Public Safety Architecture Framework

The Office for Interoperability and Compatibility
Department of Homeland Security
Volume III: Communications Data Model

Version 1.0
December 2007

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Homeland Security
Science and Technology

Command, Control and Interoperability: Communication, Interoperability and Compatibility

Defining the Problem

Emergency responders—police officers, fire personnel, emergency medical services-need to share vital voice and data information across disciplines and jurisdictions to successfully respond to day-to-day incidents and large-scale emergencies. Unfortunately, for decades, inadequate and unreliable communications have compromised their ability to perform mission-critical duties. Responders often have difficulty communicating when adjacent agencies are assigned to different radio bands, use incompatible proprietary systems and infrastructure, and lack adequate standard operating procedures and effective multi-jurisdictional, multi-disciplinary governance structures.

OIC Background

The Department of Homeland Security (DHS) established the Office for Interoperability and Compatibility (OIC) in 2004 to strengthen and integrate interoperability and compatibility efforts to improve local, tribal, state, and Federal emergency response and preparedness. Managed by the Science and Technology Directorate, and housed within the Communication, Interoperability and Compatibility thrust area, OIC helps coordinate interoperability efforts across DHS. OIC programs and initiatives address critical interoperability and compatibility issues. Priority areas include communications, equipment, and training.

OIC Programs

OIC programs, which are the majority of Communication, Interoperability and Compatibility programs, address both voice and data interoperability. OIC is creating the capacity for increased levels of interoperability by developing tools, best practices, technologies, and methodologies that emergency response agencies can immediately put into effect. OIC is also improving incident response and recovery by developing tools, technologies, and messaging standards that help emergency responders manage incidents and exchange information in real time.

Practitioner-Driven Approach

OIC is committed to working in partnership with local, tribal, state, and Federal officials to serve critical emergency response needs. OIC's programs are unique in that they advocate a "bottom-up" approach. OIC's practitioner-driven governance structure gains from the valuable input of the emergency response community and from local, tribal, state, and Federal policy makers and leaders.

Long-Term Goals

- Strengthen and integrate homeland security activities related to research and development, testing and evaluation, standards, technical assistance, training, and grant funding.
- Provide a single resource for information about and assistance with voice and data interoperability and compatibility issues.
- Reduce unnecessary duplication in emergency response programs and unneeded spending on interoperability issues.
- Identify and promote interoperability and compatibility best practices in the emergency response arena.

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Publication Notice

Abstract

This document describes the Public Safety Architecture Framework (PSAF) communications data model, which supports the development of interoperable and interactive architectures using a structured approach and common methodologies for defining and resolving wireless public safety communications interoperability challenges.

Disclaimer

The U.S. Department of Homeland Security's Science and Technology Directorate serves as the primary research and development arm of the Department, using our Nation's scientific and technological resources to provide local, state, and Federal officials with the technology and capabilities to protect the homeland. Managed by the Science and Technology Directorate, the Office for Interoperability and Compatibility (OIC) is assisting in the coordination of interoperability efforts across the Nation.

Change Log

Version	Date	Changes
1.0	December 2007	PSAF Volume III initial document.

Acknowledgements

OIC extends its sincere appreciation to the many public safety practitioners, individuals, and government organizations that directly contributed to the creation of the PSAF communications data model.

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Executive Summary

The Office for Interoperability and Compatibility's (OIC's) process for identifying and developing standards began with the Public Safety Statement of Requirements (PS SoR) [1]. (Appendix B lists footnoted references.) Those requirements are driving the vision for a migration from current *as-is* architectures to future *to-be* interoperable public safety communications enterprise architecture. The Public Safety Architecture Framework (PSAF) provides an industry-validated enterprise architecture methodology. Its purpose is to help plan and develop the migration from current public safety architectures to interoperable systems as outlined in the PS SoR.

PSAF Methodology

Two documents describe and reflect the PSAF methodology:

- *PSAF Volume I* [2] provides definitions, guidelines, and related background material.
- *PSAF Volume II* [3] contains detailed descriptions of the three PSAF views and the products that create each of the views.
  - Operational View—Shows how public safety performs its mission.
  - Systems View—Shows the systems of equipment and flow of information that support public safety.
  - Technical Standards View—Shows the technical rules and guidelines allowing these systems to interoperate.

PSAF Volume I and *PSAF Volume II* draw upon the organization and discussion of architecture principles and concepts published in Department of Defense Architecture Framework (DoDAF) [4] documents.

PSAF Communications Data Model

PSAF Volume III draws upon the experience of numerous subject matter experts in public safety radio systems, as well as the findings resulting from the PSAF trial [5] and PSAF pilot [6]. The PSAF trial and PSAF pilot were key precursors for the creation of *PSAF Volume III*. During the trial, the PSAF team identified the attributes necessary to characterize a single land mobile radio (LMR) system. During the pilot, the PSAF team identified the attributes necessary to characterize two potentially compatible LMR systems.

PSAF Volume III describes key data elements that can be used to characterize a public safety land mobile radio system, a dispatch system, and a public safety organization. This is the first step in the development of a comprehensive public safety communications data model that can be linked back into the three PSAF views and products described in detail in *PSAF Volume II*.

Organization of this Volume

Volume III includes the following sections:

Section 1 **Introduction** describes the purpose and audience of the PSAF, potential uses of the PSAF communications data model and plans for its continued evolution.

Section 2	**Radio System Data Model Diagram** provides a visual diagram of the communications data model and the relationships between entities.
Section 3	**Radio System Data Entity and Attribute Definition** describes the PSAF communications data model data elements by providing a definition of each data entity and attribute.
Section 4	**Analysis Example** gives an example of a simplified analysis of two LMR subscriber units using a portion of the PSAF communications data model.
Appendix A	**Glossary** lists the terminology and acronyms in this document.
Appendix B	**References** identifies prior publications this document references.

Contents

Figures

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Tables

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1 Introduction

The Public Safety Architecture Framework (PSAF) adapts industry-validated enterprise architecture methodologies to assess current public safety communication systems as well as to plan for future system capabilities. During day-to-day or emergency operations, it is critical that public safety police, fire, and emergency medical service (EMS) responders can communicate within their agency, as well as communicate (or interoperate) with responders from different agencies or jurisdictions that may use different land mobile radio (LMR) systems.

The PSAF vision was laid out in *PSAF Volume I*, [2] *PSAF Volume II*, [3] and the Public Safety Statement of Requirements (PS SoR) [1]. These three documents identify the communications interoperability challenges related to public safety. *PSAF Volume III* provides a communications data model, which is the first step towards fully defining the data required to build the views and products defined in *PSAF Volume II*.

PSAF Volume III presents compatibility business rules from three perspectives based on lessons learned from the PSAF trial [5] and pilot efforts [6]. The PSAF trial investigated the attributes necessary to characterize a single public safety LMR system, whereas the PSAF pilot identified the attributes necessary to characterize compatibility from subscriber unit (SU)-to-SU, SU-to-system, and system-to-system.

PSAF Volume III presents what will become a larger set of data entities along with their attributes, covering one area in this first version: LMR systems. Examples of other PSAF areas to cover are organizational and governance entities, geographical entities, and system acquisition entities.

1.1 Purpose

The communications data model presented here is the first step towards building a capability to capture and analyze public safety communications from a holistic perspective. The first portion of this effort is focused on the Technology element of the SAFECOM Interoperability Continuum [7]. Detailing public safety agency organization for the Governance element of the Continuum is under development in the communications data model. The communications data model will grow to encompass other elements of the continuum (i.e., Standard Operating Procedures, Training & Exercises, and Usage) as needs dictate.

Initially, the complexity of system analysis that is possible with the communications data model remains simple, where in many cases the use of such a complex communications data model will not be needed to perform an interoperability analysis between systems. However, as the complexity of the system under review grows, so does the capability and utility of this scalable communications data model. For example, as the communications data model leverages the methodology described in PSAF Volumes I and II to capture and share communications information across multiple public safety agencies, it, will enable comprehensive assessment of compatibility and interoperability amongst those agencies involved.

1.2 Audience

This third volume of the PSAF provides a detailed description of the data entities and supporting attributes for inter-system analysis for a technical audience, with some ability in data modeling, database administration, and data analysis.

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2 Radio System Data Model Diagram

This section presents a diagram of the radio system portion of the PSAF communications data model. This data model provides a detailed reflection of the information necessary to define a public safety radio system. This radio system definition becomes the basis for which logical database design, physical database design, and database creation can occur, assisting the gathering and analysis of radio system data.

The radio system data model diagram is not intended to represent an exhaustive view of public safety communications. Rather it is the first, and least complicated, of a series of data model diagrams that will provide a holistic understanding of public safety communications, from an operational, system, and technical standards perspective.

While the diagram presented here is not the complete view of the radio system data architecture, which would be cumbersome to reproduce in a document, it offers a good view of the larger and more important entities and relationships of the radio system architecture.

Lastly, this diagram is expected to mature over time, to incorporate more complicated components of a public safety radio system, such as connections to bridging devices, to non-public safety networks such as the PSTN (public switched telephone network) or the Internet, and back-office systems for public safety, such as criminal information sharing systems for law enforcement.

Figure 1: Radio System Data Model Diagram (Upper Left)

