

An Introduction to Government Radio Networks

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Introduction

Several levels of governments in the world have been driving towards a new type of model of two-way radio communications operations called Government Radio Networks (GRN). The popularity of this type of model has been around since the 1970's, but has really become even more popular within the last 10 years because of a variety of factors: economics, drive for improved government services & productivity, operational need for standards, and need for improved emergency communications. This paper will introduce the concept & benefits of a GRN, what is driving the need for GRNs, and some practical considerations about GRNs.

What is a GRN?

Simply, a Government Radio Network is one common and shared two-way radio communications system that is owned by a government, and is shared by all of the departments or ministries within that government. In many locations around the world today, there are still many government departments or ministries that buy their own radio system for their own functional use. The radio resources are not shared with any of the other government departments. An example of this is where a city government may have a police radio network that is used by the police department, and this radio system is not shared or used by the fire department in the same city. Instead, the city fire department would own and operate its own radio system. Under the GRN model, one level of government would deploy one shared radio network for all departments within that government level. In our example, the city government would deploy one common and shared radio network that is used by not only the city police and fire departments, but also the city administration, city maintenance, environmental protection, disease control/health department, and traffic management department.

The government level that can implement a GRN can vary: city, counties, province/state, and country-wide. In addition, it is also possible for regional areas, composed of several city and/or counties, or even several states/provinces, to come together to implement a GRN that crosses their political boundaries.

It is important to note that a GRN is not a technology or a particular system. It is an ownership concept and a business operational model. Even though a GRN is not a technology model, it does depend very heavily on the right technology and the right solutions provider/partner to be successful over the life of a GRN.

What is Driving the Popularity of GRNs?

There are several factors that are making the GRN concept very popular to governments at all levels today:

- *Economics* – Governments at all levels today are seeing lower streams of revenues to support government services, or are seeing a public demand for other services that require more budget. Because of budget pressures, government finance organizations are now looking to cut costs wherever they can, and this includes looking at combining technology usage across government departments. If many government departments can share certain resources, this allows critical government budgets to be freed up for other public needs or investments.
- *Drive for improved government services & productivity* – Many elected government officials are looking for ways to provide effective government to the public with less tax revenue dollars. One way to do this is to improve government productivity and services. Any technology, tools, operational & management processes, and business models that can help government to do this will be seriously considered. Before GRNs, each government department had to procure their own systems. Under the independent systems approach, not all departments have been able to afford their own systems and either elect not to deploy one, or deploy a simple one that may not meet their full requirements. This leaves some departments ineffective and unproductive at some level because of poor communications.
- *Operational need for standards* – When governments standardize on particular technologies, strategic partnerships, or open standards, it allows governments to operate more efficiently through leveraged buying power, which results in cost savings. It also makes it easier for governments to maintain and service their public infrastructure and systems since there is only one system to maintain and train on.
- *Need for improved emergency communications* – One of the biggest drivers of GRN deployments is the need for improving emergency communications between public safety users¹. The problem with police and fire having two separate radio systems is the lack of communications, especially during a major disaster. Time and time again, many disasters have demonstrated that the lack of communications between police and fire seriously jeopardizes or hinders their ability to respond to the public efficiently and effectively.

In many respects, a GRN is a different type of standard. A GRN is an operational standard, where participating government departments must use the defined common and shared system for the mutual benefit of all.

Benefits of a GRN

The benefits of GRNs are very clear:

¹ Public safety users include police, fire, ambulance and any organization that responds to the public's call for help.

