Powerful Connections
APCO International 77th Annual Conference & Expo
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Philadelphia, PA

What's New at PSCR?

Public Safety Communications Research Program

Jeff Bratcher, DJ Atkinson, Andrew Thiessen, Emil Olbrich

PSCR

U.S. Department of Commerce – Boulder Labs

Agenda

1. PSCR Introductions & Overview
2. Audio Quality/Intelligibility Testing Updates
3. Public Safety VoIP Working Group
4. Project 25 Compliance Assessment Program
5. Public Safety Broadband Demonstration Network

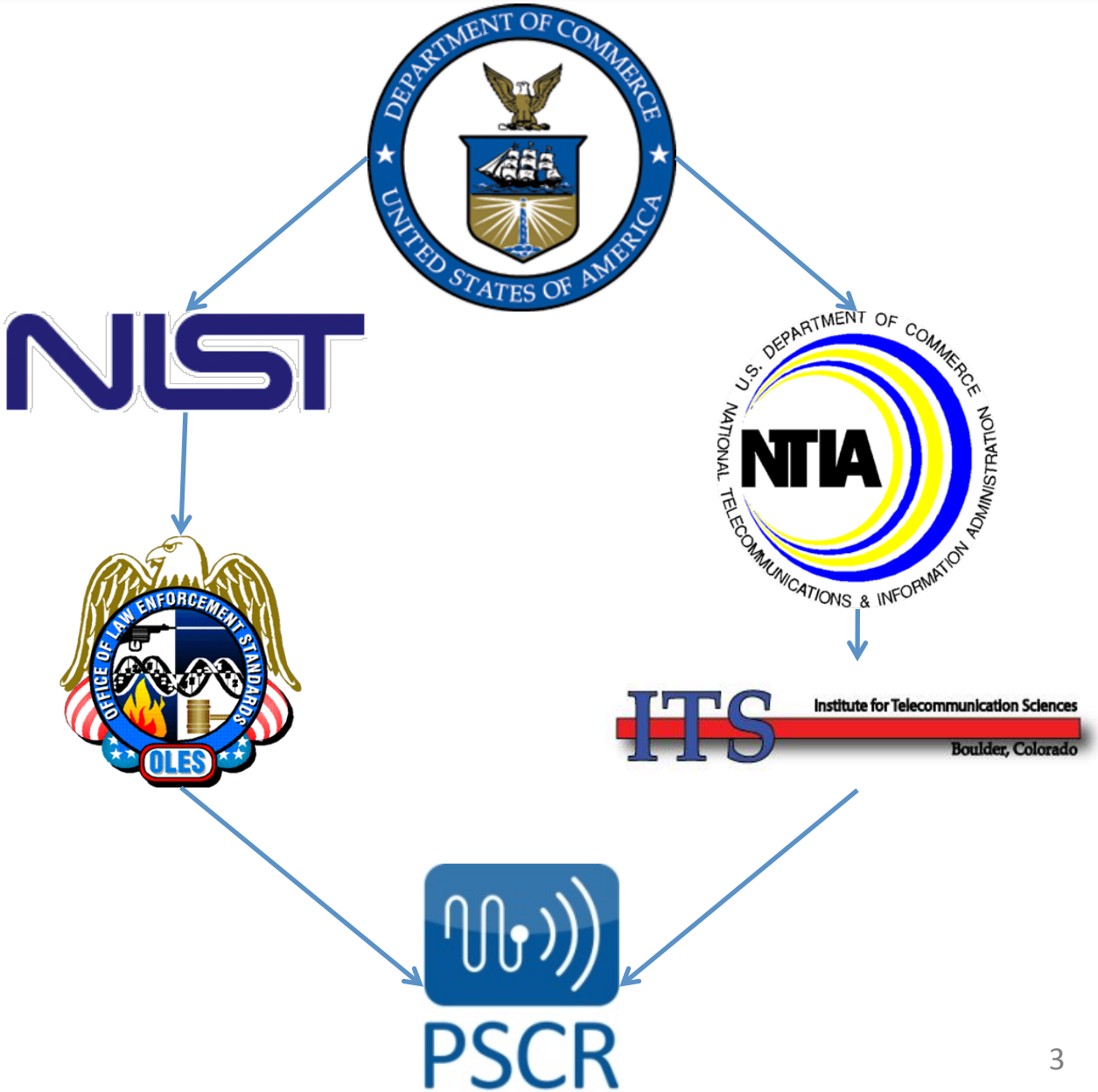
PSCR

Public Safety Communications Research Program

Located at the Department of Commerce Boulder Labs in Colorado

The PSCR Program is a joint effort between:

NIST
Office of Law Enforcement Standards (OLES)
and
NTIA
Institute for Telecommunication Sciences (ITS)



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PSCR Sponsors

Department of Homeland Security

Department of Justice

Office for Interoperability and Compatibility

Office of Community Oriented Policing Services

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PSCR Vision & Mission

VISION

The response community nationwide can exchange voice and data seamlessly to effectively respond to any incident or emergency.

MISSION

To fulfill this vision, PSCR will act as an objective technical advisor and laboratory to public safety to accelerate the adoption and implementation of only the most critical public safety communication standards and technologies.

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PSCR Portfolio

LMR Standards and Technologies	Broadband Standards and Technologies	Interoperability Device Standards and Technologies	Emerging Standards and Technologies	Cross-cutting or Supporting Activities
Project 25 Compliance Assessment Program (P25CAP)	**700MHz PSBB Demonstration Network**	Multi-Band Radio	P25 Security	Program Management & Outreach
P25 Standards Development	**Public Safety VoIP**	Interim Interoperability Device Testing	Technical Services Projects	Statement of Requirements (SOR)
ISSI Test Tools	NPSTC Broadband working group (BBWG)		Video Quality in Public Safety (VQiPS)	Public Safety Architecture Framework
Audio Quality	Modeling and Simulation			RF Propagation Studies

Detailed information on all the above PSCR projects can be found at:

http://www.pscr.gov

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Update on Audio Quality/Intelligibility

DJ Atkinson

APCO 2011
August 10, 2011
Philadelphia, PA

Experiment 1 – Scenarios

1. No mask, no background noise
2. Mask (vox port), no background noise
3. Mask (internal mic), no background noise
4. Mask (vox port), PASS 1 (-2 dB SNR)
5. Mask (vox port), PASS 2 (-2 dB SNR)
6. Mask (internal mic), PASS 1 (-2 dB SNR)
7. Mask (internal mic), PASS 2 (-2 dB SNR)
8. No mask, night club noise (5 dB SNR)
9. No mask, no background noise, static degraded RF
10. Mask (vox port), no background noise, static degraded RF
11. Mask (internal mic), no background noise, static degraded RF
12. Mask (vox port), PASS 1 (-2 dB SNR), static degraded RF
13. Mask (internal mic), PASS 1 (-2 dB SNR), static degraded RF
14. No mask, night club noise (5 dB SNR), static degraded RF

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Experiment 1 – Systems

1. 25 kHz Analog FM Reference System
2. 12.5 kHz Analog FM Reference System
3. P25 Full-Rate (ver. 1.60)* Reference System
4. P25 Half-Rate (ver. 1.60)* Reference System

*DSP version 1.60 corresponds to PC executable version 1.40e, which was used to conduct this experiment

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Modified Rhyme Test

- Intelligibility, not MOS
- "Please select the word _____."

bed	led	fed
red	wed	shed

- 50 groups of 6 words (or 6 lists of 50 words)
- 300 words total
- 4 talkers

- 300 words x 4 talkers x 56 conditions = 67,200 samples

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Listening Test

- Listening Environment
  - Pink noise @ 65 dBA
  - Noise-free speech @ 84 dBA
  - Speech source at 150 cm from listener

- 32 public safety practitioner listeners
- 7 sessions of 300 samples
- 2100 results per listener
- 67,200 results total

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Changes in P25 Intelligibility Since 2008

Mask 2008 (no background noise) 59%	PASS Alarm 2008 21%
Mask 2011 (updated best practices) 69%	PASS Alarm 2011 (Updated Vocoder) 50%

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12

Observations

- Improvements to best practices and vocoder make a difference
- There are still differences between analog and P25, but the gaps are narrowing
- No significant differences were observed in intelligibility between the two PASS alarms.
- As expected, using an internal mic helps across the board in background noise conditions
- Using an internal mic also improved intelligibility for analog systems with no background noise.

