Sprint

Public Safety Solutions White Paper

Optimal Interoperability

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Abstract

It has never been more important for our nation to strengthen its communications capabilities and improve the level of preparedness to protect our communities.

Achieving interoperability, or more specifically, interoperable communications is something that has burdened government services for decades. Linking users on disparate radio systems is a challenge faced daily by public safety and defense agencies at the local, regional, state and federal levels. Similar challenges are also encountered in the utilities, healthcare, transportation and enterprise industries. Customers in all of these industries use a variety of wired and wireless networks, including cellular, wireless LAN, and push-to-talk land mobile radios to communicate. Use of these disparate systems and networks to communicate with each other is, at best, inefficient but can also end with disastrous consequences. Innovative, cost effective solutions are available today to solve these challenges.

Introduction

One of the major issues facing the public sector is the inability of emergency service workers including traditional "first responders" to communicate with one another when the need arises. These emergency first responders have long been defined as the first arriving organized responders with the capability and mission to contain, mitigate, and resolve the emergency at hand. The lack of radio interoperability is a multi-faceted problem that is unique to each event, to each set of organizations, and changes over the course of time. First responders need a comprehensive solution that is simple to use and can be expanded as situations demand. The vendor community is presenting many technical solutions, and many local organizations have begun to procure a variety of interoperability solutions oriented toward local interoperability needs with their immediate neighbors.

As interoperability solutions become deployed and used, existing shortcomings become exposed. At the forefront is the lack of a nationwide interoperability solution that can be called upon to link first responders in previously unimaginable responder groups. First responders cannot predict with whom they might join in an emergency. As such, the nation needs a solution that can support limitless communications scenarios.

When considering a solution for communications interoperability, one need not imagine a solution that is "turned on" only during an emergency. The solution should be flexible enough to be useful on a daily basis, but robust enough to span the broadest range of agencies, geographies, and applications. Operationally, there are three levels of interoperability that must be accounted for:

> Day-To-Day
> Task Force
> Major Emergency Operations

Interoperability is not the ability for everyone to talk to everyone all the time but rather the ability for Public Safety service and support providers to talk with each other:

> On demand
> When needed
> When authorized
> In real time, across disciplines and jurisdictions

Sprint has been working closely with several of the industry's leading technology providers to bring innovative solutions to market. This paper explains the framework and value of a parallel communications system. Solutions presented here are available today, are extremely cost effective and can help to effectively achieve communications interoperability for public sector agencies at all levels.

Developing Parallel Communication Systems

Organizations that rely on real-time, emergency dispatch communications need reliable, scalable and flexible communications solutions. Nextel Land Mobile Radio (LMR) interoperability solutions complement existing LMR systems by helping minimize the operational challenges faced every day.

As the number of radio users and functional demands on private networks increase, LMR system owners are confronted by many options including upgrading, replacing or augmenting their existing radio systems. Many of these organizations lack the resources and/or funding to completely revamp a system that they rely on for their daily communications. Instead, they need cost-effective, readily available solutions that complement their existing systems to provide extended features, functionality and scalability.

Until recently it was not possible to cost effectively connect commercial communications networks to LMR systems. With recent technological advances, however, Nextel Direct Connect® and Talkgroup services can be integrated into any trunked or conventional LMR system, including analog, digital, 800 MHz, VHF or UHF. Improvements in communications technology have resulted in greatly enhanced operational capability and have reduced the long-term cost of communications system ownership.

The robust Nextel National Network serves as the ideal solution to complement existing LMR systems. Unlike those of other cellular carriers, the Nextel network is actually a nationwide digital 800 MHz trunked radio system. This differentiation provides tremendous possibilities for the public sector and first responders. The following diagram highlights a very important point about the Nextel National Network.