- *Tremendous cost savings* – Having one single shared network for all departments creates a tremendous cost savings for government due to cost efficiency and economies of scale. It becomes more efficient for the government to operate and maintain the GRN over the life of the system. It is easier for the government to maintain and support one system for all government departments. As an example, the State of Minnesota is implementing a statewide 800 MHz trunking system. In their report², Minnesota estimated that if all of the individual city, county, regional and statewide agencies continue to use, upgrade and maintain their systems, the cost ranged between US\$672M - US\$1,300M. Procuring one shared statewide system was estimated to cost US\$219.6M, resulting in taxpayer savings of US\$452.4M – US\$1,080.4M. In another example, the State of California commissioned a cost-benefit study³ for a shared government radio network. The consultants have estimated that a GRN approach will save the State over US\$795M over a 15 year period as opposed to the independent systems approach.
- *Improved government services & productivity* – When a GRN is deployed, it has the inherent benefit of giving all government departments the same level of coverage, reliability and performance for all departments. This means that departments that may not have had good two-way radio communications may now have excellent communications in the GRN environment. Indeed, some departments that may have never had two-way communications can now have access to a new productivity tool. Government administration also improves because so many more department managers can now be communicated with in real-time. As most students of management know, improved communications improves productivity, efficiency and safety.
- *Operational standards* – When a GRN is deployed, all users on the same system benefit through common usage. All users are on the same frequency band and use the same type of radios. This allows for even more savings and efficiency through common training, common procedures, common service processes, and common network management & maintenance. Users also benefit through user friendliness since everyone knows how to use the same type of radios.
- *Improved emergency communications* – A shared and common communications network solves the interoperability problem between public safety organizations. So when a major traffic accident occurs, the police, fire and ambulance at the accident site can all communicate together to coordinate their actions locally to provide aid to the injured, keep the public safe, and prevent any further damage.

Even though the benefits of a GRN are clear, there are possible complications in procuring and implementing GRNs, especially as the scale and scope of the system increases, which will be discussed later in this paper. The benefits of GRNs are even more pronounced in the post-September 11 era, where the threat of terrorist events is

² State of Minnesota Dept of Administration Planning Committee Report on the 800 MHz Statewide Shared Public Safety Radio System, February 2001

³ State of California Cost-Benefit Analysis for California's Public Safety Radio Communications Project, April 1999, by The Warner Group Management Consultants

potentially more damaging and widespread than ever before. This will require faster and better response from the public safety first responders in order to minimize its impact.

Evolution of GRN Models

The GRN concept and the various GRN models available for use today can be explained best through a historical look of how GRNs evolved over time.

When two-way radio systems were introduced in the 1940's and many governments used them as communications tools for their field workers and officers, these systems were procured and implemented on a per-department basis. The police department would buy their own system; likewise, the fire department and ambulance service would deploy their own systems. This pioneering model of a government radio network can be called the **Independent Service Model**, as shown in Figure 1 below.

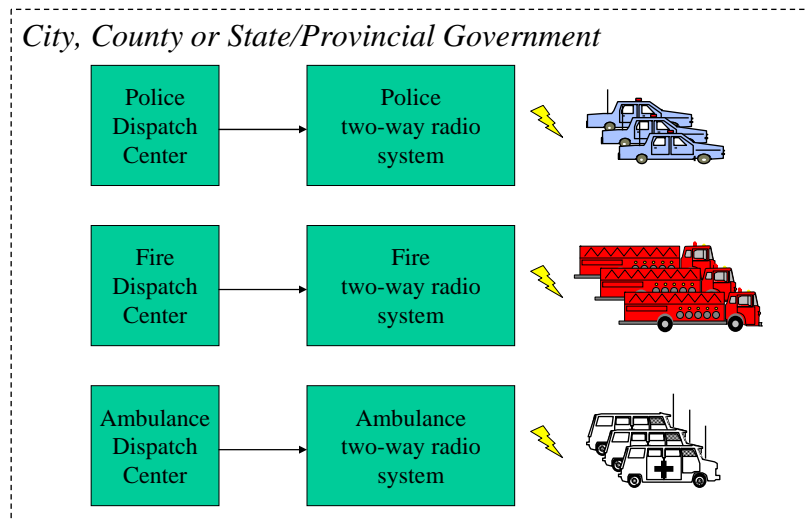


Figure 1. Independent Services

Each of the services may be deployed on different radio bands. The emergency phone numbers that the public uses to call into the dispatch centers may be different. The decision for procurement and deployment of these systems are treated independent of one another. Many cities and countries in the world today still operate using this model. This model is the easiest to start with by most governments since budget money is allocated on a per-department basis, and each department spends according to their own individual needs.

