talk groups

E F F I C I E N T

versatile

how 2 guide

for Establishing and Managing Talk Groups

PUBLIC SAFETY
PSWN PROGRAM
WIRELESS NETWORK

Contents

introduction

This guide provides public safety personnel with a user-friendly introduction to the key steps involved in establishing and managing talk groups in a trunked land mobile radio (LMR) system environment. A talk group is a preprogrammed, predetermined basic organizational group of LMR system users. Although Project 25 standards do allow for talk groups on conventional systems, this guide focuses only on the use of talk groups in the trunked LMR system environment. Trunked LMR technology and talk group planning in the trunked LMR environment are quite complex, and each implementation is unique because of the variety of manufactured products and the distinctive applications of the technology within public safety organizations. For this reason, this reference guide does not itemize specific, detailed implementation tasks for every type and application of trunked LMR systems. Instead, it discusses the best practices, technical and organizational issues, and practical aspects of talk group definition and management.

This guide contains four sections—Capturing Operational Requirements, Reviewing System Capabilities, Establishing the Talk Group Plan, and Managing Talk Groups—prefaced by this brief introduction to trunked LMR systems and talk groups:

- Capturing Operational Requirements, the first task in establishing talk groups, introduces the key steps involved in understanding the needs of the system users.
- Reviewing System Capabilities explains the process of learning about the services that should be leveraged to best meet the needs of the users.
- Establishing the Talk Group Plan discusses talk groups and how to use the information captured in the previous sections to establish talk groups on a new system.
- The final section, Managing Talk Groups, focuses on the issues that must be considered during the long-term management of talk groups.

Audience

Public safety personnel need immediate access to communications and information for routine and emergency operations. Many of these individuals use trunked LMR systems as their primary link to information and resources. According to recent surveys, however, many local, state, federal, and tribal public safety agencies experience serious problems with their wireless voice communications systems. These difficulties impair the effectiveness of their mission-critical communications and, ultimately, endanger the lives of their field personnel and the public they are entrusted to protect.

A talk group is a preprogrammed, predetermined basic organizational group of LMR system users.

The lack of interoperability is one of the primary difficulties hindering effective public safety communications. The changing and expanding missions of public safety organizations have made joint operations and joint task forces more common—increasing the need for interoperability. Effective implementation of talk groups can make interoperability much easier to establish during critical joint-agency operations. As public safety agencies migrate from conventional to trunked LMR systems, effective overall talk group implementation and the inclusion of interoperability talk groups will become increasingly important. With that in mind, this guide focuses on three overarching goals as they relate to talk groups:

- Fully support all public safety wireless voice communications needs
- Improve interoperability among diverse user groups
- Achieve optimal system and spectrum utilization from trunked LMR systems.

Numerous public safety personnel are involved in the implementation of trunked LMR systems. To achieve the overarching goals, anyone involved in planning, operating, or maintaining trunked LMR systems should be well versed in the topic of talk group management.

This guide is specifically directed at several groups of public safety personnel:

- Project managers: Public safety personnel implementing talk group plans for the first time will find this guide useful because they are likely to have an immediate need for the information. The guide provides a thorough overview of the technical and organizational issues, best practices, and guidelines that must be considered when defining and implementing a talk group plan for the first time.
- System managers: Experienced personnel will also find this guide useful because it will assist in identifying potential problems before they arise. As the number of users on a system grows and operations change, the system configuration must be reevaluated to prevent problems with channel capacity and talk group assignments. This guide helps direct that process.
- System planners: Although this guide does not specifically focus on system planning, the topics discussed could educate planners about organizational and technical challenges that may arise during the conversion from conventional to trunked LMR systems. A thorough understanding of talk groups will assist system planners in procuring systems that closely match their organizational needs.

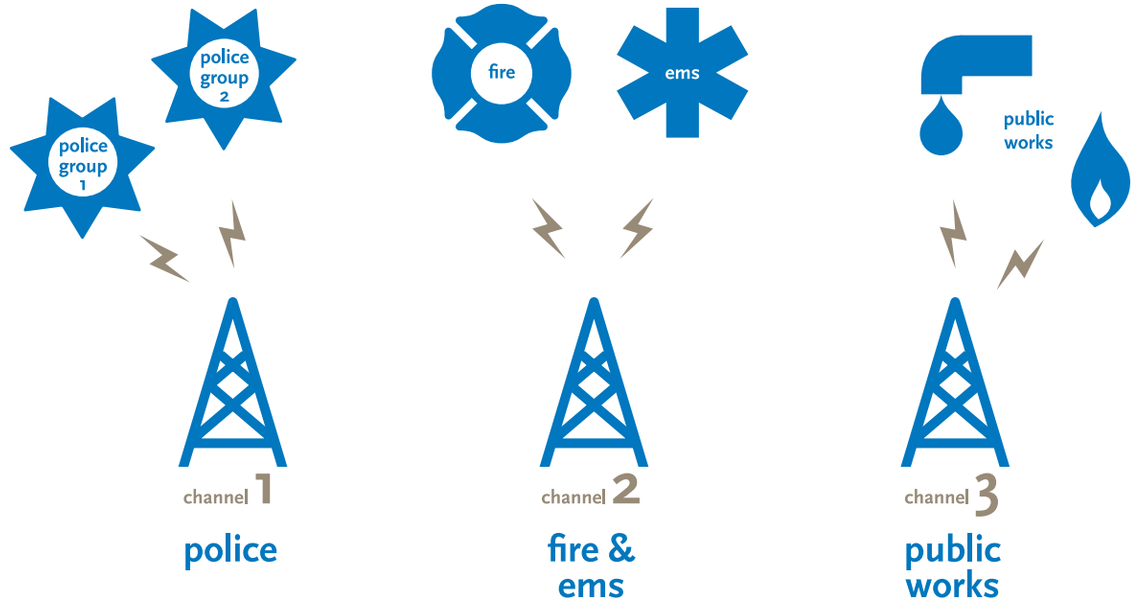


Figure 1: *Example of Channel Allocation in a Conventional Radio System*

Trunked LMR Systems and Talk Groups Overview

As an introduction to trunked LMR systems and talk groups, it is useful to compare trunked to nontrunked (conventional) LMR technology. With conventional radio, the radio system manager assigns specific channels exclusively to specific groups of users. Typical assignments might be the police department on channel 1 only, channel 2 for the fire and emergency medical services (EMS) departments, and channel 3 for the public works department. If a group of police officers is conducting communications on channel 1, other police officers must wait for that group to finish before they can communicate with their respective groups, even though channels 2 and 3 may be idle. Essentially, the different departments do not share the channel resources. This type of conventional LMR system organization is illustrated in Figure 1.

