





Radio 101 for the PSAP Manager



Idaho APCO and NENA - 2019 PSAP Conference

October 30, 2019



Today's Session:

- **Introductions**
- **History of Public Safety Radio Systems**
- **Systems and technologies**
- **System Specific issues**
- **Q&A and Discussion**



Introductions; Who am I?

- **Neil Horden**

Chief Consultant

- **Federal Engineering, Inc.**

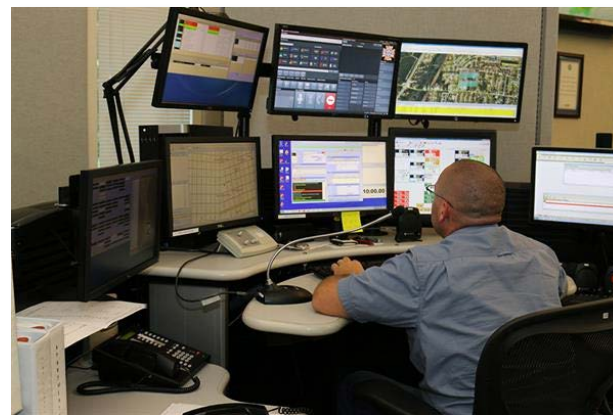
Nationwide independent consulting firm

Focused on Public Safety communications



Participant Expectations: Who are you?

- What is your roll in your center?
- What are your expectations from this session?
- What would you like to take away?
- How can we help you do your job?





A Brief History of Radio

- Radio and the FCC
- Bands
- Conventional / Trunking
- Analog / Digital
- Project 25
- FirstNet / LTE
- Future



Radio and the FCC; Who is the FCC (and why do you care)?

The Federal Communications Commission

- The Federal Department responsible for all
‘Communications’ issues
 - Wireless
 - Radio including LMR, Broadcast, Cellular, etc.
 - Wired
 - Telephone, Including 911
 - Internet
- And why do we care
 - Establish Rules and Regs
 - Set frequency allocations
 - Grant licenses
 - Enforcement (Fines)



Frequencies and Channels

● Frequency

The specific portion of the radio spectrum used for communications

- 153.6825
- 453.1275 / 458.1275
- 806.1275 / 851.1275

● Channel

The name, purpose, or other definition of a communications path

- Fire 1
- South Repeater
- County Interop
- 153.6825
- “6825”



Radio Frequency Bands; Why so confusing?

Technical definition and Practical names

- **VHF (30 MHz – 300 MHz)**
- **VHF Low Band (Usually called “Low Band”)**
30 MHz – 50 MHz
- **VHF High Band (Usually called “VHF”)**
~150 MHz – 174 MHz
- **UHF (300 MHz – 3000 MHz)**
- **UHF**
~450 MHz – ~470 MHz
403 MHz – 450 MHz (Government reallocated)
470 MHz – 512 MHz T-Band (TV reallocated)
- **800 MHz**
National Public Safety Planning Advisory Committee (NPSPAC)
Regional Planning Committees (RPCs)
- **700 MHz**
RPCs also



Technology: Why so many terms?

System types

- Simplex & Repeaters
- Conventional & Trunking
- Analog & Digital
- Voting
- Simulcast
- P25
- LTE
- Etc.



Public Safety Radio Systems: Base Stations, and Repeaters, and Control Stations; Oh My!

