Public safety users will have HPA and receive priority treatment in various call setup stages
- **Traffic Management**
  - Non FirstNet traffic will be offloaded from Band 14 during high load
- **Admission Control (ARP)**
  - Public safety primary users will have higher Priority Level (PL) and will be Pre-emption capable
  - Certain RAN resources will be reserved for high priority users

FirstNet QPP Capabilities in a Nutshell

Three levels of permanent priority that can be assigned by public safety agencies

A special, temporary "Incident Level" giving top network priority that can be assigned through the Incident Management Tool (IMT) by public safety agencies

- IMT can assign Incident Level priority to their own FirstNet users or FirstNet users in other primary or extended public safety agencies

- Uplift will apply to both on-going and new sessions

- Incident Level "uplift" expires after a predetermined time period

QPP available in AT&T-managed LTE coverage areas

Quality of Service, Priority and Preemption

Priority and Preemption

ROUTE 14

QPP PARKWAY

PRIMARY

EXTENDED PRIMARY

COMMERCIAL TRAFFIC

COMMERCIAL

PRIORITY LEVEL

PRIORITY LANE

Priority and Preemption

ROUTE 14

QPP PARKWAY
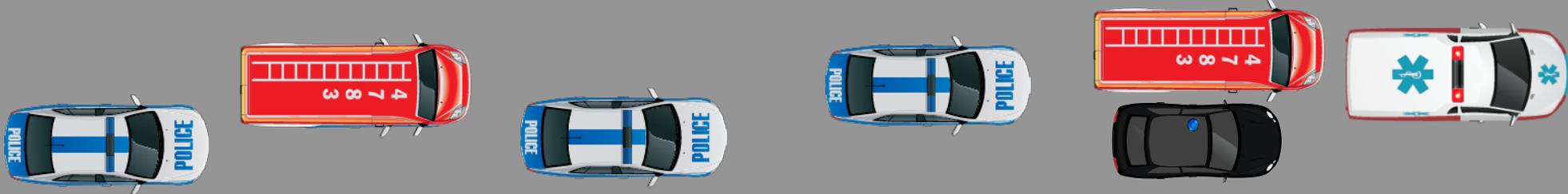
PRIMARY

PRIMARY

EXTENDED PRIMARY

PRIORITY LEVEL

PRIORITY LANE
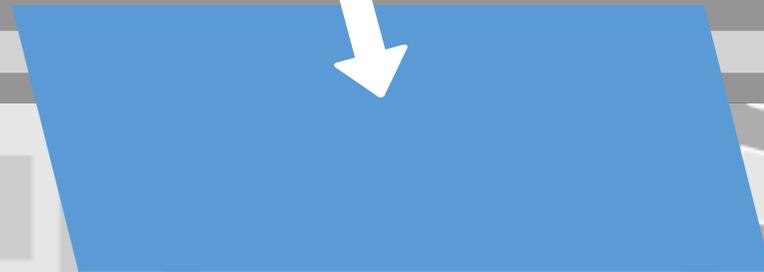
Q&A

Introduction

MELVINDALE
POLICE
DEPARTMENT
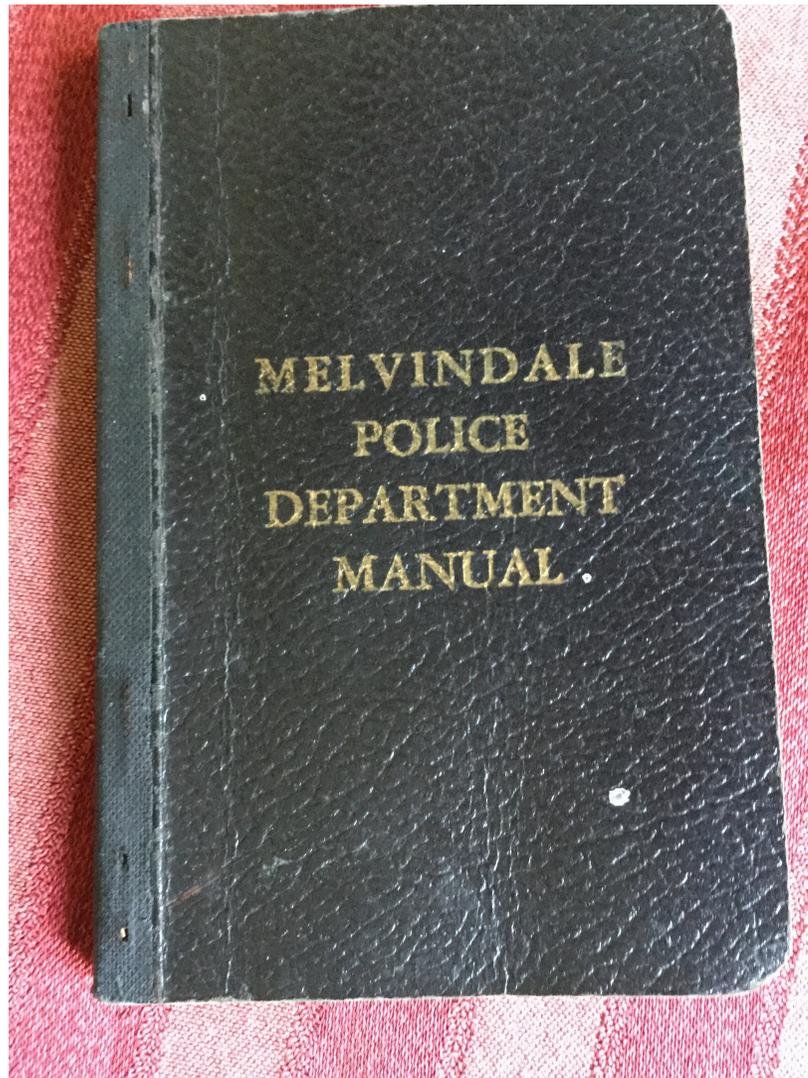MANUAL.
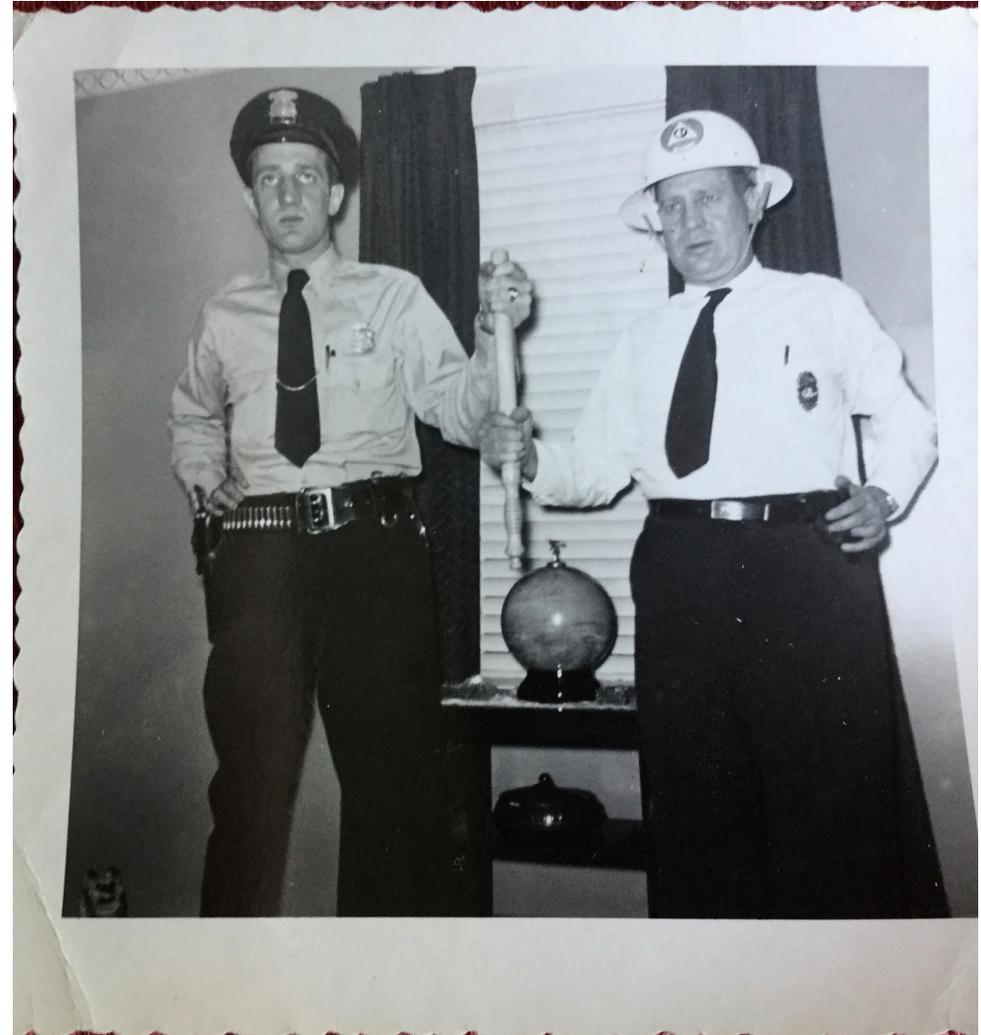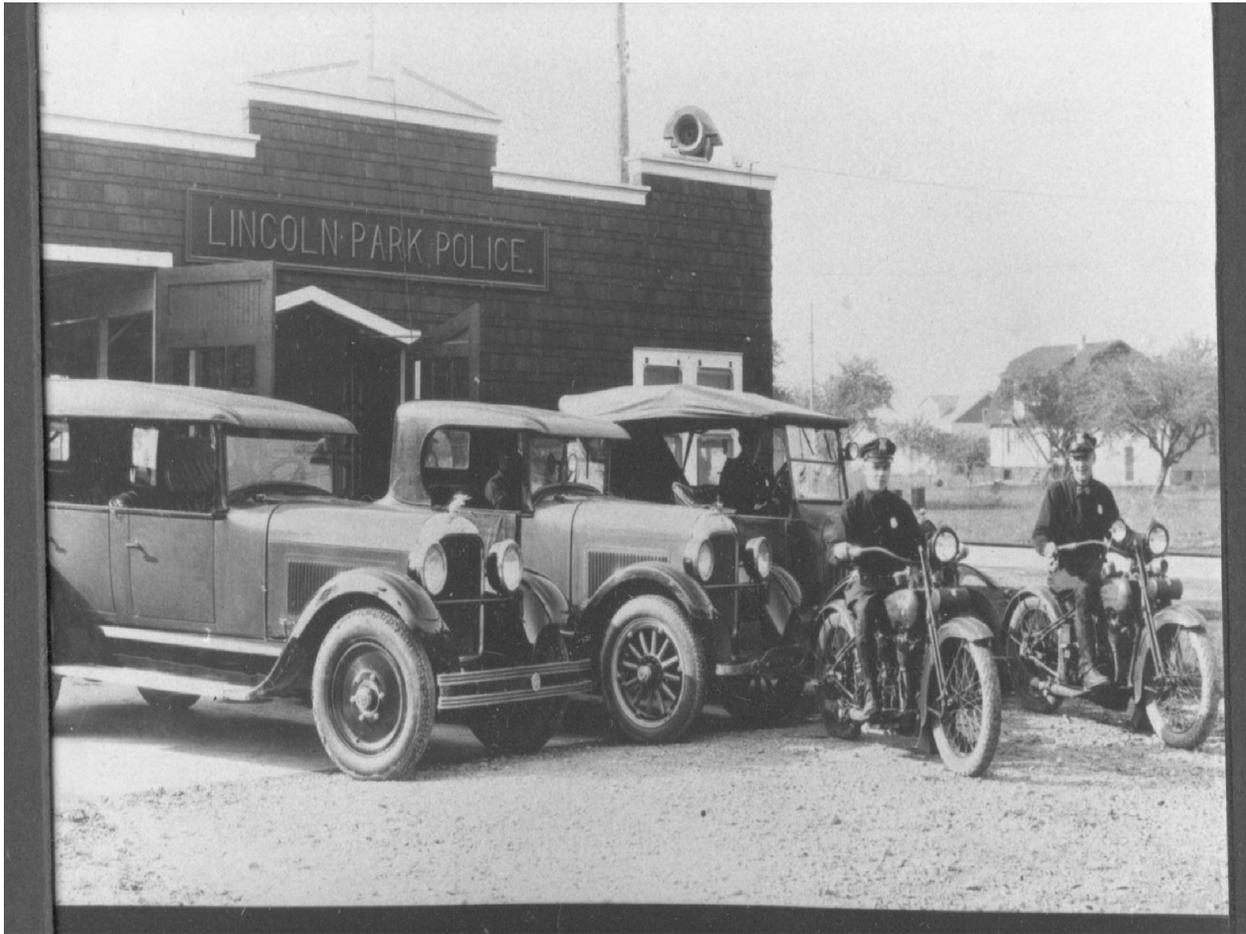
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occupants of which, in any manner may excite suspicion. He will take such immediate action as he deems necessary and will report to his commanding officer the facts. He will pay particular attention to motor vehicles of all kinds, observe their numbers and constantly watch for such as have been stolen or which may have been used in the commission of crime, or are not properly licensed or illegally equipped.