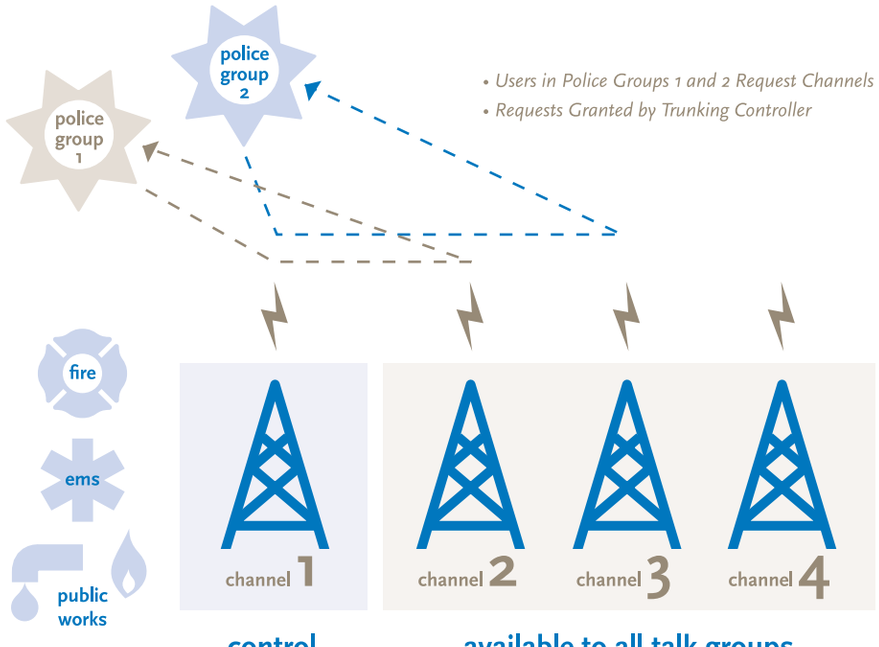


Figure 2: *Example of Channel Allocation in a Trunked Radio System*

The fundamental difference with trunked LMR is that many groups of users share the limited radio channel resources. This resource sharing is possible because a computer-driven trunking controller assigns the radio channels to the specific user groups automatically. Referring to the example, it would be possible for two groups of police officers to communicate concurrently if two channels were available. The trunking controller assigns the next available channel when the user presses the push-to-talk (PTT) button. Figure 2 illustrates this process.

The advantages of trunked radio systems include—

- More efficient use of spectrum
- Ease of use
- Improved interoperability
- Seamless roaming
- More scalable and flexible.

The disadvantages of trunked radio systems include—

- Higher cost than non-trunked systems
- Compatibility problems between different manufacturers' products
- Interoperability problems between trunked and nontrunked systems
- Limited number of equipment suppliers.

Despite their disadvantages, trunked LMR systems are replacing conventional LMR systems mainly because there is finite radio spectrum available for use by public safety agencies. In some cases, spectrum limitations leave public safety agencies no option but to convert from conventional to trunked radio systems.

As noted above, trunked radio is more efficient because of the trunking controller's ability to optimize use of available licensed channels. The trunking controller assigns a talk group to a specific channel while a member of that talk group is attempting to communicate. After a member of a talk group finishes communications, the channel returns to the available channel pool and a different talk group may use the same channel.

Establishing and Managing Talk Groups Process

The use of talk groups in a trunked LMR system allows for increased versatility and efficiency over conventional radio. This capability enables a knowledgeable system manager to consider a variety of communications options when organizing the wireless communications infrastructure. To establish and manage talk groups successfully, it is critical that the system manager has a complete understanding of all aspects of the users' operational requirements and the system's technical capabilities.

The use of talk groups in a trunked LMR system allows for increased versatility and efficiency over conventional radio.

The high degree of flexibility permitted when designing a talk group plan also creates a greater opportunity for mistakes. Some common pitfalls are—

- Not creating separate talk groups for operational teams with heavy communications traffic
- Creating too many talk groups, fostering operator confusion
- Not planning for system growth when making the talk group assignments
- Limiting interoperability on conventional frequencies
- Designing plans that produce less than optimal system performance
- Creating talk group plans that are rejected by the users.

Creating a talk group plan is a very complex, difficult, long process, requiring extensive up-front effort that delivers huge dividends if done correctly. If the system manager is not successful in avoiding these pitfalls, premature system reconfiguration and subscriber unit reprogramming may be necessary.

However, if the system manager follows a structured process, covering all the key issues affecting talk group performance, the listed pitfalls can easily be avoided. The process of establishing and managing talk groups depicted in Figure 3 is recommended for system managers to plan, implement, and manage trunked LMR talk groups. The process addresses both technical and operational considerations when configuring a system for the first time and for managing a system in the long term. The system manager is expected to be a key player throughout this process. However, it is critical that all system stakeholders are included and consulted throughout the process. In fact, the input and feedback of the operational and organizational leaders will greatly affect the actual implementation of the steps in this guide. When talk groups are established, evaluated, and reassigned, the system manager may need to use an iterative process to achieve consensus and support across the user organization. Several talk group organizations may be created and revised before a final version is agreed to by the entire organization.

The structure of this guide follows the process depicted in Figure 3. Section 1 addresses the capture of operational requirements; Section 2 discusses and reviews system capabilities; Section 3 describes how to establish a talk group plan; and Section 4 explains the talk group management cycle.

Figure 3: *Establishing and Managing Talk Groups Process*

section one

capturing operational requirements

- *Review the System Planning Documents*
- *Gather User Data*
- *Create Organizational, Operational, and Interoperability Matrices*
- *Forecast Future Requirements*

This section introduces and demonstrates the key tasks for capturing operational requirements. Operational requirements are specific needs that must be fulfilled if users are to perform routine and mission-critical functions. Be aware that some of the information gathered during the process may be contradictory. The method used for integrating the captured information and determining the needs that take precedence will depend on the individual organization. Each organization is unique, and an integrated plan can be developed only after thoroughly examining the mission and priorities of the applicable organizations.

Objectives

By the end of this section, readers will understand how to—

- Review the system planning documents
- Gather data from the entire user community
- Create organizational, operational, and interoperability matrices
- Forecast future operational requirements.

Key Steps

Review the System Planning Documents

The first step in capturing operational requirements is to review the system planning documents. Several key tasks may have been performed during the system planning process that could be of great assistance in understanding the new system's operational requirements. During the system planning process, it is likely the operational requirements for the users were thoroughly investigated and documented. Some of the operational requirements should have been refined into functional requirements, and both the operational and functional requirements should have been converted into technical requirements.

Because the planning documents may already correctly capture the operational requirements, these documents should be reviewed first. The primary focus of the requirements capturing effort is to confirm what the planning process has already established. Another reason to review the system planning documents first is that the team implementing the system may be quite different from the team that began the planning process. The system planning documents may provide some needed corporate knowledge. Information

Operational Requirements *are specific needs of users to perform mission-critical tasks (i.e., number of users, types of communications required, geographic area of operations, and interoperability).*

Functional Requirements *are sometimes needed to further explain the operational requirements and provide specific performance characteristics that define how the system will interface with the users (i.e., quality of communications, physical characteristics of the system components, and equipment operation features).*

Technical Requirements *are specific technical capabilities and limitations of the system that will fulfill the operational and functional requirements (i.e., number of available channels and towers, encryption, power, capacity, coverage, interoperability with other systems, and dimensions).*

regarding the following broad issues should be collected and confirmed when reviewing the system planning documents:

- Need for the new system
  The system planning documents should contain information evaluating the need for the new system. They should specifically address problems the new system is expected to solve. The documents should clearly define how the new technology provided by the new system will impact the user agencies. Any special circumstances that need to be addressed should have been documented and evaluated before the system was purchased. These problem areas may affect the way the talk groups are structured.
- Organizational and operational needs
  As part of the planning process, the organizational and operational communications needs should have been documented and evaluated. Organizational and operational matrices, communications flow charts, and even draft talk groups may have been used to help plan the new system. If a request for proposals (RFP) procurement process was used, much of this information was likely included.

If the system was procured using a less than rigorous planning process, the planners may not have thoroughly documented the operational requirements. In any case, system managers are strongly encouraged to take the time to add greater detail to the planned operational requirements to minimize failed or marginal deployments. Another important point to consider is that it may have taken months or even years to initiate, plan, fund, design, and build the new radio system. Therefore, even if the planners did an excellent job documenting the operational requirements at the start of the project, the operational requirements may have changed significantly during the implementation of the project.