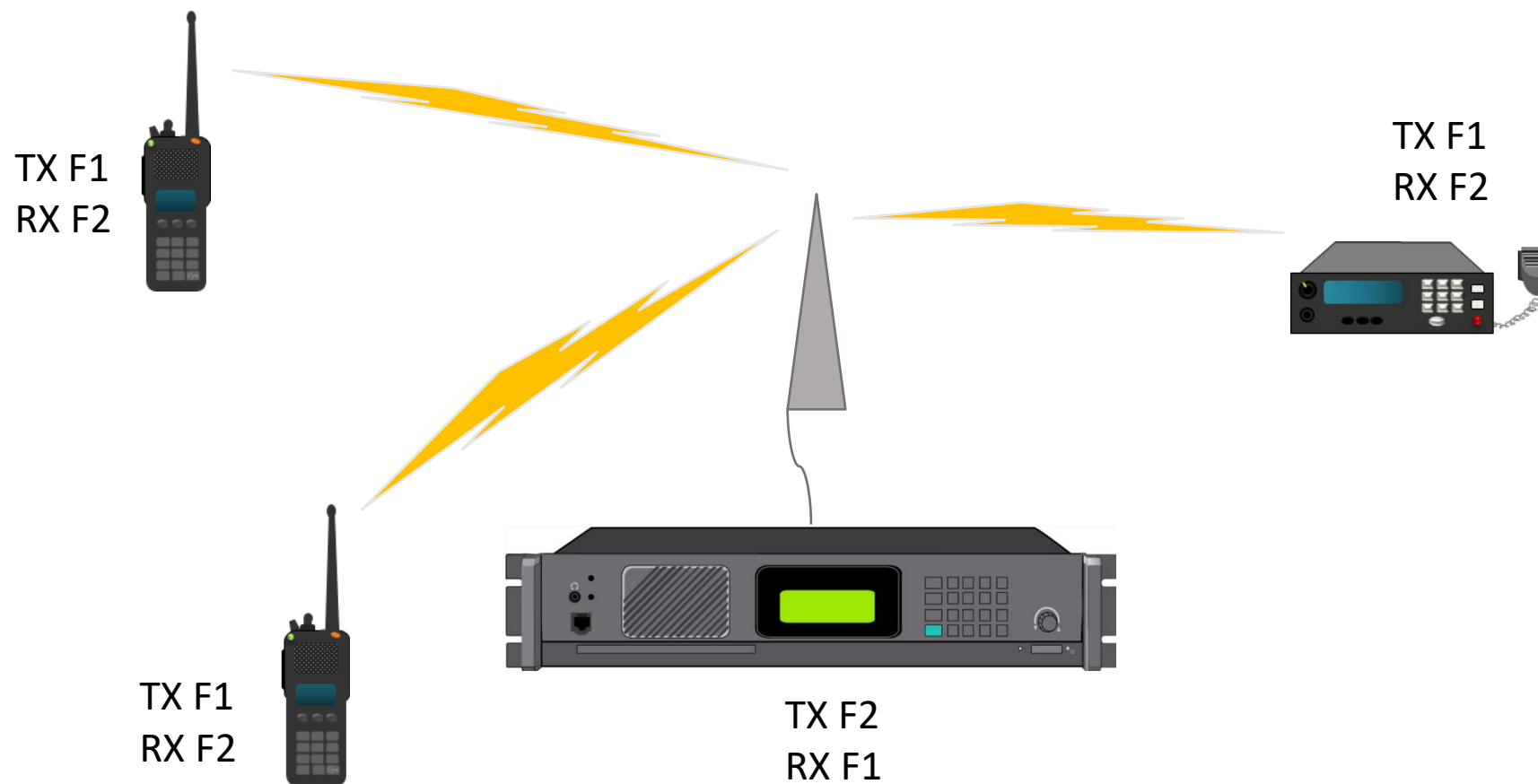
Land Mobile Radio (LMR)

- **Simplex**
- **Repeaters**
- **Control Stations**
- **Talk-Around**
- **Multi-site system**
- **Trunked systems**
- **Multi-site trunked systems**
- **Interconnected systems**