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Update on Public Safety VoIP Working Group

DJ Atkinson

APCO 2011
August 10, 2011
Philadelphia, PA

The Need for Public Safety VoIP Interoperability

- Emergency responders traditionally have used two-way radios—known as Land Mobile Radios—to communicate. Even the most powerful of these radios are often not interoperable with each other because they broadcast in different frequency bands or use proprietary equipment.

- Public safety agencies are investing millions of dollars in devices that patch these non-interoperable radio systems together.

- Large-scale incidents require the cooperation of multiple public safety disciplines and agencies, who often rely on VoIP bridging solutions to communicate and to link disparate communications technologies with conventional equipment.

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The Need for Public Safety VoIP Interoperability

- **But**… while IP itself is a formal standard that allows for interoperability, the VoIP technology built on top of that standard is often proprietary and prevents interoperability.

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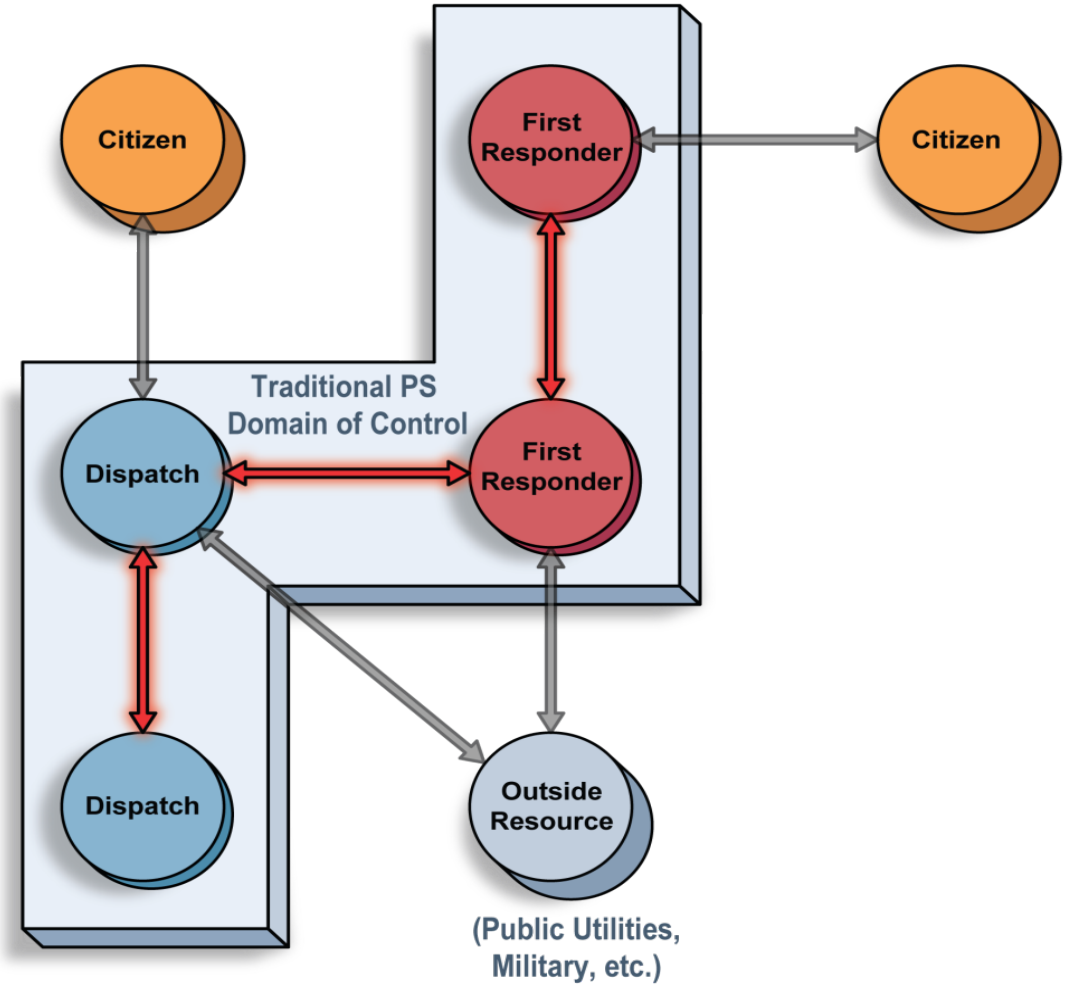
16

Solution

Partner with public safety and industry to develop VoIP specifications for public-safety to public-safety communications



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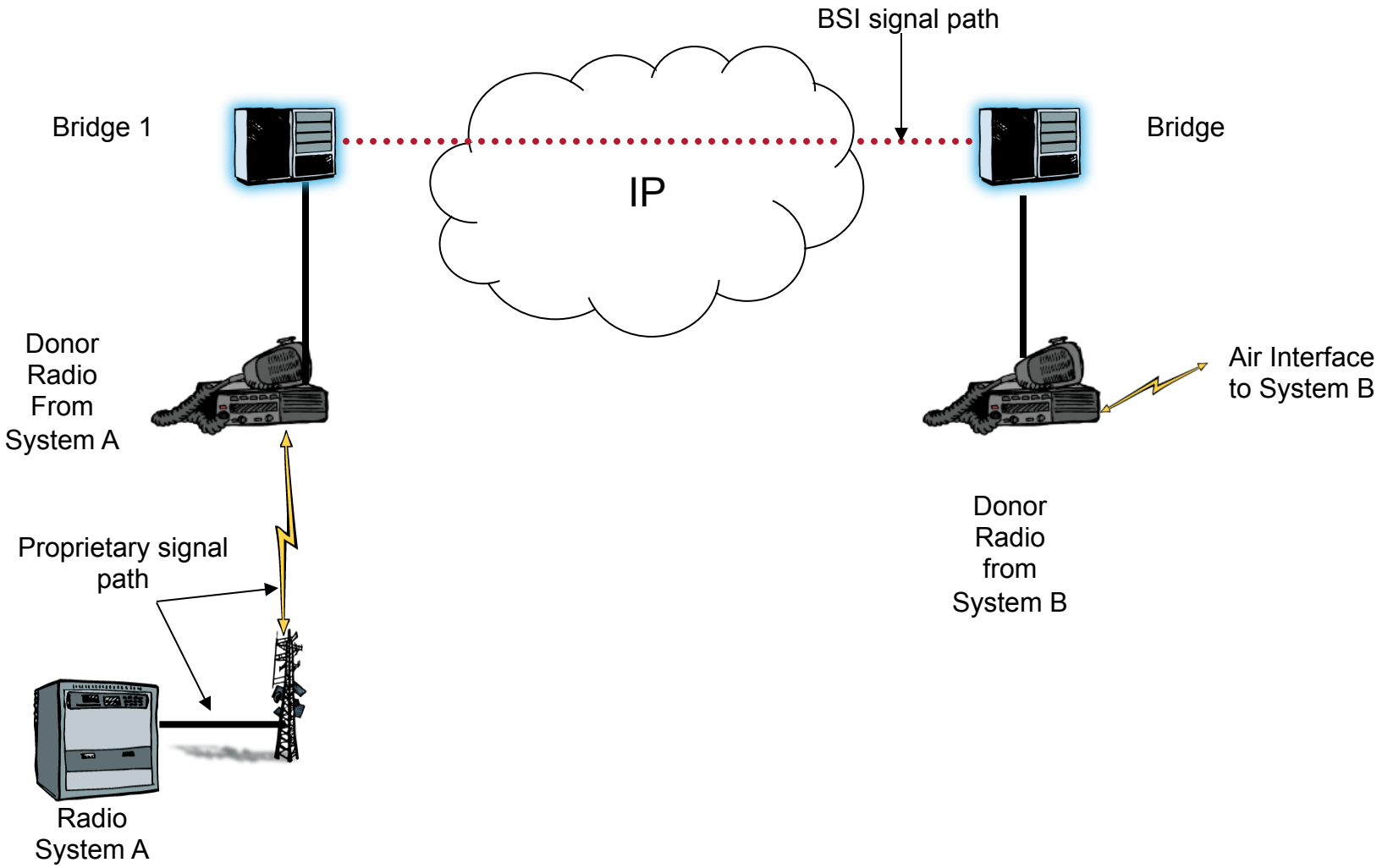
First Priority: Bridging Systems Interface (BSI)

