PSCR 2021

THE DIGITAL EXPERIENCE

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*** Please note, unless mentioned in reference to a NIST Publication, all information and data presented is preliminary/in-progress and subject to change**

LMR to Broadband (LTE/5G) Research and Funding Strategy

Jon Cook – Engineer
Tim Thompson – Engineer
Chris Walton - Engineer

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INTRODUCTION

Overview of PSCR's Current LMR to Broadband Research Projects

- Research Strategy
- Funding

PSCR's Current Interworking Projects

- Current PSCR LMR to Broadband Interworking Projects
  - IWF Tester (Jon Cook)
  - IWF Procurement (Jon Cook)
  - AT&T – LMR to EPTT Interworking (Tim Thompson)
  - Analog LMR to MCPTT (Chris Walton)
  - RoIP-based LMR to Broadband (Chris Walton)

Grants & Cooperative Agreements

- PSCR leverages Financial Assistance Awards in the form of grants and cooperative agreements to stimulate critical R&D, advanced engineering, and product development in key technology focus areas. Official announcements for all open opportunities are made available on **grants.gov**.
  - **Public Safety Innovation Accelerator Program** (PSIAP)
    - Recipients will rapidly accelerate the objectives of the PSIAP through innovative research and development (R&D) projects.
  - **Cooperative Research and Development Agreement** (CRADA)
    - Research partnerships
    - Protection of proprietary data

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Small Business Innovation Research (SBIR)

- The mission of the SBIR program is to support scientific excellence and technological innovation through the investment of Federal research funds in critical American priorities to build a strong national economy.

- Program goals
  - Stimulate technological innovation
  - Meet Federal research and development needs
  - Foster and encourage participation in innovation and entrepreneurship by women and socially or economically disadvantaged persons
  - Increase private-sector commercialization of innovations derived from Federal research and development funding
  - Foster technology transfer through cooperative R&D between small businesses and research institutions

UP NEXT

IWF Tester
IWF Procurement

Jon Cook - Engineer

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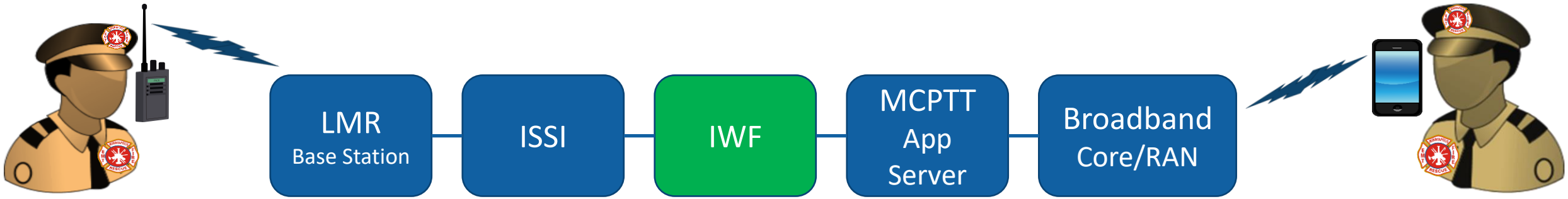
INTERWORKING FUNCTION (IWF)