Section 29. To Give Name and Badge Number: He will give his name and badge number in a respectful manner to any person who may inquire for same.

Section 30. To Relieve Traffic Congestion: When any way becomes blocked by vehicles, he shall use his best efforts to aid drivers in disentangling the same. When a street of travel is continuous, he shall open the way for foot travelers, wishing to cross, especialy women, children and aged persons.

Section 31. To Report Cases of Contagious Disease: He will immediately report to his superior officers in case of malignant infections or contagious disease coming to his notice.

Section 32. To Rectify Traffic Signs: A patrolman will familiarize himself with the location and purpose of street traffic signs, and if he sees them misplaced, turned around, or tampered with in any manner, rectify same.

Section 33. To Visit Vacant Houses: A patrolman will enter in his memorandum book a list of vacant houses on his post, visit each during his tour of patrol, and report at the expiration of his tour such buildings as are not secure.

Section 34. To Report Unlighted Street Lights: A patrolman will report street lights which should be lighted but are not.

PSCR

Technological Changes

Efficient and Effective User Interfaces Require:

- Usability testing environment
  - Where context is as realistic as possible
  - Provides for repeatability and reproducibility
  - Infrastructure and instrumentation for new interaction paradigms such as:
    - Voice/Speech Technology, Gesture, Eye Gaze, Touch/Haptics, Wearable Computers, Electronic Textiles, Bio-Sensors, Vibrations, Heads-Up Displays and Context Aware/Location (Situational Awareness)
- Well-defined methodology based on knowledge of:
  - Users (first responders)
  - Tasks (what first responders do, how and where)
 - Needs and Requirements

PSCR

Introducing: The Usability Handbook

- Specifically, for Public Safety Communication: Ensuring Successful Systems for First Responders

- Introduces concept of usability and user centered design (UCD)

- Showcases how UCD process can improve a system's effectiveness, and efficiency, and user satisfaction

- https://www.nist.gov/ctl/pscr/newsroom/publications/usability-handbook-for-public-safety-communications

Thanks to subject matter experts from NPSTC; PSAC; NFPA; APCO; NIST Fire and Police; FEMA USAR; FBI; Bomb Squad; and Fire, EMS, and Law Enforcement personnel in the northeast corridor.
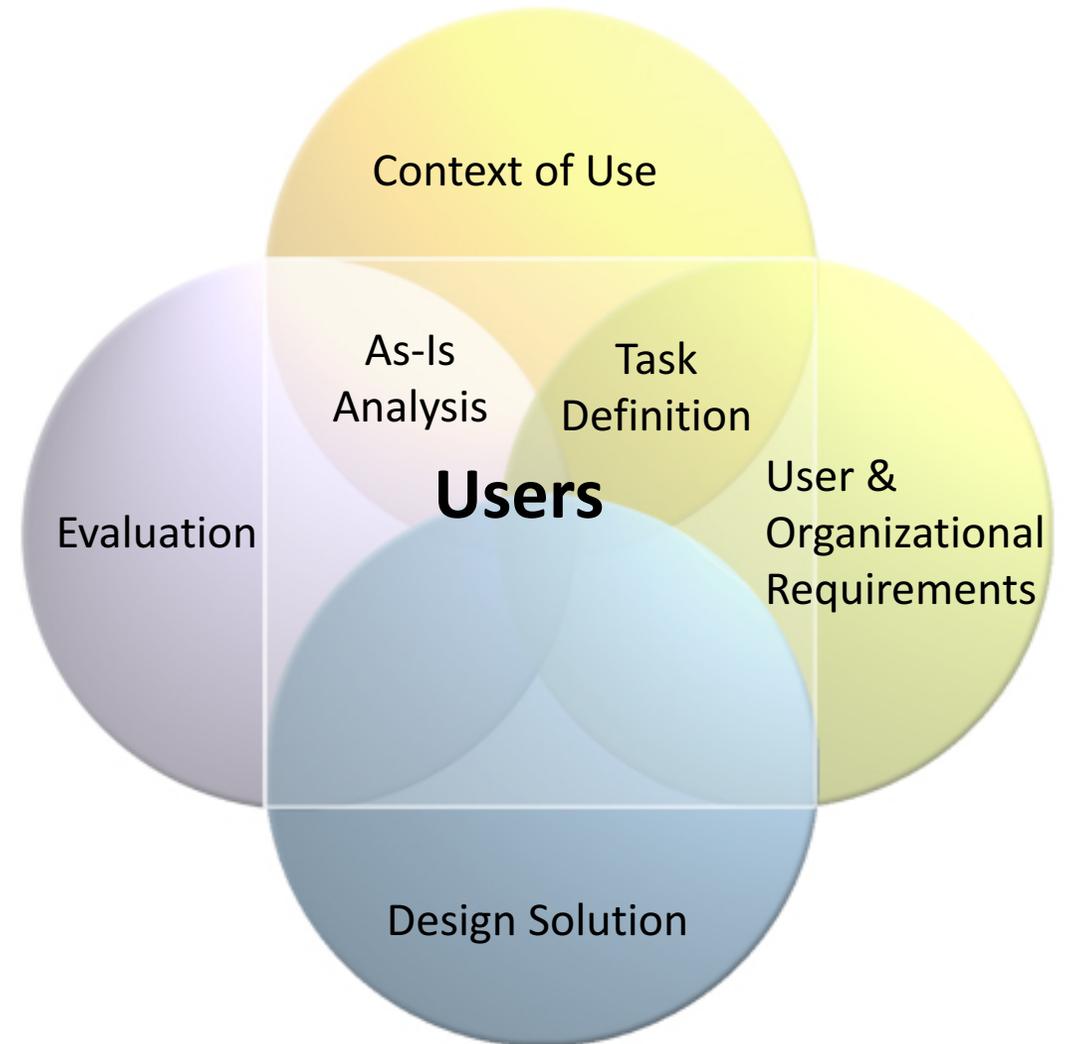
PSCR

User Centered View: Users Plus Technology
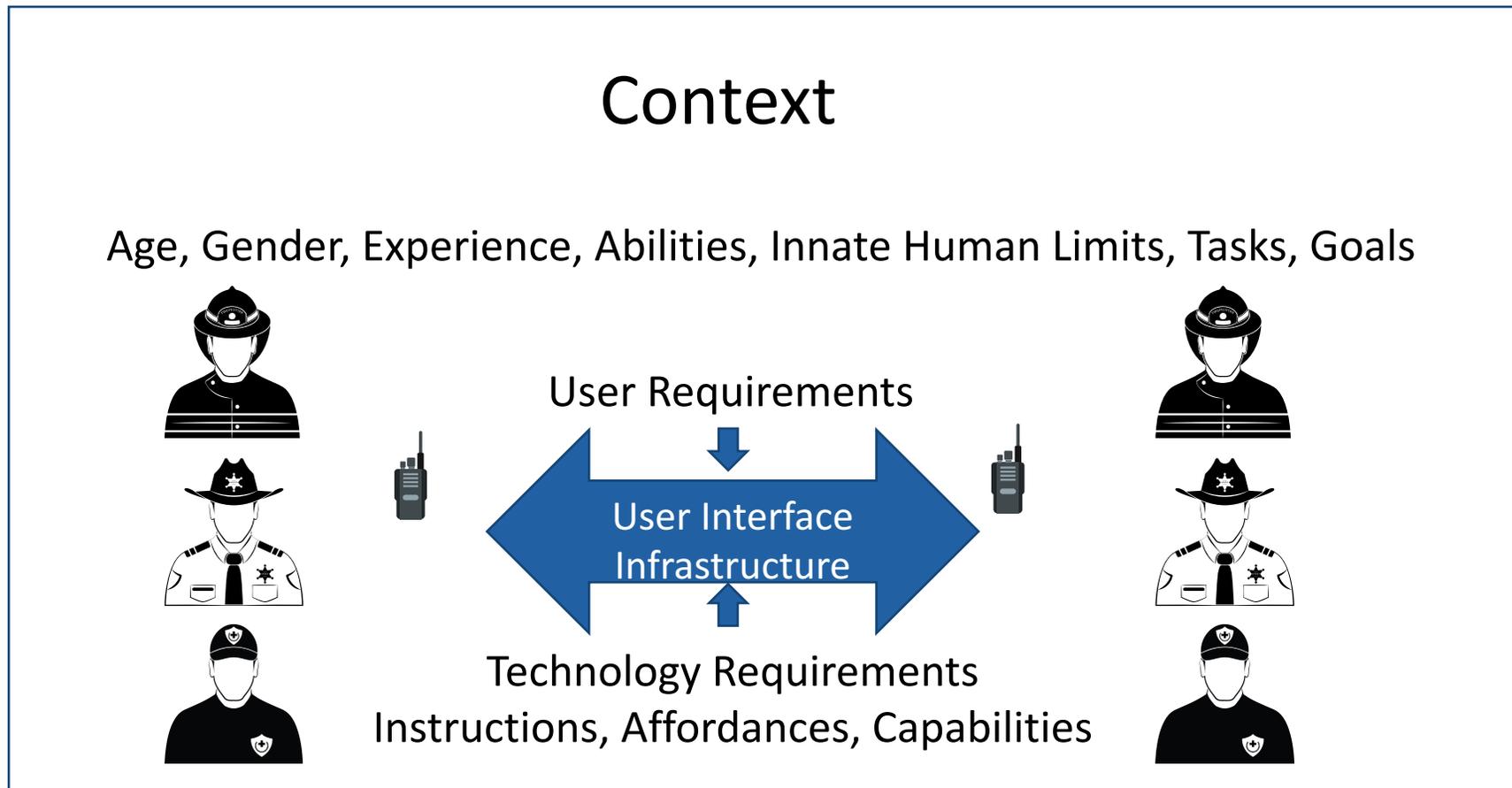
Four Phases of User Centered Design

- Currently defining the Context of Use

- The users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used

PSCR

First Responder Input is Necessary
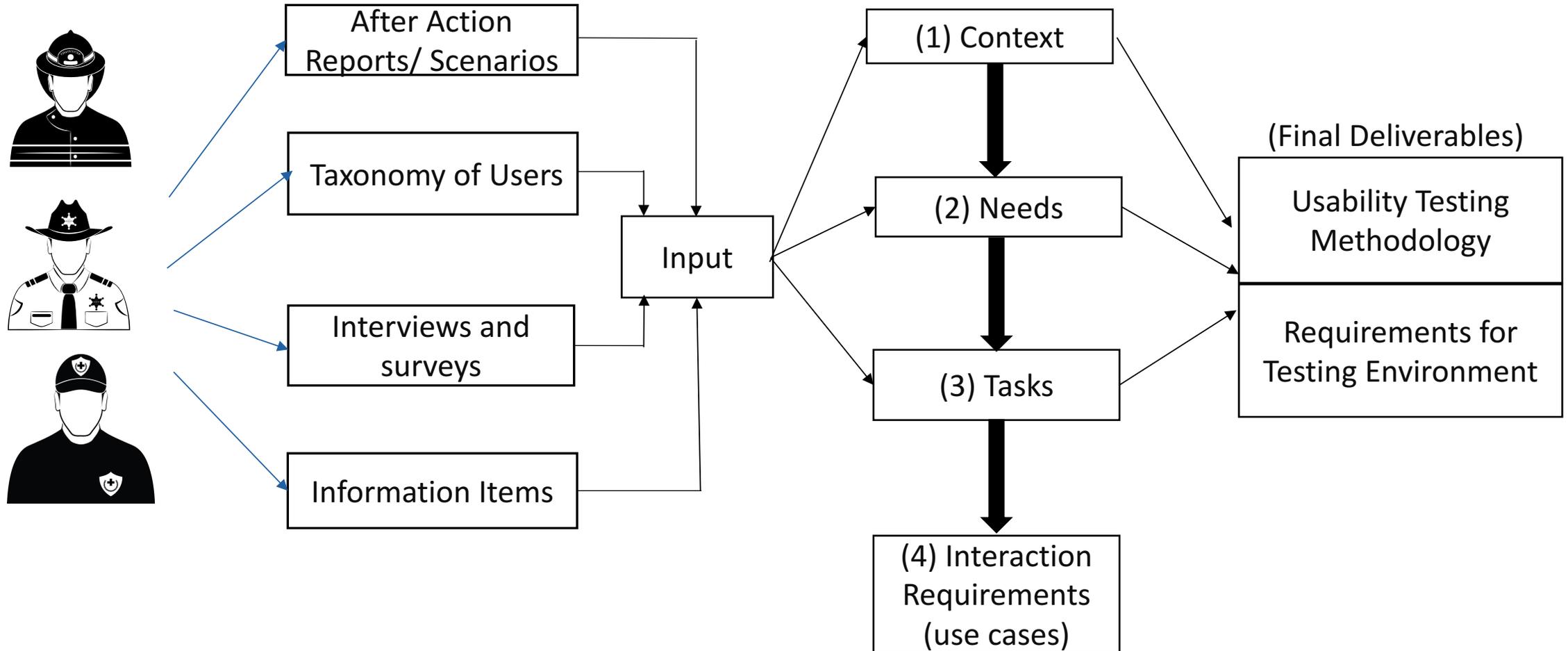
Information and Collection Methods

1. Environments and Scenarios ➡ After Action Reports and Scenarios of Use

2. Types of Users ➡ Certification Bodies

3. Operational information, Perceptions, and facts ➡ From You! (interviews and surveys)

4. Information items ➡ References and one on ones with first responders

PSCR

User Types

- Based on specialization within PS domain
  - Follows available federal standards – e.g., NFPA, APCO/NENA
  - Official titles depend on Region of the U.S.