A typical BSI network scenario



Results

- **Developed and published the BSI Core Profile with key features that can be implemented quickly.**
  - A collection of existing standards, parameters, and values necessary for VoIP-based devices to connect with one another.
  - Supports group voice communications across multiple-vendors' bridging solutions.
  - Brought together six of the leading VoIP vendors to demonstrate interoperability using the specification.
- **Developed and Published BSI Best Practices Document**
  - Administrative information for contracting officials, chiefs, etc.
  - Technical guidance for system managers, system planners, etc.

Available from SAFECOM website:
http://www.safecomprogram.gov/SAFECOM/currentprojects/voip/

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Value

- Serves as an example of how the Federal government can act as a catalyst to address an interoperability gap quickly and outside of the formal standards process.

- Reduces costs for system design and installation, saving Federal, State, and local dollars.

- Coalesces industry and public safety representatives around a technical solution that closes an interoperability gap that would have widened with new Federal grant funding.

- Informs and accelerates industry's development of interoperable public safety products.

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VoIP Efforts

Known BSI Implementers

- C4i
- Catalyst
- Mutualink
- Raytheon JPS
- TracStar
- Twisted Pair Solutions
- Cisco
- Motorola
- National Interop
- SyTech
- VoiceInterop
- Zetron

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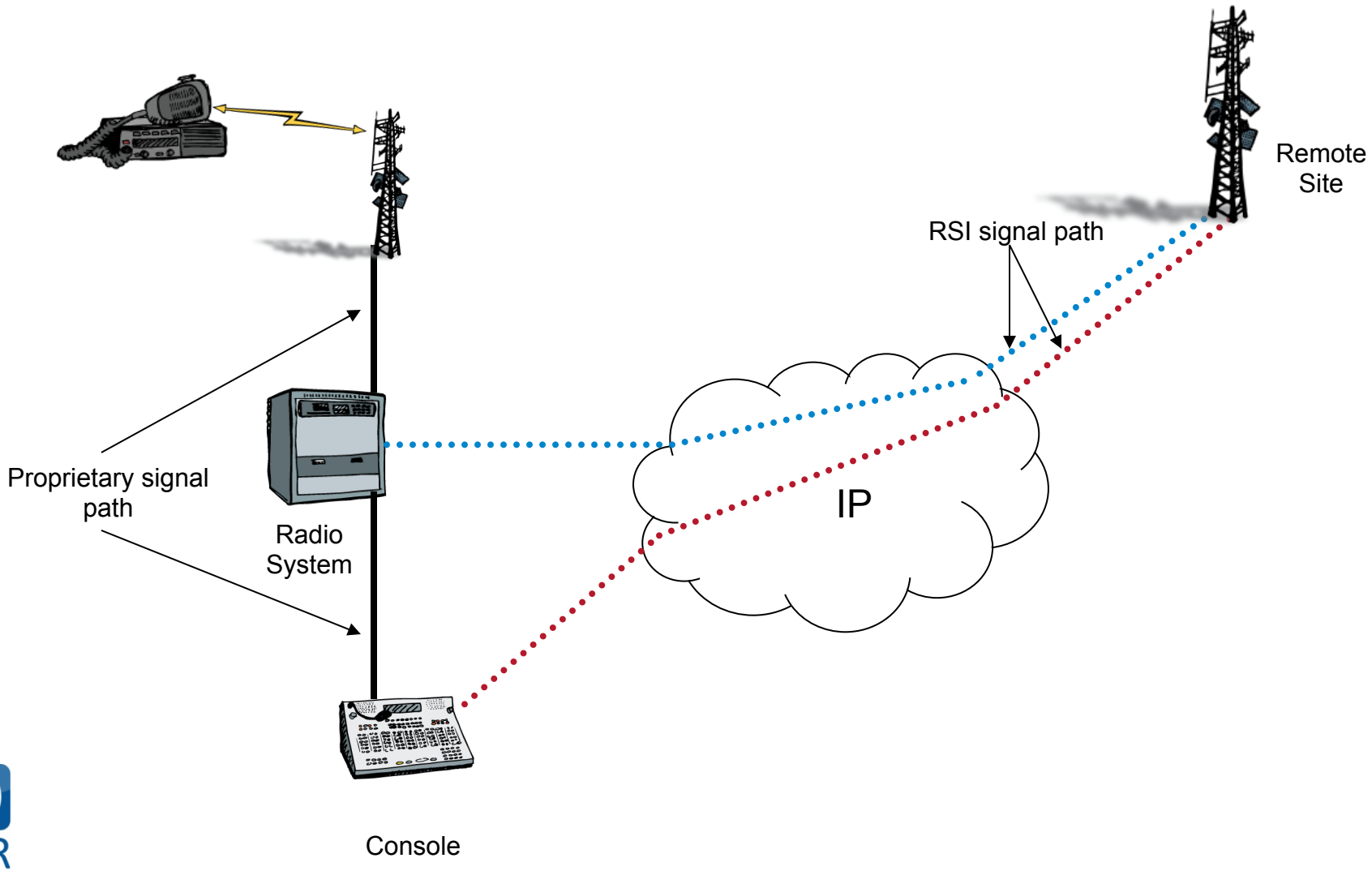
What's Next? Remote Site Interface (RSI)