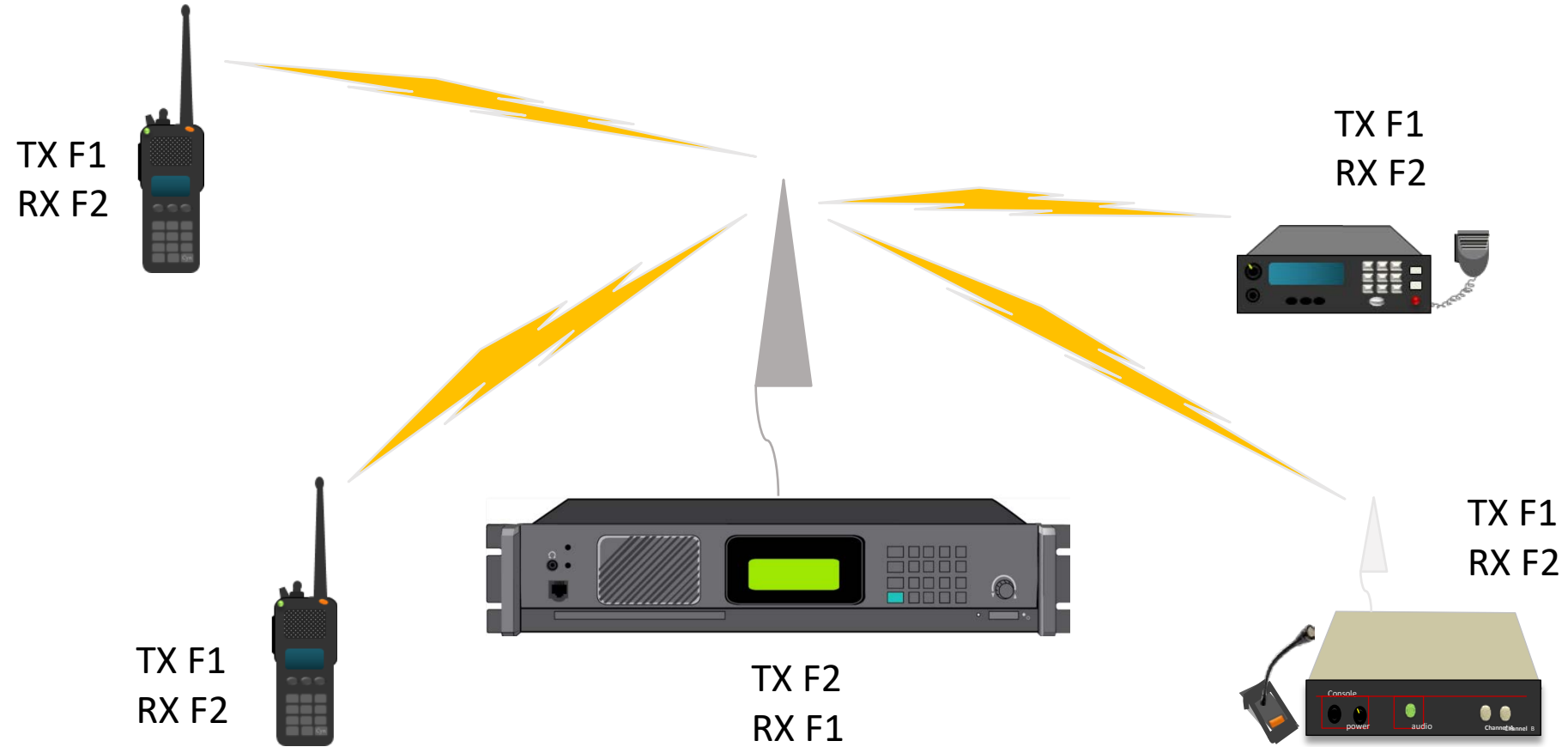
Simplex



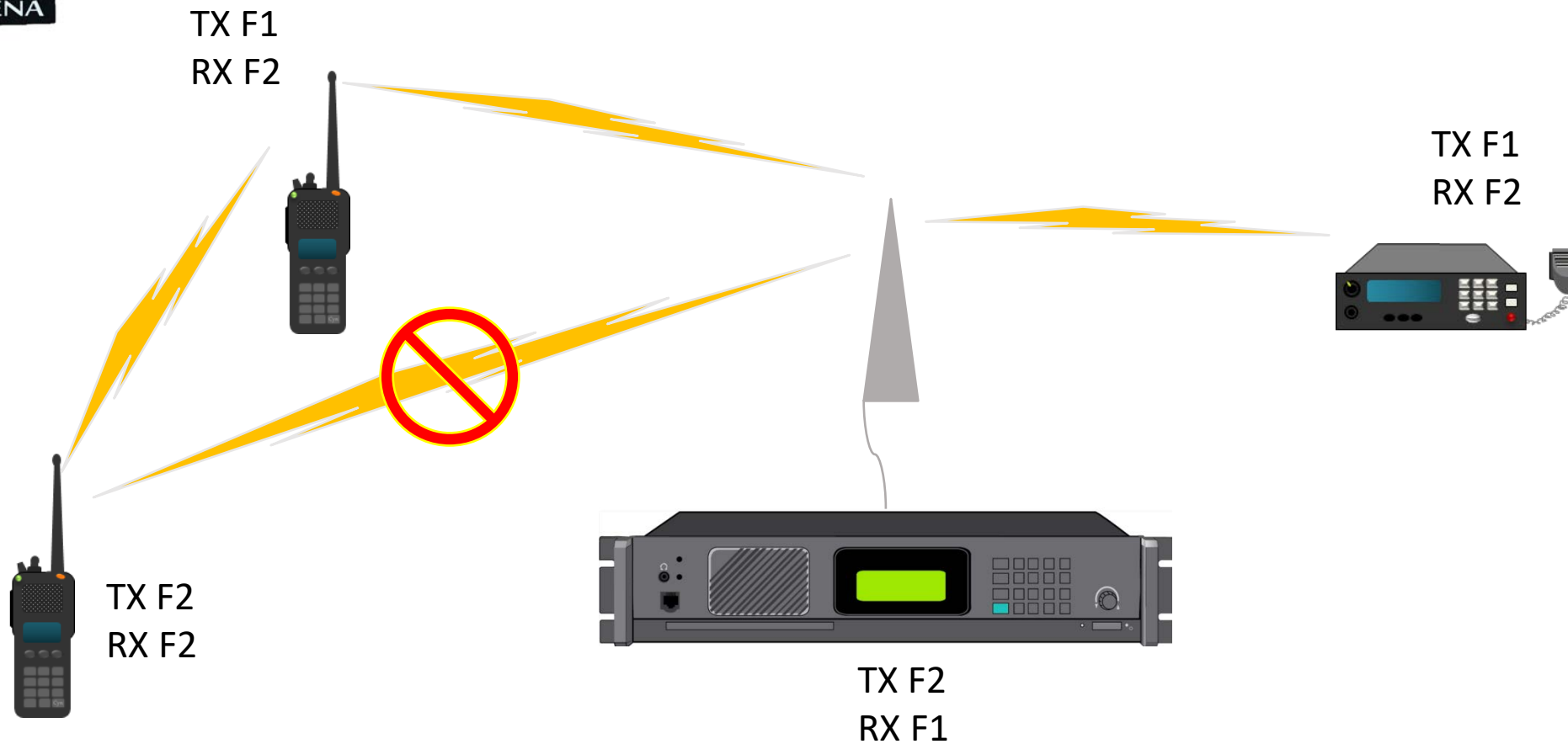
Repeater



Repeater w/ Control Station



Repeater w/ Talkaround





Conventional vs. Trunking

- **Conventional**

- Each radio channel is used for a single purpose (sometimes more than one)
 - Police Dispatch
 - Fire Tac 1
 - Public Works
- When the channel is busy, all users have to wait