- Fire Service:
  - Firefighter, Fire Officer, HazMat, Wildland, Fire Apparatus Operator

- Emergency Medical Services
  - EMT, Paramedic, Tactical Paramedic, Ambulance Vehicle Operator

- Law Enforcement Services
  - Patrol, Investigation (Narcotics, ATF), Tactical / SWAT / Special Ops, K-9

- PSAP / 9-1-1 Services
  - Call-taker, Emergency Medical Dispatch, Triage Telecommunicator

PSCR

Information Items: Original Data

- Purpose: user needs analysis
  - Research what information first responders need
  - Investigate how they use, or would use information

- Origin/Foundation: 2015 APCO/PSCR Workshop
  - "Identifying and Categorizing Data Types for Public Safety Mobile Applications" (NISTIR 8135)
  - 50 participants with diverse backgrounds in public safety
  - Discussion framed by 11 scenarios ranging from chemical explosion to traffic stop
  - Futuristic scope: imagine the perfect app(s) on the perfect mobile device
  - Objective: examine influence on cybersecurity of PS organizations
  - Over 100 "data types" identified

Information Items: Original Data

APCO/PSCR Workshop "Data Types" Identified

evacuation routes	body camera data	street traffic	NG9-1-1	Information about suspects
event location	building footprints	tactical command and control	officer status - sensor monitoring	input from social media pre processors
event location	chem track	traffic-surface	patient info casualties	law enforcement intel
evironmental conditions	common operationtal picture	types of hazardous materials	patient information	license and plate reader
facial recognition	comms	utilities	patient quarantine (no PII)	license plate recognition(LPR)
FF sensors(biometrics and equipment)	completed incident command system (ICS) forms/plans	utility info - hot wires	patient triage	location GPS
first responder assets	crime scene geographic information system (GIS) intel location	utility information	personal protective equipment (PPE) responder biometric sensors	location of caller
flight traffic/FAA	critical infrastructure(CI) around location geomapping	utility logistic info	personnel on site (employes and visitors)	location of responders
flight traffic/fAA information	critical locations	vdeo around location	personnel on-site	managing security
fuel sources	critical logistics stations	victims/casualties	photo's video audio (of target suspects)	maps
functional roles	critical static locations (shelters|ccps|EVAC|LZ)	Video	physical asset inventory	medical facility bedcount
geo data / accelerometer	crowd sourced information	video data analysis	physical asset location	Damage assessments
ground cover	deployable assets	video from security cameras	plant inventory	department of transportation(DoT) logistic info
hazardous materials	domosf needs assessment	video/photos	point of contacts	pre-plans (PII)
hospital bedcounts	elevation model	weather	blueprints of the facility	incident management
hospital capacity	Emergency Response	what is the hazard	resident contact info	Info from multiple CAD LE Location
hydrants	environmental conditions	white boarding	responder camera	shelter
ICS (incident command system) forms/plans	environmental sensor data	white force locator	responding assets	social media
images + media from ng911	equipment/smartsensor	accelerometer data	response markers/location	social media push
impact map/plume model	ERG - (Emergency Response Guide) and PPE (Personal Protective Equipment)	active authenitcation	satellite imagery	standing water
impact model (plume model)	evac routes and plans	active authentication	search status for secondary explosive devices	
incident action plan	medical facility bed count	blueprints	security check point locations	

Information Items: Original Data

APCO/PSCR Workshop "Data Types" Identified

evacuation routes	body camera data	street traffic	NG9-1-1	Information about suspects
event location	tactical command and control		officer status - sensor monitoring	input from social media pre processors
event location	traffic-surface			law enforcement intel
evironmental conditions	common operational picture	types of hazard		license and plate reader
facial recognition	comms	utilities		license plate recognition(LPR)
FF se	completed incident command system (ICS) forms/plans	utility info - hot wires	patient triage	location GPS
first r	crime scene geographic information system (GIS) intel location	utility information	personal protective equipment (PPE) responder biometric sensors	location of caller
flight traffic/FAA	critical infrastructure(CI) around geomapping		personnel or	
flight traffic/fAA information	critical locations	vdeo around location	personnel or	
fuel sources	critical logistics stations	victims/casualties	photo's video audio (of target suspects)	maps
functional roles	critical static locations (shelters|ccps|EVAC|LZ)	Video	physical asset inventory	medical facility bedcount
geo data / accelerometer	crowd sourced information	video data analysis	physical asset location	Damage assesments
ground cover	deployable assets	meras	plant inventory	department of transportation(DoT) logistic info
hazardous materials	domosf needs assesment	weather	point of contacts	
hos		what is the hazard	blueprints of the facility	
hos	onse	white boarding	resident contact info	Info from multiple CAD LE Location
hydrants	environmental conditions	white force locator	responder camera	shelter
ICS (incident command system) forms/plans	environmental sensor data	accelerometer data		social media
images + media from ng911	equipment/smartsensor			social media push
impact map/plume model		active authenitcation	satellite imagery	standing water
impact model (plume model)		active authentication	search status for secondary explosive devices	
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Body camera data

Officer status – sensor monitoring

Fuel sources

Utility information

Location of responders

Hydrants

Maps

Weather

Medical facility bed count

Impact map/plume model

Blueprints of the facility

Evac routes and plans

PSCR

Information Items: SME Needs

- Understanding users and their context of use

- Discussions with subject matter experts (SMEs)
  - ASTM Subcommittee E54.09 Response Robot Meeting
    - Fire, HazMat, EMS, Bomb Squad, FEMA USAR, FBI
  - Local first responders
    - Fire, EMS, Police

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Information Items: SME Needs – *Preliminary Findings*

- Asked first responders
  - How would you use this information item?
    - SMEs reflected on previous incident responses to describe use of information items
  - Are there any missing information items?
    - SMEs identified several items (e.g., drone/UAV, SCBA air level, robots, radio codes)
- Found that information needs varied depending on:
  - Domain
  - Location & region
  - Federal, state, local
  - User rank & role
  - User tasks
  - Scope of incident

PSCR

Information Items: SME Needs – *Preliminary Findings*

Information Item	How would you use it?
critical logistics stations	not "boots on the ground" level of responder; useful information on where to resupply water, food, etc. during emergency.
department of transportation (DoT) logistic info	In logistics context, for example, hurricanes can destroy entire bridges/roads. If a roadway is damaged, you don't want to have to backtrack a convoy 20 miles to find alternate route (very hard to maneuver a convoy; can add 10s of hours to response, e.g., happened during Hurricane Katrina). If Local LEO could tag a bridge being out, that would be gold for incident response. It would be great for local LEO to quickly disseminate information to other responding teams.
elevation model	AKA: ToPo map (topography) – used more out west
plume model / impact model / impact map	More useful for wide open areas, not urban. Maybe use at FDOC level.
first responder assets	Automation would be great for logistics and turnaround time. If you use equipment from ambulance, could automate keeping track of that and send to logistics desk so it's ready at hospital for reduced turn-around time.
hydrants	flow/GPM pressure private vs. city last scheduled checkup
fuel sources	If it's operational, locations are known (part of employee orientation). Would be helpful for mutual aid scenarios. Need to know if it's down.
location of responders	This is a huge issue, especially z-axis information. Currently technology can determine location within 3 meters, but z-axis unknown. This is especially for squad leaders; each squad leader knows location of subordinate.
deployable assets	Assets include: All public safety personnel; Vehicles; People; Robots RFID tags would be good for inventory
geo data	Use it to get data on location of hydrants, static water sources, addresses, block numbers, road changes name, where roads interrupted by a water source. Currently communicated electronically via MDT (mobile data terminal). If you log onto system, you can see where other trucks are.
location GPS	This is critical, used for everything. Needed in buildings and canyons, where there are no satellites (e.g., geolocation instead of maps)
patient info casualties	From a tech search standpoint, helps me in my planning & ability to do triage. For example, if I know there are 3 deceased and 2 potential survivors in a building, that provides info of how bad things are on the inside.
flight traffic / FAA information	Only useful if a dignitary comes in and the "bird" doesn't fly. Currently get information watching the news.
pre-plans (PII)	Especially useful for large agencies. Information included ranges. Current effort to include operational medicine in pre-plans (as EMT on SWAT team). AKA IAPs (incident action plans) for EMS. We have them for different types of events. For example, in a drowning, what units are dispatched, what people with what skills are dispatched, protocol for paramedics / what paramedics would do. There are template IAPs for large events (e.g., boardwalk events, runs, polar plunge). On a smaller scale, p____t <addre___ <health i___\>. Could ___ EVMS – ___ts with a___ hearts, I'___ ___patient ___ to let us ___ by their a___

PSCR

Information Items: SME Needs – *Preliminary Findings*

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Information Items: SME Needs – *Preliminary Findings*

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Information Item	How would you use it?
Department of Transportation (DoT) logistic info	In logistics context, for example, hurricanes can destroy entire bridges/roads. If a roadway is damaged, you don't want to have to backtrack a convoy 20 miles to find alternate route (very hard to maneuver a convoy; can add 10s of hours to response, e.g., happened during Hurricane Katrina). If Local LEO could tag a bridge being out, that would be gold for incident response. It would be great for local LEO to quickly disseminate information to other responding teams.

| flight traffic / FAA information | Only useful if a dignitary comes in and the "bird" doesn't fly. Currently get information watching the news. |
| pre-plans (PII) | Especially useful for large agencies. Informaiton included ranges. Current effort to include operational medicine in pre-plans (as EMT on SWAT team). |

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Information Items: SME Needs – *Preliminary Findings*

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Information Item	How would you use it?
Plume model / impact model / impact map	More useful for wide open areas, not urban. Maybe use at FDOC level.
Elevation model	AKA: ToPo map (topography) – used more out west