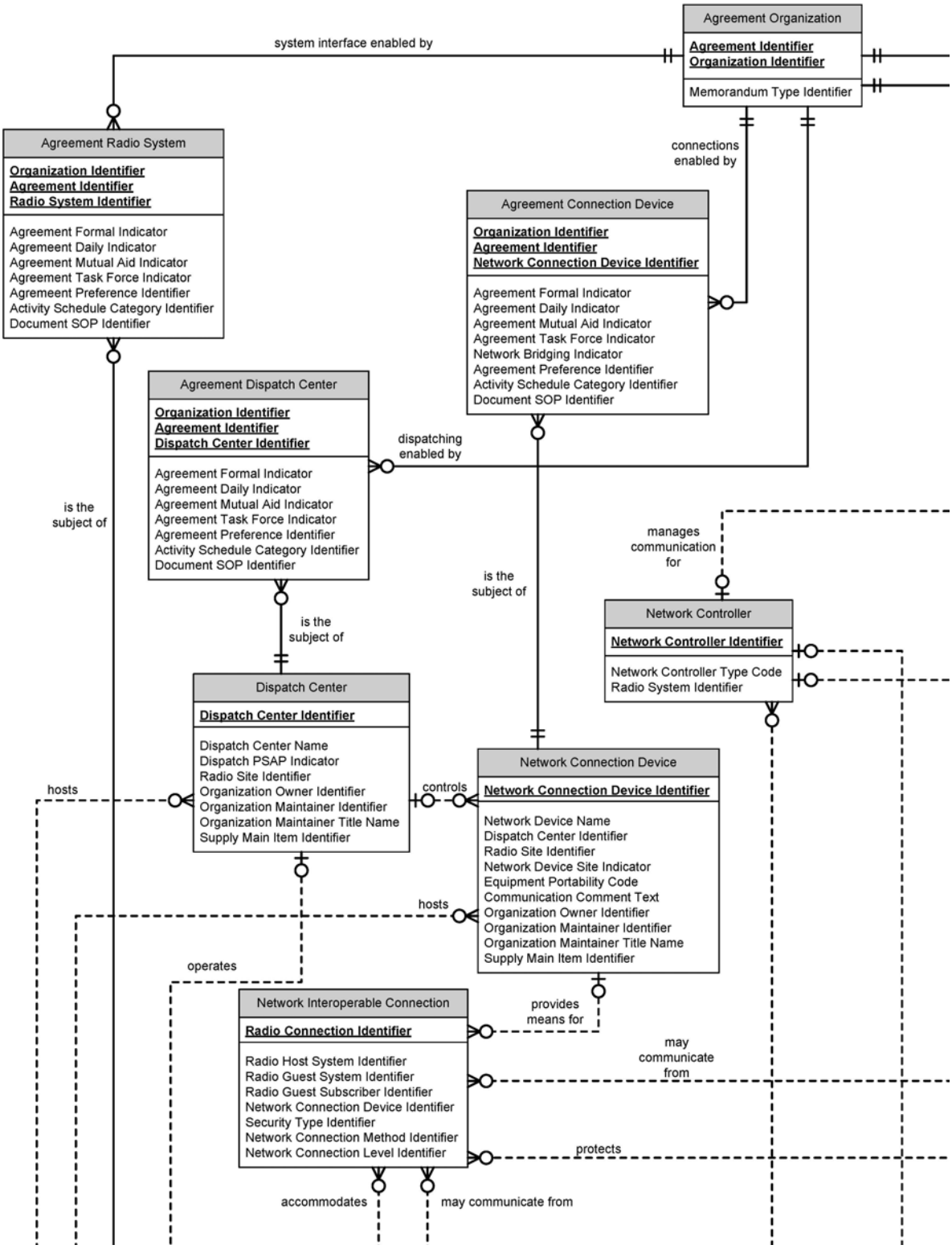


Figure 2: Radio System Data Model Diagram (Upper Right)

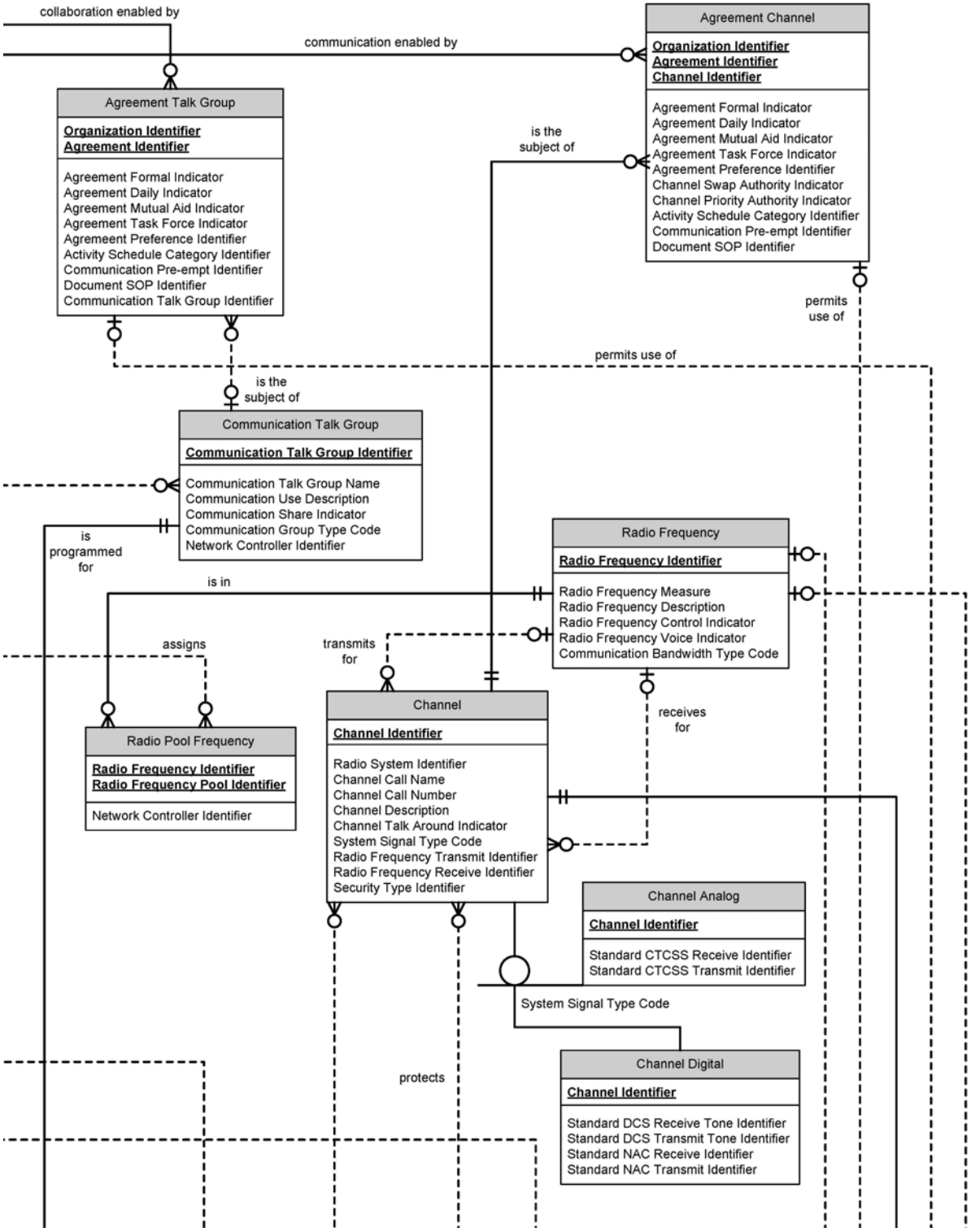


Figure 3: Radio System Data Model Diagram (Lower Left)

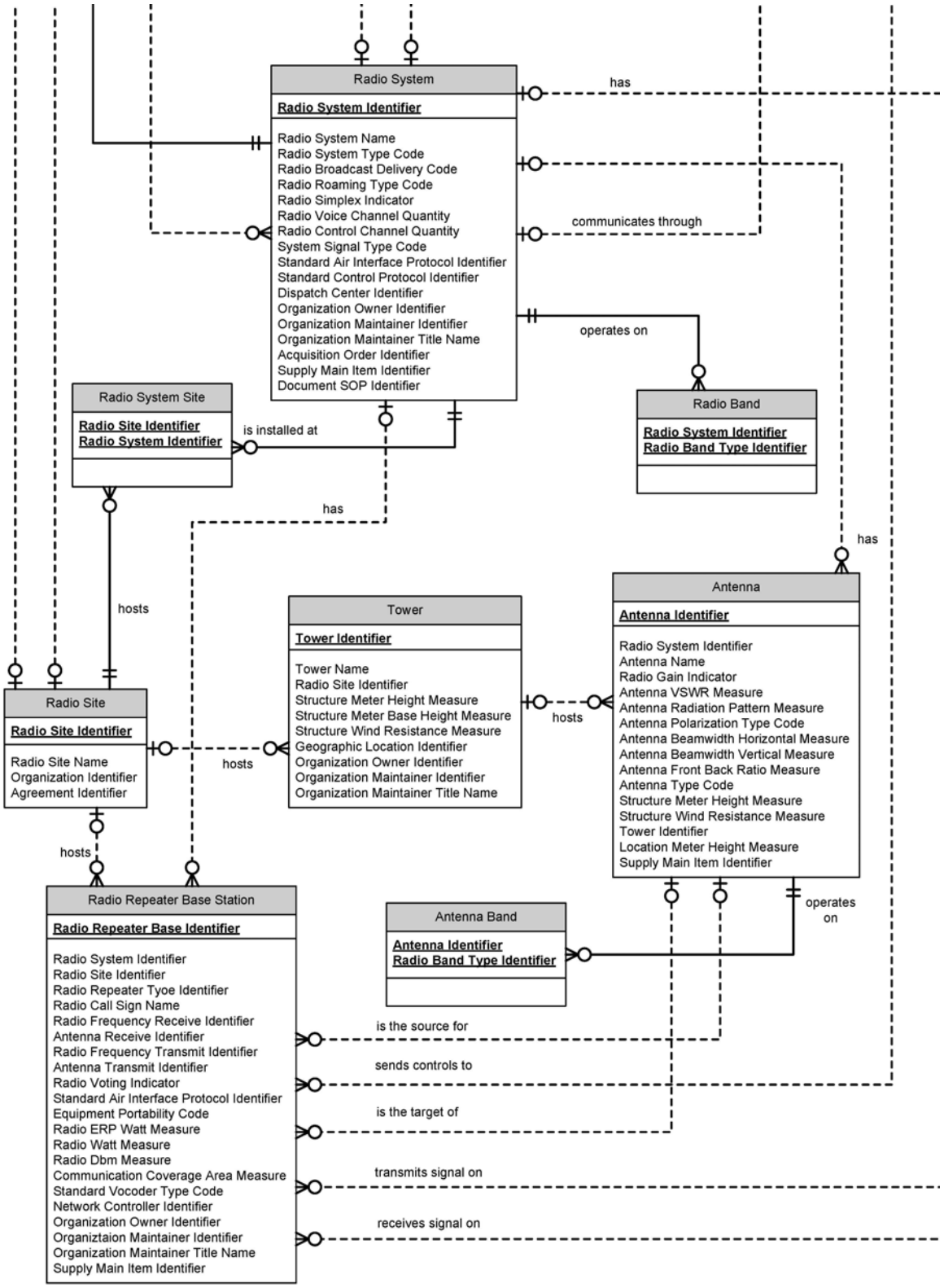
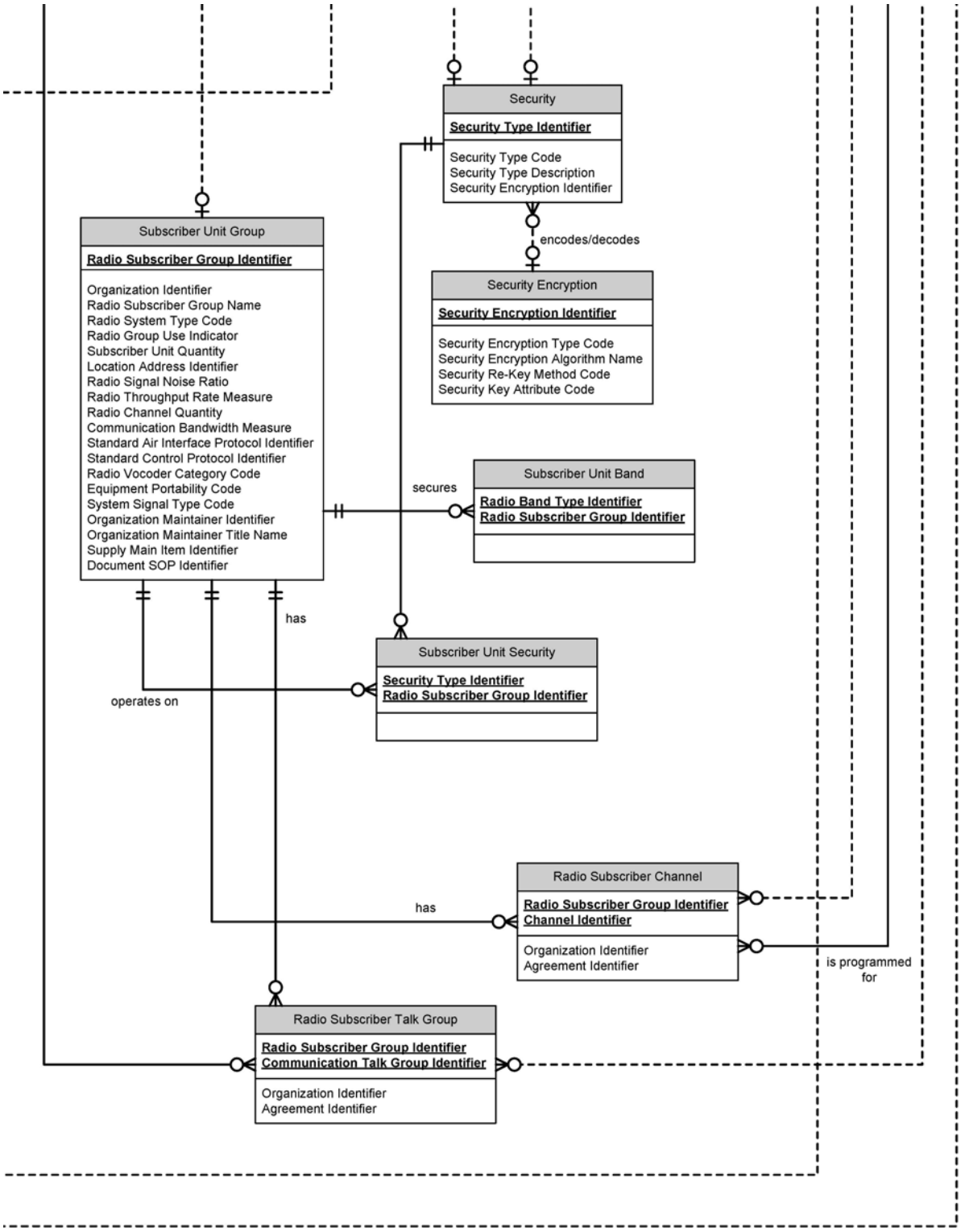