The advantages of this model are that each emergency organization gets exactly what they need for their operation, each organization has total control over their own system, and the cost of their own system is fairly borne by each of them. The

disadvantages of this model are that there are interoperability problems if some of the emergency response organizations operate on different bands (VHF, UHF, 800MHz, or others), and the ongoing operational and maintenance costs are high for the government since three separate systems must be maintained independently.

Later in the 1970's⁴, a single emergency phone number was implemented in the US, chosen as 9-1-1, to aid in the faster response of public safety to citizens calling for help. With the emphasis on needing to improve the call-taking and dispatching process for emergency services, the solution quickly drove several cities into combining the police, fire and ambulance dispatch centers into one. This allowed for much improved communication between the emergency services and for a centralized command center for larger emergencies and disaster management. This resulted in the second model of a government radio network, shown in Figure 2, called the **Shared Emergency Dispatch Center Model**.

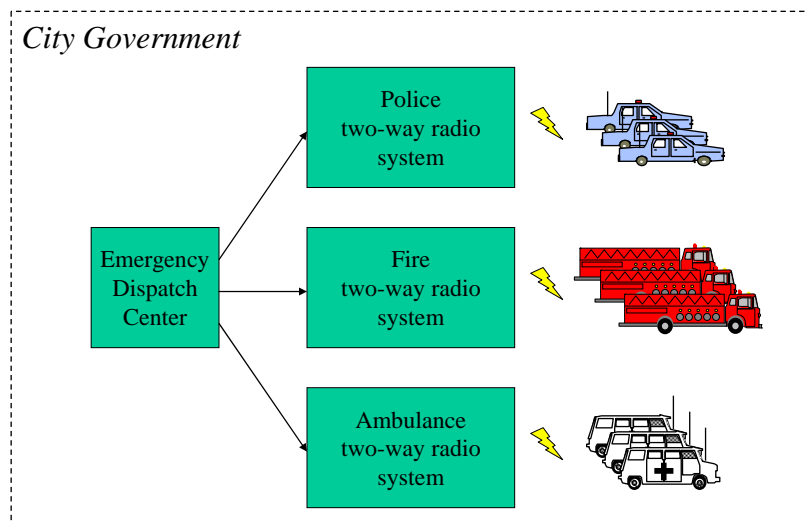


Figure 2. Shared Emergency Dispatch Center

In this model, the various emergency call-taking and dispatch centers are combined into one physical center; the radio systems are still separated. Each of the services may be deployed on different radio bands. The emergency phone numbers that the public uses to call into the dispatch centers can be a single number, or be different for each service. The decision for procurement and deployment of only the radio systems are treated independent of one another. Again, many cities and countries in the world today still operate using this model. At the time of this paper, the City of Chicago uses this model. The emergency dispatch center is operated by the Office of Emergency

⁴ The Development of 9-1-1, National Emergency Number Association, http://www.nena9-1-1.org/PR_Pubs/Devel_of_911.htm

Management & Communications (OEMC) and reports directly to the Mayor of Chicago. This model can be evolved from the Independent Services Model by simply combining all emergency services under one roof.

The advantages of this model are that each emergency organization gets exactly what they need for their two-way operation in the field, each organization has total control over their own radio system, and the cost of their own radio system is fairly borne by each of them. A major advantage of this model is that the call-taking and dispatch process has timing and service improvements for the public. Emergency calls from both the public and from the officers in the field are better managed and coordinated by all three services under one roof, especially in times of a major disaster, incident or event. A side benefit is that the city government will achieve some cost savings by maintaining one dispatch center for the public. The disadvantages of this model are that there are interoperability problems if some of the emergency response organizations operate on different bands (VHF, UHF, 800MHz, or others), and the ongoing operational and maintenance costs are high for the government since three separate systems must be maintained independently.