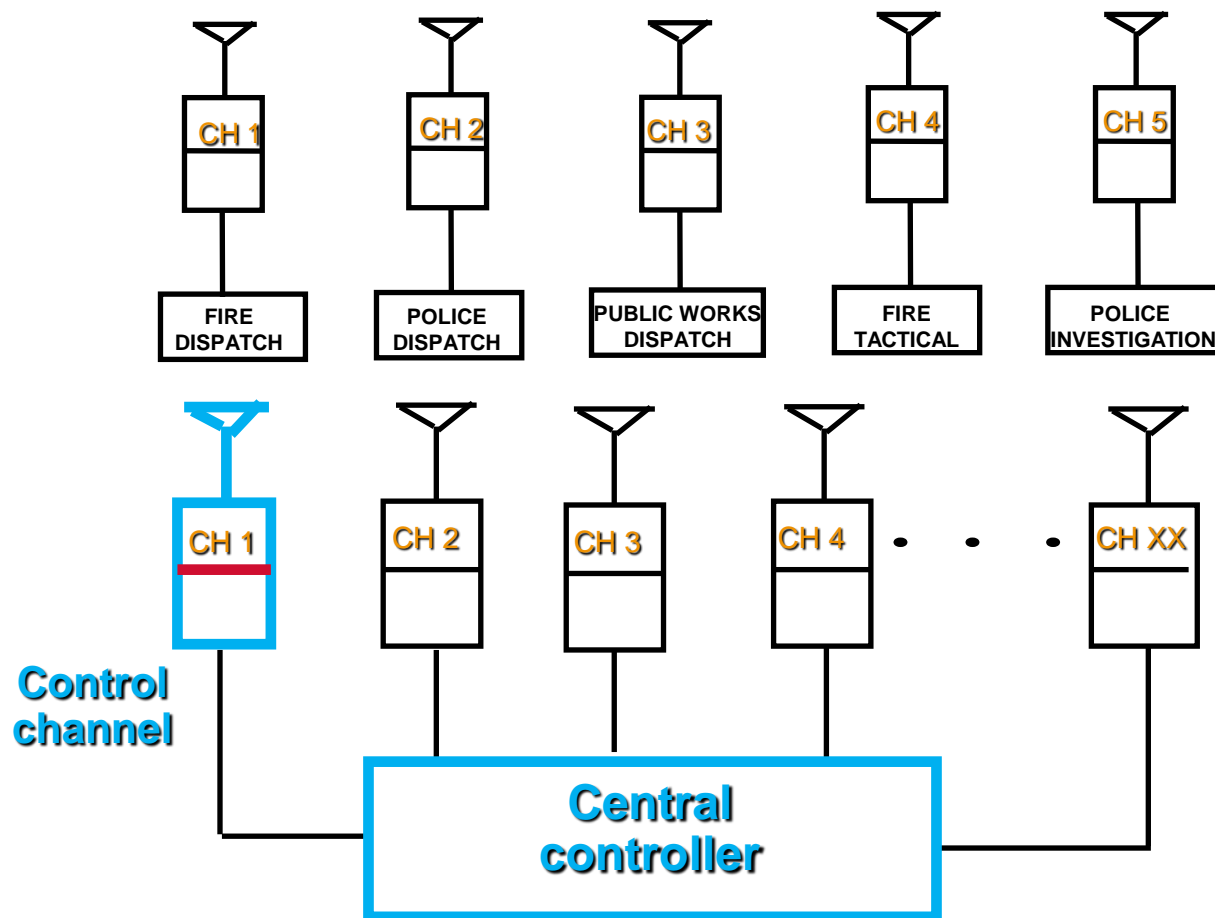
- **Trunking**

- Several channels are shared by many groups of users
- Users are assigned 'virtual' channels called "Talkgroups"
- Talkgroups are assigned to channels on an as-needed basis

- **P25**

- The P25 standard includes conventional and trunking operation
 - The term P25 is often associated with trunked systems

Conventional vs. Trunking (Diagram)