A typical RSI network scenario



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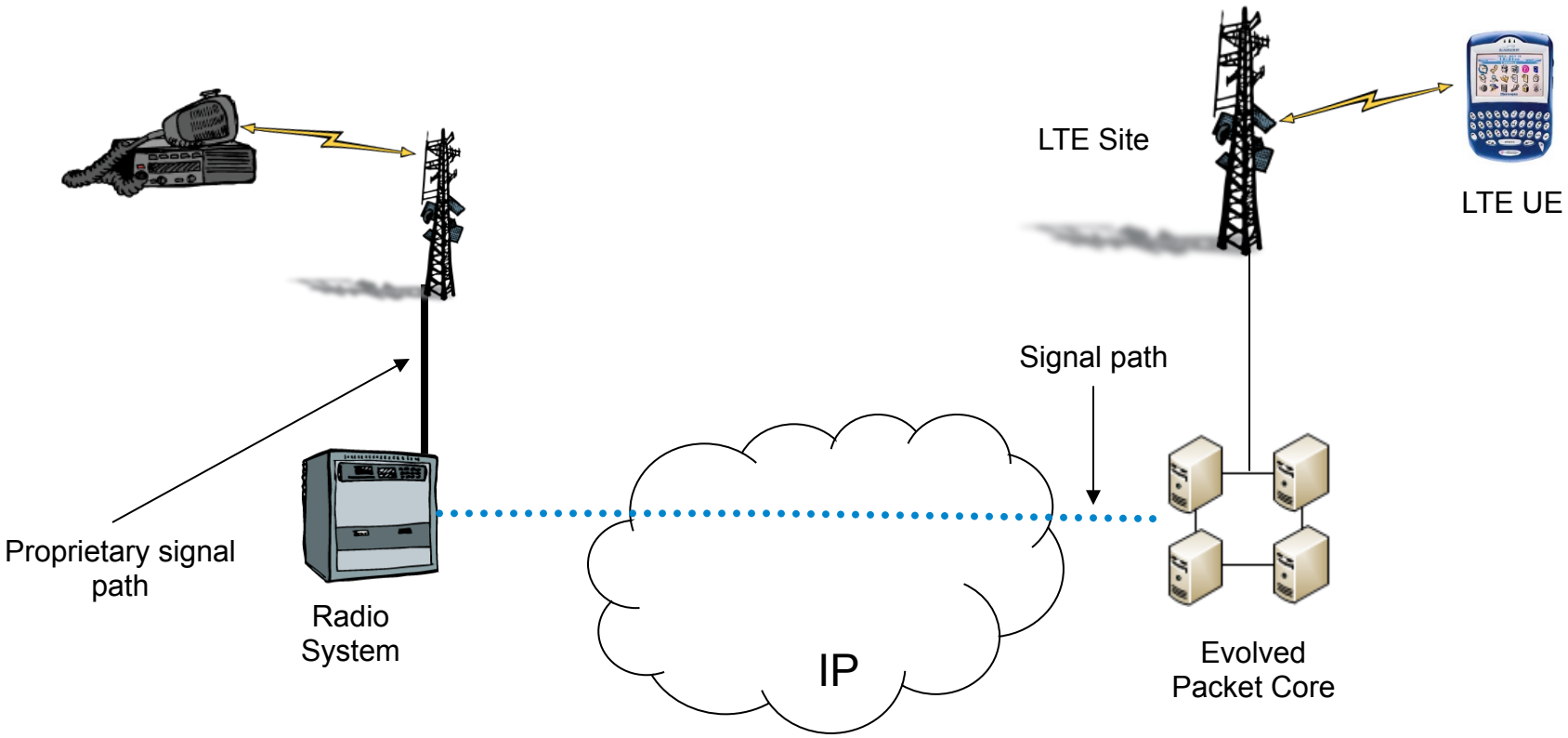
What's Next? LMR/Broadband Integration

A typical LMR/broadband scenario



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Update on Project 25 Compliance Assessment Program (P25 CAP)

Andrew Thiessen

APCO 2011
August 10, 2011
Philadelphia, PA

Project 25

Project 25 Standards are Focused on Achieving Goals that Benefit the Public Safety Community

P25 Goals	*Impact on Public Safety Community*
Graceful Migration	Allows an agency to move from a legacy system to a new system easily
Competition in System Life-Cycle Procurements	Users can select from multiple vendors that build innovative products to the same standards
Interoperability	Supports the sharing of information via voice and data signals on demand, in real time, when needed, and as authorized
Practitioner Driven Approach	Vendors develop public safety communications products that are driven by practitioner needs and requirements
User Friendly Equipment	Radio systems operate in consistent and familiar ways requiring the least mental and physical interaction by the operator
Spectrum Efficiency	Takes advantage of finite spectrum resources so more users can operate within limited bandwidths
Robust Compliance Assessment Program	A comprehensive P25 assessment program will ensure that vendor products are tested and can be trusted to be P25-compliant

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Congressional Mandate

- The P25 CAP was established on the basis of requests from the United States Congress:
  - Senate Report 109-088 – DEPARTMENTS OF COMMERCE AND JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS BILL, 2006
  - House Report 109-241 – MAKING APPROPRIATIONS FOR THE DEPARTMENT OF HOMELAND SECURITY FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 2006, AND FOR OTHER PURPOSES.

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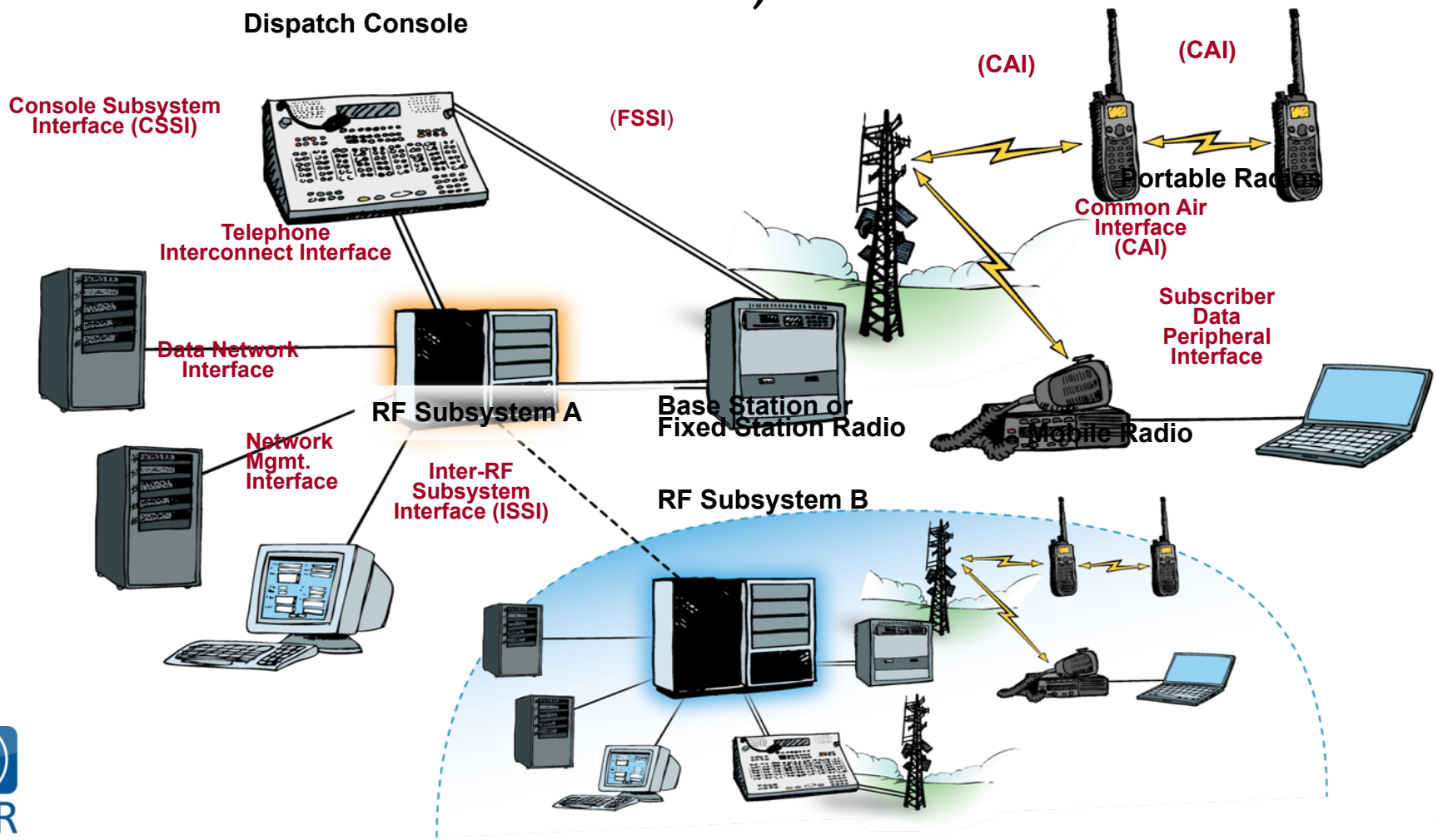
Project 25

There are <u>eight</u> P25 interfaces to be standardized, however…



Project 25

…there are four P25 interfaces that we are focusing on right now.