Figure 4: Radio System Data Model Diagram (Lower Right)



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3 Radio System Data Entity and Attribute Definition

This section provides a detailed description of each data entity and its attributes that together describe the radio system data model. Readers may note the duplication of attributes where they are included in multiple entities illustrated in the radio system data model diagram. This attribute duplication has been followed in this section as well, to provide complete data entity and attribute definitions.

3.1 Agreement Channel

The Agreement Channel entity holds facts about an agreement for the potential shared use of communication frequencies.

Table 1: Agreement Channel

Entity Attribute Name	Entity Attribute Definition
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Channel Identifier	Channel Identifier is a unique number representing a frequency configuration of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Agreement Formal Indicator	Agreement Formal Indicator represents the degree of governed commitment on shared use of a communication tool. Possible conditions: Informal Formal
Agreement Daily Indicator	Agreement Daily Indicator represents whether the shared use of a communication tool is expected day to day. Possible conditions: Yes Null
Agreement Mutual Aid Indicator	Agreement Mutual Aid Indicator represents whether the shared use of a communication tool is deployed to meet needs for mutual aid. Possible conditions: Yes Null

Table 1: Agreement Channel (Continued)

Entity Attribute Name	Entity Attribute Definition
Agreement Task Force Indicator	Agreement Task Force Indicator represents whether the shared use of a communication tool is deployed to meet needs defined by a given task force. Possible conditions: Yes Null
Agreement Preference Identifier	Agreement Preference Identifier is a unique number that represents a classification of when something is to be used.
Channel Swap Authority Indicator	Channel Swap Authority Indicator represents authorization for ordering a channel swap to alleviate the continuing interference and improve radio transmission.
Channel Priority Authority Indicator	Channel Priority Authority Indicator represents authorization for ordering the precedence of radio transmission related to the delivery of public safety services.
Activity Schedule Category Identifier	Activity Schedule Category Identifier is a unique number that represents a category of when something might happen. For example: Daily Bi-weekly Weekly Bi-monthly Monthly Quarterly Annually Incidental
Communication Preempt Identifier	Communication Preempt Identifier uniquely represents a class of circumstance when a given resource can be acquired or appropriated by an organization.
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.2 Agreement Connection Device

The Agreement Connection Device entity holds facts about an agreement for the potential shared use of hardware or software that eases communication with another network. This entity includes agreement facts about devices such as gateways, cross-band repeaters, protocol translators, impedance matching devices,

rate converters, fault isolators, or signal translators as necessary to provide interoperability between systems.

Table 2: Agreement Connection Device

Entity Attribute Name	Entity Attribute Definition
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Network Connection Device Identifier	Network Connection Device Identifier uniquely represents software or hardware that enables communication between computer networks that use different communications protocols.
Agreement Formal Indicator	Agreement Formal Indicator represents the degree of governed commitment on shared use of a communication tool. Possible conditions: Informal Formal
Agreement Daily Indicator	Agreement Daily Indicator represents whether the shared use of a communication tool is expected day to day. Possible conditions: Yes Null
Agreement Mutual Aid Indicator	Agreement Mutual Aid Indicator represents whether the shared use of a communication tool is deployed to meet needs for mutual aid. Possible conditions: Yes Null
Agreement Task Force Indicator	Agreement Task Force Indicator represents whether the shared use of a communication tool is deployed to meet needs defined by a given task force. Possible conditions: Yes Null
Network Bridging Indicator	Network Bridging Indicator represents whether a network bridge exists to connect multiple network segments at the data link layer (layer 2) of the OSI model. Bridges are similar to repeaters or network hubs, devices that connect network segments at the physical layer.

Table 2: Agreement Connection Device (Continued)

Entity Attribute Name	Entity Attribute Definition
Agreement Preference Identifier	Agreement Preference Identifier is a unique number that represents a classification of when something is to be used.
Activity Schedule Category Identifier	Activity Schedule Category Identifier is a unique number that represents a category of when something might happen. For example: Daily Bi-weekly Weekly Bi-monthly Monthly Quarterly Annually Incidental
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.3 Agreement Dispatch Center

The Agreement Dispatch Center entity holds facts about an agreement for the potential shared use of a public safety dispatch center.

Table 3: Agreement Dispatch Center

Entity Attribute Name	Entity Attribute Definition
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Dispatch Center Identifier	Dispatch Center Identifier is a unique identifier for a set of instruments in an emergency response system that automates the process of dispatching assistance in response to calls for police, fire response, emergency medical service (EMS), or other public safety services.
Agreement Formal Indicator	Agreement Formal Indicator represents the degree of governed commitment on shared use of a communication tool. Possible conditions: Informal Formal

Table 3: Agreement Dispatch Center (Continued)

Entity Attribute Name	Entity Attribute Definition
Agreement Daily Indicator	Agreement Daily Indicator represents whether the shared use of a communication tool is expected day to day. Possible conditions: Yes Null
Agreement Mutual Aid Indicator	Agreement Mutual Aid Indicator represents whether the shared use of a communication tool is deployed to meet needs for mutual aid. Possible conditions: Yes Null
Agreement Task Force Indicator	Agreement Task Force Indicator represents whether the shared use of a communication tool is deployed to meet needs defined by a given task force. Possible conditions: Yes Null
Communication Recording Indicator	Communication Recording Indicator represents whether rights to record communication traffic is granted. Possible conditions: Yes Null
Agreement Preference Identifier	Agreement Preference Identifier is a unique number that represents a classification of when something is to be used.
Activity Schedule Category Identifier	Activity Schedule Category Identifier is a unique number that represents a category of when something might happen. For example: Daily Bi-weekly Weekly Bi-monthly Monthly Quarterly Annually Incidental

Table 3: Agreement Dispatch Center (Continued)

Entity Attribute Name	Entity Attribute Definition
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.4 Agreement Organization

The Agreement Organization entity associates the organizations with their interoperability agreements.

Table 4: Agreement Organization

Entity Attribute Name	Entity Attribute Definition
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Memorandum Type Identifier	Memorandum Type Identifier represents the particular type of agreement mechanism used between two agencies, such as a Memorandum of Understanding or a Memorandum of Agreement.

3.5 Agreement Radio System

The Agreement Radio System entity holds facts about an agreement for the potential shared use of a public safety radio system.

Table 5: Agreement Radio System

Entity Attribute Name	Entity Attribute Definition
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.
Agreement Formal Indicator	Agreement Formal Indicator represents the degree of governed commitment on shared use of a communication tool. Possible conditions: Informal Formal

Table 5: Agreement Radio System (Continued)

Entity Attribute Name	Entity Attribute Definition
Agreement Daily Indicator	Agreement Daily Indicator represents whether the shared use of a communication tool is expected day to day. Possible conditions: Yes Null
Agreement Mutual Aid Indicator	Agreement Mutual Aid Indicator represents whether the shared use of a communication tool is deployed to meet needs for mutual aid. Possible conditions: Yes Null
Agreement Task Force Indicator	Agreement Task Force Indicator represents whether the shared use of a communication tool is deployed to meet needs defined by a given task force. Possible conditions: Yes Null
Agreement Preference Identifier	Agreement Preference Identifier is a unique number that represents a class of preference.
Activity Schedule Category Identifier	Activity Schedule Category Identifier is a unique number that represents a category of when something might happen. For example: Daily Bi-weekly Weekly Bi-monthly Monthly Quarterly Annually Incidental
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.6 Agreement Talk Group

The Agreement Talk Group entity holds facts about a public safety organization agreement for the potential shared use of a prescribed set of voice (talk group) traffic on a trunked mobile radio system.

Table 6: Agreement Talk Group

Entity Attribute Name	Entity Attribute Definition
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Agreement Formal Indicator	Agreement Formal Indicator represents the degree of governed commitment on shared use of a communication tool. Possible conditions: Informal Formal
Agreement Daily Indicator	Agreement Daily Indicator represents whether the shared use of a communication tool is expected day to day. Possible conditions: Yes Null
Agreement Mutual Aid Indicator	Agreement Mutual Aid Indicator represents whether the shared use of a communication tool is deployed to meet needs for mutual aid. Possible conditions: Yes Null
Agreement Task Force Indicator	Agreement Task Force Indicator represents whether the shared use of a communication tool is deployed to meet needs defined by a given task force. Possible conditions: Yes Null
Agreement Preference Identifier	Agreement Preference Identifier is a unique number that represents a classification of when something is to be used.
Communication Talk Group Identifier	Communication Talk Group Indicator is a unique identifier for a prescribed set of voice (talk group) traffic on a trunked mobile radio system.