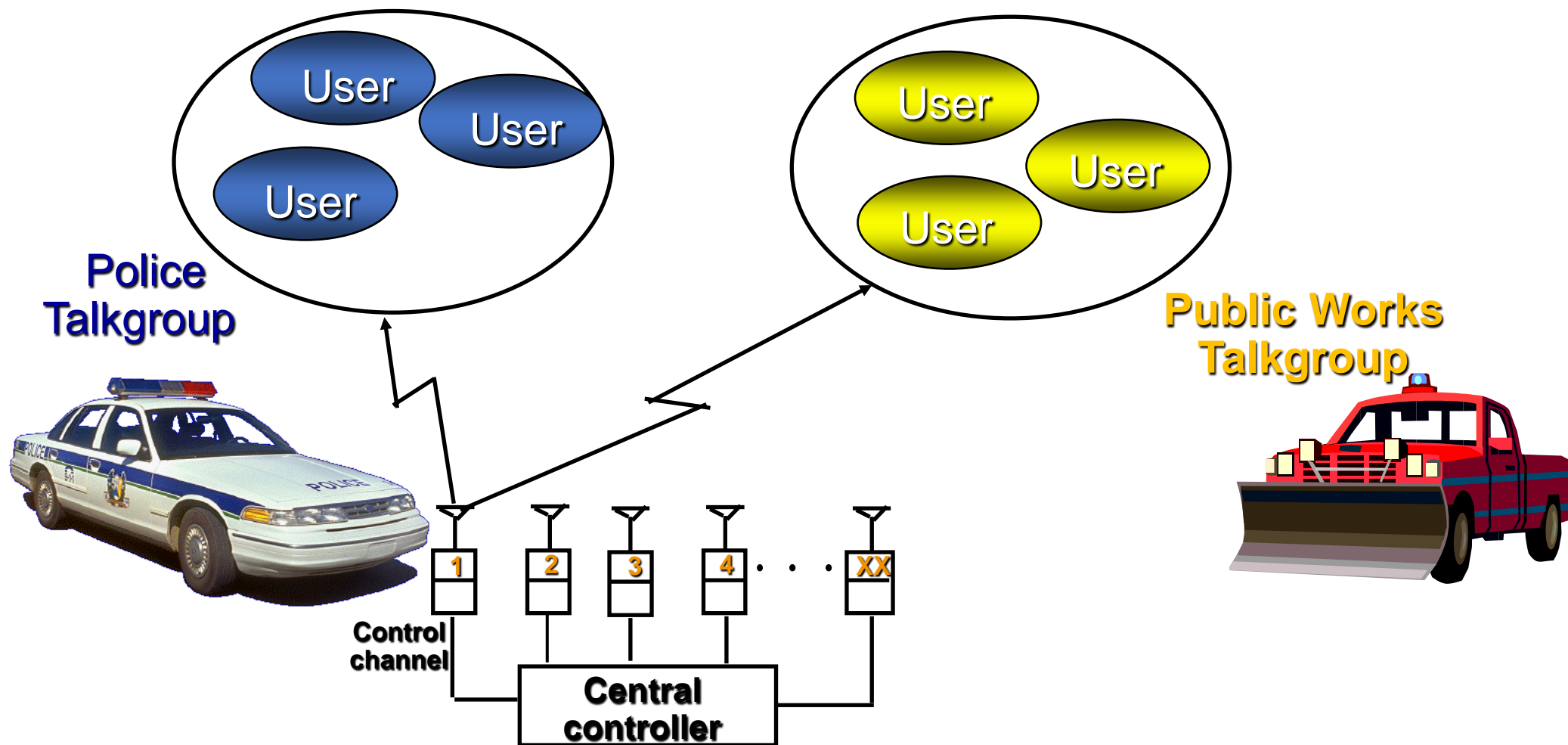




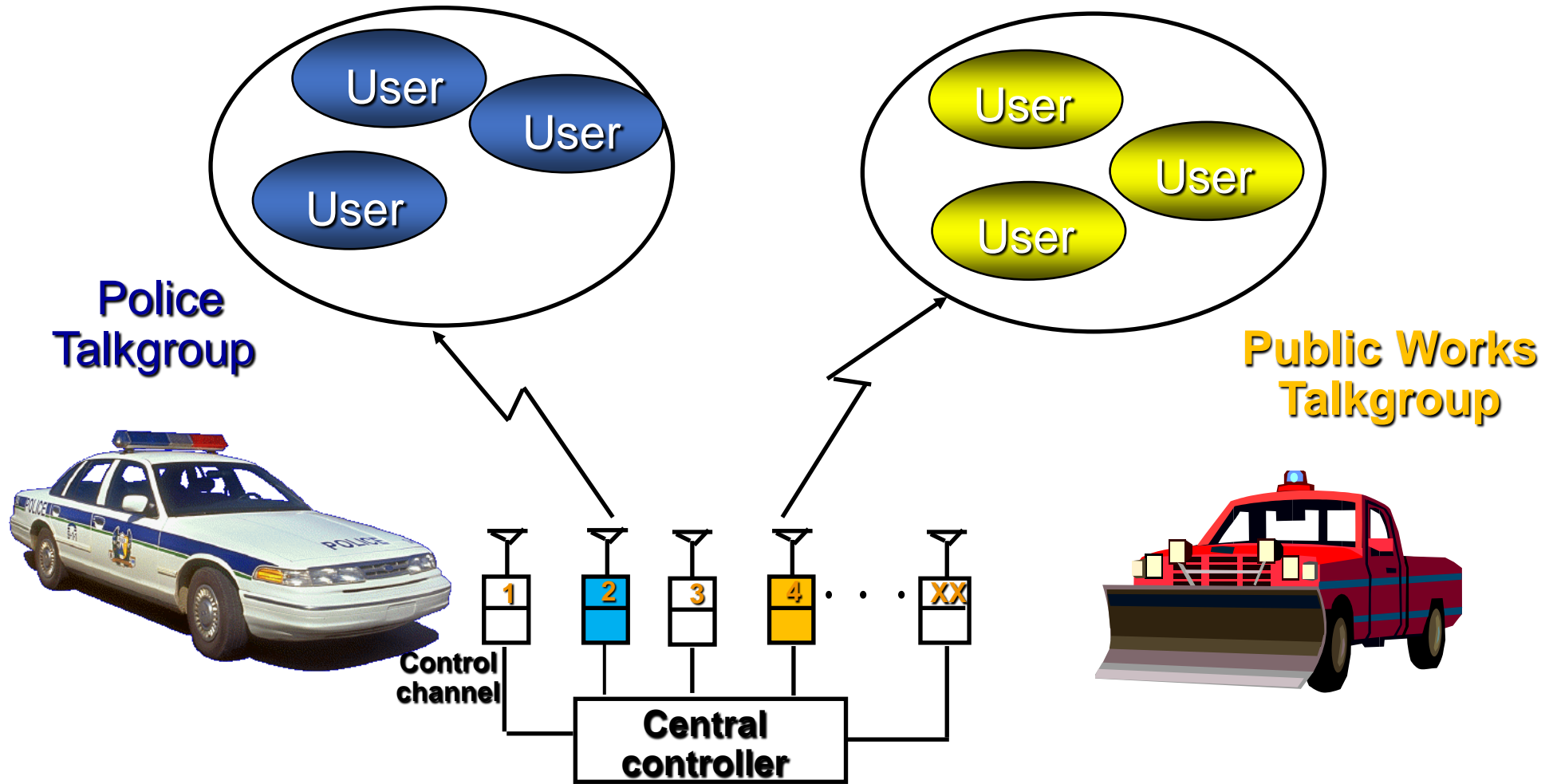
Trunking

- **Groups / Talkgroups**
- **Queuing / Busy / Callback**
- **Private Call / Unit Call**
- **Encryption / Security**