Gather Data From the Entire User Community

The second step in capturing operational requirements is to gather data from the entire user community. Meeting the operational requirements of the system users is the highest priority when developing a talk group plan. Some of the issues that must be addressed when capturing operational requirements are—

- User expectations
- Mission objectives
- Organizational structure and operations
- Interoperability requirements
- Current communications problems.

Everyone in the organization has specific functions that require specific communications capabilities, and therefore their priorities and requirements vary.

These issues can be addressed by gathering information from the user community. It is important to solicit information from all levels of the organization and all types of system users. The problems senior managers perceive may not be the same as those experienced by the larger user community, such as the operational staff. Everyone in the organization has specific functions that require specific communications capabilities, and therefore their priorities and requirements vary. In general, each user and department should be asked to carefully consider and explain the number of different talk groups they desire and their need for both internal and external communications. Three common methods for collecting data from the user community are—

- Questionnaires
  A questionnaire gives all members of the organization an easy method to communicate their perceived needs. In addition, a questionnaire may offer a good opportunity to explain the changes that may be generated by the new system. The questionnaire should be directed and written to the level of the respondent with sufficient explanations of the terminology and technology afforded by the new system. The use of illustrations, where appropriate, to visually explain the overall technology should be included. The responses to the questionnaire primarily provide information about what the user community desires and problems that may affect its communications capability. However, it is also possible that very valuable information about the organization, operations, interoperability, and future requirements will be gathered as well.
- Meetings
  Although less scientific than the questionnaire method, meetings are sometimes preferred. One specific advantage of meetings is that user expectations can be much more easily gathered and corrected. Meetings can be used to inform the users about the new system as well as allow collection of direct feedback.
- User Interviews
  One-on-one interviews with individual users and key players in the organization may provide in-depth information not available from either of the other methods. This method would be critical when trying to resolve difficult issues, especially those that require in-depth understanding of how users perform specific operations. For example, when determining how to achieve the needed interoperability, sometimes it is best to create talk groups for only specific key personnel rather than very large multiagency talk groups.

Table 1: *Example Organizational Matrix*

Agency	Department/Division	Number of Personnel
County Police Department (CPD)	—	300
	CPD Station 1	70
	CPD Station 2	70
	CPD Station 3	70
	CPD Headquarters (HQ)	50
	CPD Academy	40
City Police Department	—	60
County Fire Department (CFD)	—	200
	CFD Station 1	100
	CFD Station 2	50
	CFD Station 3	50
City Fire Department	—	40
Emergency Medical Services	—	40
Public Works Department	—	50

Create Organizational, Operational, and Interoperability Matrices

The third step in capturing operational requirements is to create matrices that closely resemble the communication patterns of the user community. These matrices should identify specific operations and their respective user groups that can be easily translated into talk groups. At this point in the process, data has been gathered from the planning documents and the user community. That data must be organized into a format that can be used when designing the talk group organization. Creating organizational, operational, and interoperability matrices is an effective step in that process.

Understanding how the organization is structured is critical to implementing a successful talk group plan. Table 1 is an example of how a county might organize the agencies, departments, and divisions that will be assigned to a consolidated trunked LMR system. This example also illustrates how a county and a local city might approach the talk group planning process. This fictitious county will be used throughout the guide to demonstrate the recommended practices of this guide.

The matrix is divided by agency to show how some agencies have more complex organizations and will therefore likely require more talk groups. The example is simplified—an organizational matrix for a county could be much more detailed. In most cases, operations run along the lines of the organization's hierarchy, and Table 1 demonstrates how that might work. For instance, the county police department has three separate stations, each with 70 officers. Each of those stations will have communications specific to its mission. Other talk groups may be necessary, but the organizational structure details the hierarchy of the organization, and it is usually logical to structure at least some of the talk groups along those same hierarchical divisions.

The operational matrix should define how the users need to communicate when performing normal operations.

Table 1 demonstrates how an organizational matrix could identify some of the talk groups. For instance, the county police department will need several separate talk groups for its many divisions. However, it is possible that the organizational structure does not mirror the actual communications flow required during some operations. Some organizations are slow to change their formal structure, and therefore their structure is less likely to reflect the way operations are actually performed. Also, even if the organizational structure accurately reflects the divisions of an organization, there will probably be operational groups that are not represented. To further capture the communications patterns of the organization, it is useful to create an operational matrix.

The operational matrix should define how the users need to communicate when performing normal operations. The purpose of the operations matrix is to further refine the talk group plan implied by the organizational matrix. This investigation cannot be done for every possible operation of an organization. Instead, the matrix should represent normal, day-to-day operations and a few major events requiring unique communications. The data gathered from the user community is critical in effectively evaluating operations. Building on the example above, Table 2 illustrates an operational matrix that documents how the users communicate during operations.

Some of the operations described in Table 2 may require some explanation because the terminology varies across the Nation:

- Dispatch and Coordination Operations involve all users on a daily basis. These operations produce the majority of organizationwide communications.
- Emergency Operations involve all users on a case-by-case basis and typically involve incident-specific, high-priority communications.
- Tactical and Investigative Operations involve small groups of users and are needed for special operations.
- Training Operations require normal communications capabilities but should not interfere with any other communications.
- Fire Ground Control Operations are incident-specific fire department operations that are part of the larger response effort.

Typical public safety agencies perform a wide variety of other operations that could be included (i.e., fire investigations, marine patrol, and traffic control).

When creating the operational matrix, it is likely that the operations considered will be those that address only the primary missions of the primary organizations. These types of operations do not normally require intensive interoperations with outside agencies. However, the last two operations identified in Table 2 require communications interoperability among multiple agencies. In the example, airport and highway emergencies specifically require intense interoperations throughout the operation.

Table 2: *Example Operational Matrix*

Agency/Department/Division	Operation	Max. # of Users at Any One Time
County Police Department (CPD) HQ County Police Department (CPD) HQ	Dispatch and Coordination Emergency	300 300
CPD Station 1 CPD Station 1 CPD Station 1	Dispatch and Coordination Emergency Tactical/Investigations	70 70 20
CPD Station 2 CPD Station 2 CPD Station 2	Dispatch and Coordination Emergency Tactical/Investigations	70 70 20
CPD Station 3 CPD Station 3 CPD Station 3	Dispatch and Coordination Emergency Tactical/Investigations	70 70 20
CPD Academy	Training	40
City Police Department City Police Department City Police Department	Dispatch and Coordination Emergency Tactical/Investigations	60 60 20
County Fire Department (CFD)	Dispatch and Coordination	200
CFD Station 1 CFD Station 1 CFD Station 1 CFD Station 1	Dispatch and Coordination Fire Ground Control 1 Fire Ground Control 2 Fire Ground Control 3	100 30 30 30
CFD Station 2 CFD Station 2	Dispatch and Coordination Fire Ground Control	50 25
CFD Station 3 CFD Station 3	Dispatch and Coordination Fire Ground Control	50 25
City Fire Department City Fire Department	Dispatch and Coordination Fire Ground Control	40 20
Emergency Medical Services	Dispatch and Coordination	40
Public Works Department Public Works Department	Transportation Animal Control	40 10
All Police, Fire, and EMS	Airport Emergency*	640
County Police, Fire, and EMS	Highway Emergency*	540

**Operations Requiring Interoperability*

Table 3: *Example Interoperability Matrix*

Agency/Department/Division	Interoperability Operation	Max. # of Users at Any One Time
All Police, Fire, EMS, and State Environmental Agency	Hazardous Material Response	200
All Police, Fire, EMS, and Multiple State and Federal Agencies	Terrorist Response	300
All Police, Fire, EMS, and National Guard	Civil Disturbance	200
City and County Police and Police From Surrounding Jurisdictions	Highway Pursuit	100
All Police, Fire, EMS, National Guard, and Other Government Officials	Natural Disaster	300

It should be noted that interoperability is sometimes required but difficult to establish, even among members of the same overall organization using the same radio system. These difficulties are often related to the specific technical features of the system. The associated issues are discussed later in the guide. Interoperability may also be difficult to establish because it had not existed in the previous radio system. The user community may not understand the full potential of the new trunked LMR system as it relates to interoperability and therefore may not provide complete information about its real interoperability needs. Also, there may be organizational or political resistance to some interoperability arrangements. Data gathered from the entire user community should have yielded—

- Current and needed interoperability opportunities
- Frequency of the interoperations (i.e., daily or incident-specific)
- Type of communications (i.e., direct radio, patching, cellular, or wireline telephone).