Table 6: Agreement Talk Group (Continued)

Entity Attribute Name	Entity Attribute Definition
Activity Schedule Category Identifier	Activity Schedule Category Identifier is a unique number that represents a category of when something might happen. For example: Daily Bi-weekly Weekly Bi-monthly Monthly Quarterly Annually Incidental
Communication Preempt Identifier	Communication Preempt Identifier uniquely represents a class of circumstance when a given resource can be acquired or appropriated by an organization.
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.7 Antenna

The Antenna entity holds data about an antenna structure, which is a transducer designed to transmit or receive radio waves. Antennas convert radio frequency electrical currents into electromagnetic waves and vice versa. They are used in public safety radio broadcasting, point-to-point radio communication, and wireless transmissions.

Table 7: Antenna

Entity Attribute Name	Entity Attribute Definition
Antenna Identifier	Antenna Identifier is a number that uniquely represents a radio transmission antenna.
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.
Antenna Name	Antenna Name is a recognized label that represents a specific radio transmission antenna.

Table 7: Antenna (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Gain Indicator	Radio Gain Indicator represents the directionality of a given antenna. An antenna with a low gain emits radiation in all directions equally, whereas a high-gain antenna will preferentially radiate in particular directions. Possible values: Omni-directional Directional
Antenna VSWR Measure	Antenna Voltage Standing Wave Ratio (VSWR) Measure is a ratio of the voltage being supplied to an antenna feed line to the voltage being reflected back down the feed line to the source by the antenna. A low VSWR rating over a specified frequency range usually identifies an antenna that is efficient at transferring power from the feed line to the atmosphere over the specified frequency range. A high VSWR as measured at a transmitter most likely indicates incorrect, mismatched, poorly tuned, or defective feed line system components.
Antenna Radiation Pattern Measure	Antenna Radiation Pattern Measure is the relative field strength transmitted from or received by the antenna. Antenna radiation patterns are taken at one frequency, one polarization, and one plane cut. The patterns are usually presented in polar or rectilinear form with a dB strength scale. Patterns are normalized to the maximum graph value, 0 dB, and directivity is given for the antenna. This means that if the sidelobe level from the radiation pattern were down -13 dB, and the directivity of the antenna was 4 dB, then the sidelobe gain would be -9 dB.
Antenna Polarization Type Code	Antenna Polarization Type Code represents how a radio transmitting and/or receiving antennas is polarized, special use of which is made in radar. Most antennas radiate either horizontal, vertical, or circular polarization (although elliptical polarization also exists). The electric field or E-plane determines the polarization or orientation of the radio wave. Vertical polarization is most often used when it is desired to radiate a radio signal in all directions such as widely distributed mobile units. AM and FM radio uses vertical polarization. Possible values: Horizontal Vertical Circular
Antenna Beamwidth Horizontal Measure	Antenna Beamwidth Horizontal Measure refers to the width of the antenna's beam along a plane that is parallel to the horizon. (Vertical beamwidth refers to the height of the antenna's beam along a plane that is perpendicular to the horizon.) Since beamwidth is expressed in degrees, the actual size of the antenna's coverage area increases as you get further from the antenna—just like the circumference of a circle increases as its radius increases.

Table 7: Antenna (Continued)

Entity Attribute Name	Entity Attribute Definition
Antenna Beamwidth Vertical Measure	Antenna Beamwidth Vertical Measure refers to the height of the antenna's beam along a plane that is perpendicular to the horizon. (Horizontal Measure refers to the width of the antenna's beam along a plane that is parallel to the horizon.) Since beamwidth is expressed in degrees, the actual size of the antenna's coverage area increases as you get further from the antenna—just like the circumference of a circle increases as its radius increases.
Antenna Front Back Ratio Measure	Antenna Front Back Ratio Measure is the gain in a specified direction, i.e., azimuth, usually that of maximum gain, compared to the gain in a direction 180 degrees from the specified azimuth. A front-to-back ratio is usually expressed in decibels (dB).
Antenna Type Code	Antenna Type Code represents whether an antenna is deployed as a receiver or transmitter antenna. Possible values: Receiver Transmitter Both (Receiver and Transmitter)
Structure Meter Height Measure	Structure Meter Height Measure is the distance from the base of a structure to the top, expressed in meters.
Structure Wind Resistance Measure	Antenna Wind Resistance Measure represents the certification measure of the overall structural integrity of the antenna to meet the wind resistance requirements.
Tower Identifier	Tower Identifier uniquely represents a structure designed to support antennas (also known as aerials) for telecommunications and broadcasting.
Location Meter Height Measure	Location Meter Height Measure represents a point in the height of a supporting structure.
Supply Main Item Identifier	Supply Item Identifier is a unique identifier for a product or service.

3.8 Antenna Band

The Antenna Band entity holds facts about an antenna's range of operation on a section (band) of the radio communication spectrum, where frequencies are usually used or set aside for the same purpose. Example radio bands are: VHF High, VHF Low, UHF, 700 MHz, and 800 MHz.

Table 8: Antenna Band

Entity Attribute Name	Entity Attribute Definition
Antenna Identifier	Antenna Identifier is a number that uniquely represents a radio transmission antenna.

Table 8: Antenna Band (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Band Type Identifier	Radio Band Type Identifier uniquely represents a section of the spectrum of radio communication frequencies, in which channels are usually used or set aside for the same purpose.

3.9 Channel

The Channel entity holds facts about frequencies for one-way or two-way communication from or to a transmitter.

Table 9: Channel

Entity Attribute Name	Entity Attribute Definition
Channel Identifier	Channel Identifier is a unique number representing a frequency configuration of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.
Channel Call Name	Channel Call Name is a label representing a frequency pair of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Channel Call Number	Channel Call Number is a measurable position on a tuning device instrument panel that represents frequency for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Channel Description	Channel Description is a brief sketch about a frequency band of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or text communication.
Channel Talk Around Indicator	Channel Talk Around Indicator represents whether a channel is used in "Talk Around" mode. Public Safety Agencies may designate specific radio frequencies as a "Talk Around Channel. Such channels have no repeating capability, thus limiting their transmitting range usually to a quarter mile or less. This allows emergency personnel to communicate freely with each other without fear of overloading the entire communication system. Possible Conditions: T—Talk Around Null—Not for Talk Around

Table 9: Channel (Continued)

Entity Attribute Name	Entity Attribute Definition
System Signal Type Code	System Signal Type Code represents the signal class. Possible values: Analog Digital Both
Radio Frequency Transmit Identifier	Radio Frequency Identifier is a unique number representing a frequency of alternating current electrical signals used to produce and detect radio waves.
Radio Frequency Receive Identifier	Radio Frequency Receive Identifier is a unique number representing a frequency of alternating current electrical signals used to produce and detect radio waves.
Security Type Identifier	Security Type Identifier uniquely represents a class of protective control.

3.10 Channel Analog

The Channel Analog entity holds data about a channel that carries a signal with varying frequencies for voice or video communication. It is a subtype of the Channel supertype.

Table 10: Channel Analog

Entity Attribute Name	Entity Attribute Definition
Channel Identifier	Channel Identifier is a unique number representing a frequency configuration of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Standard CTCSS (Continuous Tone-Coded Squelch System) Receive Identifier	Standard CTCSS Tone Identifier is a unique number representing a tone used to aid the routing of a received or transmitted analog voice signal and in the elimination of interference from other signals on the same frequency.
Standard CTCSS Transmit Identifier	Standard CTCSS Tone Identifier is a unique number representing a tone used to aid the routing of a received or transmitted analog voice signal and in the elimination of interference from other signals on the same frequency.

3.11 Channel Digital

The Channel Digital entity holds data about a channel that carries digital signals for voice, data, or video communication. It is a subtype of the Channel supertype.

Table 11: Channel Digital

Entity Attribute Name	Entity Attribute Definition
Channel Identifier	Channel Identifier is a unique number representing a frequency configuration of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Standard DCS (Digital Coded Squelch) Receive Tone Identifier	Standard DCS Receive Tone Identifier is a unique identifier for a tone.
Standard DCS Transmit Tone Identifier	Standard DCS Transmit Tone Identifier is a unique identifier for a tone.
Standard NAC (Network Access Code) Receive Identifier	Standard NAC Identifier is a unique number that represents a code used to permit the routing of a received or transmitted digital signal.
Standard NAC Transmit Identifier	Standard NAC Identifier is a unique number that represents a code used to permit the routing of a received or transmitted digital signal.

3.12 Communication Talk Group

The Communication Talk Group entity holds facts about a prescribed set of voice (talk group) traffic on a trunked mobile radio system. In trunked radio systems, units are separated into virtual groups by the embedded radio system logic, and frequency assignments are controlled by a computer and software. These virtual groups are referred to as “talk groups,” “fleet,” or “subfleet.” They can be thought of as virtual channels that appear and disappear as conversations occur.

Table 12: Communication Talk Group

Entity Attribute Name	Entity Attribute Definition
Communication Talk Group Identifier	Communication Talk Group Identifier is a unique identifier for a prescribed set of voice (talk group) traffic on a trunked mobile radio system.
Communication Talk Group Name	Communication Talk Group Name is a label for a prescribed set of voice (talk group) traffic on a trunked mobile radio system.
Communication Use Description	A Communication Use Description is a brief narrative about the nature of intended use of a prescribed set of voice (talk group) traffic on a trunked mobile radio system.
Communication Share Indicator	Communication Share Indicator represents whether a communication facility is available for shared use.

Table 12: Communication Talk Group (Continued)

Entity Attribute Name	Entity Attribute Definition
Communication Group Type Code	Communication Group Type Code represents a classification of the purpose of a talk group. Examples are: Emergency (monitored by dispatch center) Non-emergency (general information sharing) Backup (in the event of a repeater failure) Command Center (in event leaders' communication)
Network Controller Identifier	Network Controller Identifier uniquely represents a device circuitry necessary to interpret and execute instructions through an input/output device.

3.13 Dispatch Center

The Dispatch Center entity holds data about a set of instruments and suite of software packages used to manage public safety calls for service, for dispatch service, and to maintain the status of responding resources in the field. The entity represents an emergency communications operation, including call-takers, and 911 operators in a centralized, public-safety call center.

Table 13: Dispatch Center

Entity Attribute Name	Entity Attribute Definition
Dispatch Center Identifier	Dispatch Center Identifier is a unique identifier for a set of instruments in an emergency response system that automates the process of dispatching assistance in response to calls for police, fire response, emergency medical service (EMS), or other public safety services.
Dispatch Center Name	Dispatch Center Name is a commonly recognized label used by operations personnel for a dispatch center.
Dispatch PSAP (Public Safety Answering Point) Indicator	Dispatch PSAP Indicator represents whether a facility is sponsored by a PSAP, which is an agency, typically county or city controlled, that is responsible for answering 9-1-1 calls for emergency assistance from police, fire response, and ambulance services. Possible Values: PSAP—Indicating public sponsorship Null—Indicating non-public sponsorship
Radio Site Identifier	Radio Site Identifier is a unique identifier for a physical location where elements of a radio system or related infrastructure and equipment are located.
Organization Owner Identifier	Organization Owner Identifier uniquely represents an agency or bureau unit that performs a public safety service.