- **The interfaces that are key to interoperability**
  - The Common Air Interface (CAI)
  - The Inter-subsystem Interface (ISSI)
- **Two other important interfaces**
  - The Console Subsystem Interface (CSSI)
  - The Fixed Station Subsystem Interface (FSSI)

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P25 CAP Goals

- P25 CAP will:
  - Operate a recognition program that fulfills, as applicable, ISO/IEC 17011;
  - Promote confidence in the technical competence of DHS/OIC recognized laboratories and the reliability of their results;
  - Communicate frequently with laboratories, public safety users, and other stakeholders to ensure the P25 CAP is meeting public safety needs and requirements; and
  - Meet the highest professional standards for integrity, impartiality, and ethical conduct.

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Key P25 CAP Program Features

- Program will review 1st, 2nd, or 3rd party labs who will participate in the P25 CAP program
- Manufacturers must use approved laboratory to participate in the program
- Participating manufacturers must publish a Suppliers Declaration of Compliance (**SDoC**) and a Summary Test Report (**STR**)
  - SDOCs/STRs will be housed on a common website (http://www.rkb.us), and DHS grantees are expected to purchase equipment with approved SDOCs/STRs
- Initial phase of the program is focused on the Common Air Interface (CAI) and the Inter-RF SubSystem Interface (ISSI)

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Roles and Responsibilities

- The P25 CAP is a joint program between:
  - **Public Safety Communications Research (PSCR)**
    - Performs laboratory assessments and provides recommendation for recognition to DHS OIC
  - **DHS S&T Office of Interoperability and Compatibility (OIC)**
    - Sets overall policy for the P25 CAP program
    - Recognizes assessed labs to participate in the program
    - Maintains clearinghouse of manufacturer Supplier's Declaration of Compliance and test reports participating in the program

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Suppliers Declaration of Compliance

Project 25 Compliance Assessment Program

SUPPLIER'S DECLARATION OF COMPLIANCE (SDoC)

Company Name
Company Department
Street Address
City, State Zip
Name of Authorized Representative
Phone: xxx-xxx-xxxx Fax: xxx-xxx-xxxx
E-mail: authorized_rep@company.com
URL: http://www.companyname.com

Product Name: {Name of product}
Installed options: {List of options}

{Company Name} hereby declares that the above referenced product complies with the following Project 25 standards:

RECEIVER TESTS, TIA-102.CAAB-B:

§3.1.4 Reference Sensitivity under the following test conditions:
§3.1.5 Faded Reference Sensitivity under standard test conditions
§3.1.6 Signal Delay Spread Capability under standard test conditions
§3.1.7 Adjacent Channel Rejection under the following test conditions:
§3.1.8 Co-Channel Rejection under the following test conditions:
§3.1.9 Spurious Response Rejection under the following test conditions:
§3.1.10 Intermodulation Rejection under the following test conditions:
§3.1.11 Signal Displacement Bandwidth under the following test conditions:
§3.1.17 Late Entry Unsquelch Delay under standard test conditions
§3.1.18 Receiver Throughput Delay under standard test conditions

TRANSMITTER TESTS, TIA-102.CAAB-A:

§3.2.8 Unwanted Emissions: Adjacent Channel Power Ratio under standard test conditions
§3.2.12 Transmitter Power and Encoder Attack Time under standard test conditions
§3.2.14 Transmitter Throughput Delay under standard test conditions
§3.2.15 Frequency Deviation for C4FM under standard test conditions
§3.2.16 Modulation Fidelity under standard test conditions
§3.2.18 Transient Frequency Behavior under standard test conditions

2007-09-28
_____ _____
Issue date *Laboratory's Authorized Representative*

Page 1 of 2

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Summary Test Report

Project 25 Compliance Assessment

Interoperability Test Report

Common Air Interface

Trunked Mode Operation

Test Case	Description	Radio #1	Radio #2	Radio #3	Radio #4	Radio #5	Radio #6	Radio #7	Radio #8	Radio #9
		Verdict								
3.1	Basic Group Call Tests									
3.1.1	Basic Group Call Test – One RF Site (Test 1.1)	P	P	P	P	P	P	P	P	P
3.1.2	Talk Group Privacy Test – One RF Site (Test 1.2)	P	P	P	P	P	P	P	P	P
3.1.3	Group Call Late Entry Subscriber Test – Subscriber Initially Set for a Different Talk Group – One RF Site (Test 1.3)	P	P	P	P	P	P	P	P	P
3.1.4	Group Call Late Entry Subscriber Test – Subscriber Initially Involved in a Unit to Unit Call – One RF Site (Test 1.4)	P	P	P	P	P	P	P	P	P
3.1.8	Group Call Late Entry Subscriber Test – Subscriber Initially Involved in a Unit to Unit Call – Two RF Sites (Test 1.8)	P	P	P	P	P	P	P	P	P
3.2	Queued or Denied Group Call Tests									
3.2.1	Busy Queuing and Call Back Test for Group Call – One RF Site (Test 2.1)	P	P	P	P	P	P	P	P	P
3.2.3	Call Originator Subscriber Unit Not Valid Test – One RF Site (Test 2.3)	P	P	P	P	P	P	P	P	P
3.2.4	Target Talk Group Not Valid Test – One RF Site (Test 2.4)	P	P	N/A	P	P	P	P	P	P
3.3	Announcement Group Call Tests									
3.3.1	Basic Announcement Group Call Test – One RF Site (Test 3.1)	P	P	N/A	P	P	P	P	P	P
3.4	Protected Traffic Channel Tests									
3.4.1	Group Call Protected Traffic Channel Test – One RF Site (Test 4.1)	P	P	N/A	P	P	P	P	N/A	P

P25 Trunked Interoperability Test Report v6 Page 9 of 9

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The Status of the P25 CAP

- **In May 2009, DHS OIC recognized 8 laboratories that can now perform compliance testing as part of the P25 CAP:**
  - Labs were recognized for Performance and Interoperability testing for products implementing the P25 CAI.
  - SDOCs/STRs are required for CAI purchases using Federal grant money as of November 6, 2009
- **DHS OIC established the P25 CAP Governing Board:**
  - This board is comprised of users and operators of P25 systems from local, state, and federal agencies.
  - The purpose of the P25 CAP Governing Board is to provide recommendations to DHS OIC on issues related to the governance of the P25 CAP:
    - Types of tests (performance, conformance, and interoperability) and specific tests within these types
    - Timelines for required implementation

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The Status of the P25 CAP

- **DHS OIC has recently developed the policy documents that will incorporate the P25 Inter-RF-Subsystem Interface (ISSI) into the P25 CAP:**
  - SDOCs/STRs are required for ISSI purchases using Federal grant money on March 5, 2011
  - Awaiting laboratories for recognition

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Results

- Land mobile radio equipment vendors are now publicly publishing test documents online through the P25 CAP.
  - The more than 60,000 emergency response agencies nationwide are now informed of the standards compliance of equipment, impacting billions of dollars in procurements
  - In January 2010, the first Supplier's Declaration of Compliance and Summary Test Reports were posted on the DHS Responders Knowledgebase Website – http://www.rkb.us
    - Currently 12 vendors information available on rkb.us

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Public Safety Broadband Demonstration Network

Emil Olbrich

APCO 2011
August 10, 2011
Philadelphia, PA

Why a BB Demo Network for Public Safety?