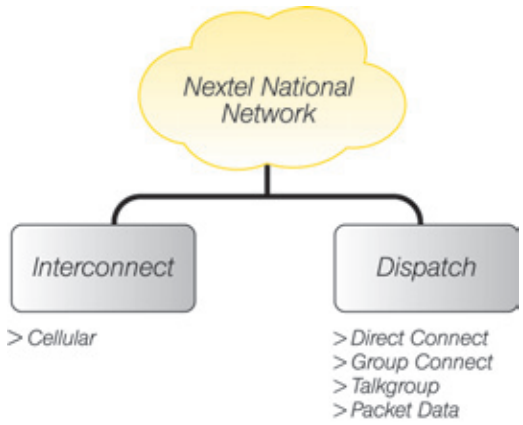


Figure 1. Dispatch services on a dedicated, private network

One commonly overlooked weakness in a typical commercial communications solution is that every landline and wireless telephone call depends, to a large degree, on the public switched telephone network to function. Generally, large-scale events or catastrophes result in a flood of telephone calls impairing the public telephone network – the "all circuits are busy, please try your call later" syndrome. While this situation can adversely affect telephone service, it is important to understand that Nextel dispatch services do not use the public telephone network. Instead, Nextel private and group calls utilize a dedicated and private network optimized for secure, reliable, priority communications.

Together, the combined Nextel-LMR network delivers an integrated and interoperable system that maintains each individual network's unique strengths. Serving as the ideal supplemental or complementary system, the Nextel network delivers the interoperability, coverage, capacity and reliability that public sector organizations need now and well into the future.

For example, while Nextel and private networks provide dispatch capabilities, only an integrated solution provides a nationwide dispatch overlay resulting in:

1. **Nationwide interoperability**
   Administrative officers can keep in touch with field operations from anywhere on the Nextel network – nationwide and international.

2. **Conservation of primary radio systems resources**
   Less critical staff can use Nextel radios, conserving channels needed by first responders and reducing the possibility of congestion.

3. **Enhanced reliability, coverage and capacity**
   Immediately following the collapse of the World Trade Center, almost every communication system (including the public telephone system and wireless telephone systems) failed for one reason or another, yet Nextel's digital Direct Connect feature stood out by allowing firefighters at Ground Zero to communicate with each other.

Day-to-Day Operability

In order to achieve effective communications interoperability, the solution must be used each and every day. The most effective way to accomplish this is through dispatch operations. At the heart of any private, LMR system is the dispatch operations center, sometimes called the Emergency Communications Center. At the heart of any dispatch center is a dispatch console system under the control of a 24x7x365 staff of very proficient dispatchers.

Sprint offers interoperability solutions based on PC-based dispatch consoles capable of interconnecting private radio networks with the Nextel National Network. Once integrated, the console operator controls communications between Nextel and disparate two-way radio, public telephone and paging systems. This consolidation of multiple telecommunication connections simplifies a complex combination of services into a single, integrated system. Console solutions are compatible with private radio communications systems including P25, ASTRO, SmartNet, SmartZone, EDACS and many other proprietary communications systems and networks. An integrated Nextel LMR solution provides interoperable communications between virtually any LMR and a Nextel handset. Consoles systems supported include Motorola, Zetron, Telex, Avtec, Microvoice, Positron/Orbacom and many others.

Key capabilities of dispatch console systems include:

> User Friendly Graphical User Interface to assist the dispatcher
> Database Management – Capable of storing thousands of alias names for Nextel IDs, radio IDs and telephone numbers
> Simul-Select – Simultaneously transmit to multiple individuals or Talkgroups
> Voice Patching – Bridging two or more individual or talkgroups together
> Activity Logging – Allows dispatchers to review the most recent calls
> Voice Recording – Audio recording using standard Voice Logging Recorders
> Telephone Interconnect – Telephone calls can be made, received, patched and recorded.
> Facility monitoring and control
> Economical, scalable LAN based architecture

Once integrated with the Nextel National Network, these capabilities are extended to include Nextel Direct Connect and Talkgroup services, resulting in Nextel becoming a true extension of any private radio system.

Key Benefits:

> Elimination of traditional geographical dispatch communications boundaries.
> Multi Agency Interoperability – Effective communications between jurisdictions and agencies regardless of the type of radio or assigned frequencies they normally use.
> Improved Incident Management – Instantly connect critical resources to incident command and task forces from anywhere on the Nextel National Network.
> Dispatch Operations Consolidation – Incorporate less-critical (volunteer, maintenance, public works) operations into central dispatch.
> Frequency Conservation – Off-load non-critical communications, freeing up LMR channels for first responders that need them most.
> Cost Effective Coverage and Capacity Enhancements – Augment private system coverage where and when it makes most sense.

When administrative staff members using Nextel handsets need to communicate with users on LMR systems, they can be connected through the dispatch console. Nextel handsets are much less expensive than land mobile radios and users can be anywhere on the Nextel National Network.