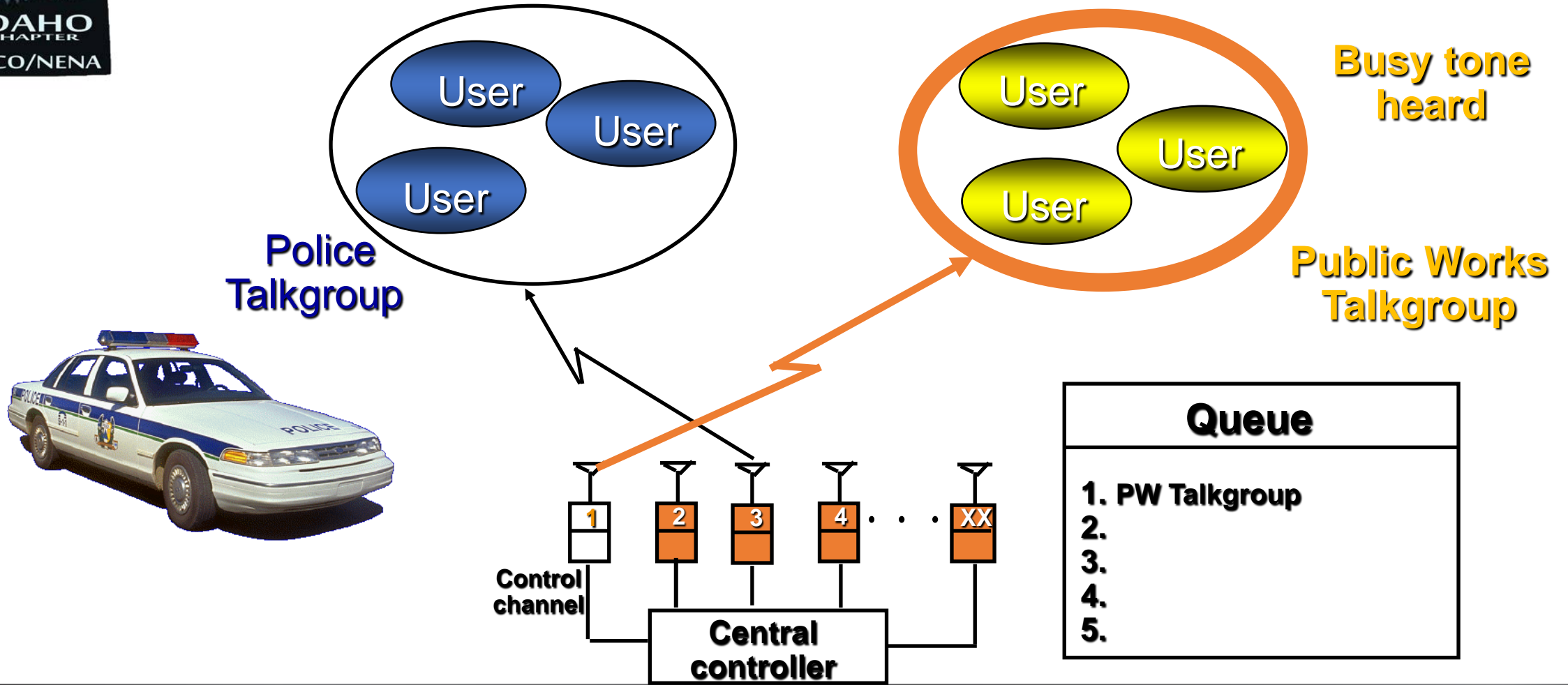
Trunked system ... no conversations



Trunked system ... w/ conversations



Call placed in queue





Analog vs. Digital

- **Analog**

- The message (your voice) is directly applied to the radio signal
 - Similar to the groove in a vinyl record
- When recovered (received) you get the message plus any noise and missing any loss