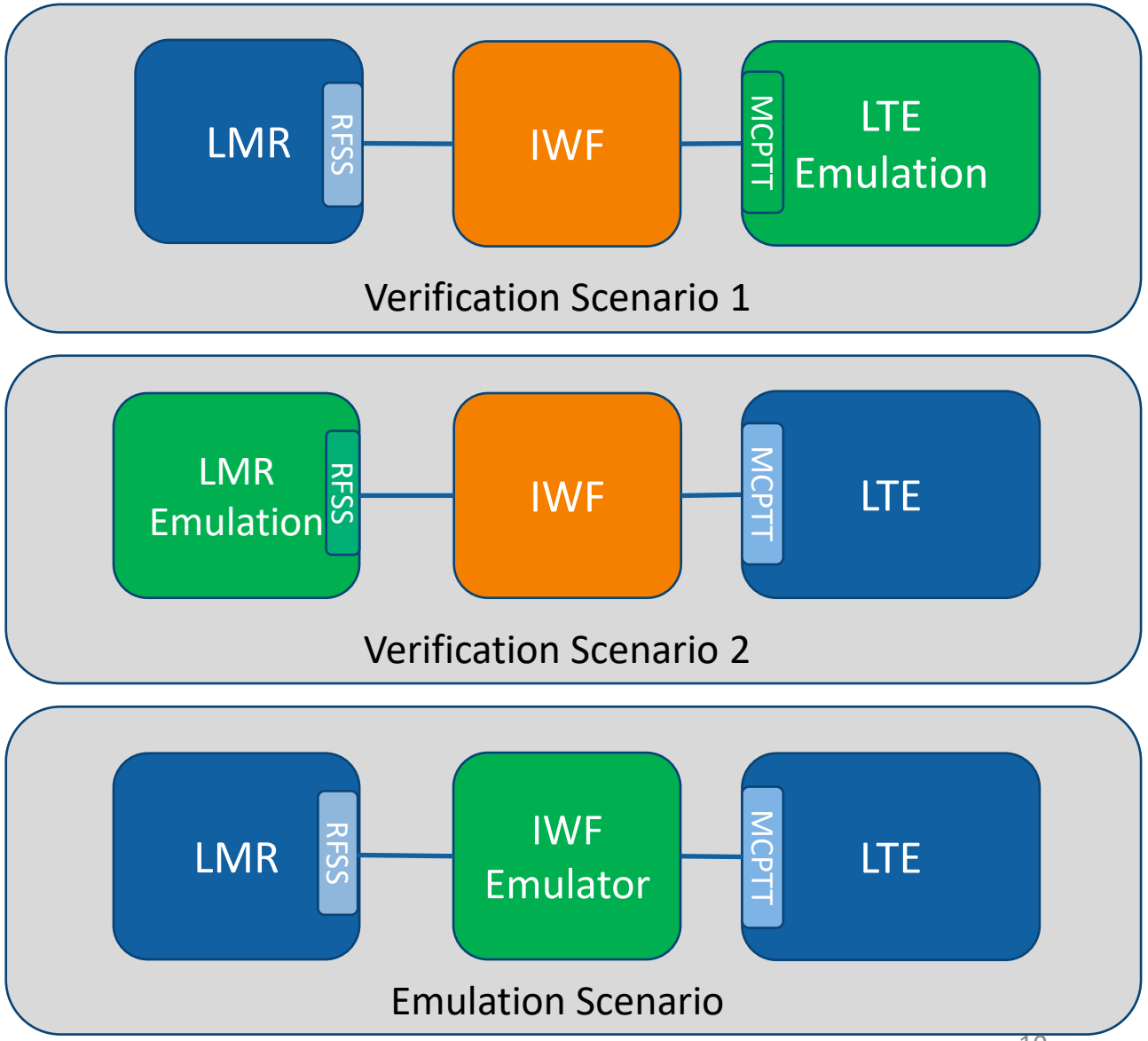
- Translation between P25 LMR and Broadband-based MCPTT
  - 3GPP Interfaces (TS 23.283)
    - IWF-1 (MCPTT Server)
    - IWF-2 (MCData Server)
    - IWF-3 (Group Management Server)
  - P25 TIA interface (TSB-102.BACC-B and TIA-102.BACA-B)
    - ISSI (LMR)



LMR–Land Mobile Radio **MCPTT**-Mission Critical Push-to-Talk **MCData**–Mission Critical Data **ISSI**–Inter RF Subsystem Interface

IWF TESTER & EMULATOR PROJECT

- Compliance Verification Tool
  - IWF Verification
    - Verification to 3GPP Release 16 specifications
    - Verification to current TIA specifications
    - Used to test all interfaces of a full production IWF
- IWF Emulation Tool
  - Provides all IWF functions in a lab environment
  - Low-capacity standards compliant IWF