Table 13: Dispatch Center (Continued)

Entity Attribute Name	Entity Attribute Definition
Organization Maintainer Identifier	Organization Maintainer Identifier uniquely represents a particular capability (a facility, a piece of equipment, supply, support, or aid) that can be readily drawn upon when needed for the delivery of public safety services and communication.
Organization Maintainer Title Name	Organization Maintainer Title Name is the job title of an individual that participates in the delivery of public safety services. For example: Police Officer Firefighter Police Chief Fire Chief Dispatcher EMS Supervisor Precinct Commander Police Commissioner
Supply Main Item Identifier	Supply Item Identifier is a unique identifier for a product or service.

3.14 Network Connection Device

The Network Connection Device entity holds data about an element in a communications network that eases communication with another network, including devices such as gateways, cross-band repeaters, protocol translators, impedance matching devices, rate converters, fault isolators, or signal translators as necessary to provide interoperability between systems.

Table 14: Network Connection Device

Entity Attribute Name	Entity Attribute Definition
Network Connection Device Identifier	Network Connection Device Identifier uniquely represents software or hardware that enables communication between computer networks that use different communications protocols.
Network Device Name	Network Device Name is the commonly referenced label for a specific set of protocol interpretation/conversion hardware or software.
Dispatch Center Identifier	Dispatch Center Identifier is a unique identifier for a set of instruments in an emergency response system that automates the process of dispatching assistance in response to calls for police, fire response, emergency medical service (EMS), or other public safety services.
Radio Site Identifier	Radio Site Identifier is a unique identifier for a physical location where elements of a radio system or related infrastructure and equipment are located.

Table 14: Network Connection Device (Continued)

Entity Attribute Name	Entity Attribute Definition
Network Device Site Indicator	Network Device Site Indicator represents the primary placement of a communication device. Possible indicators are: Fixed (base station, repeater, or other infrastructure) Mobile (vehicle radio)
Equipment Portability Code	Equipment Portability Code classifies the place of use category of a piece of equipment. Examples: Mobile (vehicle radio) Portable (hand-held radio) Fixed (base station, repeater, or other infrastructure)
Communication Comment Text	Communication Comment Text is information relevant to operation of a hardware or software device that is used in the delivery of public safety communications.
Organization Owner Identifier	Organization Owner Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Organization Maintainer Identifier	Organization Maintainer Identifier uniquely represents a particular capability (a facility, a piece of equipment, supply, support, or aid) that can be readily drawn upon when needed for the delivery of public safety services and communication.
Organization Maintainer Title Name	Organization Maintainer Title Name is the job title of an individual that participates in the delivery of public safety services. For example: Police Officer Firefighter Police Chief Fire Chief Dispatcher EMS Supervisor Precinct Commander Police Commissioner
Supply Main Item Identifier	Supply Main Item Identifier is a unique identifier for a product or service.

3.15 Network Controller

The Network Controller holds data about the key component of a peripheral device, as a terminal, printer, or external storage unit, which contains the circuitry necessary to interpret and execute instructions fed into the device.

Table 15: Network Controller

Entity Attribute Name	Entity Attribute Definition
Network Controller Identifier	Network Controller Identifier uniquely represents a device circuitry necessary to interpret and execute instructions through an input/output device.
Network Controller Type Code	Network Controller Type Code represents a functional category of circuitry necessary to interpret and execute instructions fed into an input/output device. Examples are: Site Controller Master Controller Zone Controller
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.

3.16 Network Interoperable Connection

The Network Interoperable Connection entity holds facts about a system to system interoperable connection. A connecting party may be communicating from a remote radio system or remote subscriber unit.

Table 16: Network Interoperable Connection

Entity Attribute Name	Entity Attribute Definition
Radio Connection Identifier	Radio Connection Identifier uniquely represents an interoperable connection.
Radio Host System Identifier	Radio Host System Identifier is a unique identifier for a public safety radio system.
Radio Guest System Identifier	Radio Guest System Identifier is a unique identifier for a public safety radio system.
Radio Guest Subscriber Identifier	Radio Guest Subscriber Identifier is a unique number that represents a set of radio devices (Subscriber Units).
Network Connection Device Identifier	Network Connection Device Identifier uniquely represents software or hardware that enables communication between computer networks that use different communications protocols.

Table 16: Network Interoperable Connection (Continued)

Entity Attribute Name	Entity Attribute Definition
Network Connection Method Identifier	Network Connection Method Identifier uniquely represents an interconnection approach. Possible values: Console patch RFSS interface P25 ISSI VoIP
Network Connection Level Identifier	Network Connection Level Identifier represents a class of connection capability and reflects the capability for communication. For example: One-way audio Two-way communication
Security Type Identifier	Security Type Identifier uniquely represents a class of protective control.

3.17 Radio Band

The Radio Band entity holds facts about a radio system's range of operation on a section (band) of the radio communication spectrum, where frequencies are usually used or set aside for the same purpose. Example radio bands are: VHF High, VHF Low, UHF, 700 MHz, and 800 MHz.

Table 17: Radio Band

Entity Attribute Name	Entity Attribute Definition
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.
Radio Band Type Identifier	Radio Band Type Identifier uniquely represents a section of the spectrum of radio communication frequencies, in which channels are usually used or set aside for the same purpose.

3.18 Radio Frequency

The Radio Frequency entity holds facts about a frequency available in a radio system.

Table 18: Radio Frequency

Entity Attribute Name	Entity Attribute Definition
Radio Frequency Identifier	Radio Frequency Identifier is a unique number representing a frequency of alternating current electrical signals used to produce and detect radio waves.

Table 18: Radio Frequency (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Frequency Measure	Radio Frequency Measure is a frequency in the range within which radio waves may be transmitted, from about 3 kHz to about 300,000 mHz.
Radio Frequency Description	Radio Frequency Description is a brief narrative about the typical use of a frequency in the range of radio waves, from about 3 kHz to about 300,000 mHz.
Radio Frequency Control Indicator	Radio Frequency Control Indicator represents whether a frequency is to be deployed as a control frequency for a trunked radio system. Possible values: C—Control Null
Radio Frequency Voice Indicator	Radio Frequency Voice Indicator represents whether a frequency is to be deployed as a voice frequency on a radio system. Possible values: V—Voice Null
Communication Bandwidth Type Code	Communication Bandwidth Type Code represents various methods used in the communications industry to design and assign frequencies to different wireless applications. Possible values: Wide Band Narrow Band

3.19 Radio Pool Frequency

The Radio Pool Frequency entity holds facts about a frequency in a “trunked radio system”. A trunked system constantly renegotiates the frequencies used for radio conversations. Instead of using each frequency pair for a dedicated purpose (like conventional radio system channels), frequencies are combined in a “pool” that can be shared among all radio system users. When someone wants to use the system, the request is handled by a central controller, which looks at the pool of frequency pairs, locates frequencies that are not currently in use, and temporarily assigns them to the radio subscriber making the

request. When that conversation is done, the frequencies are released, put back in the pool, and made available for the next need.

Table 19: Radio Pool Frequency

Entity Attribute Name	Entity Attribute Definition
Radio Frequency Pool Identifier	Radio Frequency Pool Identifier is a unique number that represents a set of radio frequencies.
Radio Frequency Identifier	Radio Frequency Identifier is a unique number representing a frequency of alternating current electrical signals used to produce and detect radio waves.
Network Controller Identifier	Network Controller Identifier uniquely represents a device circuitry necessary to interpret and execute instructions through an input/output device.

3.20 Radio Repeater Base Station

The Radio Repeater Base Station holds data about a device capable of receiving one-way or two-way communications signals and delivering corresponding signals that are amplified; the signal may also be reshaped. With most emergency dispatching systems, the repeater is synonymous with the base station, which performs both functions.

Table 20: Radio Repeater Base Station

Entity Attribute Name	Entity Attribute Definition
Radio Repeater Base Identifier	Radio Repeater Base Identifier uniquely represents a device capable of receiving one-way or two-way communications signals and delivering corresponding signals that are either amplified, reshaped, or both.
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.
Radio Site Identifier	Radio Site Identifier is a unique identifier for a physical location where elements of a radio system or related infrastructure and equipment are located.
Radio Repeater Type Identifier	Radio Base Repeater Type Identifier uniquely represents a class of radio repeaters.
Radio Call Sign Name	Radio Call Sign Name is a unique designation for a transmitting station. In broadcasting and radio communications, a call sign may also be known as a callsign or call letters, or abbreviated as a call.
Radio Frequency Receive Identifier	Radio Frequency Receive Identifier is a unique number representing a frequency of alternating current electrical signals used to produce and detect radio waves.
Antenna Receive Identifier	Antenna Receive Identifier is a number that uniquely represents a radio transmission antenna.

Table 20: Radio Repeater Base Station (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Frequency Transmit Identifier	Radio Frequency Transmit Identifier is a unique number representing a frequency of alternating current electrical signals used to produce and detect radio waves.
Antenna Transmit Identifier	Antenna Transmit Identifier is a number that uniquely represents a radio transmission antenna.
Radio Voting Indicator	Radio Voting Indicator represents whether a “voting” device is included in the configuration. Voting, in two-way radio systems is a method for improving talk-back range from walkie-talkie and vehicular mobile radios. The voting comparator performs an evaluation of all received signals and picks the most usable received signal. In repeater systems, the voted signal is retransmitted. In simplex systems, it goes to the console speaker at the base station. Audio from the receivers that are not voted is ignored. Voting comparators in analog FM systems can switch between receivers in tenths- or hundredths-of-a-second (faster than one syllable). So long as an intelligible signal gets to a single receiver in the system, the repeated audio, or audio sent to the console speaker, would be intelligible.
Standard Air Interface Protocol (AIP) Identifier	Standard Air Interface Protocol (AIP) Identifier is a unique number for a specific signal protocol that provides the means for radio-based communication links between the mobile radios and the active base stations. It may represent an AIP such as: Common Air Interface (P25) Enhanced Digital Access Communication System (EDACS) OpenSky SMARTnet SmartZone
Equipment Portability Code	Equipment Portability Code classifies the place of use category of a piece of equipment. Examples: Mobile (vehicle radio) Portable (hand-held radio) Fixed (base station, repeater, or other infrastructure)
Radio ERP (Effective Radiated Power) Watt Measure	Radio ERP Watt Measure represents Effective Radiated Power (ERP), which is determined by subtracting system losses from system gains. This is the amount of power that a radio station reports as its power, as in, “We're 100,000 watts of rock 'n' roll.”