Interestingly, the GRN concept has been around since the 1970's. When Motorola first introduced its famous single-site Smartnet trunking systems in the early 1970's, many small and medium sized cities implemented Smartnet trunking at a city government level. City mayors realized how much city budget they can save by deploying one radio system for their entire city level departments. Larger cities, however, continued to deploy two-way radio systems using the independent system model or the shared emergency dispatch center model. Over the years, two-way radio technology evolved and improved, which allowed for large cities to also take advantage of the GRN model, resulting in the third model which we will call the **Small Government Radio Network Model**, as shown in Figure 3.

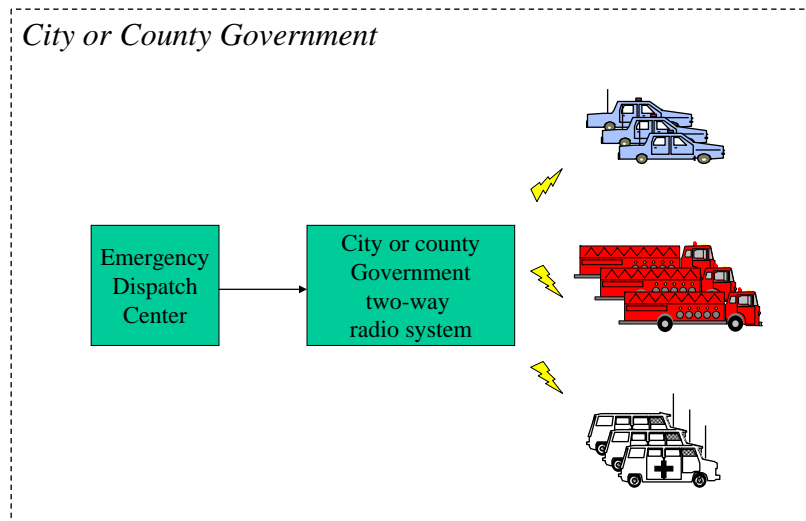


Figure 3. Government Radio Network (Small)

In this model, the emergency call-taking and dispatch center is still combined. The radio system is now also combined into one shared common network. All of the emergency services use one common frequency band. The emergency phone numbers that the public uses to call into the dispatch centers can be a single number, or be different for each service. The decision for procurement and deployment of the one radio system is treated as one entity with everyone's requirements taken into account. There are many cities and countries in the world today that operate using this model. This model can be evolved from the Shared Emergency Dispatch Center Model by simply combining the two-way radio network under one system.

The advantages of this model are carried over from the previous models, plus the added benefit that all of the public safety responders can now talk to each other when required – the interoperability problem between various organizations inside the same city has been solved. When a local traffic accident occurs where police, fire and ambulance are on the scene, the responders can now talk to each other at the scene over the radio system very easily. In addition, there is only one radio network for the government to manage for all city services, thereby leveraging economies of scale for cost savings. Other city departments, such as the Department of Health or the Public Works Department, can now also use the same system for their own operations. The disadvantage of this model is that most of the departments must give up control of their radio networks to someone else in the government. In addition, the selection of the best provider of the two-way radio system will be most critical. If the wrong selection of the technology or vendor is made, all of the city departments will suffer together for a long time until that technology is replaced.

The small government radio network model worked very well in the US and in many parts of the world during the 1980's and 1990's. However, one major problem began to emerge. As more cooperation agreements for public safety support between cities became more prevalent (where City 1 can send its officers to City 2 to provide additional resources to a critical event), the operational deficiency of the small GRN model started becoming clearer with analog trunking. City governments starting realizing that while they enjoyed the economic and operational benefits of a shared radio network inside their own city boundaries, they could not talk to their neighbors with the same radio system. A high-speed car chase that crosses city boundaries can stop police communications once radio coverage is exceeded. Likewise, if City 1 needed additional help from neighboring City 2, City 2 public safety personnel potentially could not use their radios on City 1's system. This eventually led to two significant trends and initiatives within the public safety community – the drive to create open standards for digital two-way radio systems, and the motivation to procure larger scale government radio networks to solve the interoperability issue between cities. This leads us into our fourth model, called the **Large Government Radio Network**, as shown in Figure 4. The state/provincial governments are now deploying two-way radio networks that can cover the entire state/province.