Gathering this information should define all the interoperability requirements. Investigating interoperability is directly related to the task of evaluating the operational organization. When specifically seeking out interoperability requirements, it is useful to create a matrix of operations requiring multiple agencies. A good start for this process is to identify past events when interoperability was either successfully achieved or desired. Table 3 builds on the earlier matrices and is an example of an interoperability matrix for a county and outside agencies.

The three types of matrices recommended in this step can be used to create a draft talk group plan. With these matrices, the groups requiring communications are identified and the basic communications characteristics can be understood. These matrices should accurately represent the organization's operational requirements and will be very useful throughout the talk group planning process.

Forecast Future Operational Requirements

The final step in the capturing operational requirements process is to forecast future operational requirements. As the organization and its operations change, the operational requirements will change. If flexibility has been built into the talk group plan, operational changes may not require changes to the plan. Such changes in operations can sometimes be predicted by coordinating with city, county, or state management, senior public safety officials, or possibly regional planning departments or agencies. Some changes that might be expected are—

- Operations
- Annexations
- Large commercial investments or build-outs
- Addition of other area agencies onto system
- Providing communications services to neighboring agencies
- Department and user population growth
- Operations of surrounding city, county, state, and federal departments
- Future interoperability needs
- Demographic changes.

If flexibility has been built into the talk group plan, operational changes may not require changes to the plan.

All of these changes could be accounted for in the current talk group plan. For instance, in the case where operations will change, talk groups can be included that will meet the needs of those new operations. Or, in the case of department population growth, talk groups can be sized to accommodate the future number of users. These changes could be documented as separate matrices or the organizational, operational, and interoperability matrices could simply be revised. For example, assume the county discussed earlier expected to annex an area that included a police and fire department. Tables 1 and 2 could be changed to include a "new" County Police Department Station 4 and County Fire Department Station 4. If these future stations are included in the talk group plan now, when the area is eventually annexed, the talk group plan will be ready. No additional changes will be necessary.

section two

reviewing system capabilities

- *Review System Planning Documents*
- *Review the Manufacturer's Documents*
- *Consult with the Vendor*
- *Identify Technical Barriers to Interoperability*

System capabilities are system-specific services a system can provide. System capabilities form the foundation upon which the talk group plan is built. After the operational requirements have been captured, it is imperative to review the technical features of the system before attempting to establish the talk group plan.

Because of the variety of trunked radio systems available and the unique environments in which they operate, a detailed explanation of the technical aspects applicable to all trunked LMR systems cannot be provided in this short guide. In fact, the diversity of systems is so great that even the terms for trunked systems features sometimes vary among manufacturers, even when describing the same capability. Therefore, it is very important that the system manager uses the following steps as a starting point in the learning process.

Section 1 covered documenting and refining the operational requirements; Section 2 focuses on the task of learning about the system's actual features and capabilities. The system capabilities should be detailed in the manufacturer's design documents. This section describes a process readers can follow when learning about their new system for the first time. Of course, if the system managers establishing the talk group plan are experienced with the system technology, some of the following tasks may not be necessary.

Objectives

By the end of this section, readers will understand how to—

- Review the system planning documents
- Review the manufacturer's design documents
- Consult with the vendor
- Identify technical barriers to interoperability.

Key Steps

Review the System Planning Documents

The first step in reviewing system capabilities is to again revisit the system planning documents. However, this time, rather than looking for operational requirements, one should look at the capabilities of the new system. Much of the functionality, capabilities, and features intended by the system planners should be documented in a manner that is easy to understand in relation to the given system. While it is possible that the planning documents are incomplete or inaccurate, understanding the planning process should assist in understanding the direct connection between system technical characteristics and system capabilities. The following specific topics were probably documented by the system planners and could be a valuable learning tool for the talk group planners:

- Justification of the new system
  The planning documents may include a comparison document that explained the need for the new system early in the planning process. Such a document would contain a clear explanation of the problems experienced with the old system and why trunking technology was the solution.
- System specifications
  The planning documents should contain system specifications that describe the required new system features. Feature descriptions should be very clear and relatively easy to understand. It is assumed that during the final system testing and acceptance, the information in the planning documents would be verified as correct. The RFP and evaluations of RFP responses should contain relevant discussions of system specifications and how they relate to the operational requirements.
- Conventional system(s) usage and loading statistics
  It is highly likely that during the planning process a traffic analysis of the conventional system was performed. If so, the planning documents may provide specific statistics about the use of the conventional system(s) and an explanation of how those statistics might predict the loading of the planned trunked system.

Functionally, one talk group is like one radio channel in a conventional system—only one person can speak at a time on a conventional radio channel or a trunked LMR system talk group.

With the conventional system, each operational group was probably assigned to one or more communications channels. If a traffic analysis was performed, it should be possible to determine which channels and operational groups were experiencing too much traffic and therefore poor communications. This information is useful when establishing talk groups because if a specific group's communications were too much for one channel, that same group would need more than one talk group. Functionally, one talk group is like one radio channel in a conventional system—only one person can speak at a time on a conventional radio channel or a trunked LMR system talk group.

As noted in Section 1, the planners may have thoroughly analyzed the operational requirements and even specified the talk groups they thought would be necessary. If so, these same talk groups may have been used to perform a traffic analysis to predict the loading of the system and determine the optimum talk group organization. If the planners performed this type of evaluation, the documentation would be very useful in evaluating and finalizing the talk group plan.

Review the Manufacturer's Documents

After reviewing the system planning documents, it is critical to review the manufacturer's documents to look for explanations of system-specific features, operations and maintenance procedures, and overall system capabilities. The manufacturer's documents should be resources that the system manager uses throughout the life of the system. The manufacturer should provide documents on talk group definition, subscriber and trunking controller programming, system management, trunking controller management, system statistics evaluation, and system maintenance. Some of the specific topics directly affecting talk group organization and performance that should be studied closely are—

- Types of calls (i.e., mobile-to-mobile, private, emergency, group, dispatch, and telephone interconnect)
- Talk group and subscriber unit prioritization (i.e., levels of priority, tactical priorities, and ruthless preemption)
- Communications center console configurations
- Conventional systems interfacing
- Implementation of the vendor's products on the system
- The number of subscriber unit and talk group identification numbers available, and how those numbers should be organized to anticipate long-term growth
- Talk group scanning
- Forced calls and emergency calls
- Type of trunking protocol (transmission or message)
- System statistics monitoring and evaluation
- Talk group patching
- Dynamic regrouping
- Available capabilities for maintaining communications during partial and complete failure of the system (i.e., failure of the trunking controller, links to the trunking controller, or individual sites)
- Encryption support and definition.

Consult with the Vendor

The third step in the reviewing system capabilities process is to consult with the vendor. The vendor's technical representatives should be a source of expert information and technical support throughout the life of the system. However, the system manager should avoid being completely dependent on the vendor. The roles of the vendor and the system manager are different. The vendor's first responsibility is to deliver a working system in accordance with the agreed contract developed from the RFP documents and the vendor's response. On the other hand, it is the system manager's responsibility to optimize the system and fully meet the operational requirements of the organization. The ultimate goal of the system manager should be to become the local expert and use the vendor only for special circumstances and ongoing maintenance needs. In this way, the system manager can better serve the user community, and minimize the cost of the vendor consulting services.