	squad leader knows location of subordinate.
deployable assets	Assets include: All public safety personnel; Vehicles; People; Robots RFID tags would be good for inventory
geo data	Use it to get data on location of hydrants, static water sources, addresses, block numbers, road changes name, where roads interrupted by a water source. Currently communicated electronically via MDT (mobile data terminal). If you log onto system, you can see where other trucks are.
location GPS	This is critical, used for everything. Needed in buildings and canyons, where there are no satellites (e.g., geolocation instead of maps)
patient info casualties	From a tech search standpoint, helps me in my planning & ability to do triage. For example, if I know there are 3 deceased and 2 potential survivors in a building, that provides info of how bad things are on the inside.
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Information Items: SME Needs – *Preliminary Findings*
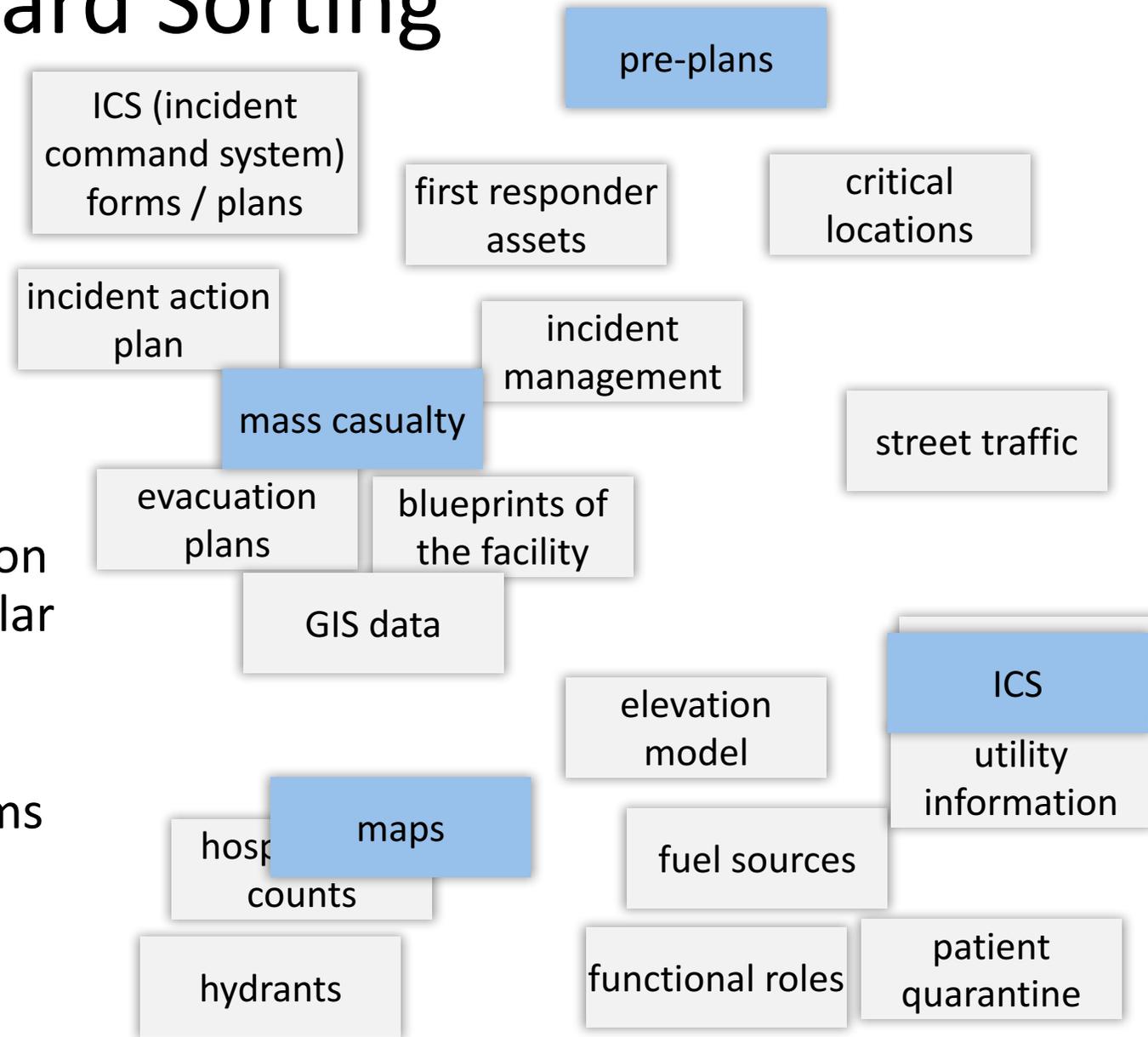
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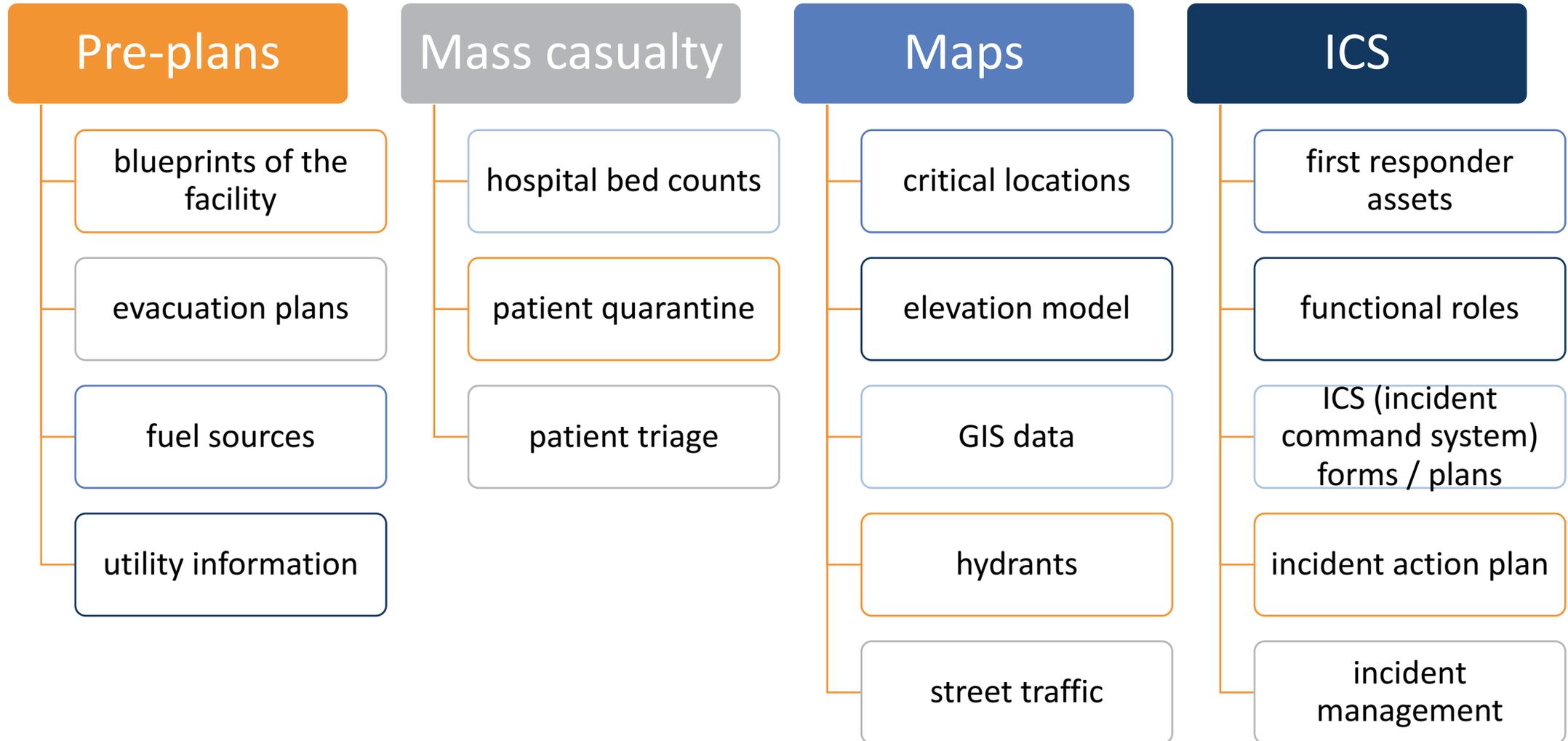| Information Item	How would you use it?
critical logistics stations	Not for "boots on the ground" level of responder; useful information on where to resupply water, food, etc. during larger emergencies.
location of responders	This is a huge issue, especially z-axis information. Currently technology can determine location within 3 meters, but z-axis unknown. This is especially for ICs/squad leaders; each squad leader knows location of subordinate.

	Currently communicated electronically via MDT (mobile data terminal). If you log onto system, you can see where other trucks are.
location GPS	This is critical, used for everything. Needed in buildings and canyons, where there are no satellites (e.g., geolocation instead of maps)
patient info casualties	From a tech search standpoint, helps me in my planning & ability to do triage. For example, if I know there are 3 deceased and 2 potential survivors in a building, that provides info of how bad things are on the inside.
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Information Items: Card Sorting

- Goal: to elicit categories and relationships

- First responders in Fire, EMS, and Law

- Procedure:
  - Group information items based on which are closely related or similar to each other
  - Label each group
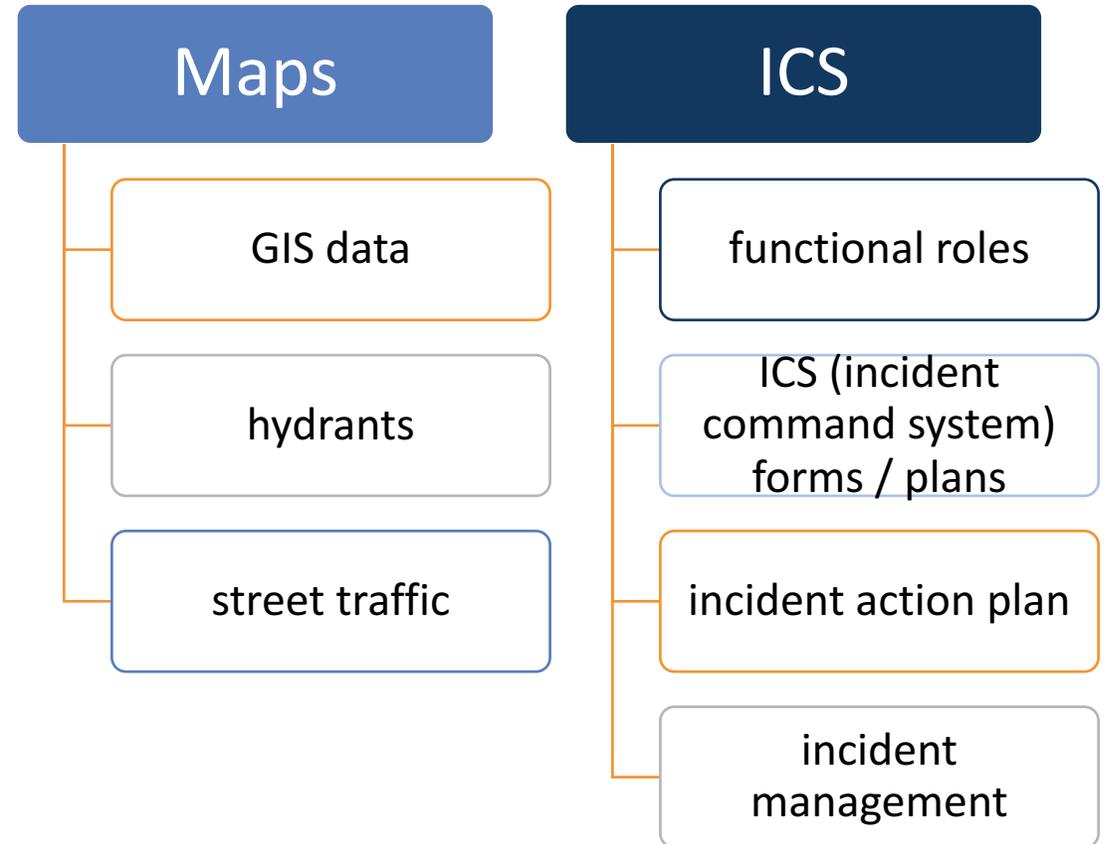 - Identify missing information items

pre-plans

ICS (incident command system) forms / plans

first responder assets

critical locations

incident action plan

incident management

mass casualty

street traffic

evacuation plans

blueprints of the facility

GIS data

elevation model

ICS

utility information

maps

hosp... counts

fuel sources

hydrants

functional roles

patient quarantine

Information Items: Card Sorting

Information Items: Card Sorting – *Preliminary Findings*

Pre-plans
- blueprints of the facility
- evacuation plans
- fuel sources
- utility information

Mass casualty
- hospital bed counts
- patient quarantine
- patient triage

Maps
- critical locations
- elevation model
- GIS data
- hydrants
- street traffic

ICS
- first responder assets
- functional roles
- ICS (incident command system) forms / plans
- incident action plan
- incident management

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Information Items: Scenario Mapping – *Preliminary Findings*

- Goal: Identify scenario-based relationship between user needs and user tasks

- Procedure:
  - Review scenario
  - Select information relevant to scenario from list of items

Maps
- GIS data
- hydrants
- street traffic

ICS
- functional roles
- ICS (incident command system) forms / plans
- incident action plan
- incident management

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Incident Scenarios Collection

- Compiled from Various Sources
  - DHS SAFECOM Program – *Public Safety Statement of Requirements for Communications & Interoperability, Vol 1, v 1.2*
  - NIST PSCR
  - NISTIR 8135 – *Identifying and Categorizing Data Types for Public Safety Mobile Applications: Workshop Report*
  - After Action Reports (AARs) - summarized and anonymized

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Incident Scenarios - *Attributes*

- Vignette

- Region and Location

- Time, day and month of the year

- Incident duration

- Actors

- Resources

- Complicating factors or considerations as the incident unfolds

- Incident outcomes

PSCR

Incident Scenarios - *Example*

Incident: Subway Fire

Region: South: South Atlantic

Location: Metropolitan city

Time of year: Monday in January

At 15:14, an Office of Unified Communications (OUC) operator received a call from a subway supervisor about a debris fire on the tracks near a major subway station. Additional 9-1-1 calls were received reporting heavy smoke at and near the station. A train stopped after encountering an accumulation of heavy smoke while traveling southbound in a subway tunnel. After stopping, the rear car of the train was about 386 feet from the south end of the subway station platform.

Ten minutes later, the OUC operator received a call for medics at the station because people could barely breathe due to the smoke. OUC dispatched a Rail Station Box Alarm to the subway station.

Considerations:

- Due to heavy smoke, responders could not see the train in the tunnel until they were right next to it.

- Radio communication was sporadic in the subway stations and tunnels.

- The side door of the train required special keys and would not open for passengers.

- One person on train was found unconscious.

- The following were dispatched: 5 Engine Companies; 2 Ladder Trucks; 2 Battalion Fire Chiefs; 1 Battalion Fire Chief to Operations Command Center; 1 Heavy Rescue Squad; 1 Basic Life Support Unit; 1 Advanced Life Support Unit; and 1 Emergency Medical Services Supervisor.