Figure 2 below is an example of unified, multi agency incident command under the control of central dispatch. In this example, users of LMR systems and Nextel handsets can be coordinated seamlessly and can be interconnected as needed, in real time. Additionally, in the event that an outside resource would be needed (for example, a federal agency) they could be contacted using Nextel Direct Connect and patched to first responders through the console system. During such an incident there is a very good chance that users of the public telephone network are experiencing “all circuits are busy, please try your call later”.

Figure 3 below provides an example of a how the Nextel National Network is integrated with a Land Mobile Radio console system. The private system in this example can be any conventional or trunked radio system.

Depending on the console system, a single Nextel control station can be used to communicate with different talkgroups or individuals. If more than one Nextel Talkgroup or individual needs to be contacted simultaneously, multiple Nextel control stations can be employed. For console systems that don’t offer full support of the Nextel radio protocol, the Nextel control station can be connected using the console’s basic conventional “local control” interface. This means that virtually any console system can be integrated with Nextel.

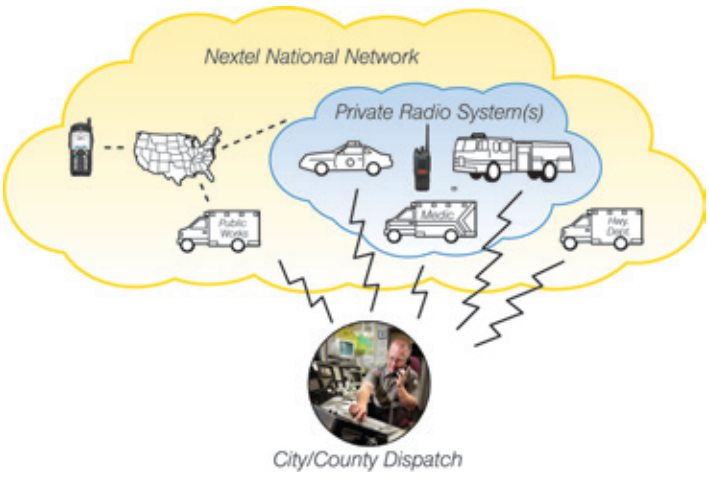


Figure 2. Example of unified, multi-agency incident command controlled by central dispatch

Figure 3. Integration of the Nextel National Network with Dispatch Console system

VoIP Based Dispatch Solutions: Increased Redundancy, Mobility and Interoperability

Over the past decade Voice over IP (VoIP) has matured and evolved into to a reliable, secure solution for Public Safety dispatch communications. As VoIP has been applied to dispatch communications it's become known throughout the industry as Radio Over IP (RoIP).