In the short term, the vendor should provide adequate training for the system manager and the user community unless the agency is responsible for all user training. The cost of this training should have been specified in the procurement and included in the contract. Also, the ability to have "after implementation" vendor support is also an important aspect for continuing to optimize and use all the system's capabilities. Of course, the more familiar the system manager is with the system before being trained by the vendor, the more valuable that training time will be.

Of course, the manufacturer's manuals and guides will not describe all skills and technical issues. In these difficult areas, the system manager should obtain guidance from the vendor. A difficult technical area

A difficult technical area to understand is the use of the trunking controller statistics.

to understand is the use of the trunking controller statistics. Each system has a different method of collecting message traffic data. Such statistics as busies, delays, calls per hour, quality of service, and peak loading should be captured and routinely analyzed. Although this information is not critical for establishing talk groups, it will be critical for the long-term management of the system. Topics such as this should be thoroughly reviewed with the vendor.

Identify Technical Barriers to Interoperability

The final step in understanding system capabilities is to understand how the capabilities affect interoperability. Section 1 discussed the topic of interoperability and recommended that matrices be created to document specific cases in which interoperability was needed or would be needed in the future. These matrices should be reviewed to determine whether it is technically possible to communicate as desired using the new system. Some possible barriers to achieving or improving interoperability might be—

- Accommodating varying technologies, a variety of vendor products, and systems and subscriber units of varying ages
- Interfacing with conventional systems
- Addressing group organization and complexity.

As noted in Section 1, interoperability is needed within the system users' organization as well as outside. Within the organization, there are various separate operational groups. The method these operational groups use to interoperate on the new system will be different from the method used on the conventional system. Although interoperability may not be technically difficult when the groups are on the same system, there are technical aspects of how the talk groups are set up that must be addressed to make the right kind of interoperability possible. These issues must be studied carefully, and the planning requires a detailed understanding of a variety of system features and capabilities that can be used to facilitate interoperability with trunked LMR systems:

- Interoperability talk groups
  Talk groups specifically designed for special interdepartmental or interagency communications can be programmed into the radios exclusively for the special circumstances when interoperability will be needed.
- Standard and permanent patches
  Standard and permanent patches connecting multiple talk groups can be activated by the console operators. A patch is a hardware or software cross-connect between talk groups that essentially makes one large talk group for as long as the patch is activated. Patches can also be made between different systems and also with trunked and conventional systems. A standard patch is a patch that is planned and that the console operator can activate quickly. A permanent patch is a patch that is always activated. Patches are desirable because they can allow communications between talk groups without requiring programming of the individual subscriber units with an additional talk group for that purpose. In addition, the console operator can easily alter patches to meet changing operational demands.
- Conventional channels
  Some organizations may use conventional LMR systems. Interoperability with those organizations can be established if the subscriber units of the trunked LMR system are capable of using conventional channels.

section three

establishing the talk group plan

- *Optimize System Performance*
- *Assign the Right Kind of Talk Groups*
- *Create the Talk Group Plan*
- *Train and Communicate with the User Community*

After capturing operational requirements and system capabilities, a great deal of information is available for establishing a talk group plan. In fact, the talk group plan will be established from integrating the findings of operational requirements and matching them with the system capabilities. Unfortunately, there is no perfect equation in which to enter the captured information and output the perfect talk group plan. Establishing a talk group plan is both an art and a science—there are usually several good ways to implement talk groups.

Executive priorities, organizational adaptability, and the political environment are intangible factors that also must be considered in this process. Each system requires critical thinking, flexibility, and continual communications with the users. Establishing a talk group plan is an iterative process. In reality, several draft talk group plans will probably be created and reviewed by the various user groups. This process will enable the users to provide critical feedback before the final talk group plan is established and programmed into the equipment.

This section gives general guidelines and best practices for working with the user community, considering technical issues, and implementing a variety of talk group plans. This section does not provide a stepwise process because that is not a realistic expectation during this process. The consideration of the operational requirements and the system capabilities will probably produce several talk group plans that will subsequently be refined. However, regardless of the actual steps taken to establish talk groups, this section discusses several key issues that should be considered.

Objectives

After reading this section, readers will understand how to—

- Optimize system performance
- Assign the right kind of talk groups
- Create the talk group plan
- Train and communicate with the user community.

Key Issues

Optimize System Performance

The first issue to address when establishing the talk group plan is system performance. When creating the talk group plan, a variety of technical issues must be considered so that the best possible system performance is achieved. It is possible that talk groups could be assigned to meet the minimum user requirements while significant system and spectrum resources are wasted. One of the goals of the system manager should be to meet the operational requirements while making the best use of the system capabilities and available spectrum. Taken together, the technical issues affecting system performance are quite complicated, and it is recommended that the system manager and the vendor accurately model the system to determine the optimal configuration. Specific technical issues affecting system performance include—

- Size of the Talk Groups
  Creating talk groups that are too large could cause delays that impede critical communications. Some large broadcast or announcement type talk groups may be needed for some specific communications (i.e., dispatch). The number of users that can effectively communicate using one talk group varies depending on the frequency and duration of the communications. It is possible that the vendor can model the system to determine the optimal talk group size. The primary problem with large talk groups is that they may contain small groups of users that conduct communications that the entire talk group does not need to hear. In many cases, this situation may be acceptable if the per user traffic is relatively low.

The first issue to address when establishing the talk group plan is system performance.

However, if the communications of a particular group within a talk group are interfering with the communications of the overall talk group, that smaller group may need to be assigned a separate talk group.

- Number of Talk Groups
  The number of talk groups is important for the converse reason—talk groups should not be too small. If a group that could communicate using one talk group is segregated into two talk groups, a group that could, at most, effectively use only one channel can, with two talk groups, occupy two channels. Extrapolated to many talk groups, it can easily be imagined how the capacity limit for the system could be reached. The ultimate result of establishing too many talk groups is that users endure long delays before their talk group is assigned a channel. Another problem with a very large number of talk groups is that the users may find the talk group plan cumbersome and have difficulty locating the talk group they need for communications.

- Channel Monopolizing Talk Groups
  Another talk group issue that could affect the system's performance is the number of users capable of using one-to-one (private call) and/or telephone interconnect features. These features allow two radio users, or a radio user and a user on the public switched telephone network (PSTN), to communicate. In essence, the features allow the users to create a temporary two-person talk group. This is a very powerful feature. However, if too many users are able to use it, the system performance degrades significantly. The system manager should limit the number of subscriber units enabled with this feature and closely monitor its use.

- Geographical Separation of the Talk Groups
  Talk groups should be geographically separated on a trunked, multicast LMR system. A trunked, multicast LMR system employs dynamic frequency allocation by tracking users and keying only sites and channels required to reach a particular user group. It does this by tracking the location of the individual subscriber units and the talk groups that the subscriber units are scanning and intelligently allocates channels on individual sites on an as-needed basis. In a trunked, multicast LMR system, if the members of a particular talk group are within the coverage area of a single site, then only that specific site is needed to provide connectivity for the entire talk group. However, if the members of the talk group are spread throughout the system's coverage area, then numerous sites are needed to provide connectivity. In the first case, when the talk group members are within the range of one site, the channel of only one site in the entire system is required. In the second case, with geographic dispersion of the talk group members, one channel on numerous sites is required. If talk groups are geographically organized to use as few sites as possible, each talk group uses less radio spectrum and therefore more channels are available for other talk groups. A simulcast system, transmitting simultaneously from every site for every message, would not benefit from geographically separated talk groups.