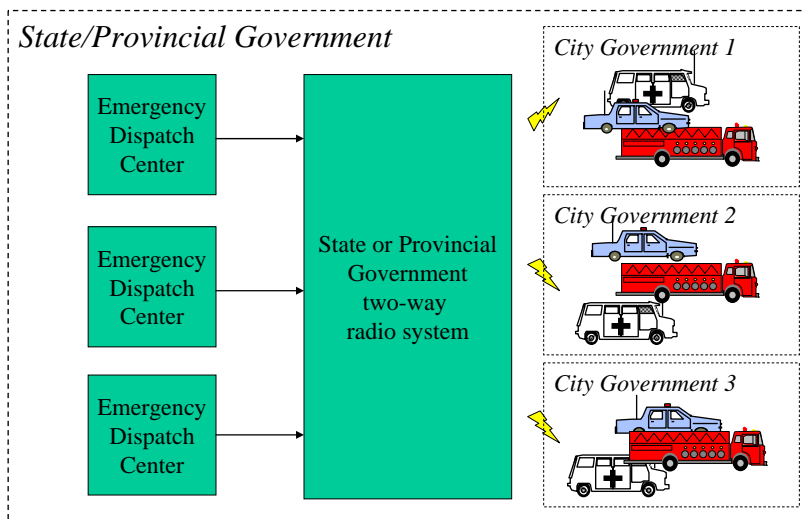


Figure 4. Government Radio Network (Large)

In this model, the emergency call-taking and dispatch center is still combined as before, but there can be multiple numbers of these dispatch centers. These emergency dispatch centers can be located in large metropolitan areas, or they can be a common dispatch center serving many small cities. The radio system is a combined shared common network, but is immensely larger in coverage size, often covering a major metropolitan area, or up to an entire state/province, or even a whole country. All of the emergency services use one common frequency band. The emergency phone numbers

that the public uses to call into the dispatch centers can be a single number, or be different for each service. The decision for procurement and deployment of the one radio system is treated as one entity with everyone's requirements taken into account. There are a several states/provinces and countries in the world today that operate using this model. This model has been the model of choice over the past 10 years, and is gaining more popularity because of its benefits to the public and to the state/provincial, county and city governments. This model can be evolved from the Small Government Radio Network Model by expanding the small two-way radio network into a large one, and adding remote dispatch centers to the system.

The advantages of this model are carried over from the previous models, plus the added benefit that all of the public safety responders in the same state/province can now talk to each other when required – the interoperability problem between various organizations has been solved. When a large traffic accident or a major disaster occurs where police, fire and ambulance *from multiple cities* are on the scene, the responders can now talk to each other at the scene over the radio system very easily. In addition, there is only one radio network for all of the governments to use for all city, county, and state/provincial services, thereby leveraging economies of scale for cost savings. Many statewide/provincial departments can now also use the same system to communicate with their city counterparts. In general, communications within the state/province have improved using this model between all layers of government. It is important to note that under normal situations, every group will still maintain their own privacy as if they had their own radio system. The difference under this GRN model is that all government departments can talk to those whom they need to talk with urgently with a twist of a knob or a simple reconfiguration of the radios remotely. The disadvantage of this model is that a vast majority of the departments must give up control of their radio networks to someone else in the government. The larger the scope and scale of the two-way radio system, the larger the organizational relationship and control issues tend to be. In addition, the selection of the best provider of the two-way radio system becomes a very critical factor because you are putting “all of your eggs in one basket”. The statewide/province-wide radio network becomes the one common platform for communications. If that system fails, there is a potential that many users won't be able to speak. If the vendor goes out of business, support for such a large scale system becomes a huge problem, especially if the system must be replaced.