- Public Safety licensed to use 700MHz spectrum and chose Long Term Evolution (LTE) as their broadband technology.
- There was no government or independent laboratory facilities in the United States to test and demonstrate the Public Safety specific LTE implementation requirements
  - PSCR created this network to provide manufacturers a site for early deployment of their systems, an opportunity to evaluate them in a multi-vendor environment, and create integration opportunities for commercial service providers.

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Spectrum

- Licensing: Experimental Special Temporary Authorizations (STAs)
  - 5x5 MHz Public Safety allocation for the Boulder Demo Network
    - Base TX/Mobile RX: 763-768 MHz
    - Base RX/Mobile TX: 793-798 MHz
  - 4940-4990 MHz Public Safety allocation for backhaul
- Ongoing State of Colorado DTRS coordination with Statewide 700MHz Narrowband LMR system

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PSCR Boulder Sites

- The demonstration network utilizes the PSCR facilities located in Boulder, Colorado:
  - PSCR Boulder labs used for evaluation of signalling, RF and EPC hosting
  - Vendor eNodeB equipment co-located
  - Sites are Federal property and are secure locations
  - VPN connections for external vendor access provided

DOC Boulder Labs

Table Mountain Mesa

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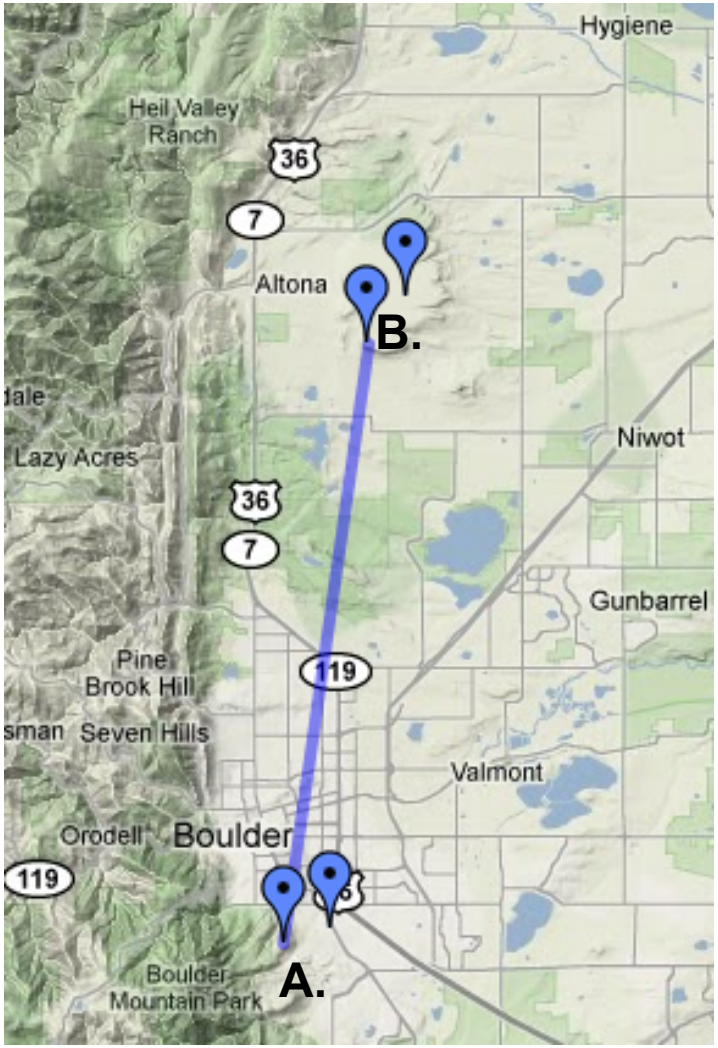
PSCR Boulder Sites

Site locations for the Boulder Demo Network:

A. Green Mountain Mesa
   (on DoC Labs campus)

B. Table Mountain
   (9 miles NE of DOC Labs)
   - Radio Quiet Zone
   - Managed by NTIA/ITS



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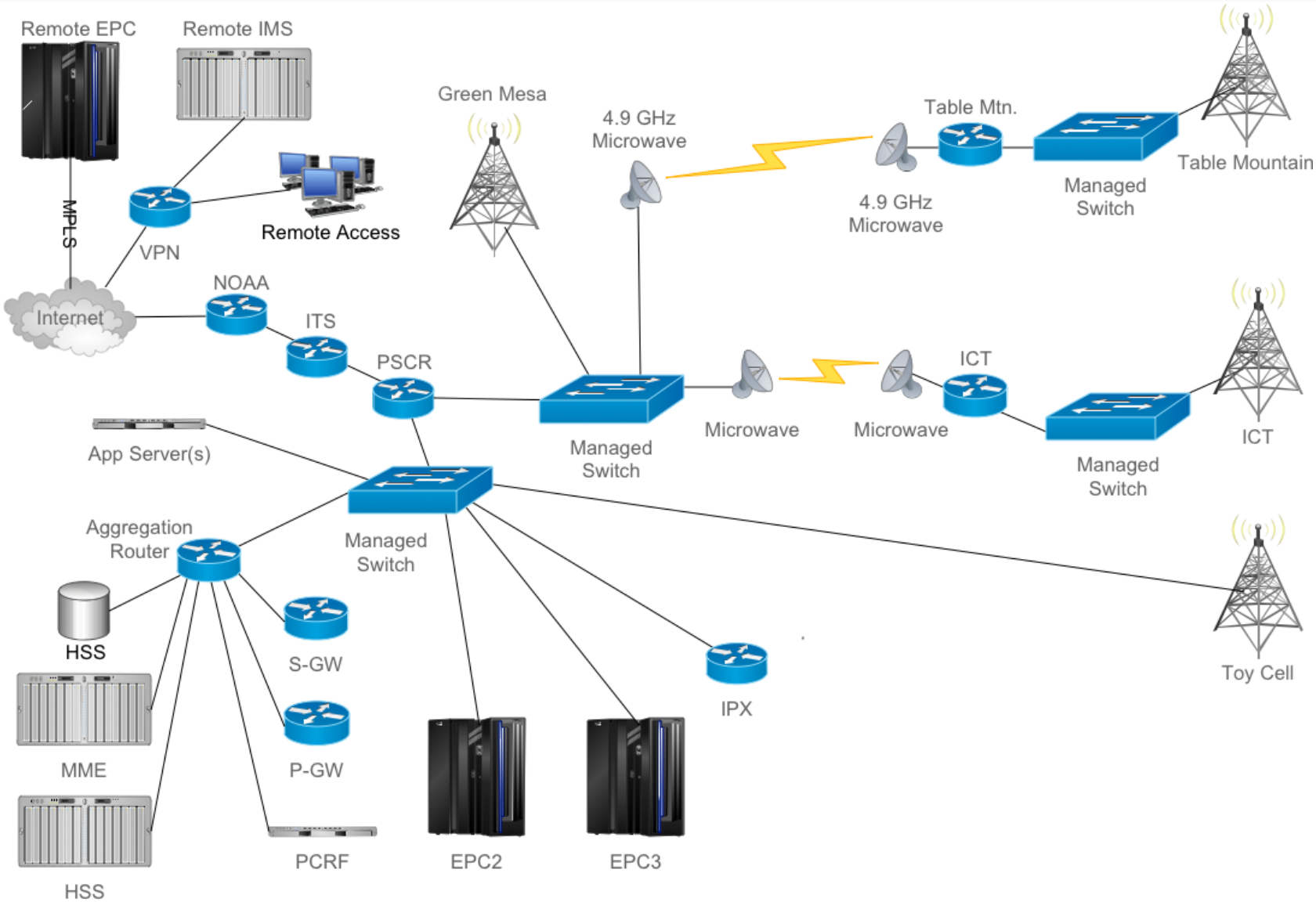
PSCR Test Network