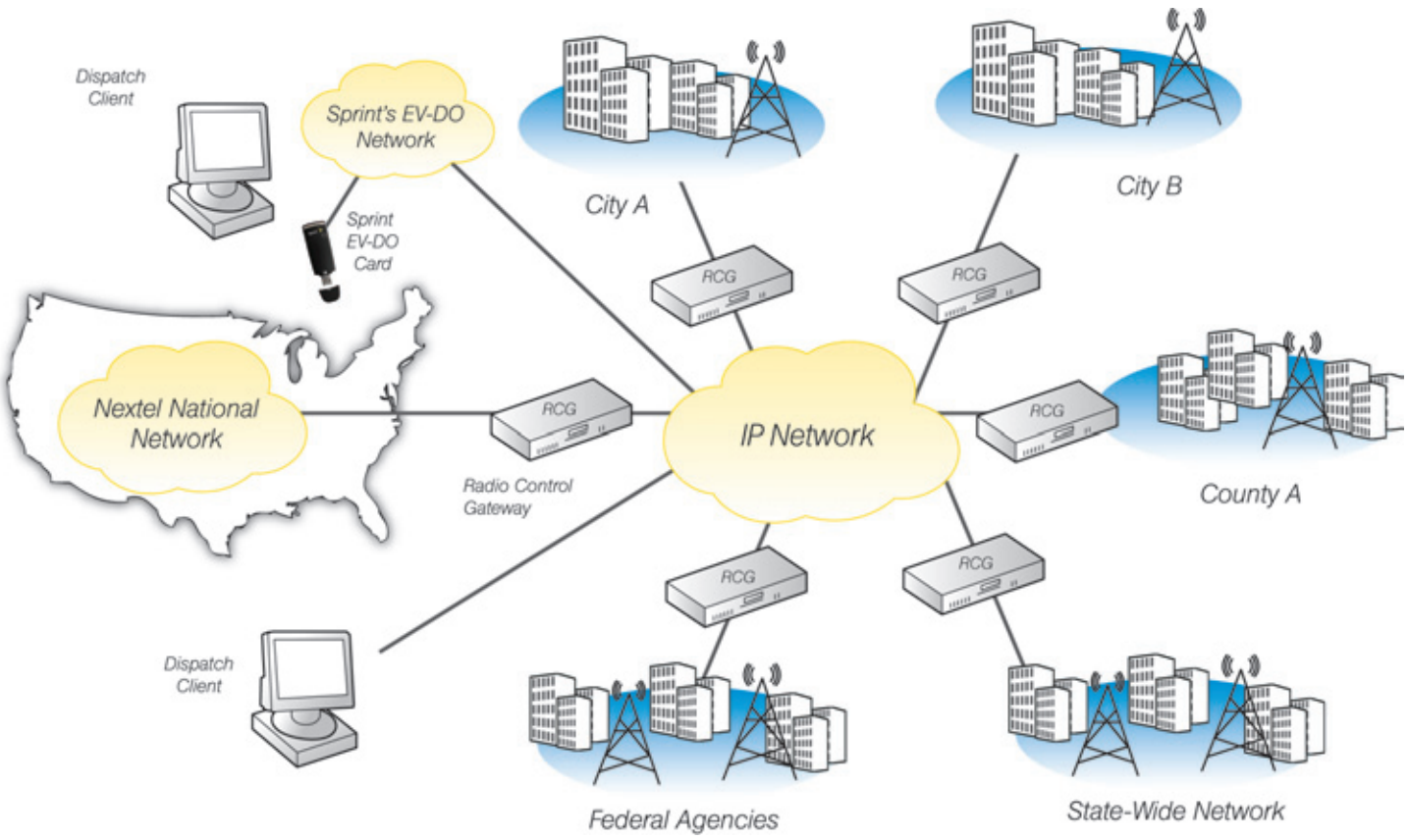
VoIP dispatch systems result in very cost effective radio communication solutions that make use of a customer's existing private IP and radio networks. Because communications utilizes IP, there are absolutely no boundaries or confines – a dispatch operator can be anywhere his/her job requires them to be, even if they're mobile. Additionally, a dispatch operator has the ability to communicate with and establish interoperability between any and all radio systems that are part of the solution.

Interoperability is not limited to Nextel and LMR systems; VoIP can effectively connect telephone systems, intercom systems and satellite based push-to-talk services for dispatch communications regardless of geographic territory.

VoIP is also a very user friendly, flexible and scalable tool. A basic solution would include a Windows-based PC to run the dispatch client, an IP to Radio interface and some number of radio control stations (or access radios). This configuration can scale very easily to include any number of client PCs, any number of radio interfaces and the number of end users is virtually unlimited.

And finally, because IP is fundamentally a distributed architecture, these solutions can be built as redundant and fault tolerant as needed with no single point of failure. In the event a primary dispatch center goes down or network connectivity is lost, dispatchers at remote locations could seamlessly take over.

Figure 4. Dispatch VoIP: Increased Redundancy, Mobility and Interoperability



Nationwide Interoperability and Emergency Response Support

Critical to the success of any interoperability plan is communications between local, regional, state and federal responding agencies – regardless of jurisdiction, discipline or location. The solution must be flexible enough to be useful on a daily basis, but ubiquitous enough to span the broadest range of agencies, geographies and applications.