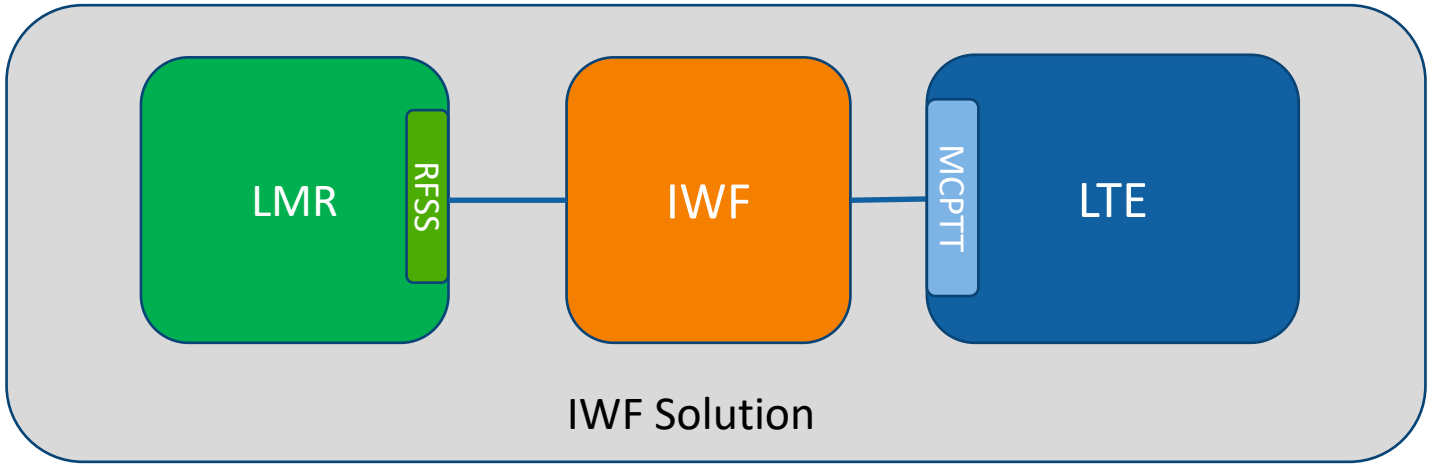


IWF TESTER & EMULATOR CONTRACT

- Contract awarded to Valid8.com, Inc.
  - Valid8 is a network testing company with 18 years of experience
  - Contract start date of March 30, 2020
  - Scheduled completion date of September 30, 2021
  - Support to be provided through September 30, 2026

Interworking Function (IWF) PROJECT

- Fully-functional IWF
  - Supports all connectivity models in 3GPP specification
  - Group, private and emergency communications
  - Security gateway
  - Transcoding
  - Location services
  - 250 private calls/500 group calls
  - 10,000 active 3GPP clients/10,000 active P25 clients



IWF CONTRACT

- Contract awarded to Nemergent Solutions
  - Nemergent has demonstrated expertise in designing mission critical solutions over mobile broadband technologies.
  - Nemergent is the developer of the MCPTT server in use in the PSCR lab
  - Contract start date of October 16, 2020
  - Scheduled completion date of October 8, 2021
  - Support to be provided through October 8, 2025

nemergent® solutions

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LMR to EPTT Interworking

Tim Thompson – Engineer

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INTERCONNECTED SYSTEMS

- Interconnected Systems via ISSI
  - Purchased two ISSI licenses with our Project 25 (P25) system
  - Land Mobile Radio (LMR) to Enhanced Push To Talk (EPTT)
    - Motorola ASTRO 25 to AT&T's EPTT System
    - First step in interconnecting disparate PTT systems
      - Challenges in establishing physical connection and network configuration (steep learning curve, limited expertise industry wide)
    - Indiana statewide Motorola ASTRO 25 system interconnected to AT&T's EPTT system
    - PSCR contracted Motorola to configure ISSI and train PSCR engineers on ISSI configurations for other systems in December 2020
    - PSCR contracted AT&T to complete interconnection
      - Completion timeframe March/April 2021