- Passengers and pedestrians near the subway station were evacuated. Rescue personnel estimated that evacuation was completed by 16:25.

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Incident Scenarios - *Example*

Incident: Subway Fire

Region: South: South Atlantic

Location: Metropolitan city

Time of year:

At 15:14, an Of̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶ tracks near a major subway s̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶ encountering an accumulatio̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶ ut 386 feet from the south̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶

Ten minutes lat̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶ ke. OUC dispatched a Ra̶̶̶̶̶̶̶̶̶̶̶̶̶̶

Considerations

- Due to heav̶̶̶̶̶̶̶̶̶
- Radio communication was sporadic in the subway stations and tunnels.
- The side door of the train required special keys and would not open for passengers.
- One person on train was found unconscious.
- The following were dispatched: 5 Engine Companies; 2 Ladder Trucks; 2 Battalion Fire Chiefs; 1 Battalion Fire Chief to Operations Command Center; 1 Heavy Rescue Squad; 1 Basic Life Support Unit; 1 Advanced Life Support Unit; and 1 Emergency Medical Services Supervisor.
- Passengers and pedestrians near the subway station were evacuated. Rescue personnel estimated that evacuation was completed by 16:25.

Region[1]: South: South Atlantic

Location: Metropolitan city

Time of year: Monday in January

[1] Census Bureau https://www.census.gov/geo/reference/gtc/gtc_census_divreg.html

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Incident Scenarios - *Example*

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Vignette

At 15:14, an Office of Unified Communications (OUC) operator received a call from a subway supervisor about a debris fire on the tracks near a major subway station. Additional 9-1-1 calls were received reporting heavy smoke at and near the station. A train stopped after encountering an accumulation of heavy smoke while traveling southbound in a subway tunnel. After stopping, the rear car of the train was about 386 feet from the south end of the subway station platform.

Ten minutes later, the OUC operator received a call for medics at the station because people could barely breathe due to the smoke. OUC dispatched a Rail Station Box Alarm to the subway station.

Incident Scenarios - *Example*

Incident: Subway Fire

Region: South: South Atlantic

Location: Metropolitan city

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Command Center; 1 Heavy Rescue Squad; 1 Basic Life Support Unit; 1 Advanced Life Support Unit; and 1 Emergency Medical Services Supervisor

- Passengers and pedestrians near the subway station were evacuated. Rescue personnel estimated that evacuation was completed by 16:25.

Complicating Factors

- Due to heavy smoke, responders could not see the train in the tunnel until they were right next to it.

- Radio communication was sporadic in the subway stations and tunnels.

- The side door of the train required special keys and would not open for passengers.

- One person on the train was found unconscious.

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Incident Scenarios - *Example*

Incident: Subway Fire

Region: South: South Atlantic

Location: Metropolitan city

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Command Center; 1 Heavy Rescue Squad; 1 Basic Life Support Unit; 1 Advanced Life Support Unit; and 1 Emergency Medical Services Supervisor

- Passengers and pedestrians near the subway station were evacuated. Rescue personnel estimated that evacuation was completed by 16:25.

Resources and Outcomes

- The following were dispatched: 5 Engine Companies; 2 Ladder Trucks; 2 Battalion Fire Chiefs; 1 Battalion Fire Chief to Operations Command Center; 1 Heavy Rescue Squad; 1 Basic Life Support Unit; 1 Advanced Life Support Unit; and 1 Emergency Medical Services Supervisor.

- Passengers and pedestrians near the subway station were evacuated. Rescue personnel estimated that evacuation was completed by 16:25.

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Summary – 40 scenarios currently

Fire	Law Enforcement	EMS	Multi-Discipline
Structure fire (2)	Active shooter (4)	Heart attack	Bombings at a planned event
Subway fire	Barricade standoff	Medical emergency	Earthquake (2)
WUI fire (7)	Manhunt on shooting suspects	Routine patient services and car crash	Earthquake exercise
	Police ambush		Explosion at a chemical plant (2)
	Rioting		Hurricane (3)
	Search in a national park		Overturned tractor trailer on highway
	Terrorist car bomb		Personal injury collision with hazards
	Traffic stop (2)		Pre-planned event: college football game
	Undercover officer		River flooding
			Winter storms
10	**13**	**3**	**14**

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Incident Scenarios Collection

- Living and evolving
- Long-term goal – Use cases for testing and evaluation
  - Consistent set of attributes

Share your stories with us!

usability@nist.gov

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In-depth Interviews

- To understand first responders'
  - Experiences, tasks and context
  - Views on public safety communications technology
  - Technology usage and user interaction with technology
  - Information needs

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In-depth Interviews

- Sampling considerations:
  - Fire, Law Enforcement, EMS, and PS officials
  - Urban, suburban, and rural
  - Federal, state, local, and tribal
  - Geographical regions
  - User groups, full-time and volunteer first responders
- Strategic sampling plan
- Phased approach
  - 8 areas in FY17
  - Urban, suburban, and rural
  - "Boots on the Ground"

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Geographical Regions
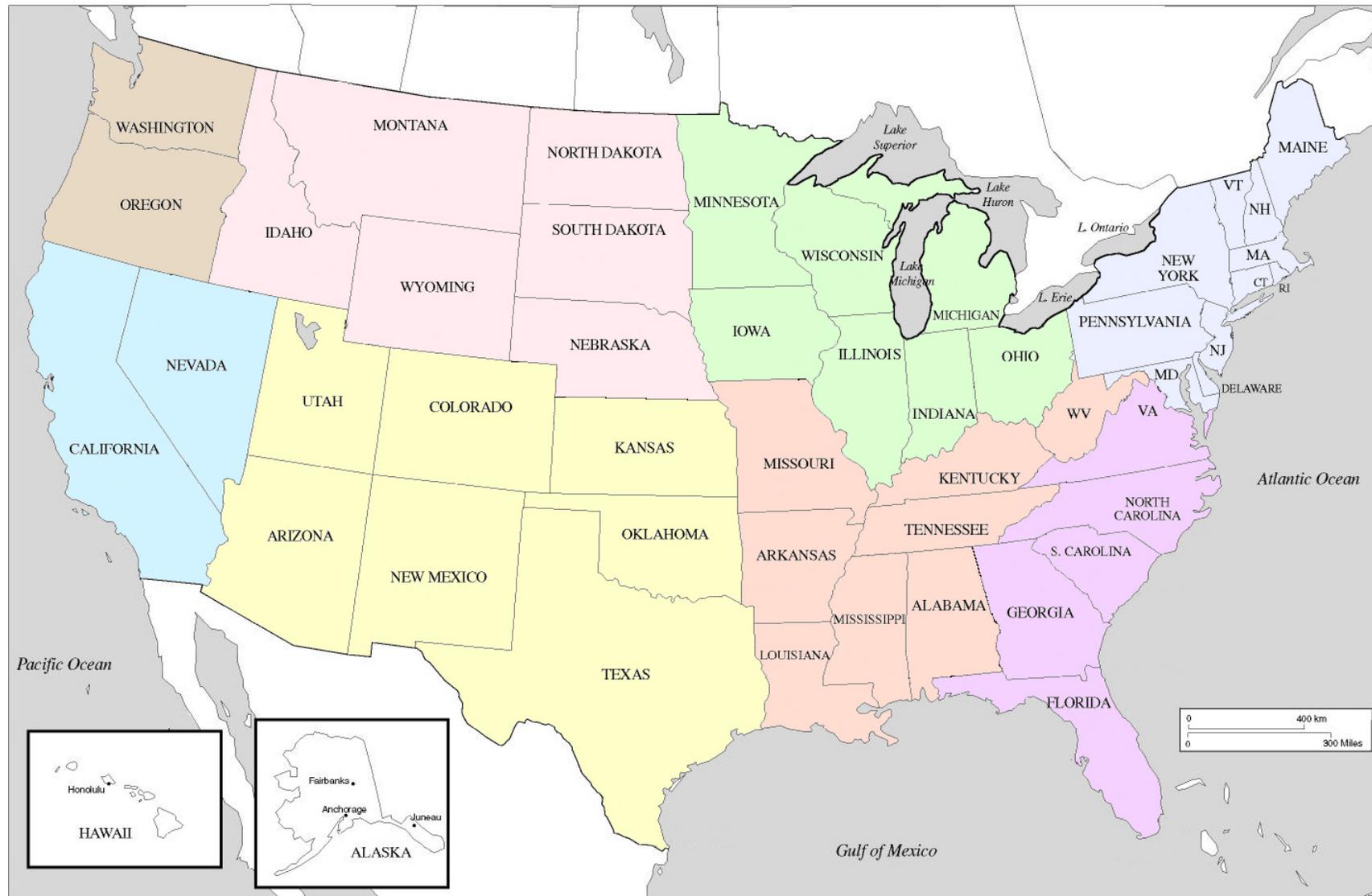
Geographical Regions – 4 Coastal regions
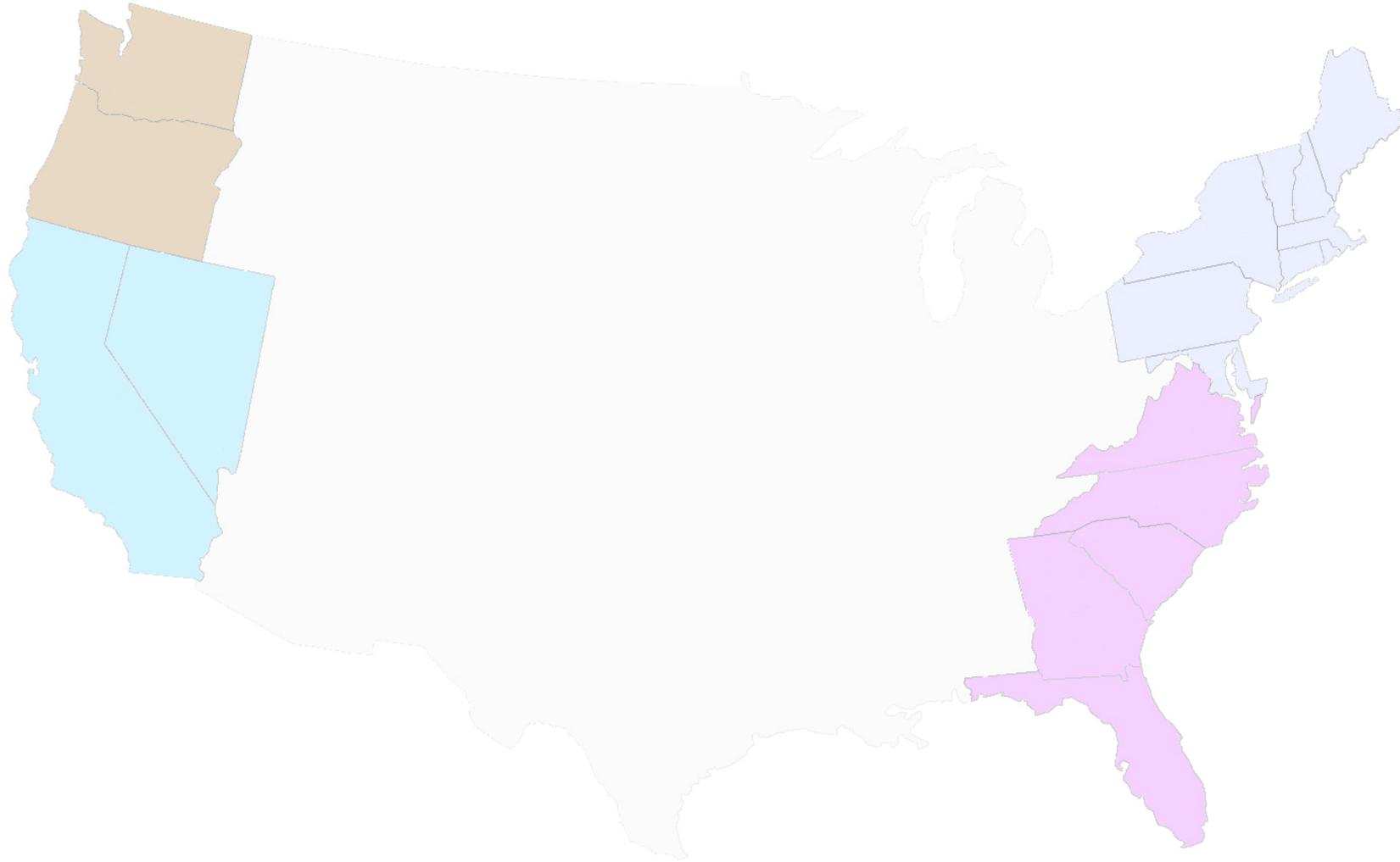
Geographical Regions – 4 Inland regions
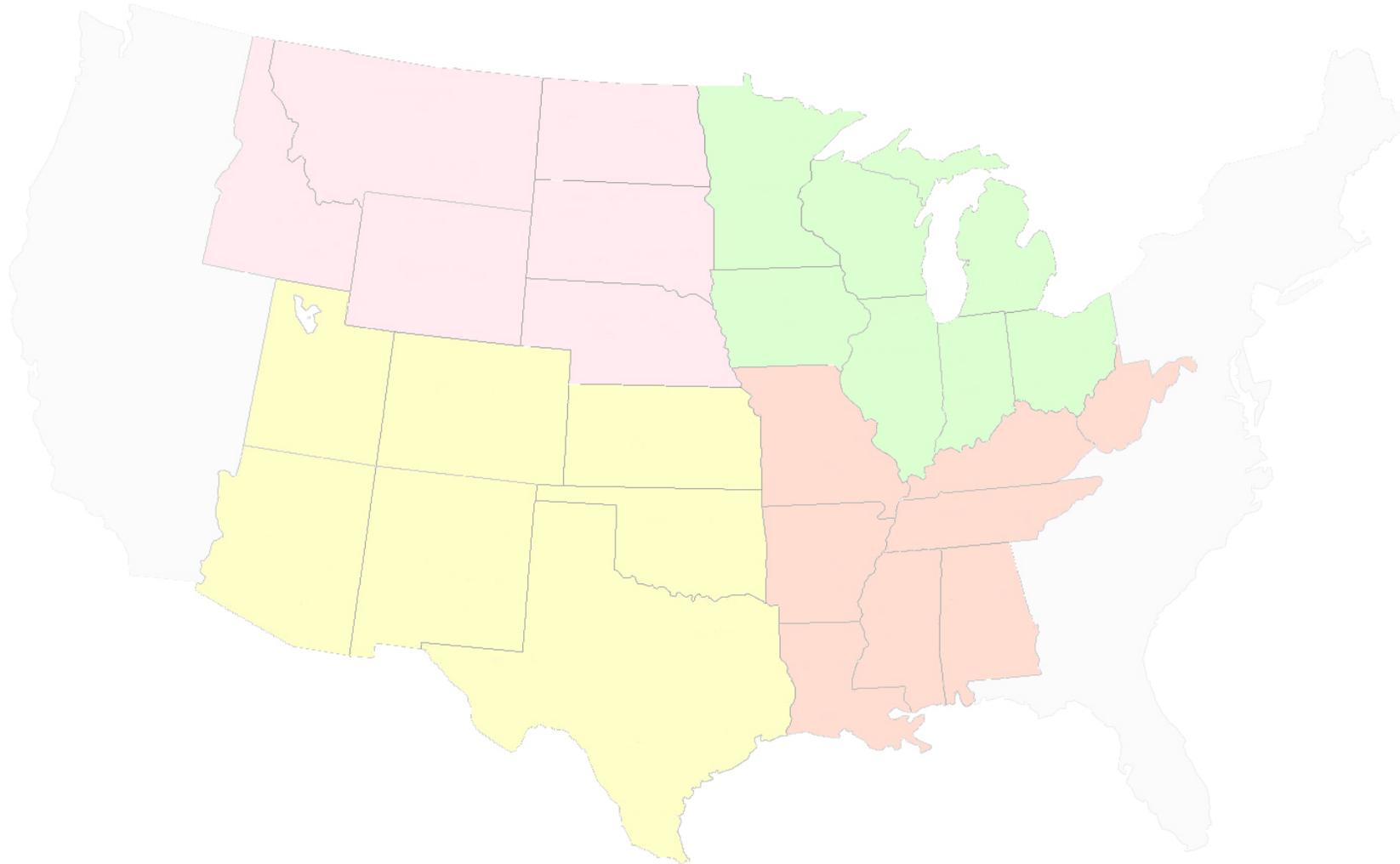
Geographical Regions for Sampling – *Potential FY17*
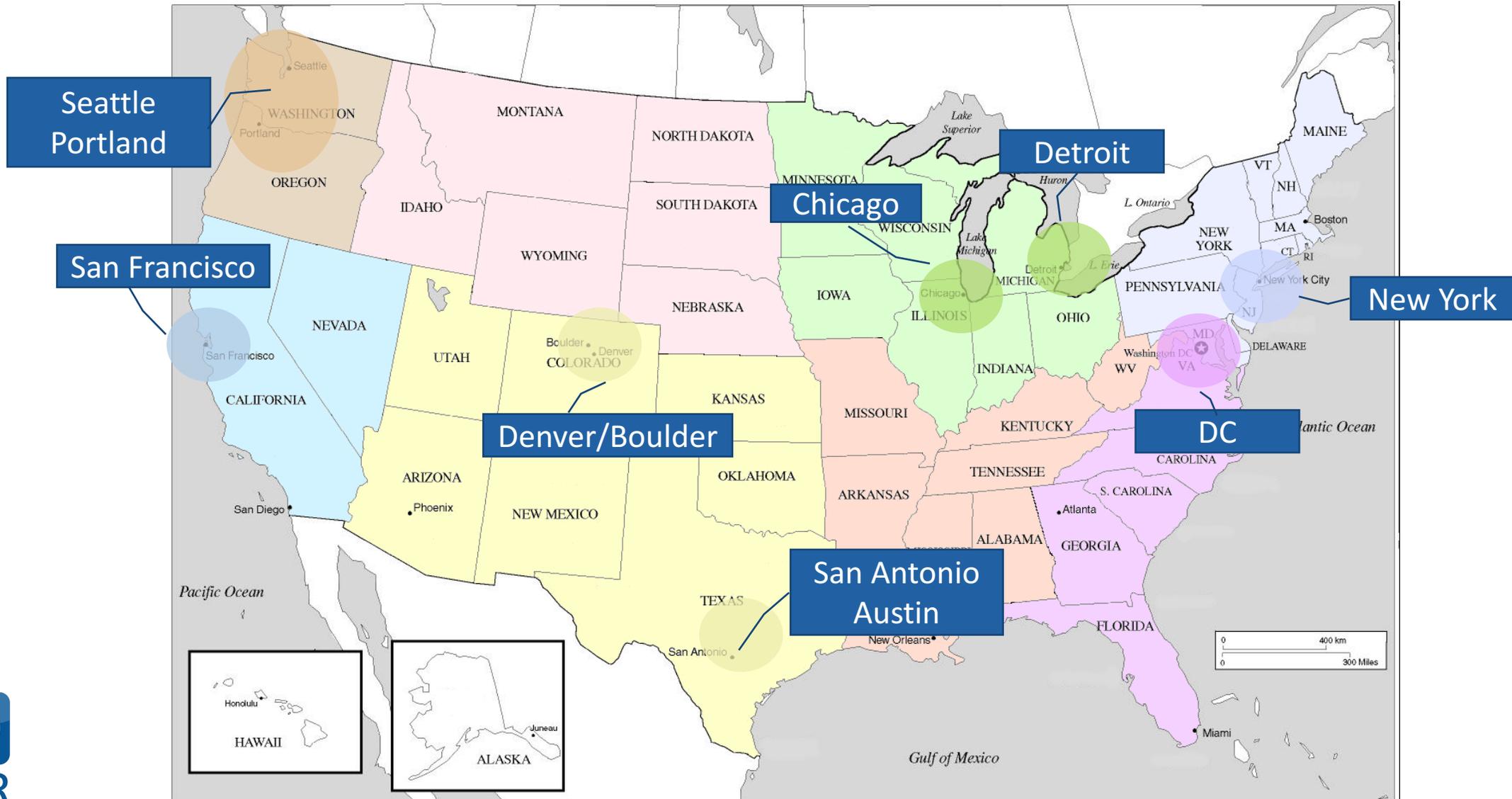
In-depth Interviews