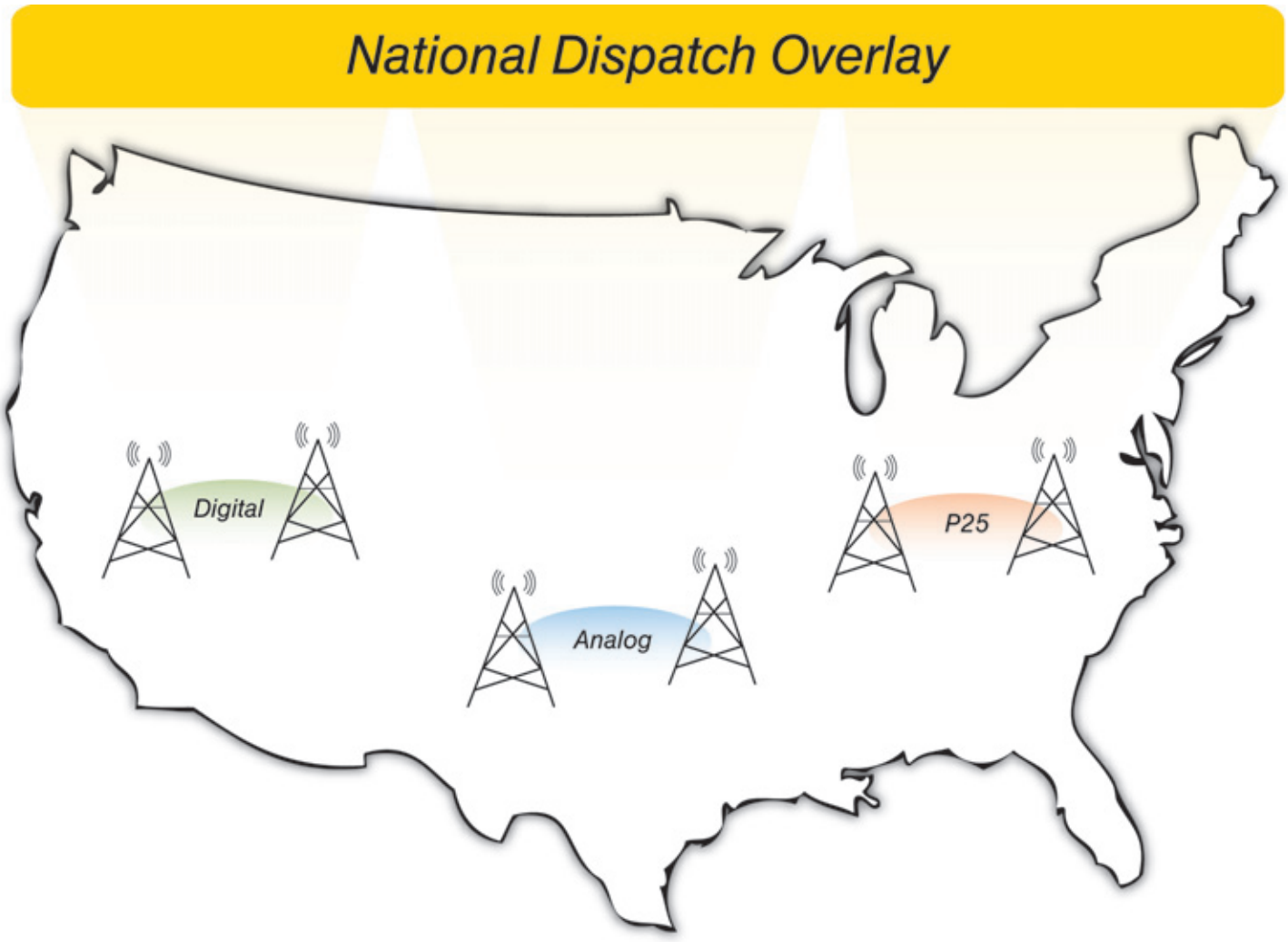
One critical point that has been identified at a number of large-scale events is that there is a need for another way to communicate if the primary radio system fails or becomes overloaded. Integrating the Nextel nationwide radio network with regional private radio systems creates system of systems – essentially a radio system overlay that can be integrated into any and all radio systems.

A parallel method of communications allows for logistical conversations to take place without interfering with the main public safety radio systems. This parallel concept also offers a way to interconnect agencies that are not affiliated with public safety but are essential to successful mitigation of large-scale emergencies/events.

During the catastrophic events at the Pentagon and the World Trade Center for example, primary public safety radio systems were overwhelmed with radio traffic, sometimes rendering them ineffective. In both of these cases the use of Nextel Direct Connect was very important to first responder operations.

Figure 8 shows an example of large-scale, unified, multi-agency, multi-jurisdictional incident command. In this example, users of LMR systems and Nextel handsets can be coordinated seamlessly and interconnected as needed, in real time. In this example, a federal agency resource is contacted using Nextel Direct Connect and patched to the on-scene incident commander under the control of Emergency Dispatch Operations.