- Test the Talk Groups
  After the talk groups have been assigned and programmed into the equipment, they should be tested and evaluated to ensure that they operate as expected. Various features should be prototyped or tested before implementing those features across the system. Specifically, the emergency talk groups should be tested to ensure proper operation.

Assign the Right Kind of Talk Groups

Once a system manager has assessed the number and size of the potential talk groups and has successfully aligned operational requirements with system capabilities, the system manager must ensure that the groups that need communications are assigned to the right kind of talk groups. Each type of talk group serves a specific communications purpose. With a full understanding of the operational requirements, system capabilities, and system performance issues, the system manager can assign the proper kind of talk group to the appropriate users. However, depending on the needs of the users, the radio manager should consider all types of available talk groups:

- Dispatcher Talk Groups
  Some talk groups require a console operator or a dispatcher to monitor communications. This issue must be addressed when creating the talk group plan because each dispatcher can effectively monitor only a limited number of talk groups. The number of talk groups that can be monitored depends on the number of dispatchers the organization has available at any given time. The ultimate impact of this limitation is that the number of talk groups might need to be reduced or their structure might need to be changed to enable dispatcher(s) to effectively monitor communications and react accordingly.

- Announcement Talk Groups
  Some talk groups consist of many talk groups. Such groups are also called fleet and supervisory talk groups. These types of talk groups are typically used for supervisory, announcement, dispatch, interoperability, or emergency purposes.

- Emergency Talk Groups
  Several types of talk groups could be used to implement emergency talk groups. The organization of each emergency talk group would be based on the operations required during each type of emergency. Emergency talk groups can be created to meet the communications needs of groups and individuals during emergencies. Group emergency talk groups are sometimes referred to as "storm talk groups" and are used to conduct actual operations during major emergencies. An example of an emergency talk group for individual users could be one that allows non-police users to report an emergency to a police or 911 dispatcher.

- Quiet and Silent Talk Groups
  Some special talk groups may be needed for covert operations that require a silent radio, or where the user only wants to receive emergency or other high-priority calls. Special talk groups can be created to provide that capability.

- Training Talk Groups
  All organizations conduct training. Some training may require normal operational communications. In those situations, it is best to use training talk groups so that normal operations are not disrupted.

- Test Talk Groups
  Test talk groups may be used to test talk group and system features. Test talk groups can also be implemented for short-duration, unspecified purposes.

- Interoperability Talk Groups
  As discussed in Section 2, there are several ways to achieve interoperability with trunked LMR systems (i.e., standard talk groups, patches, and conventional channels). Emergency, announcement, and dispatch talk groups can also act as interoperability talk groups.

Table 4: *Example Police Talk Groups*

Talk Group #	User(s)/Operation	Display Name	# of Users
1	County Police Department (CPD) HQ/Dispatch & Emergency	PD-DSPC	300
2	CPD Station 1/Dispatch	PD-DSP1	70
3	CPD Station 2/Dispatch	PD-DSP2	70
4	CPD Station 3/Dispatch	PD-DSP3	70
5	City Police Department/Dispatch	PD-DSPY	60
6	All PDs/Tactical Operations	TAC-1	20
7	All PDs/Tactical Operations	TAC-2	20
8	All PDs/Tactical Operations	TAC-3	20
9	All PDs/Tactical Operations	TAC-4	20
10	All PDs/Special & Emergency Operations	SPEC-1	100
11	All PDs/Special & Emergency Operations	SPEC-2	100
12	All PDs/Special & Emergency Operations	SPEC-3	100
13	CPD Academy/Training	TRAN-A	40
14	All PDs/Training	TRAN-C	15
15	CPD Criminal Investigations Division/Investigations	CID-C	10
16	City Criminal Investigations Division/Investigations	CID-Y	10
17	Future Operations	FUTR-1	*
18	Future Operations	FUTR-2	*

**These talk groups are programmed into all police radios but are inactive.*

Create the Talk Group Plan

After reviewing the system capabilities, considering system performance, and determining the kind of talk groups needed, the talk group plan should be created. At this point in the process, it is time to revisit the matrices that were created in Section 1. Although Tables 1 through 3 are a bit simplistic for an entire county, they can be used to demonstrate how to establish the basis for designing the talk group plan and how to use some of the best practices described in this guide. When defining the talk groups, one approach would be to assign talk groups to major divisions of the organization and then define the talk groups that will be needed for interoperability between those major divisions. For example, if the police talk groups are defined first, they might look like the ones listed in Table 4.

All the examples used in this section follow the same format. The talk group number is the identification number that would be programmed into the radios and the controller. An actual numbering scheme would be more complex and typically based on the particular system's features. The vendor will be able to recommend the appropriate numbering scheme for the system. The display name is what the user will see on the display of the radio when the talk group is selected. The length of the display name is limited by the number of available characters on the specific radios. In this example, it is assumed that seven characters are available. In any case, the names should follow a logical format that will allow the users to easily recognize the talk groups. Finally, the number of users listed for the talk groups is the expected number of users. For instance, talk group 6 will be programmed into all police radios. However, only about 20 police officers should be using any particular tactical talk group at one time.

Some important characteristics to notice about the talk groups in Table 4 are—

- The County Police Department's coordination requirements would be met by just one talk group; separate groups for dispatch and emergency were not necessary. (Talk Group 1)
- One pool of tactical talk groups was defined, and they would be assigned to groups as needed. (Talk Groups 6–9)
- One pool of emergency talk groups was defined and would be assigned to groups as needed. The expected size of the groups, 100 users, was based on the maximum number of users in past operations. If more than 100 users were involved in the emergency operations, the police would assign parts of the operations to other talk groups. (Talk Groups 10–12)
- Not only did the CPD Academy need a training talk group, so did the County and City Police Departments. This talk group is expected to support only 15 personnel at a time because of the type of training being performed. (Talk Group 14)
- It was determined during the traffic analysis that two investigation talk groups, one each for the county and city, would be sufficient for all investigation operations. Traffic analysis revealed that these operations typically involve fewer than 10 users at a time. (Talk Groups 15 and 16)
- It was determined during the traffic analysis that some communications should be segregated, such as tactical and investigative communications. (Talk Groups 6–9, 15, 16)
- Talk groups for future operations were added due to anticipated changes in operations. (Talk Groups 17 and 18)

Table 5: *Example Fire/EMS Talk Groups*

Talk Group #	User(s)/Operation	Display Name	# of Users
19	County Fire Department (CFD)/Dispatch	FDISPC	200
20	CFD Station 1/Dispatch	FDISP1	100
21	CFD Station 2/Dispatch	FDISP2	50
22	CFD Station 3/Dispatch	FDISP3	50
23	City Fire Department/Dispatch	FDISPY	40
24	All FDs/Fire Ground Operations	FD-GR1	30
25	All FDs/Fire Ground Operations	FD-GR2	30
26	All FDs/Fire Ground Operations	FD-GR3	30
27	All FDs/Fire Ground Operations	FD-GR4	30
28	All FDs/Fire Ground Operations	FD-GR5	30
29	All FDs/Fire Ground Operations	FD-GR6	30
30	All FDs/Administrative Operations	FD-ADM	15
31	All FDs/Training	TRAN-C	100
32	All FDs/Inspections & Investigations	FD-INSP	20
33	Emergency Medical Services (EMS)/Dispatch	EMS-1	40
34	EMS/Response	EMS-2	10
35	EMS/Hospital Contact	EMS-3	1

The fire and EMS talk groups follow the pattern of the police talk groups. Table 5 illustrates how many divisions of the organization that requested several of their own talk groups were assigned talk groups that would be shared as needed. Also, the EMS operations were given more talk groups because of the critical nature of their communications.