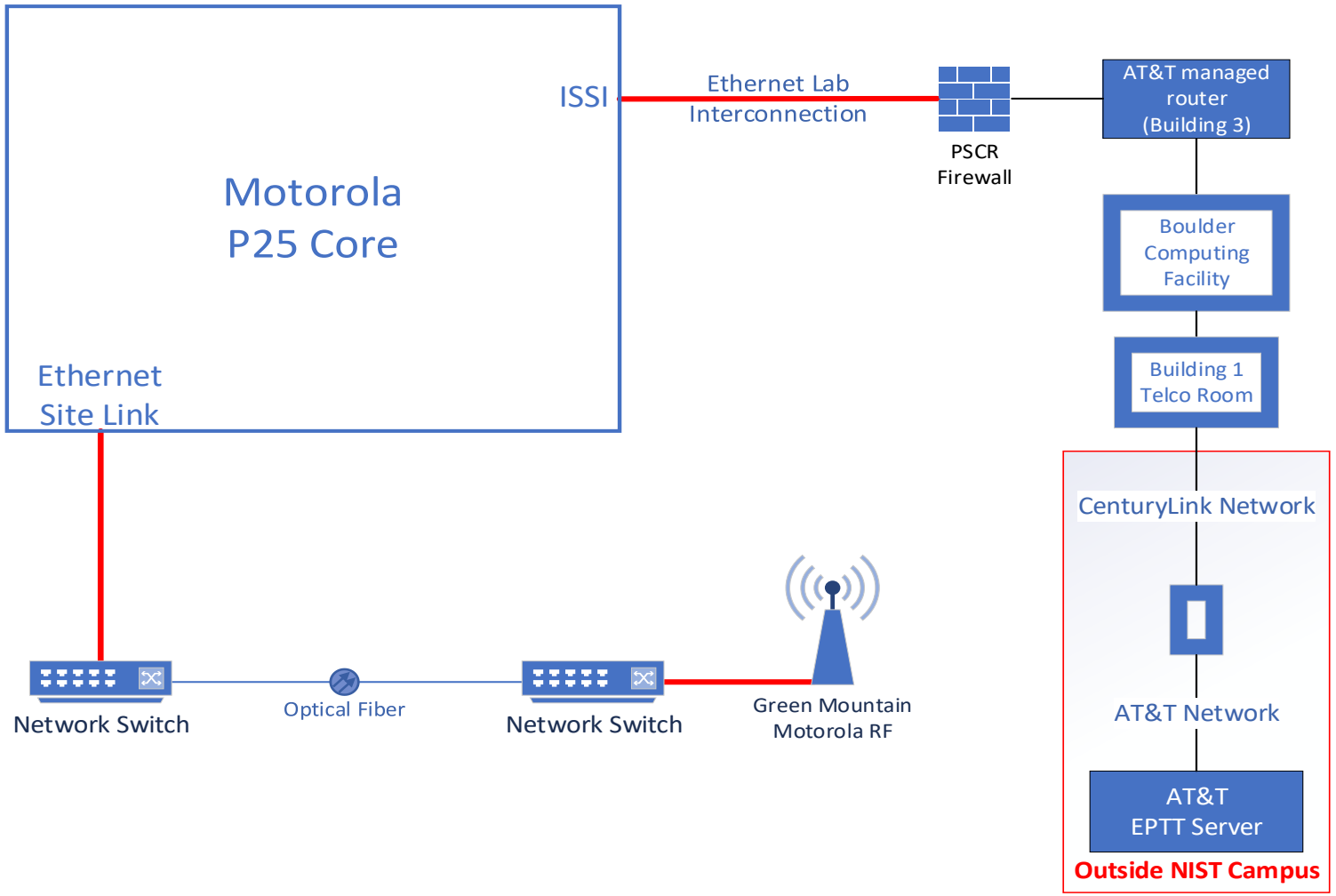
INTERCONNECTED SYSTEMS

- Motivation
  - Measure quality-of-experience (QoE) key performance indicators (KPIs)
    - Mouth-to-Ear Latency
    - End-to-End Access Time
    - Probability of Successful Delivery
- Ability to place calls between P25 Phase 1 (FDMA) and EPTT and between P25 Phase 2 (TDMA) and EPTT
  - Dynamic Dual Mode (DDM) not supported