Table 20: Radio Repeater Base Station (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Watt Measure	Radio Watt Measure is radio transmitter power output (TPO) and the actual amount of power (in watts) of radio frequency (RF) energy that a transmitter produces at its output. This is not the amount of power that a radio station reports as its power, as in "we're 100,000 watts of rock 'n' roll," which is usually the effective radiated power (ERP). The transmitter power output is normally less than the ERP.
Radio DBM (Decibels per Milliwatt) Measure	Radio DBM Measure represents decibels per milliwatt.
Communication Coverage Area Measure	Communication Coverage Area Measure represents the area within the broadcasting range of a network element.
Standard Vocoder Type Code	Standard Vocoder Type Code represents the class of vocoder (name derived from voice encoder), which is a speech analyzer and synthesizer. Its primary use is for secure radio communication, where voice has to be digitized, encrypted and then transmitted Example values are: IMBE—Improved Multi-Band Excitation EMBE—Enhanced Multiband Excitation Model
Network Controller Identifier	Network Controller Identifier uniquely represents a device circuitry necessary to interpret and execute instructions through an input/output device.
Organization Owner Identifier	Organization Owner Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Organization Maintainer Identifier	Organization Maintainer Identifier uniquely represents a particular capability (a facility, a piece of equipment, supply, support, or aid) that can be readily drawn upon when needed for the delivery of public safety services and communication.
Organization Maintainer Title Name	Organization Maintainer Title Name is the job title of an individual that participates in the delivery of public safety services. For example: Police Officer Firefighter Police Chief Fire Chief Dispatcher EMS Supervisor Precinct Commander Police Commissioner
Supply Main Item Identifier	Supply Item Identifier is a unique identifier for a product or service.

3.21 Radio Site

The Radio Site entity holds data about a physical site location that houses or hosts towers, antennas, controllers, base station repeaters, and other transmission equipment necessary for radio system operation.

Table 21: Radio Site

Entity Attribute Name	Entity Attribute Definition
Radio Site Identifier	Radio Site Identifier is a unique identifier for a physical location where elements of a radio system or related infrastructure and equipment are located.
Radio Site Name	Radio Site Name is a commonly recognized name for a physical place where elements of a radio system or related infrastructure and equipment are located.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Location Address Identifier	Location Address Identifier is a unique number that represents a place where a person, organization, or the like is located or may be reached.

3.22 Radio Subscriber Channel

The Radio Subscriber Channel entity holds data about a channel programmed into a group of radio subscriber units, as permitted by agreement or ownership.

Table 22: Radio Subscriber Channel

Entity Attribute Name	Entity Attribute Definition
Radio Subscriber Group Identifier	Radio Subscriber Group Identifier is a unique number that represents a set of radio devices (subscriber units).
Channel Identifier	Channel Identifier is a unique number representing a frequency configuration of sufficient width for one- or two-way communication from or to a transmitter used for television, radio, CB radio, telephone, or telegraph communication.
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.

3.23 Radio Subscriber Talk Group

The Radio Subscriber Talk Group entity identifies a set of radios to the system controller as a member(s) of a talk group. An instance of this entity confirms that a talk group has been programmed in the group of subscriber units.

Table 23: Radio Subscriber Talk Group

Entity Attribute Name	Entity Attribute Definition
Radio Subscriber Group Identifier	Radio Subscriber Group Identifier is a unique number that represents a set of radio devices (Subscriber Units).
Communication Talk Group Identifier	Communication Talk Group Indicator is a unique identifier for a prescribed set of voice (talk group) traffic on a trunked mobile radio system.
Agreement Identifier	Agreement Identifier uniquely represents an agreement between public safety organizations.
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.

3.24 Radio System

The Radio System entity holds data about a system that can both transmit and receive voice communication, specifically the radio system's options, configurations, and settings.

Table 24: Radio System

Entity Attribute Name	Entity Attribute Definition
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.
Radio System Name	Radio System Name is the commonly referenced label used by the operations personnel for the system.
Radio System Type Code	Radio System Type Code classifies how a radio system deploys available frequencies for public safety communication. There are three types: 1. Conventional 2. Trunked 3. Hybrid (conventional and trunked) “Trunked” radio systems use a pool of channels that are available for a great many different groups of users. “Conventional” radio systems use dedicated channels (frequencies) for each individual group of users.

Table 24: Radio System (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Broadcast Delivery Code	Radio Broadcast Delivery Code represents the scope of radio broadcast. Possibilities are: Simulcasting —Simulcast is a contraction of “simultaneous broadcast”, and refers to programs or events broadcast across more than one medium, or more than one service on the same medium, at the same time. “Multicasting”—Something of a reversal of simulcast, where multiple program streams are combined into a single broadcast.
Radio Roaming Type Code	Radio Roaming Type Code represents the manner of how the extending of connectivity service in a location is accomplished. This is referred to as “roaming.” Roaming occurs when a subscriber of one service provider uses the facilities of another service provider. This second provider has no direct pre-existing financial or service agreement with this subscriber to send or receive information. A device will usually indicate when it is roaming. Possible codes are: Regional roaming —This type of roaming refers to the ability of moving from one region to another region inside national coverage of the mobile operator. National roaming—This type of roaming refers to the ability to move from one mobile operator to another in the same country. International roaming—This type of roaming refers to the ability to move to a foreign service provider's network. It is, consequently, of particular interest to international tourists and business travelers. Inter-standards roaming—This type of roaming refers to the ability to move seamlessly between mobile networks of different technologies.

Table 24: Radio System (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Simplex Indicator	Radio Simplex Indicator represents the radio as being a simplex channel system, one capable of using a single channel for transmit and receive. This is typical of aircraft VHF AM and marine radios. Simplex systems are often legacy systems that have existed for years or decades. The architecture allows old radios to work with new ones in a single network. In the case of all ships worldwide or all aircraft worldwide, the large number of radios installed, (the installed base) can take decades to upgrade. Simplex systems often use open architectures that allow any radio meeting basic standards to be compatible with the entire system. Advantage: As the simplest system configuration, reliability stems from the fact that only two radios are needed to establish communication between them. Disadvantages: The simplex configuration offers communication over the shortest range or distance because mobile units must be in effective range of each other. The available channel bandwidth limits the number of simultaneous conversations, since “dead” air time cannot be easily used for additional communication. Simplex is also referred to as “talk around”, when portables are used to communicate through other portables.
Radio Voice Channel Quantity	Radio Voice Channel Quantity is the total number of channels in a radio system that is dedicated to voice communication.
Radio Control Channel Quantity	Radio Control Channel Quantity represents the total of logic channels carrying network information, rather than the actual voice or data messages transmitted over a network.
System Signal Type Code	System Signal Type Code represents the signal class. Possible values: Analog Digital Both
Standard Air Interface Protocol (AIP) Identifier	Standard Air Interface Protocol (AIP) Identifier is a unique number for a specific signal protocol that provides the means for radio-based communication links between the mobile radios and the active base stations. It may represent an AIP such as: Common Air Interface (P25) Enhanced Digital Access Communication System (EDACS) OpenSky SMARTnet SmartZone

Table 24: Radio System (Continued)

Entity Attribute Name	Entity Attribute Definition
Standard Control Protocol Identifier	Standard Control Protocol Identifier is a unique number for a standard communication control schema.
Dispatch Center Identifier	Dispatch Center Identifier is a unique identifier for a set of instruments in an emergency response system that automates the process of dispatching assistance in response to calls for police, fire response, emergency medical service (EMS), or other public safety services.
Organization Owner Identifier	Organization Owner Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Organization Maintainer Identifier	Organization Maintainer Identifier uniquely represents a particular capability (a facility, a piece of equipment, supply, support, or aid) that can be readily drawn upon when needed for the delivery of public safety services and communication.
Organization Maintainer Title Name	Organization Maintainer Title Name is the job title of an individual that participates in the delivery of public safety services. For example: Police Officer Firefighter Police Chief Fire Chief Dispatcher EMS Supervisor Precinct Commander Police Commissioner
Acquisition Order Identifier	Acquisition Order Identifier uniquely identifies a request to a vendor for supply or service.
Supply Main Item Identifier	Supply Main Item Identifier is a unique identifier for a product or service.
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.25 Radio System Site

The Radio System Site entity associates radio systems to a hosting radio site. A radio system may have components at multiple radio sites.

Table 25: Radio System Site

Entity Attribute Name	Entity Attribute Definition
Radio Site Identifier	Radio Site Identifier is a unique identifier for a physical location where elements of a radio system or related infrastructure and equipment are located.
Radio System Identifier	Radio System Identifier is a unique identifier for a public safety radio system.

3.26 Security

The Security entity holds data about privacy, integrity, identification, and authentication of radio system communications.

Table 26: Security

Entity Attribute Name	Entity Attribute Definition
Security Type Identifier	Security Type Identifier uniquely represents a class of protective control.
Security Type Code	Security Type Code is a class of protective control. Examples are: Authentication Authorization Registration Access Privs Integrity
Security Type Description	Security Type Description provides a brief capsule that defines a protection category. Example: Authentication—The verification of the identity of a person or process. In a communication system, authentication verifies that messages really come from their stated source.
Security Encryption Identifier	Security Encryption Identifier uniquely represents an encryption mechanism.

3.27 Security Encryption

The Security Encryption entity holds facts about the encoding techniques needed to make communications secure, particularly those that verify the integrity and authenticity of a message.

Table 27: Security Encryption

Entity Attribute Name	Entity Attribute Definition
Security Encryption Identifier	Security Encryption Identifier uniquely represents an encryption mechanism.
Security Encryption Type Code	Security Encryption Type Code is class of encryption. There are a variety of different types of encryption. Modern ciphers can be classified according to how they operate and whether they use one or two keys. Examples are: RC4 DES (Data Encryption Standard) 3DES DVP AES (Advanced Encryption Standard) None
Security Encryption Algorithm Name	Security Encryption Algorithm Name represents a cipher (or cypher) for performing encryption and decryption—a series of well-defined steps that can be followed as a procedure to encode or decode a message.
Security Re-key Method Code	Security Re-key Method Code represents the method to be used by the intended recipient to decode an encrypted message. Schematically, there are two classes of encryption primitives: public-key cryptography and private-key cryptography; they are generally used complimentarily. Public-key encryption algorithms include RSA; private-key algorithms include the obsolescent DES, the AES, as well as RC4.
Security Key Attribute Code	Security Key Attribute Code is a piece of information that controls the operation of a cryptography algorithm. In encryption, a key specifies the particular transformation of plain text into cipher text, or vice versa during decryption. Keys are also used in other cryptographic algorithms, such as digital signature schemes and keyed-hash functions. Further, encrypted data should not in practice be recoverable—at least for high-quality encryption algorithms and large-enough key sizes.

3.28 Subscriber Unit Band

The Subscriber Unit Band entity holds facts about a subscriber unit's range of operation on a section (band) of the radio communication spectrum, where frequencies are usually used or set aside for the same purpose. Example radio bands are: VHF High, VHF Low, UHF, 700 MHz, and 800 MHz.

Table 28: Subscriber Unit Band

Entity Attribute Name	Entity Attribute Definition
Radio Band Type Identifier	Radio Band Type Identifier uniquely represents a section of the spectrum of radio frequencies, in which channels are usually used or set aside for the same purpose.
Radio Subscriber Group Identifier	Radio Subscriber Group Identifier is a unique number that represents a set of radio devices (subscriber units).