The public works department talk groups are not illustrated because those talk groups will be defined much like the others. The final talk groups to define are the interoperability talk groups. These are the most complex talk groups to define and implement. Table 6 is a list of interoperability talk groups for the example county system. Some of the interoperability talk groups were transferred directly from Tables 2 and 3. However, others are new and are possible because of the capabilities provided by the trunked LMR system.

The talk groups listed in Table 6 will meet the requirements identified in Tables 2 and 3 and some additional ones. Some of the interoperability talk groups listed require some explanation:

- Talk Group 37 is needed to allow non-police or fire personnel to speak directly with an emergency dispatcher.
- Talk Groups 38 through 40 would commonly be used in the event of one or more countywide emergencies or disasters (i.e., major highway or airport accident). During these emergencies, there are many possible interoperability requirements. One option would be to assign one talk group to senior command personnel from across the county while the other two talk groups could be used to support operations.
- Talk Groups 41 and 42 are normal talk groups on the trunked LMR system. However, they are permanently patched to two separate state police very high frequency (VHF) channels. These talk groups can be used to coordinate operations with all non-county police agencies.

Table 6: *Example Interoperability Talk Groups*

Talk Group #	User(s)/Operation	Display Name	# of Users
36	All Police, Fire, EMS / Helicopter Operations	AIR-OPS	20
37	All System Users/County and City Police and Fire Dispatch	PD-FIRE	10
38	All System Users/Countywide Operations	CNTY-1	100
39	All System Users/Countywide Operations	CNTY-2	100
40	All System Users/Countywide Operations	CNTY-3	100
41	All PDs, Outside County & State Police/Highway Pursuit and Other Cross-Jurisdictional Operations	PDPTCH1	30
42	All PDs, Outside County, & State Police/Highway Pursuit and Other Cross-Jurisdictional Operations	PDPTCH2	30
43	All Users/NPSPAC National Calling Channel	NATCALL	20
44	All Users/NPSPAC Mutual Aid Channel	NATMUA1	20
45	All Users/NPSPAC Mutual Aid Channel	NATMUA2	20
46	All Users/NPSPAC Mutual Aid Channel	NATMUA3	20
47	All Users/NPSPAC Mutual Aid Channel	NATMUA4	20
48	Future Operations	FUTURE	*

**These talk groups are programmed into all police radios but are inactive.*

- Talk Groups 43 through 47 are the National Public Safety Planning Advisory Committee (NPSPAC) National Calling and Mutual Aid Channels. Although these "talk groups" are actually conventional channels, they should be included in the talk group plan.

The talk groups described in Tables 4 through 6 could have been organized differently and still have met the operational requirements of the users. For this reason, after first defining the talk groups, the system manager will likely revise them several times before they are finally agreed to and established.

Train and Communicate with the User Community

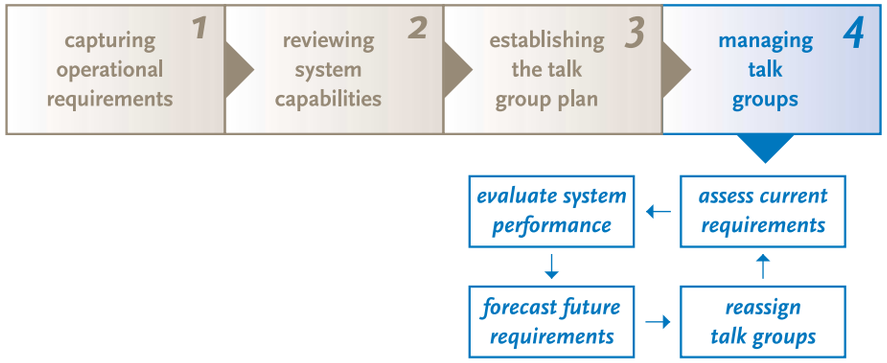
It should be a goal to create a talk group plan that is likely to be well received by the user community. When establishing a talk group plan, it is critical that the system manager learns to balance the ideal system configuration with a talk group organization that the user community will accept. The user community would likely prefer to continue communicating as it has using the conventional system. The system manager should critically evaluate the way those communications were conducted. In some cases, implementing a plan that mimics the way the conventional system operated actually defeats the purpose of trunking technology. In addition, even the best possible talk group plan may leave some users without the exact communications capabilities they desire. The system capabilities only allow a certain level of service because communications spectrum resources are finite. Therefore, establishing a talk group plan may require some difficult decisions. These issues should be confronted, and the problems, solutions, and tangible benefits should be communicated to the users so that they are readily understood and accepted.

The deployment of trunking technology within an organization that has been using a conventional system is an important operational change for most users. A significant amount of change management is crucial to ensure that users fully understand the new technology. Users must have a fundamental understanding of equipment operation and how the new system may operate similarly and differently from the previous system. All users must be kept informed about the progress of the deployment and the "cutover" plans for their specific group, department, or agency. Effective change management, incorporating frequent and open communications, helps minimize misinformation, negative user perceptions, and potential user rejections of the new technology.

Additionally, a training plan for the users is critical to the success of the system. Although the talk group plan may be well founded, if the users do not understand the organization of the plan, they will not be able to use the system correctly and experience maximum benefits. Also, there are subtle differences between conventional and trunked LMR systems. For example, with trunked LMR, there is always about a half-second delay between the moment the user depressed the PTT button and the assignment of a channel. With some conventional LMR systems, the users can speak immediately after keying the radio because there is no delay. Explaining this issue and others like it provides critical information and prevents unnecessary user frustrations. Therefore, a training plan should be created and implemented that serves to improve the ability of the personnel to use their new equipment and gives them a foundation to understand the logic of the talk group plan.

section four

managing talk groups



After the talk group plan has been successfully established, the primary focus of managing the radio system should be the day-to-day operation and maintenance of the system. However, a structured and regular talk group management process is critical to identifying problems and optimizing the system over the long term.

While establishing the talk group plan was guided by capturing the operational requirements and optimizing use of the system capabilities, managing the talk groups is driven by changes in operational requirements and the user community. It is assumed that after the system is accepted from the vendor, the system's functional capabilities will not change.

Unlike the system capabilities, the operational requirements almost certainly will change over time. When establishing a talk group plan, several sources provided input to the process of capturing the operational requirements. It is easy to imagine how the input from any of those sources could change over time. This section centers on monitoring the system, communicating with the users, and forecasting possible changes. The goal is to understand what the current operational requirements are and what they will be in the foreseeable future. When the operational requirements change significantly, changes to the talk group plan may be required.

Objectives

By the end of this section, readers will understand how to—

- Assess current operational requirements
- Evaluate system performance
- Forecast future operational requirements
- Reassign the talk group plan.

Key Steps

Assess the Current Operational Requirements

The first step in the managing talk groups process is to assess the current operational requirements and determine whether the immediate operational needs of the users are being met by the current talk group assignments. The current operational requirements can be determined much as they were in Section 1. However, it should not be necessary to review the planning documents again. Three main tasks are involved in determining operational requirements:

- Monitoring the organization for changes
- Tracking operations and how they are performed
- Seeking new opportunities for interoperability.

All three of these tasks can be accomplished through communications with the user community. Section 1 recommended three methods for gathering data from the users: questionnaires, meetings, and interviews. At this point, the needed information concerns perceived problems with the system, changes in the organization, new operations, and needed interoperability opportunities. The frequency and detail of this step varies depending on the size and complexity of the system and the user community.

Two main issues affect system performance: radio frequency coverage and system capacity.