- More interviews in FY 18
- Perform *qualitative* analysis – interview data
- Lead to *quantitative* large-scale survey

Your voice is critical!

usability@nist.gov

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Introductions

- Paul Grassi – NIST, Applied Cybersecurity Division
- Bill Fisher – NIST, National Cybersecurity Center of Excellence
- Mike Korus – Motorola Solutions
- John Bradley – Ping Identity
- Arshad Noor – StrongAuth
- Mark Russell – Mitre Corporation

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Challenge

Security Challenge

- Mobile platforms offer a significant operational advantage to public safety stakeholders by providing access to mission critical information
- These advantages can be limited if unnecessary or complex authentication requirements prohibit an official providing emergency services, especially when delay – even seconds – is a matter of containing or exacerbating an emergency situation.

Benefits of an NCCoE Solution

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NCCoE Benefits – Industry Collaboration

NCCoE brings in Industry experts to design and build the reference design:

Mobile SSO Technology Vendor Build Team:

NCCoE Benefits – Standards Based

NCCoE solutions implement standards and best practices:

Using modern commercially available technology:
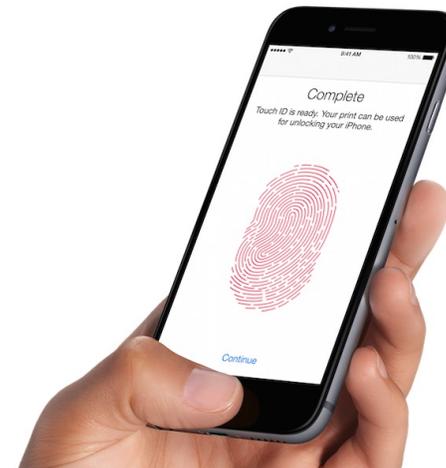
NCCoE Benefits – Practical Guidance

- Project will result in a freely available NIST Cybersecurity Practice Guide (SP 1800-x) including:

NIST SPECIAL PUBLICATION 1800-8A

Securing Wireless Infusion Pumps
In Healthcare Delivery Organizations

Volume A:
Executive Summary

DRAFT

Gavin O'Brien
National Cybersecurity Center of Excellence
Information Technology Laboratory

Sallie Edwards
Kevin Littlefield
Neil McNab
Sue Wang
Kangmin Zheng
The MITRE Corporation
McLean, VA

May 2017

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

NCCoE
NATIONAL CYBERSECURITY CENTER OF EXCELLENCE

- Technical Decisions
- Trade-offs
- Lessons Learned
- Build Instructions
- Functional Tests

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Value to Public Safety/First Responder Sector (PSFR) Community

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Value to PSFR Personnel

Efficiency
Save time and efficiency by reducing the need to authenticate to multiple mobile applications individually

Simplicity
Allowing a user to manage less username/password credentials
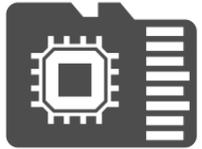
Flexibility
Multiple options for multifactor authentication

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Value to PSFR Organizations

Modern
Solution takes advantage of the latest commercially available mobile technology and best practices

Interoperable
Technology uses standard protocols and flows to improve interoperability
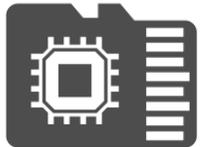
Security
Architecture designed with security characteristics as core requirement (more on this later)

Cost Savings
Reduction in costs - NCCoE delivers requirements, architecture and a reference implementation

PSCR

Internet Engineering Task Force - BCP

- Title: OAuth 2.0 for Native Apps

- Implemented via AppAuth Software Development Kit developed

    - Developed by OpenID for Android and iOS

    - Implements standards such as Oauth and PCKE (RFC7636)

    - Free and open source

    - Ensures mobile applications do no have access to username/password

    - Support identity federation

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Benefits of AppAuth

- Securely implements standards
- "Drag and Drop" into a mobile app
- User's password and other credentials are never exposed to the SaaS provider or mobile app
- Apps get an OAuth Token with limited scope of authorization - apps only get access to back-end systems they should be accessing
- IdP policy controls which user attributes are shared with the SaaS provider
- PKCE prevents malicious apps on the device from intercepting the authorization code and using it to get access tokens

AppAuth

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Standards Based Multifactor Authentication

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Introduction to FIDO (Arshad Noor)

Passwordless Experience

Second Factor Experience

Flexible authentication spanning any number of service providers

*slide taken from FIDO Presentation to NCCoE 5/31/2017

MFA using External Authenticator via FIDO U2F

FIDO U2F – External Authentication over NFC

- U2F token used in addition to primary authenticator (e.g., password)

- Authenticators typically have "proof of user presence" (e.g., by pushing a button) but not strong user authentication

- IdP may support the protocol directly (natively or using a plug-in)

- Authenticator attestation sent at time of registration & authentication – IdP can decide whether or not the authenticator is acceptable

MFA using Biometrics via FIDO UAF

FIDO UAF - Biometric

- UAF token may be the sole authenticator once it's registered with the IdP

- Authenticators typically have stronger user authentication (e.g., biometrics)

- IdP can send policies during initial registration request with a list of accepted authenticator criteria (manufacturer, security characteristics, etc.)