3.29 Subscriber Unit Group

The Subscriber Unit Group entity holds facts about a group of subscriber units that can be interconnected to communicate with subscriber units located within a radio system or with others on another radio system. A subscriber unit, or SU, is a broadband radio that is operated by a public safety organization to send and receive voice or data, wired or wirelessly.

Table 29: Subscriber Unit Group

Entity Attribute Name	Entity Attribute Definition
Radio Subscriber Group Identifier	Radio Subscriber Group Identifier is a unique number that represents a set of radio devices (subscriber units).
Organization Identifier	Organization Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Radio Subscriber Group Name	Radio Subscriber Group Name is a label for a set or cache of radios (subscriber units), commonly used by operating personnel.
Radio System Type Code	Radio System Type Code classifies how a radio system deploys available frequencies for public safety communication. There are three types: 1. Conventional 2. Trunked 3. Hybrid (conventional and trunked) “Trunked” radio systems use a pool of channels that are available for a great many different groups of users. “Conventional” radio systems use dedicated channels (frequencies) for each individual group of users.

Table 29: Subscriber Unit Group (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Group Use Indicator	Radio Group Use Indicator represents whether a group of radio subscriber units is deployed for active use or held in reserve for special events. Possible values: A—Active Null —Held in reserve (also referred to as “cache”)
Subscriber Unit Quantity	Subscriber Unit Quantity is the total of subscriber units that are being represented in the group. A subscriber unit is to be counted and described in only one group.
Location Address Identifier	Location Address Identifier is a unique number that represents a place where a person, organization, or the like is located or may be reached.
Radio Signal Noise Ratio	Radio Signal Noise Ratio compares the level of a desired signal (such as music) to the level of background noise. The higher the ratio, the less obtrusive the background noise.
Radio Throughput Rate Measure	Radio Throughput Rate is the amount of data transferred in one direction over a link divided by the time taken to transfer it, expressed in bits or bytes per second.
Radio Channel Quantity	Radio Channel Quantity represents the total number of channels resident on a communication device.
Communication Bandwidth Measure	Communication Bandwidth Measure is the amount of data that can be passed along a communications channel in a given period of time. For analog devices, such as standard telephones, bandwidth is the range of frequencies that can be transmitted and is expressed in hertz (cycles per second). For digital devices, bandwidth is measured in bits per second. The wider the bandwidth, the faster data can be sent.
Standard Air Interface Protocol (AIP) Identifier	Standard Air Interface Protocol (AIP) Identifier is a unique number for a specific signal protocol that provides the means for radio-based communication links between the mobile radios and the active base stations. It may represent an AIP such as: Common Air Interface (P25) Enhanced Digital Access Communication System (EDACS) OpenSky SMARTnet SmartZone
Standard Control Protocol Identifier	Standard Control Protocol Identifier is a unique number for a standard communication control schema.

Table 29: Subscriber Unit Group (Continued)

Entity Attribute Name	Entity Attribute Definition
Radio Vocoder Category Code	Radio Vocoder Category Code represents a category of an electronic device or system for synthesizing speech. A vocoder is composed of hardware or software that implements a compression algorithm particular to voice.
Equipment Portability Code	Equipment Portability Code classifies the place of use category of a piece of equipment. Examples: Mobile (vehicle radio) Portable (hand-held radio) Fixed (base station, repeater, or other infrastructure)
System Signal Type Code	System Signal Type Code represents the signal class. Possible values: Analog Digital Both
Organization Maintainer Identifier	Organization Maintainer Identifier uniquely represents a particular capability (a facility, a piece of equipment, supply, support, or aid) that can be readily drawn upon when needed for the delivery of public safety services and communication.
Organization Maintainer Title Name	Organization Maintainer Title Name is the job title of an individual that participates in the delivery of public safety services. For example: Police Officer Firefighter Police Chief Fire Chief Dispatcher EMS Supervisor Precinct Commander Police Commissioner
Supply Main Item Identifier	Supply Item Identifier is a unique identifier for a product or service.
Document SOP (Standard Operating Procedure) Identifier	A Document SOP Identifier uniquely represents a document in a digital library repository.

3.30 Subscriber Unit Security

Subscriber Unit Security is an entity that holds facts about a security aspect of a subscriber unit model.

Table 30: Subscriber Unit Security

Entity Attribute Name	Entity Attribute Definition
Radio Subscriber Group Identifier	Radio Subscriber Group Identifier is a unique number that represents a set of radio devices (subscriber units).
Security Type Identifier	Security Type Identifier uniquely represents a class of protective control.

3.31 Tower

The Tower entity contains data about structures designed to support antennas (also known as aerials) for telecommunications and broadcasting. A tower can host antennas for multiple radio systems.

Table 31: Tower

Entity Attribute Name	Entity Attribute Definition
Tower Identifier	Tower Identifier uniquely represents a structure designed to support antennas (also known as aerials) for telecommunications and broadcasting.
Tower Name	Tower Name is the commonly recognized label for a structure that hoists radio broadcast antennas.
Radio Site Identifier	Radio Site Identifier is a unique identifier for a physical location where elements of a radio system or related infrastructure and equipment are located.
Structure Meter Height Measure	Structure Meter Height Measure is the distance from the base of a structure to the top, expressed in meters.
Structure Meter Base Height Measure	Structure Meter Base Height Measure is the height of a base, building, or platform from ground level to the elevation where it provides support for the subject structure.
Structure Wind Resistance Measure	Structure Wind Resistance Measure represents certification measure as to the overall structural integrity of the tower to meet the wind resistance requirements.
Geographic Location Identifier	Geographic Location Identifier is a unique number that represents a place or region as marked by geographic coordinates.
Organization Owner Identifier	Organization Owner Identifier uniquely represents an agency or bureau unit that performs a public safety service.
Organization Maintainer Identifier	Organization Maintainer Identifier uniquely represents a particular capability (a facility, a piece of equipment, supply, support, or aid) that can be readily drawn upon when needed for the delivery of public safety services and communication.

Table 31: Tower (Continued)

Entity Attribute Name	Entity Attribute Definition
Organization Maintainer Title Name	Organization Maintainer Title Name is the job title of an individual that participates in the delivery of public safety services. For example: Police Officer Firefighter Police Chief Fire Chief Dispatcher EMS Supervisor Precinct Commander Police Commissioner

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4 Analysis Example

This section describes an example analysis of PSAF LMR inter-system compatibility business rules using the subscriber unit (SU)-to-SU context.

4.1 Business Rules

Each business rule is presented graphically in a flow chart. A table describing the business rule's questions and responses accompanies each flow chart. The flow chart and table provide the business rule logic to determine whether SUs are compatible, and the conditions under which they might be.

All flow charts support the possibility for being compatible in more than one way. For example, it is possible for LMR systems to be capable of operating with multiple signal types, multiple bands, and multiple protocols, as well as having both analog and digital capability.

All business rules assess system compatibility solely from a LMR system architectural point of view. Further, they assume that:

- LMR system software and programming is configured correctly with a common channel, tone, or network access code (NAC), and encryption key.
- Operational considerations, such as frequency licensing, are established.

4.2 SU-to-SU Connection

The SU-to-SU connection provides communications directly from one LMR SU to another. This mode of communication is commonly referred to as "talk-around" mode. It allows an SU to communicate to another SU without the use of LMR system infrastructure (i.e., repeaters). Determining SU-to-SU compatibility with encryption is a two-step process, which involves determining SU-to-SU compatibility first without encryption, and then with encryption. Figure 5 and Figure 6 show the compatibility business rules for this mode of operation.

1. First, determine SU-to-SU compatibility *without* encryption.

A *yes* answer to both Y/N questions in Figure 5 indicates SU-to-SU compatibility when *not* operating in encrypted mode. Table 32 explains the questions from Figure 5. Note that it is possible for SUs to communicate in both digital and analog modes.

Figure 5: SU-to-SU Business Rules Without Encryption

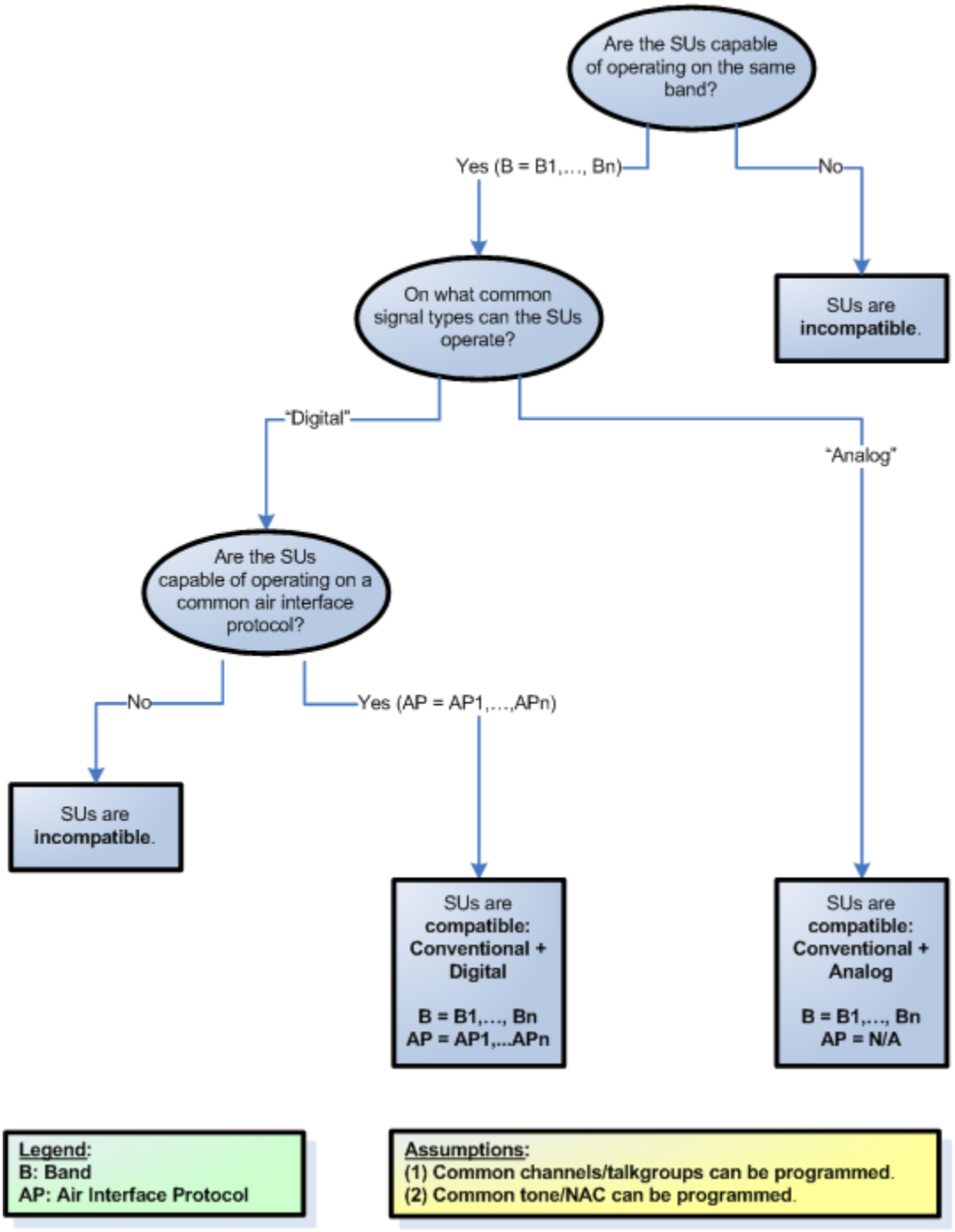

Table 32: SU-to-SU Business Rules Without Encryption

Question	Description	Responses
Are the SUs capable of operating on the same band?	Determines if the SUs operate on a common RF band.	■ Yes—includes one or more of the following RF bands: VHF low, VHF high, UHF low, 700 MHz and 800 MHz, multi-band ■ No
On what common signal types can the subscriber units operate?	Determines if the SUs are compatible in analog, digital or both analog and digital.	■ Analog ■ Digital ■ Both analog and digital
Are the SUs capable of operating on a common air interface protocol?	Determines the air interface protocol that is common to the SUs.	■ Analog ■ P25 ■ ASTRO ■ ASTRO 25 ■ OpenSky ■ Multi-protocol ■ Other

2. Next, determine SU-to-SU compatibility *with* encryption.

A *yes* answer to both questions in Figure 6 indicates SU-to-SU compatibility when operating in encrypted mode. Table 33 explains the questions from Figure 6.