Evaluate System Performance

The next step is to evaluate the system performance. System performance is the ability of the system to provide the service needed by the system users. The goal of evaluating system performance is to ensure that the system capabilities are used such that optimal performance is obtained from the system. Two main issues affect system performance: radio frequency coverage and system capacity. This step focuses on system capacity because it directly affects talk group management.

Using the message traffic statistics of the old system, the system planners may have projected how the new system would perform. Planners may have used a variety of probability calculations to determine whether the system would have adequate channels to accommodate the number of users intended for the system. This information about the system loading is directly related to the life of the new system. The life of the new system is the length of time the new system is expected to perform effectively with the current features, available frequency spectrum, and amount of message traffic. If planners accurately predicted and accounted for growth in the number of users and changes in the operational requirements, system capacity should not be a source of problems.

Despite even the best planning, the system can still become overloaded during major emergencies. The system manager and the department representatives can address this situation by setting the most critical users' and talk groups' priority levels to allow them priority access to the system during busy conditions. Even if the system capacity is fully loaded, the system could still perform adequately if the available capacity is allocated to the most important message traffic. The goal should be to understand the system's limitations and configure it so that the available capabilities are optimized.

The organization's system manager typically performs this task. However, the commercial vendor can usually be contracted to monitor, manage, and optimize the system after implementation. Because of the complexity of trunked LMR systems and the capacity issues affecting system performance, it may be in the interest of the organization to outsource this specific service.

The most common and most important symptom of poor system performance is delay. Delay is normally due to system loading or the organization of the talk groups:

- Channel assignment delay
  One type of delay occurs when a user depresses the PTT button and must wait an unacceptable amount of time before being assigned a channel.
- Talk group traffic delay
  Another type of delay occurs when a user must wait to initiate a message because another member of the talk group is already speaking.

When evaluating delay problems, the message traffic statistics collected during the regular busy hour and during high message traffic emergencies are very useful. It is also important to evaluate how the system performance changes as new users are added to the system. Two main approaches can be used to evaluate the system performance to reveal the cause of delay problems:

- Overall system loading
  If system users are experiencing channel assignment delays, the entire system could be overloaded. A system is overloaded when there are not enough radio frequency channels to carry the message traffic. There are a variety of probability calculations for determining whether a system has an adequate number of frequency channels for effective operations. The vendor should be consulted to determine the calculations that most closely model a particular system. The goal of assessing the system's overall loading is to determine whether the frequency spectrum (number of channels) currently allocated is adequate for the required message traffic. These same calculations should be used to determine the long-term performance. The long-term performance is directly related to the addition of new users and changes in operational requirements. If the allocated frequency spectrum is inadequate or is expected to become inadequate, it is very important to detect that problem early because it normally takes a long time to obtain additional spectrum. It should be noted that in some cases, new spectrum is not available at all.
- Individual talk group traffic
  The system manager should monitor the message traffic of each talk group. The system controller software that provides this message traffic varies a great deal among manufacturers. While some manufacturers have features that are fully automated, others require the creation of customized spreadsheets to produce usable calculations and charts. The system manager should ask the vendor for a method to track the traffic of each talk group on a daily, weekly, and monthly basis. If it is determined that a specific talk group has higher than expected message traffic, that group may be causing talk group traffic delays for its own members. Another problem with talk groups using more than the required capacity is that they could cause channel assignment delays for other talk groups. If it is determined that a particular talk group is using more system capacity than desired, there are numerous ways to limit that talk group's message traffic—restrict its channel access, change the talk group priority, consolidate talk groups, or train the talk group members on radio discipline and proper radio etiquette.

Forecast Future Operational Requirements

The third step is to forecast future operational requirements. The goal of forecasting future requirements is to prevent problems with the talk group plan. If changes to the operational requirements are predicted and assessed early, the system manager has the time to adapt the system and talk groups, and the system can continue its uninterrupted support of the operational requirements. Some of the changes that would likely affect the operational requirements are—

- Changes in operation
- Annexations
- Large commercial investments or build-outs
- Absorption of other area agencies
- Providing of communications services to neighboring agencies
- Department and user population growth
- Changes in operations of surrounding city/county/state/federal departments
- Future interoperability
- Demographic changes.

Information about these types of changes can be gathered in a variety of ways. Key sources that can provide valuable information about these topics could include—

- The user community
- City, county, and state management
- Senior public safety officials
- Regional planners.

The changes listed above may cause revisions to the system beyond the talk group organization. For example, changing operations may require new talk groups for those operational groups. However, the annexation of new land may require major infrastructure procurements. In either case, recognizing the need for these system changes early will prevent problems and improve the ability of the system to meet the operational requirements of the users.

Reassign the Talk Groups

After the operational requirements are reviewed, the system loading and performance has been evaluated, and the expected changes have been assessed, it may be concluded that the talk group plan must be revised. In some ways, the process of revising active talk groups is similar to establishing talk groups. The majority of the organizational issues that were previously considered must be revisited. Most importantly, the forecasting process described above may have occurred as a closed process where the system manager was seeking to determine the need for revising the talk group plan. Once the determination has been made to revise the plan, it may be necessary to form a team from across the organization to assist in revising and implementing the changes.

Of course, each system, organization, and situation is unique, and it is up to the system manager to initiate this process and keep it focused on solving the identified problems. In addition, the management process is cyclical and ongoing throughout the life of the system. The order in which the steps in this section are completed is not critical, only that that they are completed on a regular basis. The keys to successful system management are a thorough understanding of the user community and their operational requirements, the knowledge of how to optimize the system and fully leverage the system capabilities, and an ability to look to the future to determine how the operations of the organization may change.

About the Public Safety Wireless Network Program

The Public Safety Wireless Network (PSWN) Program, a jointly sponsored endeavor of the Department of Justice and the Department of the Treasury, was created in 1996. The program is responsible for fostering interoperability among wireless networks so that local, state, federal, and tribal public safety communications requirements can be addressed. Through a variety of activities, the program strives to achieve the vision it shares with the public safety community—seamless, coordinated, and integrated public safety communications for the safe, effective, and efficient protection of life and property. Specifically, the program seeks to—

- Improve public safety wireless communications by addressing each of the five key issue areas of interoperability—coordination and partnerships, funding, spectrum, standards and technology, and security
- Listen to, learn from, and collaborate with local and state public safety officials to improve communications interoperability
- Encourage the implementation of regional interoperability by collaborating with major wireless systems development efforts.

During its first several years, the PSWN Program has promoted partnerships among public safety agencies and has pursued case studies and pilot projects, analytical studies, and outreach efforts. Examples of these activities include—

- Establishing a technical resource center and an information clearinghouse that helps unify and educate the public safety community regarding wireless interoperability issues
- Developing a national strategy for public safety interoperability that provides proven, high-level implementation guidelines, best practices, innovative designs, and operating procedures to help the public safety community improve and implement interoperable communications networks
- Collecting and analyzing data to assess the operational environment for public safety communications as it relates to the five key issue areas of interoperability
- Hosting regional shared systems symposiums that bring together local, state, and federal public safety agencies to share information on wide-ranging issues such as regional planning, site acquisition, funding, and systems planning
- Pressuring for further resolution of unanswered public safety spectrum needs at the Federal Communications Commission, within the Public Safety National Coordination Committee, and in open publications
- Developing "how to" guides on local, state, and federal system planning, system management, and spectrum management to assist public safety officials build and operate effective systems
- Providing leadership by partnering with state and local agencies to address interoperability obstacles in multiple regions of the country
- Engaging in a high-profile communications campaign to educate government decision makers and public safety personnel on the importance of wireless interoperability.

Further information regarding PSWN Program products and services can be found at **http://www.pswn.gov.**

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800.565.PSWN