- Typically supported by a FIDO server separate from the IdP

Benefits of FIDO

No 3rd Party in the Protocol
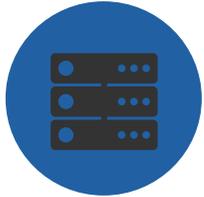
No Secrets on the Server Side

Biometric Data (if used) Never Leaves Device

No Link-ability Between Services

No Link-ability Between Accounts

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*slide taken from FIDO Presentation to NCCoE 5/31/2017

Simple Example

High Level Components

Technologies

Software as a Service (SaaS)

- This approach uses centrally-hosted software that is provided "on demand", includes apps and back-end servers

OpenID Provider

- Server used to manage user identities and roles, and to share user info with other organizations

Authorization Server

- Server used by SaaS provider to communicate with an OpenID Provider and authorize users

Fast Identity Online (FIDO)

- Work-in-progress: This protocol, and hardware that uses it, allows users to sign on w/ tokens instead of passwords

Actors

Central Public Safety Service Provider (CPSSP)

- Represents a SaaS provider that hosts a back-end for mobile apps used by the PSFR community

- This may or may not be the same entity that writes the mobile client apps

Local Public Safety Department (LPSD)

- Represents a local Police, Fire, EMS, or other public safety or first responder organization that uses the services provided by CPSSP

- This organization manages user accounts and has an OpenID Provider for authentication

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Simple SSO Scenario

Other SaaS Providers accept initial login and grant access.

3. User Info

2. User Logs in

FIRE DEPT

1. User asks for Data

SaaS Provider

4. Return Data

POLICE DEPT

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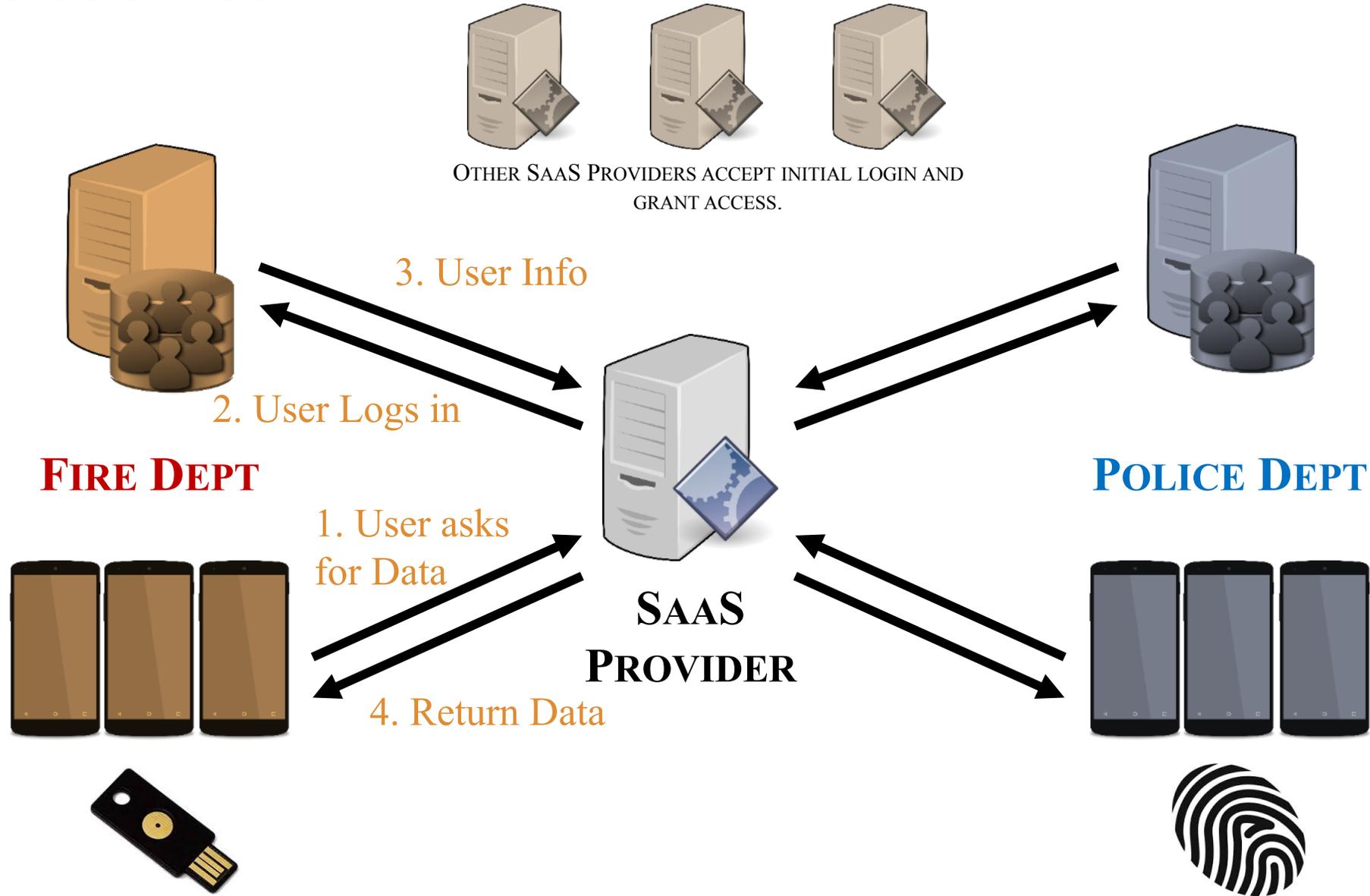
Architecture Benefits

Security Benefits:

Security Without Sacrificing Usability

- No need to establish accounts and passwords for each application

- FIDO tokens can eliminate the need for complex passwords

- Seamless single sign-on when switching between apps

- Improved audit/revocation

Secure Implementations of Secure Protocols

- OAuth 2.0, OpenID Connect 1.0, SAML 2.0, FIDO U2F & UAF - all very secure when deployed correctly

- Implementation complies with best practice and security guidance from IETF

- Common OAuth implementation weaknesses addressed

- Credentials, tokens, and codes transmitted over HTTPS

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Questions?

Project Resources

- Project Description Document:
    - https://nccoe.nist.gov/sites/default/files/library/project-descriptions/psfr-mobile-sso-project-description-final.pdf
    - Document has details architecture and flow diagrams

- Build Team Announcement & Blog:
    - https://nccoe.nist.gov/news/nccoe-and-industry-collaborate-mobile-application-single-sign-project
    - Discusses products used in the build

- PSFR-NCCoE@nist.gov
    - Inquiries go directly to NIST project leads

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PSCR Security Community

- ✓ Mission Critical Voice Community
- ✓ LBS Community
- ✓ Analytics Community
- ✓ UI/UX Community
- ? **Security Community**

PSCR Security Community Partnership

PSCR Security is interested in creating a community of stakeholders to provide the following services:

- Stakeholders receive updates on our research projects

- Stakeholders have an opportunity to help select the most critical and promising research areas and help guide the projects

- Stakeholders can participate in certain research projects through partnerships including Federal Funding Opportunities and CRADAs

- First Responders can participate in certain research projects to ensure user requirements are incorporated, and help us collect field data

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Results from Conference Application Survey

- How many people have signed up?
- What were the preferred methods of communication?
- What were the top Public Safety Broadband Security topics of interest?

Ways to Sign Up

Sign up through the following methods:

- On the PSCR Conference App

- Email John Beltz, john.beltz@nist.gov

- At the table in the back of this room

- At the PSCR Security Demo Table tomorrow

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SIM Cards and Over the Air Updates

- UICC known as a 'SIM Card' is the security anchor for the LTE Network.

- Store sensitive cryptographic keys used for authentication and to protect communication

- Public Safety specific features in LTE may increase the use of Over the Air (OTA) updates to enable features such as Group and Device to Device Communications (e.g., Proximity Services).

- Updates to the SIM card can occur over the air

Background

- Proximity Service information stored on UE in UICC

- Sensitive data may need to be updated using LTE's existing Over The Air (OTA) mechanism.

- Applied security testing on a critical function that could potentially be used to enable Mission Critical Voice and Device to Device communications
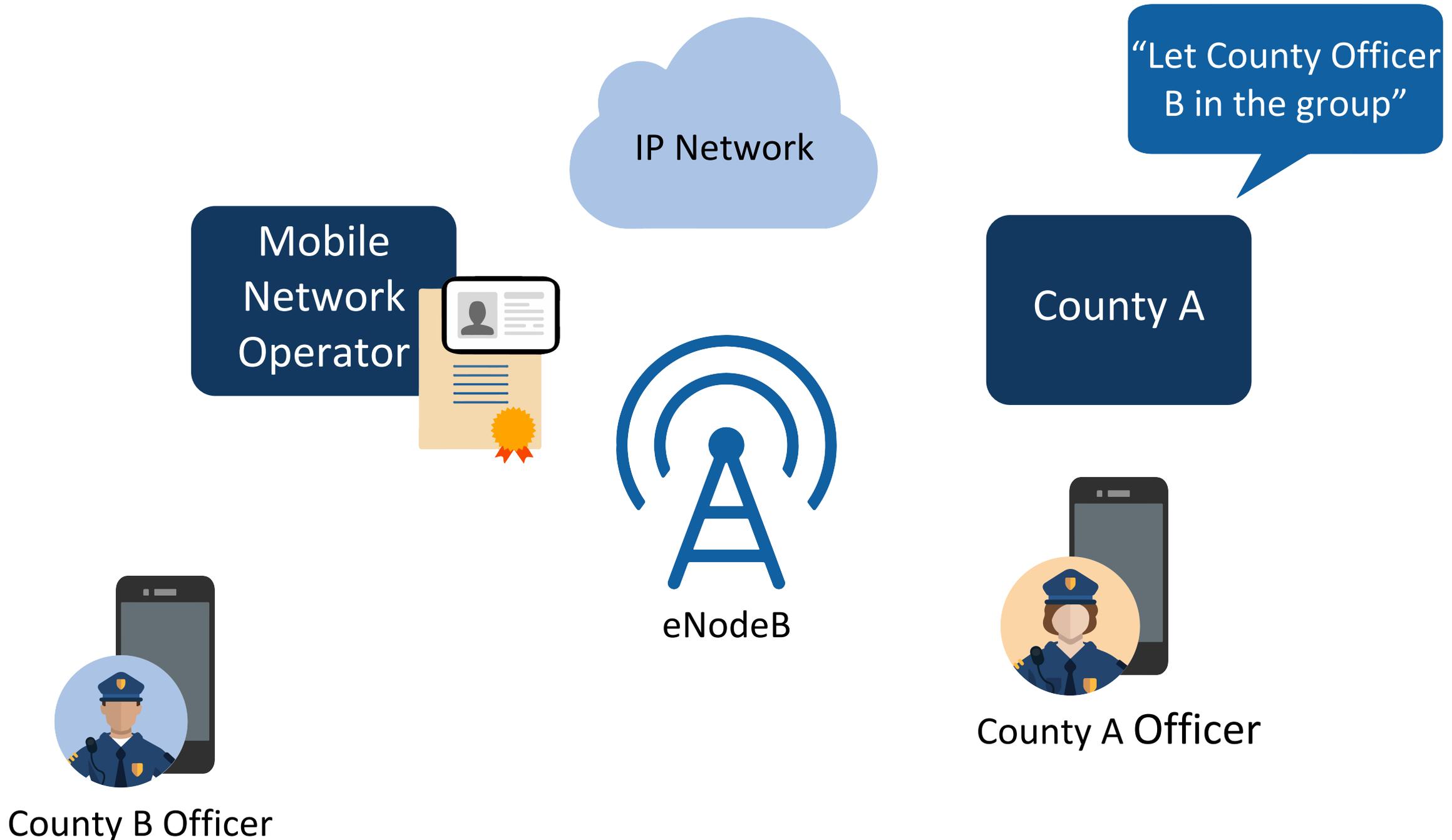
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Project Objectives

Standards, Specifications, and Vendor Documentation

Use Cases for OTA Updates for Public Safety Scenarios

Threat Model for OTA Updates and UICC

Security Guidance & Best Practices

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Benefits

- Gain organizational expertise about the UICC OTA update process and its dependency and/or interconnection with MCV

- Inform Public Safety Community of potential threats and implications to their mission

- Validation that ProSe can leverage current implementations of UICC OTA updates in a secure manner

- Security Guidance that can influence industry implementation and use of the UICC OTA update process

- PSCR may find areas of weakness or improvements that can be made through Grants and Prize Challenges based on outcomes of this research

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A Vulnerable App Can Endanger the Entire Enterprise
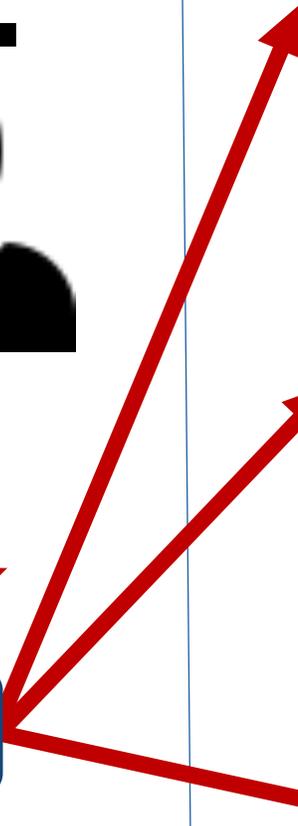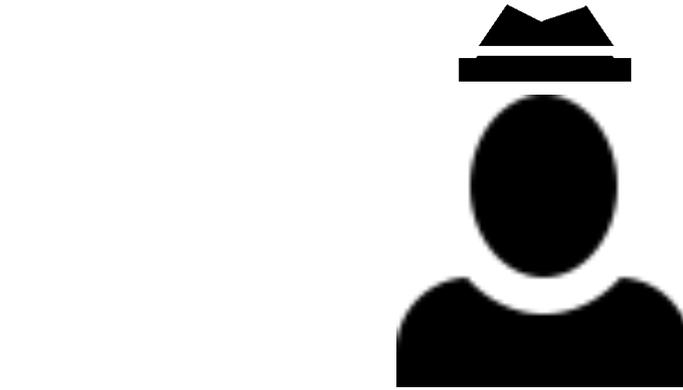
What Can Be Done to Strengthen App Security?