The advantages, however, outweigh the disadvantages. The gains in interoperability and improved communications between cities and layers of government seem to outweigh the risk of technology or the supplier, as evidenced by the ongoing procurements of many GRNs worldwide. This is because the gains actually save lives and make the working environment for public safety officers safer, whereas the risk of the technology and vendor can be managed by selecting the right technology basis (such as open standards-based technologies) and choosing sound and trusted vendors who manage their business well.

GRN Management Models

In addition to the dispatch center and two-way radio system models discussed above, there are also new GRN management models that have emerged over the years. These management models can be classified into three typical areas:

- *Police-maintained* – The largest employee base of any government is typically the public safety organization. They are the most visible representation of the local government. In addition, the police and fire are also the group that has the highest and most stringent requirements for two-way radio communications. They typically require portable and mobile coverage, and in many instances in-building coverage. Many other government departments, such as the Street Maintenance Department, may only require mobile outdoor coverage. Because public safety has the most stringent communications requirements, the GRN is typically designed to that requirement. Between all three public safety services, the police are typically the group that is elected or required to manage and maintain the system on behalf of the other government departments. Examples of this include the Michigan's State Police, who own and operate a statewide network for all state and local government public safety agencies, and many small and medium sized cities.
- *Other Government Department maintained* – Even though public safety is the largest group of government radio users, it is also possible for another government organization to manage and maintain the system on behalf of the other government organizations, including public safety. A separate Government Telecommunications Department could manage the GRN. Examples of this include the Utah Communications Agency Network (UCAN)⁵, which is a separate government agency that procured, operates and maintains the network for all public safety agencies in the state of Utah, and Minnesota Metro (Minnesota's Statewide GRN)⁶, where the Minnesota Department of Transportation owns and is maintaining the system for all state and local government radio users.
- *Outsourced* – It is also possible to have external private companies manage and maintain the GRN. The ownership of the network can also be open. For example, a few states in Australia own their GRN, but have employed Telstra, the local telecommunications carrier, to manage the network for them. The State of Victoria in Australia⁷ recently awarded Motorola a contract to build, own, operate and maintain the GRN for all of the emergency services.

In terms of management, it really doesn't matter who owns, operates and maintains control of the network. The important thing is that everyone agrees who should manage it and let that entity do so. The police are usually the group that is typically chosen to operate the system because they are the ones that have the highest level of public dependency when a major crisis occurs. Their requirement for extremely high reliability and quality of communications is what enables them to do their jobs well for public order and service. So when they own and maintain the system, they do so knowing that radio communications is very critical for life-and-death situations. Other

⁵ <http://www.ucan800.org/>

⁶ <http://www.metroradioboard.org/faq.htm>

⁷ [http://www.best.vic.gov.au/CA256DB4000B5760/page/Metropolitan+Mobile+Radio+\(MMR\)](http://www.best.vic.gov.au/CA256DB4000B5760/page/Metropolitan+Mobile+Radio+(MMR))

government organizations can also manage the network effectively if they understand the very critical nature of communications for government operations.

One of the biggest benefits of having a public safety GRN is that the technical and operational requirements will be mission-critical in nature. This will yield additional benefits to the other non-mission-critical government organizations. For example, if a public safety GRN is designed for portable in-building coverage, the City Water Department using the same GRN will now have portable in-building coverage in the same areas where public safety requires it. Without GRN participation, the Water Department would only be able to afford their own street-level mobile coverage system. In addition, because of the critical need for constant and uninterrupted communications, public safety GRNs will have emergency backup power designed into the system. The Water Department, using the GRN system, will be able to inherit these new operational features since they will use the same radio system. On their own, chances are likely that the Water Department may not have been able to afford a long duration emergency power backup system. The benefits are also mutual for public safety. Even though public safety may need GRN communications as part of their tools for emergency response to the public, they also benefit by having other government departments as part of the GRN. For example, in an emergency the city towing service (used to tow cars) can be called via radio to a disaster scene to quickly tow cars out of the way for large fire trucks that need to respond to a major fire. For seasonal or emergency operations, the police can also coordinate with snow command to manage snow plowing in critical areas. Public safety effectiveness for any government is measured by the speed at which they respond and manage the incident. Any tool that can help them to respond to the location, assess quickly the need for resources, and issue commands to start the response plan is a welcome tool. The GRN is one such tool.