FDMA – frequency division multiple access

INTERCONNECTED SYSTEMS

CONNECTION DIAGRAM FOR AT&T EPTT



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Analog LMR to MCPTT

RoIP-based LMR to Broadband

Chris Walton– Engineer

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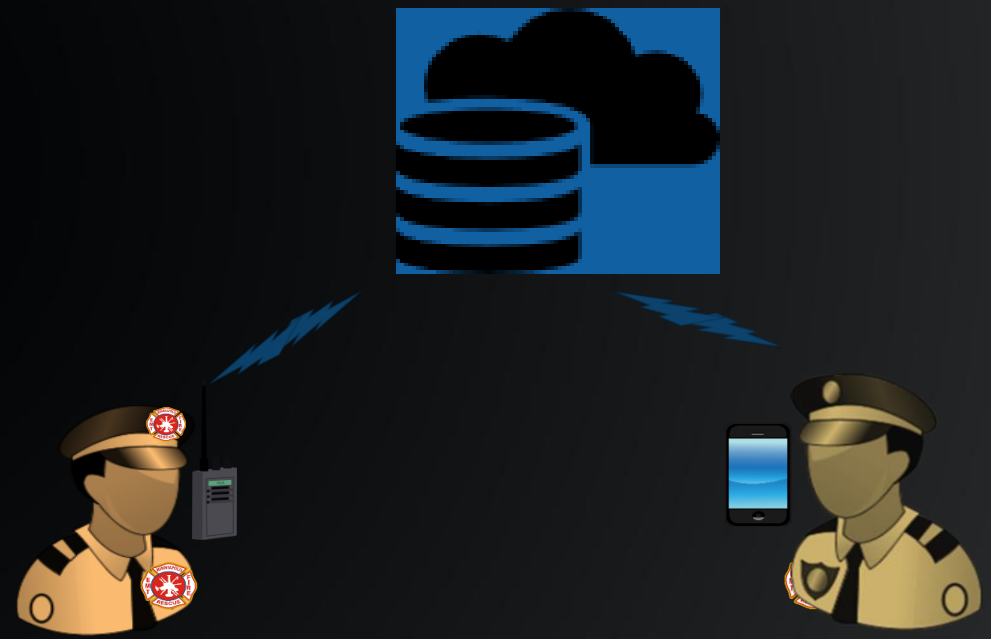
Bridging Analog LMR to MCPTT

- Project Timeline
  - Project Conception – mid FY2019
    - Initial research, document industry baseline
  - Development Phase - late FY2019
    - Focus scope of the project for in house development
  - Proof of Concept – FY2020
    - Creation and validation of lab-based prototype
  - Research Paper – FY2020
    - NISTIR-8338 (Published Dec 2020)
  - Feature Enhancements – FY2021
    - RTP (Audio enhancements)
    - GNU Radio Development



*Please see the Analog LMR to MCPTT Communication session for a technical deep dive.