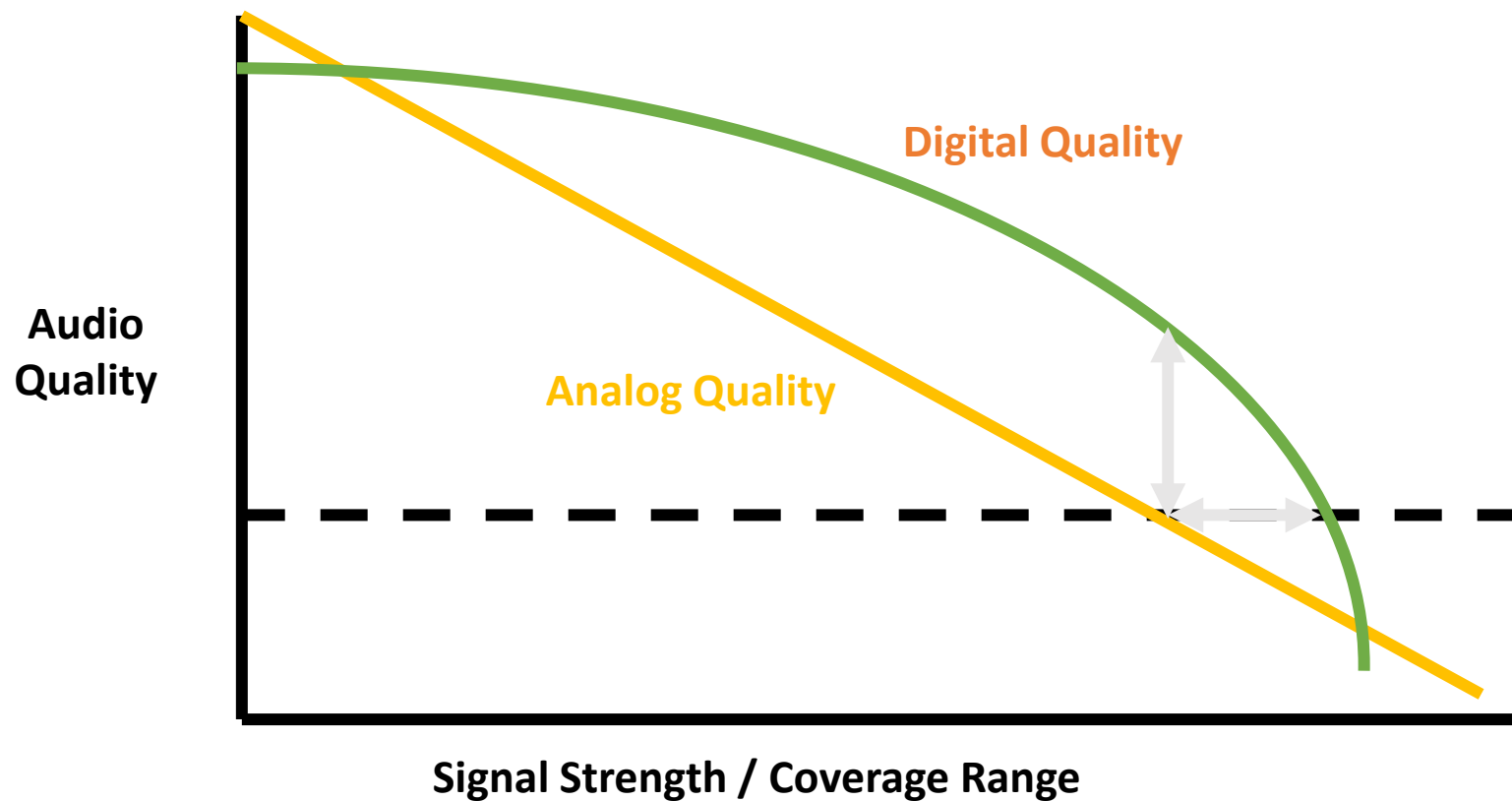
- **Digital**

- The message (your voice) is converted into digital data and encoded onto the radio signal
 - Similar to a CD or DVD
- When recovered, small amounts of message loss due to noise have little effect
- However; large losses or noise make the message unrecoverable