Considerations for GRNs

For a GRN, a conventional or a trunked two-way radio system can be used. GRNs today have been implemented successfully either both type of radio systems. Conventional radio systems tend to be very cost-effective, especially for the rural or low-density areas. Trunking is typically preferred by public safety since trunked systems have more capacity built-in in case of increased voice traffic, and for its inherent reliability.

They can also be analog or digital in design. Analog tends to be lower cost, but digital offers newer features and services (spectrum efficiency, integrated voice & data, voice privacy, etc.) that analog doesn't offer today. They can also be on any frequency band.

Because of the expansive nature of GRNs, the choice of the two-way radio technology design for the GRN will be, and should be, driven by government radio user technical & operational requirements, and budget.

While the GRN model is not a technology model, it does depend very heavily on technology and vendor partnership to be successful. The larger a GRN is, the more imperative and critical that the right technology base and a sound vendor are chosen.

Because a GRN covers so many radio users, it is important that care be taken in understanding the technology choices available. If the wrong technology is chosen, it will take many years before a replacement can be procured and deployed for so many government radio users. The right technology base will allow for future growth and expansion of the system as more and more state and local government organizations join the system. A proper choice will also balance the technical requirements with the budget to remain cost-effective for the GRN users and the public that it serves. Not all technologies can be suited for GRN operations. Some systems are simply not scalable to the immense sizes that some GRNs require. Therefore, it is important to place a lot of emphasis on the proper planning and selection of the GRN technology.

Equally imperative is the choice of vendor. Part of the business case for a GRN is predicated on the longevity of the GRN's life. The longer a GRN operates, the more cost-effective it has become to the government and to taxpayers. Choosing the right technology provider will enable a long life, especially if the vendor is sound business-wise, and is a trusted supplier. If the wrong vendor is chosen, and they go out-of-business, support for a large-scale GRN will become problematic for all users of the system. Statewide/provincial-wide GRNs can amount to not 10's or 100's of users, but 10,000's of users. Not all vendors are sized for supporting GRN operations. Some vendors are simply not organized to the challenges that some GRNs pose operationally, organizationally, and politically. Therefore, it is important to place a lot of emphasis on the proper selection and contracting of the GRN provider. In the US, Motorola has contracted and/or implemented 28 out of 32 statewide GRN systems.

One major consideration for GRNs is the decision to choose open standards or not. Open standards are good for GRNs since it allows for multiple vendors to supply compatible products into the GRN. This protects the investment of a GRN since the disappearance of any one vendor will not affect the supply of product into the GRN. In a proprietary system, the disappearance of that sole supplier will stop all future development and supply of product into that GRN. Multiple vendors in an open standards-based GRN also allow for wider selection of choice of products while maintaining compatibility with the GRN system. Features offered by one vendor may not be offered by others. As GRNs become larger, open standards become more imperative in order to protect a GRN investment.

Summary

In summary, Government Radio Networks make economic, political, and operational sense. In practice, GRNs truly contribute to solving the technical challenges of the interoperability puzzle in public safety today. There has been a serious trend in the deployment of statewide/provincial-wide GRNs over the past 15 years in the US. In Europe, country-wide GRNs are being deployed for the same operational and economic

reasons. GRNs are the model of choice for government to respond to the public's desire for more efficient and productive government services. With the threat of terrorism and terrorist plans of widespread death and destruction, GRNs are becoming one of the weapons of choice for emergency responders to effectively save lives and minimize property damage. The GRN concept promotes safety, security, and good Government as it allows all government departments to utilize advanced communications tools and for public safety & law enforcement to communicate effectively.

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