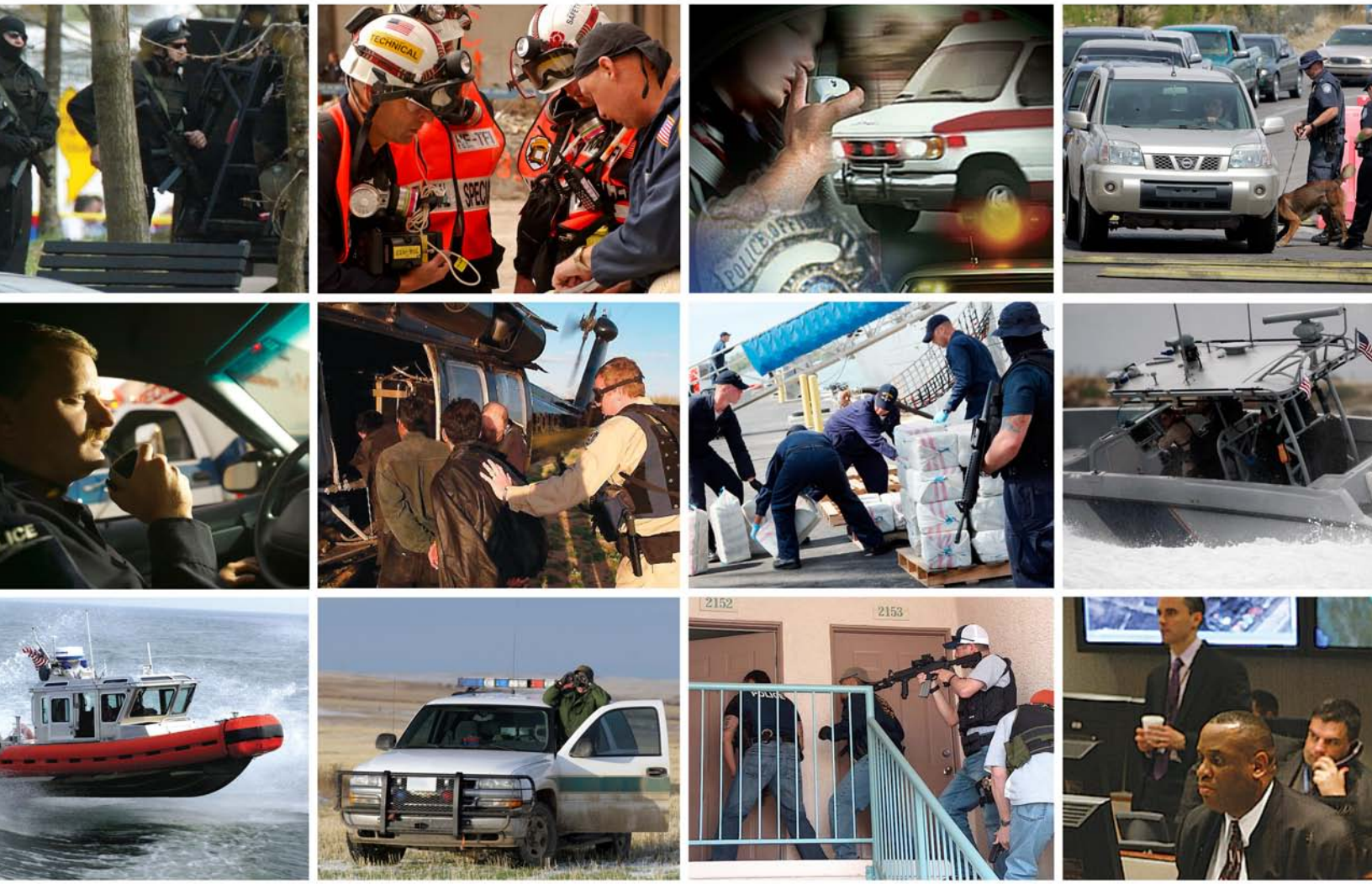
WHITE PAPER

Using CrossComm® to Upgrade Your LMR System



GENERAL DYNAMICS
C4 Systems

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Abstract

Upgrading a land mobile radio (LMR) system is difficult because LMR systems were not designed to be upgraded on a component by component basis. As it turns out, the same technology that solves the interoperability problem can be used to facilitate the augmentation of an existing LMR system. Augmenting an existing LMR system allows an agency to preserve the investment in the legacy system while mitigating the risk associated with adopting new products or technology. This paper discusses a product called CrossComm from General Dynamics that was designed to provide Network Level interoperability and discusses how CrossComm can be used to upgrade a legacy LMR system.

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Introduction

LMR systems, like anything else, need updating from time to time. The update can be necessitated for a combination of reasons, including:

- The RF footprint no longer covers all of the agency's area of responsibility due to growth.
- The system has run out of capacity.
- The system has degraded from use so some parts are out of commission.
- The system needs new features so that the agency can serve the community in an up-to-date manner.
- Replacement parts, either for upkeep for expansion, are not available due to being end-of-life.