- **P25 - Project 25 (APCO 25)**

- Standard for public safety digital LMR

Digital vs. Analog





Coverage

- **Definition**
- **Coverage solutions**

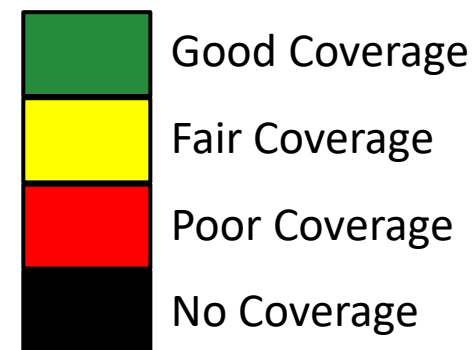
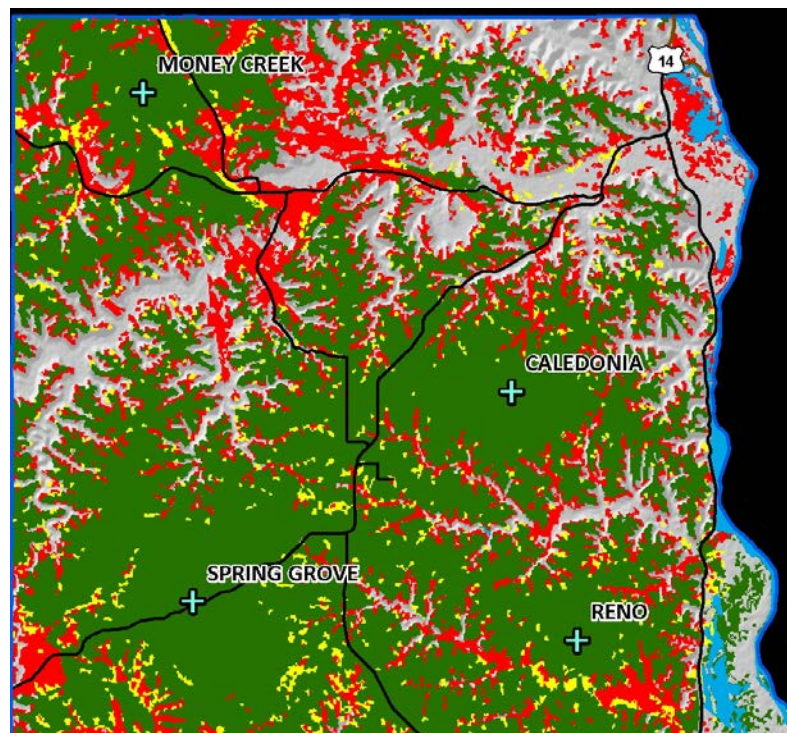


Coverage Definition

- **Percent**
 - Percent of area
 - Percent of time/situations
- **Equipment**
 - Mobile vs. portable
 - Antenna types
- **Environment**
 - In open
 - In clutter
 - In buildings
- **Buildings**
 - Types
 - Locations



Coverage Mapping





Coverage Solutions

- **Sites**
 - Placement
 - Design of the site
- **Multisite systems**
 - Steering
 - Voting
 - Simulcast



Multisite Systems

- **Voting**

- System that selects the best audio from several receivers
- Provides increased receive coverage

- **Steering**

- System that allows the selection of one transmitter site
- Often paired with voting to automate site selection

- **Simulcast**

- System that transmits from all site simultaneously
- Provides increases transmit coverage
- Almost always paired with voting



Consoles; Your connection to the system

- **Resources – Communications paths**
 - Channels
 - Talk Groups
 - Other resources
- **Computer Aided Dispatch (CAD)**
 - Radio system interfaced
- **Other functions**
 - Some radio related
 - Some not



Interoperation

- **Who needs to communicate with who**
Who has access
- **Where do they need to communicate**
What do they cover
- **Interoperation on your system**
- **Interoperation on other agency systems**
- **Interoperation of shared channels**
- **Overlay systems**



Paging

- **Personal pagers**
- **Mobile alerting**
- **Type of signaling**
 - Tone and Voice
 - Digital
- **Station Alerting**
- **Siren activation**



System Specific issues

- **Unique operating modes**
- **Location**
- **CAD interfaces**
- **Logging Recorder**



The Rest of the Story

- **FirstNet / LTE**
- **Land Mobile Radio going forward**
- **Future? ? ?**



Q&A - DISCUSSION





For More Information

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Thank you...