Application Vetting

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# Vetting Early and Late in the App Lifecycle
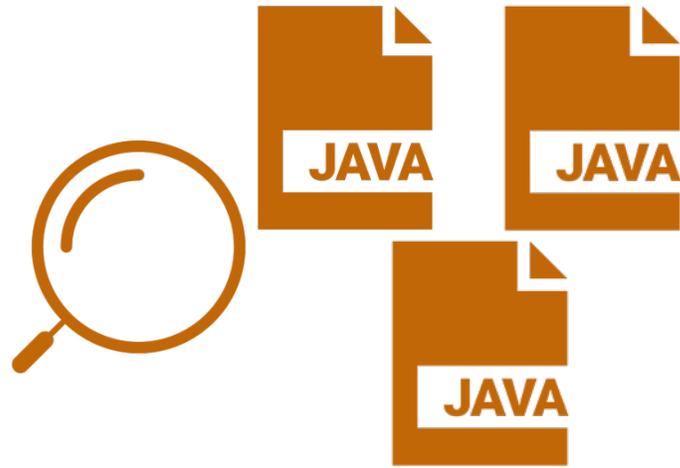
PSCR Research Goals

- Identify the capabilities of vetting technology and how they can be

  used for public safety

- Identify strengths and weaknesses in mobile app vetting technology

- Aid in improving the state of the art in vulnerability detection

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What is the Benefit to Public Safety?

- Increased trust in mobility as a platform

- Increased protection from threats

- Access to modern mobility functionality
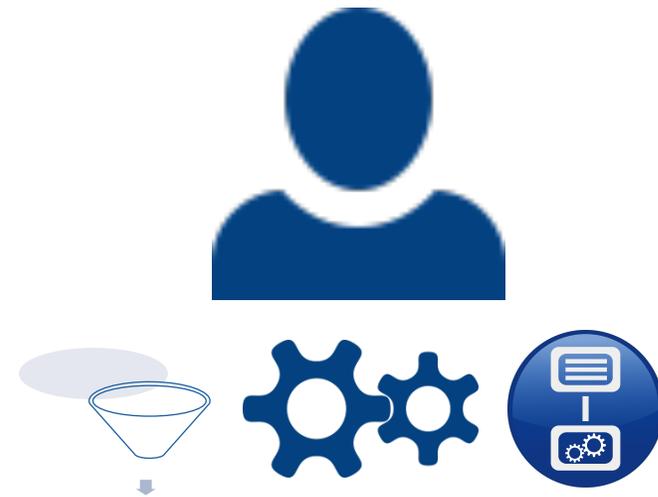
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PSCR Research Activities

- NISTIR 8136: An Overview of Mobile Application Vetting Services for

  Public Safety (January 2017)

  - https://doi.org/10.6028/NIST.IR.8136

- Mobile Application Security Exercise(July 2017)

- Expanding the Static Analysis Tool Exposition (December 2017)
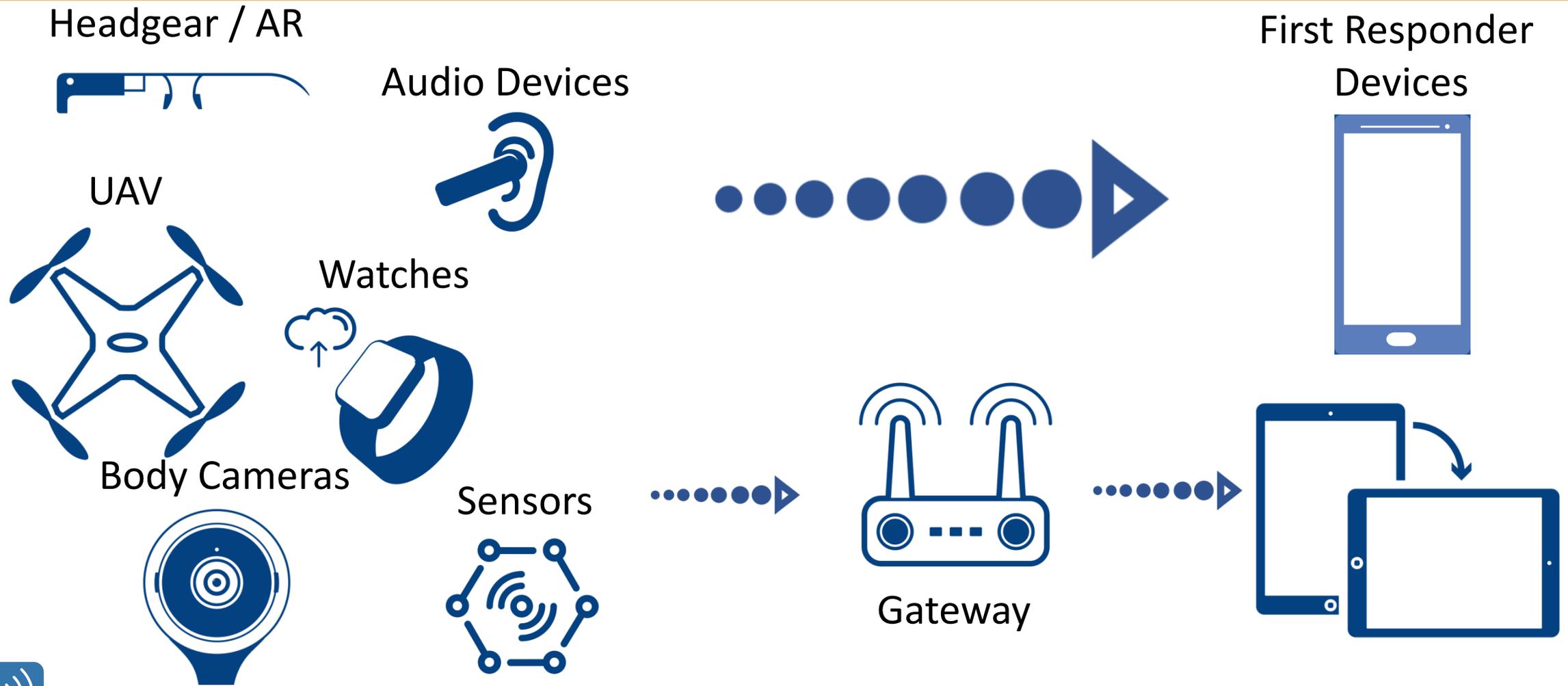
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Importance to Public Safety and the NPSBN

- Mobile devices and wearables will be used on the NPSBN

- Securing mobile devices and wearables ensures life saving activities can continue

DATA
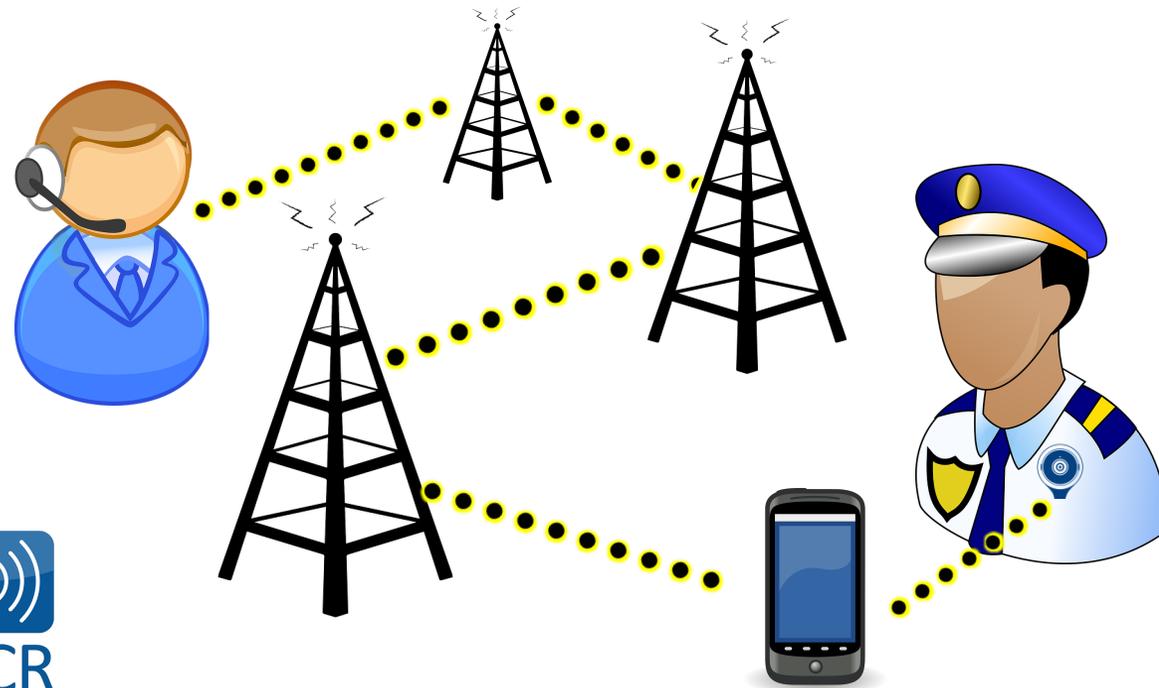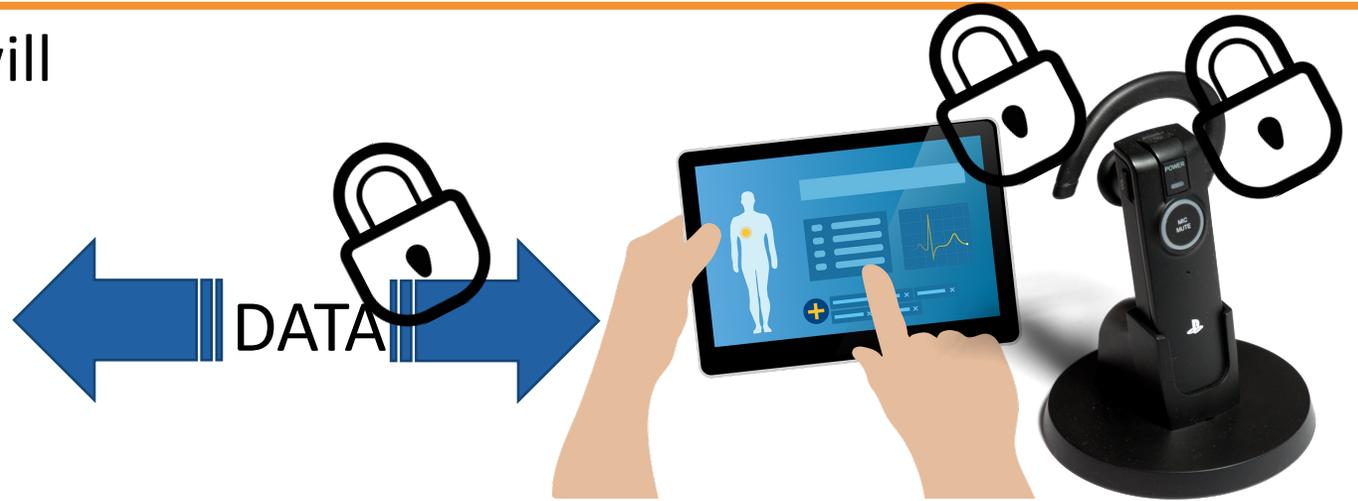
- What are the security needs for public safety devices?

- How can we provide guidance to architect secure public safety systems?

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Public Safety Wearables

Headgear / AR

Audio Devices

UAV

Watches

Body Cameras

Sensors

Gateway

First Responder Devices

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Research Flow

Identify Mobile Security Objectives → Analyze Public Safety Devices → Gap Analysis and Recommendations

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Conclusion

- Interviewing members of the public safety and industry to understand their security needs

- Identify how can industry architect to secure public safety systems

- Review the security posture of phones and wearables built specifically for public safety

- Draft best practices for public safety radio operators to provision, deploy, and manage new cellular devices