Figure 6: SU-to-SU Encryption Business Rules

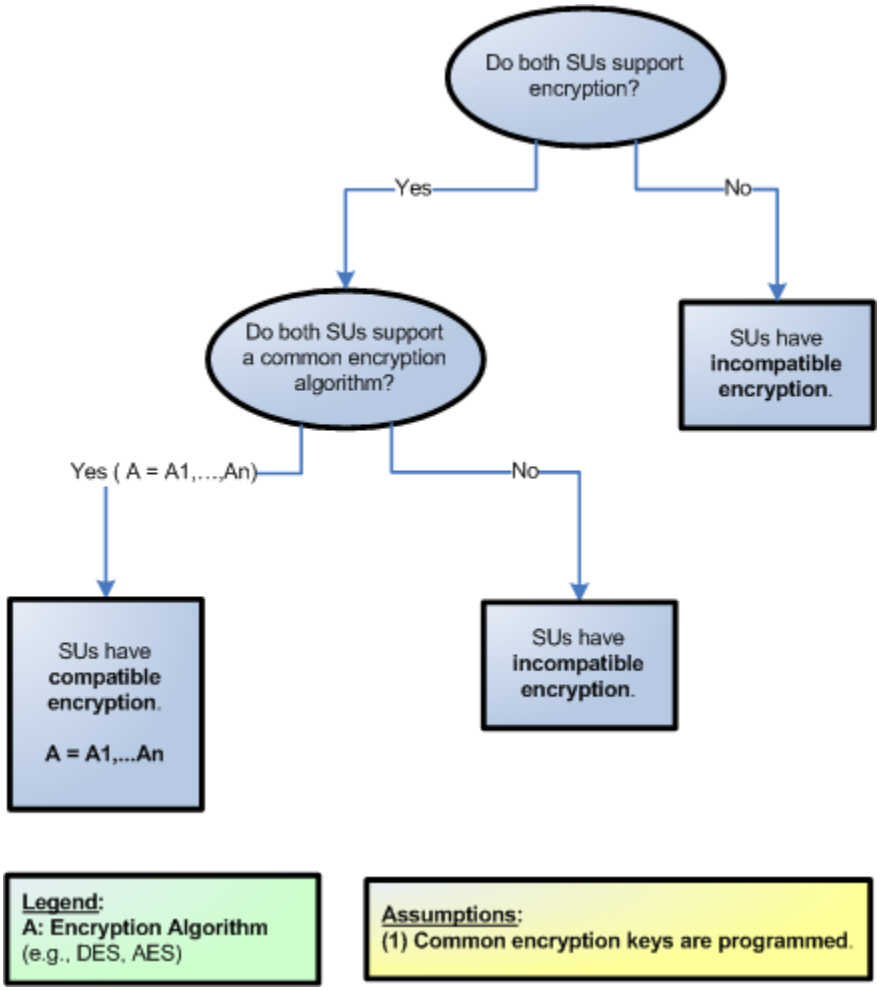

Table 33: SU-to-SU Encryption Business Rules

Question	Description	Responses
Do both SUs support encryption?	Determines if encryption is supported on both SUs.	■ Yes ■ No
Do both SUs support a common encryption algorithm?	Determines the encryption algorithm that is common to both SUs.	■ DES (Data Encryption Standard) ■ AES (Advanced Encryption Standard) ■ Multi-algorithm

Appendix A Glossary

Note: ***The following terms and acronyms are derived from various sources, including the National Incident Management System (NIMS), PSAF documents, and Public Safety Statement of Requirements (PS SoR) documents.***

A

AES

Advanced Encryption Standard

Air Interface Protocol (AP)

Represents a standard or proprietary implementation of a wireless signal protocol that provides the schema for radio-based communication links between the mobile radios and their active base stations.

Analog Communications

The process of communicating through a signal in which some time-varying feature of the signal is a representation of some other time-varying quantity. Analog technology takes an audio or video signal and translates it into electronic pulses. Contrast with *Digital Communications*.

B

Band

See *RF Band*.

C

Conventional Radio System

Conventional radio systems operate on fixed radio frequency channels. The user operates a channel selector or buttons on the radio control panel to pick the channel.

D

Data

A representation of individual facts, concepts, or instructions in a manner suitable for communication, interpretation, or processing by humans or by automatic means. (IEEE 610.12)

Data Model

A representation of the data elements pertinent to an architecture, often including relationships among the elements and their attributes or characteristics. (PSAF)

DES

Data Encryption Standard

Digital Communications

The process of communicating through digital technology, which breaks a voice or video signal into binary code—a series of 1s and 0s—and then transfers it to the other end of the transmission, where another device (radio, phone, modem, or video monitor) reassembles the numbers into the original signal. Contrast with Analog Communications.

E

EDACS

Enhanced Digital Access Communications System

EMS

Emergency Medical Services

Encryption

The process of encoding a message so that it can be read only by the sender and the intended receiver. Encryption systems often use two keys: a public key available to anyone, and a private key that allows only the receiver to decode the message.

Encryption Algorithm

A mathematical procedure for encrypting data. Through the use of an algorithm, information is made into meaningless cipher text and requires the use of a key to transform the data back into its original form. Blowfish, AES RC4, RC5, and RC6 are examples of encryption algorithms.

Encryption Key

Specifies the particular transformation of plain voice (or text) into cipher voice (or text), or vice versa during decryption.

I

ISSI

Inter-RF Subsystem Interface

Incident

An occurrence or event of natural or human cause that requires an emergency response to protect life or property. An incident can include, for example, major disasters, emergencies, terrorist attacks, terrorist threats, wildland and urban fires, floods, spills of hazardous materials, nuclear accidents, aircraft accidents, earthquakes, hurricanes, tornadoes, tropical storms, war-related disasters, public health and medical emergencies, and other occurrences requiring an emergency response. (NIMS)

Interoperability

In the public safety context, interoperability is the ability of public safety agencies to communicate across disciplines and jurisdictions via radio systems, exchanging voice and data with one another on demand, in real time, when needed. (PS SoR)

Jurisdiction

A range or sphere of authority. Public agencies have jurisdiction at an incident related to their legal responsibilities and authority. Jurisdictional authority at an incident can be political, geographical (e.g., city, county, tribal, state, or Federal boundary lines), or functional (e.g., law enforcement, public health). (NIMS)

L

Link

An instance of connectivity between LMR systems.

LMR

Land Mobile Radio

N

NAC

Network access code. An identifier embedded in voice or data transmissions to indicate the identity of the system responsible for a transmission.

Network

The joining of two or more communications nodes for a specific purpose.

O

OTAR

Over-the-air rekeying. The common name for the method of changing encryption keys in a two-way radio system over the radio channel (“over the air”).

P

P25

Project 25 was established to address the need for common digital public safety radio communications standards for first responders and Homeland Security/emergency response professionals.

PSAF

Public Safety Architecture Framework

PS SoR

Public Safety Statement of Requirements

R

Requirement

A need or demand.

RF

Radio frequency

RF Band

Radio frequency band. A section of the radio communication spectrum, where frequencies are usually used or set aside for the same purpose. Example RF bands are: VHF high, VHF low, UHF, 700 MHz, and 800 MHz.

RFSS

Radio frequency subsystem

S

Signal Type

Signal type in the business rule diagrams (see Section 2) represents the signal class, which is either analog or digital.

SU

Subscriber unit. A broadband radio used by public safety personnel to connect to an access point in order. The aim is to send or receive high-speed voice and data by wire or wirelessly. Devices commonly referred to as an SU include hand-held and vehicle communications radios and mobile phones.

System

Any organized assembly of resources and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions. (PSAF)

T

Talkgroup

A prescribed set of voice traffic on a trunked mobile radio system. In trunked radio systems, radio units are programmed (identified) to virtual groups by the embedded radio system logic, and frequency assignments are controlled by a computer and software. These virtual groups are also known as “fleet,” or “subfleet.”

Talk-Around Mode

A mode of operation in which subscriber units communicate directly with one another over the air, bypassing the LMR system infrastructure. Public safety agencies may designate specific radio frequencies as “talk-around” channels. Such channels have no repeating capability, thus limiting their transmitting range usually to a quarter mile or less. This allows emergency personnel to communicate freely with each other without fear of overloading the entire communication system.

Tone

A circuit function used to filter unwanted traffic from other users on a shared two-way radio communications channel.

Trunking Protocol

A proprietary or open standard communication schema that affiliates a trunked radio system with its subscriber units. It defines a relationship between the radios and the radio backbone that supports them. Examples of trunking protocols are Motorola Privacy Plus, Motorola iDEN, E.F. Johnson LTR - Logic Trunked Radio, and General Electric/Ericsson EDACS.

Trunked Radio System

A radio system that maximizes capacity by giving users access to logical talkgroups, rather than dedicated frequencies. This allows for more efficient utilization of limited frequencies for multiple communication needs. Trunking is used by many government organizations to provide two-way communication for fire departments, police departments, and other municipal services who all share spectrum allocated to a city, county, or other organization.

Trunked radio systems take advantage of the probability that in any given number of user units, not everyone will need channel access at the same time. Therefore, with a given number of users, fewer discrete radio channels are required. This permits a much greater number of user groups to be accommodated. In the example of a police department, this additional capacity could then be used to assign individual talkgroups to specialized investigative, traffic control, or special-events groups who might otherwise not have the benefit of individual private communications.

U

UHF

Ultra high frequency. The radio frequency range from 300 MHz to 3 GHz.

V

VHF

Very high frequency. The radio frequency range from 30 MHz to 300 MHz.

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Appendix B References

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