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PSCR Demo Network Project Plan

- Generate interest from broadband vendors to develop a 700 MHz broadband equipment ecosystem
  - **Band Class 14 (D Block & Public Safety Block), Long Term Evolution (LTE)**
  - **Stimulate early development for public safety systems (e.g. Waiver Orders)**
  - **Support the commercial standards and testing process with public safety requirements e.g.**
  - **Publish test results (non-attributable) to inform stakeholders**

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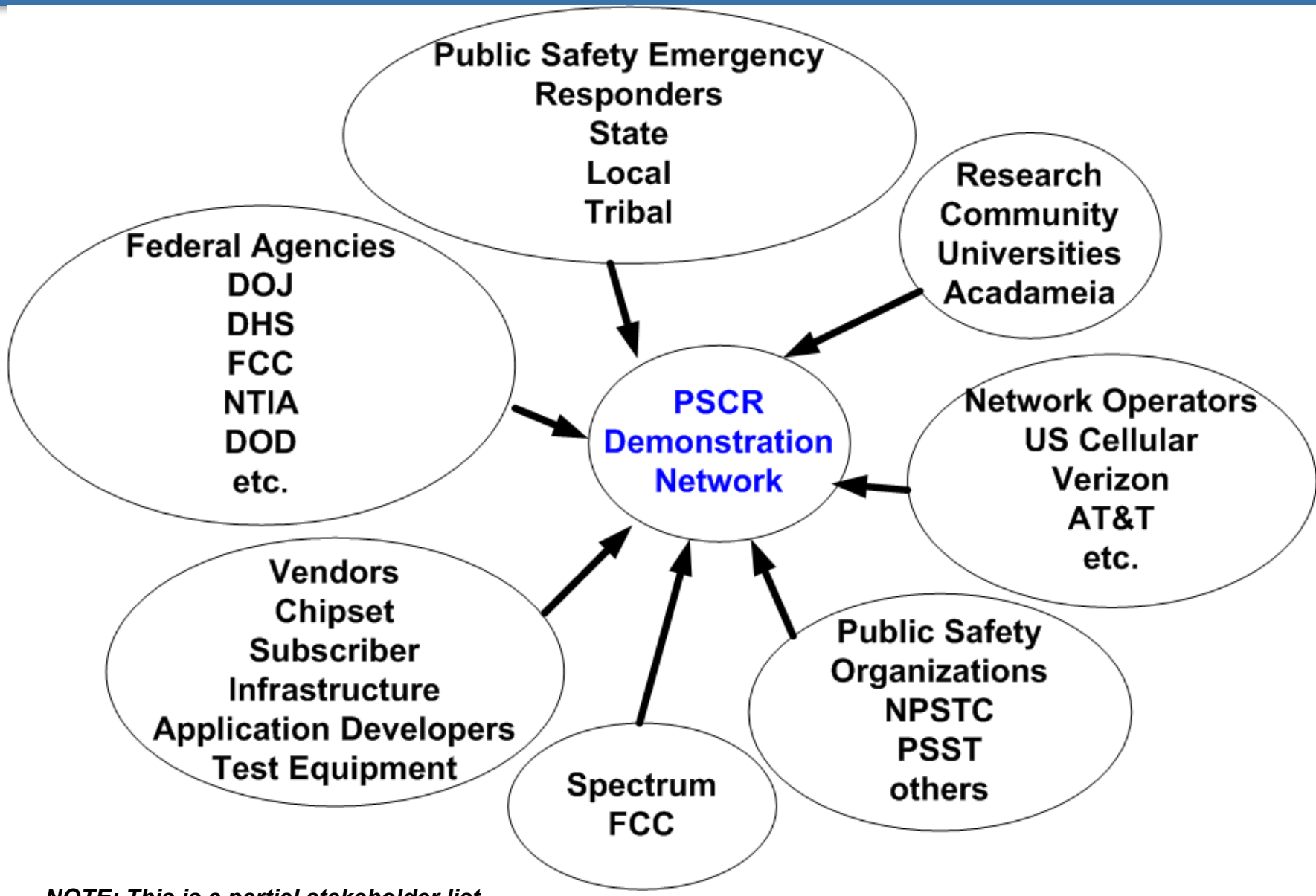
Demo Project Stakeholders



NOTE: This is a partial stakeholder list

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Project Process

- Demonstration Network has three major stages for stakeholder participation:
  1. Stage 1—Network and Test Planning
     - Stakeholders will be involved in creating a common test plan for all vendors and creating a common network deployment and coverage scheme.
  2. Stage 2—Deployment (3 sub-phases)
     1. Equipment is scheduled for delivery to site locations.
     2. Coverage, network planning, site preparation is completed.
     3. Systems are installed and commissioned.
  3. Stage 3—Testing and Demonstrations
     - Test plan execution takes place. This is staggered into three main phases with sub-phases as equipment and features become available. Network is available to perform system level testing and demonstrations on.

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Project Status – Stage 1

- Stage 1 is nearing completion
  - Phase 1 and 2.1 stable and released
  - Test planning for Phase 2.2 and Phase 3 out for review
    - Phase 2.2 target publish date by end of August 2011
    - Phase 3 target publish date by end of September 2011
  - UE related tests removed from Phase 1 test plan
    - UE test plan standalone from system & infrastructure testing
  - All test documents available on www.pscr.gov

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Project Status – Stage 2

- Infrastructure deployment
  - Alcatel Lucent EPC & eNodeB completed
  - Motorola Solutions Inc./Ericsson EPC & eNodeB
    - Phase 1 test configuration complete
    - Phase 2 & 3 test configuration in progress (late Q3)
  - Harris/Nokia Siemens EPC & eNodeB
    - Phase 1 test configuration complete
    - Phase 2 & 3 test configuration in progress (Sept)
  - Cisco EPC installation beginning in two weeks, integration in early September
  - IPWireless TBD

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Project Status – Stage 2 cont.

- UE & UICC deployment
  - LG deployed
  - Motorola Solutions Inc. deployed
  - IPWireless deployed
  - Gemalto deployed
  - Others TBD
- Test Equipment
  - Aeroflex, Agilent, Rohde & Schwarz, Anritsu, Sanjole

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Stage 3 - Testing Updates (1)

- The PSCR program has established a test plan with three major phases of testing and evaluation.
  - Phase 1: Basic Functionality Testing
    - Phase 1: Basic Functionality Tests
    - Basic functionality testing will determine if the LTE equipment submitted for use in the PSCR demonstration project has been configured correctly to achieve a minimal level of functionality. Tests will include:
      - Physical layer tests to ensure that the submitted equipment will not interfere with other existing 700 MHz LMR, PSCR demonstration systems
      - Messaging/protocol tests
      - Public safety application tests
      - Basic performance tests

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Stage 3 - Testing Updates (2)

- Phase 2.1: System and Node Level Testing
  - Predominately simulated propagation
    - Physical Layer Tests: Examine several characteristics of the eNB that will indicate how this equipment will operate in PS scenarios.
      - Provides indication of sensitivity level and robustness for the RF section of the eNB.
    - Throughput Performance Tests
      - Tests examine throughput in bidirectional, downlink and uplink configurations.
      - Test configurations examine both TCP and UDP throughput.
    - Messaging/Protocol Tests: The test in this phase examines the messaging behavior of the LTE system in the event that an additional radio bearer is requested.