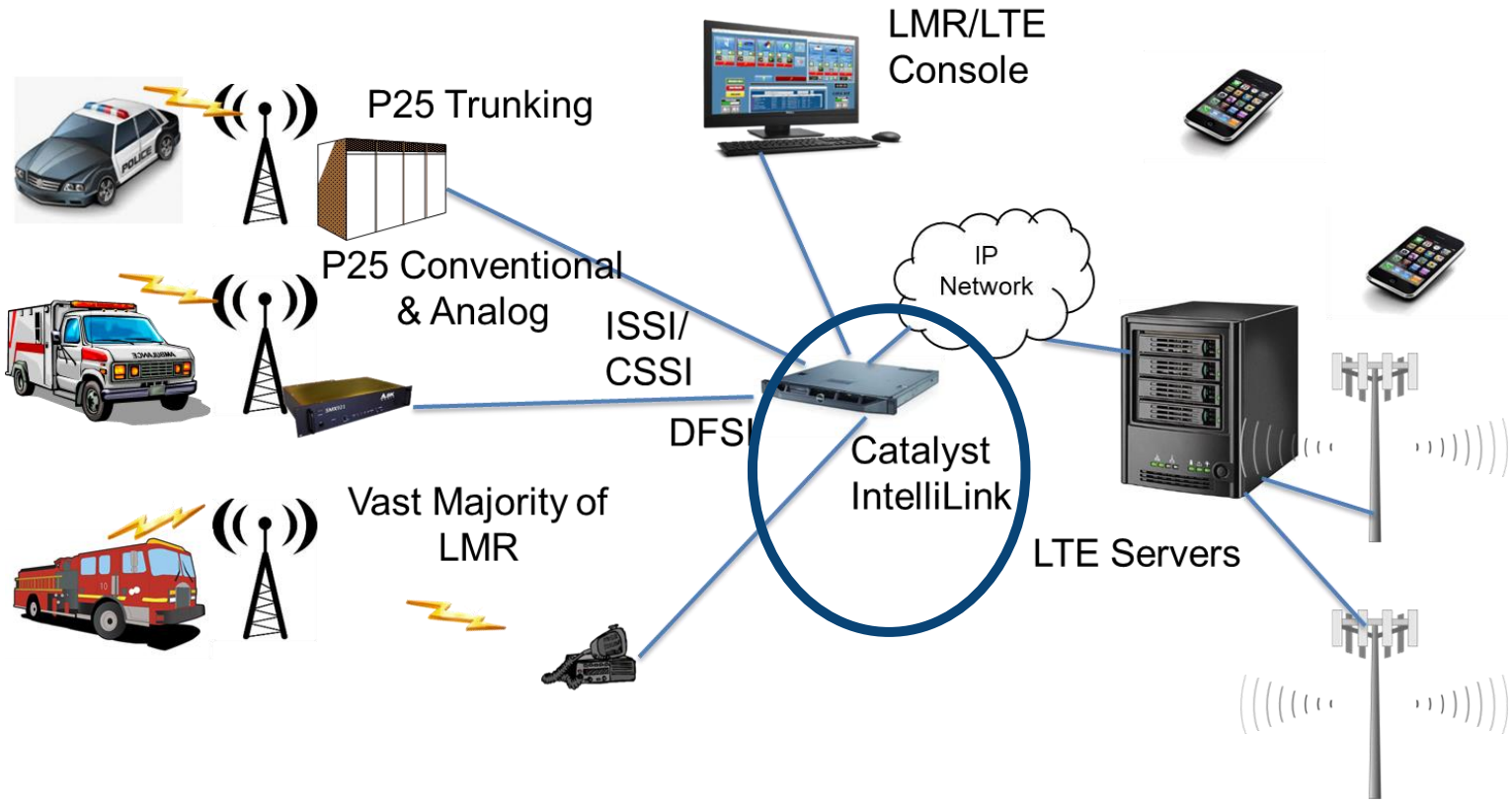
Radio Control over IP-based Interworking Solution

- PSCR Catalyst SBIR Phase 2 Support
  - CRADA supported work
  - Implementation of servers to bridge P25 (P25 Phase1 and P25 Phase2)

- PSCR Catalyst SBIR Phase 3 Support
  - Declared via Solicitation/Contract NB671000-21-00042
  - Four standard packages
  - 20 field trials
  - 5 kits across the 20 trials
  - 10 permanently fielded interworking and dispatch systems
  - Lab-based installs - PSCR
    - Existing components (LMR system, MCPTT system, commercial PTT)
  - Lab/Demo based install – DHS

Catalyst Interworking Solution

- Enables communications between subscriber devices on legacy Land Mobile Radio networks and new Mission Critical Push-to-Talk Applications on mobile phones
- Complies with standards on both the LMR (p25) and LTE (3GPP) sides
- Also connects to other, non-standard radio systems used by Public Safety
- Essential for migration from legacy LMR to FirstNet™ and other Mission Critical Push-to-Talk networks



Conclusion

- Research Types and Funding
  - Internally-funded research
  - CRADA partnerships
  - Grants
  - Competitive procurements
- PSCR Current Research Areas
  - LMR to Broadband Interworking Function Testing
  - LMR to Broadband Interworking Function (IWF)
    - Standards-based MCPTT – LMR
    - Commercially available EPTT - LMR
  - Standards-based MCPTT – Analog LMR (non-ISSI)
  - RoIP-based Solutions

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