Figure 5. National Interoperability Framework



Tactical/Incident Command Interoperability

To address the challenges of on-scene command and control, Sprint has partnered with industry leading manufacturers of radio cross-connect devices. These solutions greatly improve the Incident Commander's ability to achieve on-scene, real-time interoperable communications. Under the control of Incident Command, Nextel Direct Connect and Group Connect services can be interconnected with Land Mobile Radio users as needed. Primary benefits of these solutions include:

> **Multi Agency Interoperability** – Effective communications between jurisdictions and agencies regardless of the type of radio or assigned frequencies they normally use.

> **Improved Incident Management** – Instantly connect critical resources to incident command and task forces from anywhere on Nextel's nationwide digital trunked wireless network.

> **Cost Effective Coverage Enhancement** – Augment private communications systems coverage where and when it makes most sense.

One extremely powerful benefit of this solution is the ability to bridge (patch) Nationwide Nextel Direct Connect calls into local/regional, first responder talkgroups. For example, during an emergency situation, federal agencies using Nextel Direct Connect can communicate directly with local agencies communicating on LMR talkgroups, Nextel Talkgroups or both. Agency interconnectivity can be accomplished under the control of Incident Command or Dispatch Operations.

Figure 9 shows how Nextel Direct Connect can be combined with both Land Mobile Radio talkgroups and Nextel Talkgroups.

Communications Assurance in Times of Crisis

Sprint can provide rapid, temporary increases in capacity and coverage in response to major events across the country. This increase in coverage and capacity can be provided at our existing cell sites, at the local level or through our Emergency Response Team (ERT). Sprint's ERT supports high-volume, short notice equipment needs of our customers with its substantial inventory of COW's (Cell-sites On Wheels), SatCOLTs (Satellite Cell-sites On Light Truck), microwave facilities, ruggedized handsets, and command-and-control solutions based on radio interconnect devices. Sprint's implementation managers and engineers are accustomed to deploying communications infrastructure both within and outside traditional cellular network coverage areas.

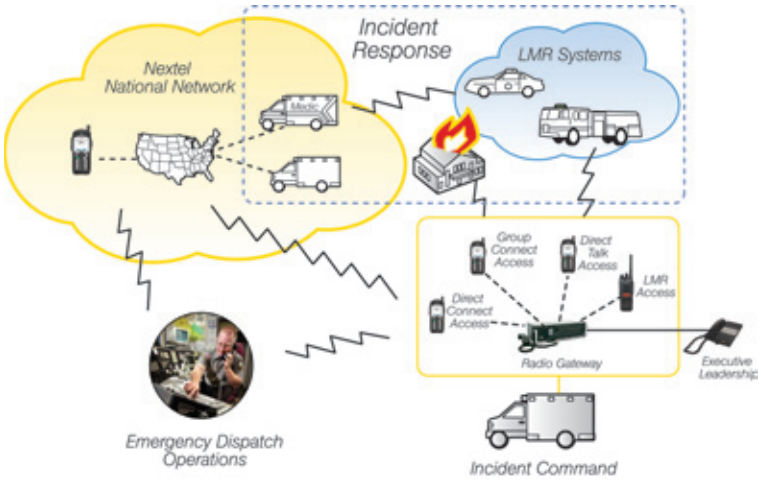


Figure 6. Incident Response and Command

Figure 7. Combining Nextel Direct Connect, Nextel Talkgroups and Land Mobile Radio Talkgroups and/or Channels

Conclusion

When considering a solution for nationwide communications interoperability, one need not imagine a solution that is "turned on" only during an emergency. The solution should be flexible enough to be useful on a daily basis, but robust enough to handle the broadest range of agencies, geographies, and applications.

Together, the combined Nextel-LMR-VoIP system of systems delivers an integrated and interoperable system that maintains each individual network's unique strengths. Serving as the ideal supplemental or complimentary system, the Nextel network delivers the interoperability, coverage, capacity and reliability that public sector organizations need now and well into the future. This combined solution can be deployed today at a fraction of the cost proposed by those offering proprietary or forklift replacement solutions.

The primary benefits of this permanent interoperability solution include:

- Affordable overlay network that promotes interoperability between different agencies and organizations
- Improved efficiencies through flexible management of field and mobile personnel
- Leverage investment in existing systems and extend life cycles
- Streamline staff communications by eliminating the need for multiple communication devices
- Reduce the on-going costs of two-way radio communications systems maintenance and expansions
- Scalable network that supports both priority voice services and data applications

Figure 8. National Interoperability Framework