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Stage 3 - Testing Updates (3)

- Phase 2.2: System and Node Level Testing
  - Stress Tests: These tests will examine the loading and potential capacity of the target cell.
    - Multi-user, loaded network stress testing
  - Performance Tests: There are three tests, two of which are designed to examine user plane latency.
  - Messaging/Protocol Tests: These tests cover the areas of security, interoperability, and failure modes.
    - The Security tests focus on intrinsic security modes in LTE as opposed to Over the Top (OTT) methods that may be used at higher levels in the protocol stack.
  - Network O&M - Alarm/Fault Reporting
  - "Status Info Homepage" evaluate a standardized mechanism to quickly inform the user of system information.

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Stage 3 - Testing Updates (4)

- Phase 3: Advanced Feature, Conformance, Interoperability, and Roaming Testing
  - Network architecture type testing, including evaluation of various PLMN, eNUM and IP implementations
  - Interoperability testing that includes testing the EPC and inter-connecting multiple EPCs
    - Basic RAN IOT – UE and eNB based both
  - Handover testing and evaluation (pending UE availability)
    - LTE-to-LTE (public safety-to-public safety)
    - LTE-to-LTE (PS to commercial)
    - LTE-to-3G
  - Stress, performance, messaging/protocol, application tests all included. Several based off of VZW Open Test Procedures
- New webpage created just for testing updates:
  http://www.pscr.gov/projects/broadband/700mhz_demo_net/testing/about_testing.php

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Testing Status

- Phase 1 tests published & available on www.pscr.gov
  - Test plan stable at v1.12
  - Completed Phase 1 testing with Alcatel-Lucent
  - Started testing with MSI and NSN
- Phase 2.1 testing complete with Alcatel-Lucent (in review now)
- Phase 2.2 scheduled to start late August (ALU)
- Phase 3 TBD start date
- Once we have multiple vendors that have executed all tests we will publish data (non-attributable)

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UE Testing

- UE testing covers several key aspects
  - RF Conformance & Performance tests based on several key documents
    - 3GPP 36.521-1 v8.4.0 (Dec 2009)
    - PTCRB RFT #76
  - Radio Resource Management (RRM) Conformance Testing
    - 3GPP 36.521-3 v8.4.0 (Dec 2009)
  - Scenario Based Tests
    - Based upon Verizon Wireless Device Requirements LTE 3GPP Band 13 Network Access Issued May 2010 v4.0
  - Field Performance Tests
    - Verizon Wireless Device Requirements LTE 3GPP Band 13
    - GSMA DG.11 Device Field and Lab Test Guidelines, Version 8.0, 11 June 2010, Annex C

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UE Testing (2)

- Using Conformance test equipment – R&S 8980S w/Contest 2.20
- PSCR looking to move most UE testing to PTCRB certified labs
- Working with PTCRB on PVG submittal for Band 14 validation
  - CRADAs signed with 7Layers & AT4 Wireless + 1 in progress
  - One lab has already tested on one UE chipset but did not meet 2 chipset criteria
- No UE vendors have final designs ready for full conformance yet
  - Could have testing done by end of 2011 if UEs

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Infrastructure Conformance

- PSCR submitted a new work item in March 2011 to the Multi-Service Forum entitled: MSF LTE EPC Certification Program
  - Initially accepted but slow response for sponsorship due to "certification" aspect
  - Initially tested S1-MME
    - Would eventually evaluate :
      - S1-U (eNB to S-GW)
      - S-11 (MME to S-GW)
      - S6a (MME to HSS)
      - S5 (S-GW to P-GW)
      - Gx (P-GW to PCRF)
      - Rx (PCRF to P-CSCF)

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Infrastructure Conformance (2)

- PSCR will re-submit a modified work item next week at the August 2011 MSF that removes certification aspect
- PSCR still investigating other organizations such as GSMA and ATIS to perform infrastructure IOT for public safety on an on-going basis

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Study Item Groups

Updates

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Study Item Groups

- PSCR has defined nine initial, specific Study Items for the Broadband Demonstration Network. These Study Items are areas of technical need identified within the PSCR Demonstration Network project that require input from our stakeholders.
- PSCR will directly be leading six of these groups.
- The other three Study Items will be handled outside of PSCR e.g. NPSTC – we are working with these organizations to ensure a smooth transition and will provide updates on how to specifically get involved in these three other Study Items.
- To join the groups goto www.pscr.gov and sign up for the groups and for sharepoint/web portal access

PSCR

Study Item Groups (2)

- The following Study Items will be led by the PSCR Project Team:
  - UE Testing
  - Network Identifiers
  - Network Performance
  - Infrastructure Testing - RAN & EPC
  - Roaming & Clearing
  - UICC
- The remaining Study Items will eventually be folded back in to the PSCR Study Items
  - Network Security
  - QoS
  - Application Testing
- *Each Study Item has a scope of work document associated with it.*

PSCR

CRADA

Updates

PSCR

CRADA

- CRADA – Cooperative Research And Development Agreement
  - CRADAs are partnering tools allowing federal laboratories to work with US industries, academia and other organizations on cooperative R&D projects. CRADAs provide flexibility in structuring project contributions, intellectual property rights, and in protecting proprietary information and CRADA research results.
  - 33 of 45 submissions executed
    - Project Phased Approach relates to phased CRADA execution
    - Judgment of NIST on whether or not to execute CRADA based on project needs

PSCR

Executed CRADAs

COMMSCOPE® ANDREW®

INMOTION TECHNOLOGY

IXIA®

ROHDE&SCHWARZ

Alcatel·Lucent

IPWireless

verizon wireless

TALLEY®

Anritsu Discover What's Possible™

HARRIS®

at&t

Sprint

MOTOROLA SOLUTIONS

U.S. Cellular

Powerwave technologies

7 layers

AIRCOM INTERNATIONAL

Wavesat

CASSIDIAN AN EADS COMPANY

CISCO

LG

JDSU

CAVIUM NETWORKS

EDX WIRELESS

ERICSSON

ISCO INTERNATIONAL

Nokia Siemens Networks

AEROFLEX

TWISTEDPAIR Rethink Critical Communications

AT4 WIRELESS

Agilent Technologies

PSCR

T-Mobile

NORTHROP GRUMMAN

Syniverse

Executed CRADAs

- Alcatel Lucent
- Andrew Commscope
- Anritsu
- IP Wireless
- ISCO
- LG
- US Cellular
- Wavesat
- Cisco
- Ixia
- Ericsson
- Aeroflex
- T-Mobile
- Agilent
- Harris
- EDX
- Syniverse
- Powerwave
- Talley
- In Motion Tech
- Northrop Grumman Systems Corporation
- Cassidian
- Nokia Siemens Networks
- Motorola Solutions Inc.
- Rohde & Schwarz
- Verizon Wireless (VZW) Cellco
- Sprint Nextel
- AT&T Services
- 7 Layers Inc.
- AIRCOM
- JDS Uniphase Corp
- AT4 Wireless
- Twisted Pair Solutions

PSCR

CRADA Submissions

- If you want to submit your information to execute a CRADA please provide the following to 700MHz@its.bldrdoc.gov

1. Official Company **name and address**
2. Company point of contact **name, address, phone, email** (this is the person that will sign the CRADA)
3. Company Principal Investigator **name, address, phone, email** (this is our primary POC for the project)
4. Names of other members of the Company's project team (active members of the project)
5. What the company will be contributing to the research-- such as specific infrastructure equipment, subscriber equipment, test equipment, antenna's, software testing, hardware testing or any other collaboration.

PSCR

Face-to-Face

- Semi-Annual PSCR Face-to-Face meetings held in April 2010 & December 2010
- Tentatively scheduling for late July or early November 2011 in Boulder, CO - **but remains TBD based on testing**
- **Considering hosting virtual web conference**
  - Send email to 700MHz@its.bldrdoc.gov to get added to distribution list or if interested in presenting
  - Will update via email distribution list and www.pscr.gov website

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Thank you!

For Additional Information:

http://www.pscr.gov

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