But unlike a house that can be remodeled by having a wall painted here or a carpet replaced there, LMR systems were not designed to have individual pieces updated. From their inception, LMR systems were not designed to be open. In the early days of private radio communication, systems were fielded by a single vendor who handled every aspect of the system including design of the products, architecture of the system, deployment of the equipment, and maintenance of the fielded system. A lot has happened in the world since those days, most notably the computer and networking revolution. The computing revolution has standardized the interconnect between networked elements in the form of the Internet Protocol, which is most commonly known as IP. Nowadays computer networks are pervasive which has been driven by the ability to connect these computers together using IP and the Internet.

Unfortunately, even though it is possible to treat a radio network as just another communications network with radio endpoints, most LMR vendors resist this open standards-based approach. Instead they prefer to keep their systems closed and proprietary because this allows them to maintain high profit margins. This means that should your LMR system require an update for one or more of the reasons listed above, rather than augmenting the system, the LMR vendor will push you to completely replace the system. It's kind of like buying a new car instead of buying a new set of tires.

Fortunately, General Dynamics C4 Systems has invested significant R&D in CrossComm, a product that enables Network Level Interoperability, even for LMR systems without standards-based interfaces. It turns out that Network Level interoperability, which was created so that different agencies could interoperate across systems of different type, also can be used to tie together disparate systems within the same agency. When an agency can add services to their legacy system instead of installing a completely new system, their investment in the legacy system is preserved and a risk reduced pathway to new technology and additional capacity is formed.

Network Level Interoperability

The idea behind Network Level Interoperability is that disparate systems are connected together at the Network level using standard protocols. This differs from the typical form of interoperability which uses Radio Gateways such as the Raytheon ACU-1000. Network Level interoperability has several advantages over Radio Gateway interoperability. Figure 1 illustrates some of the differences between

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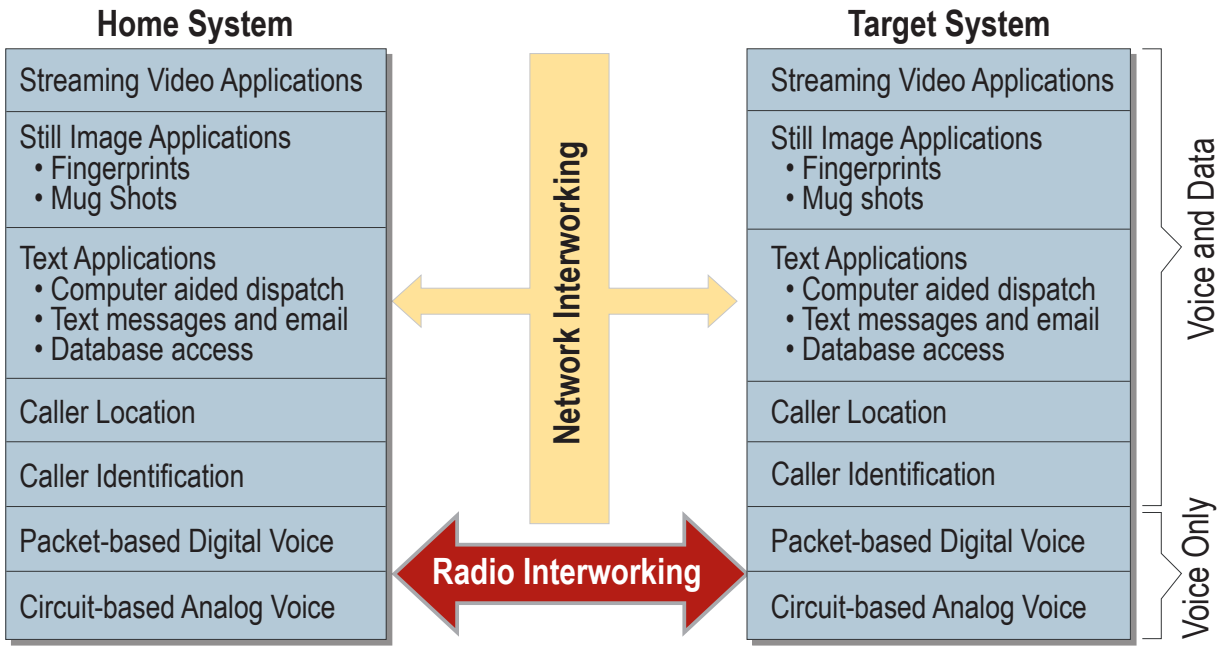

Figure 1. Network versus Radio Interoperability

the two. First and foremost, Network Level interoperability is scaleable. Unlike Radio Gateway interoperability where each dialog mapped between two systems required a proxy radio with its associated cabling, Network Level Interoperability can carry a large number of dialogs over a single physical IP (Internet Protocol) connection. Avoiding connecting the two systems with an over-the-air interface also avoids other RF problems such as interference, and the need to have the two systems physically collocated within the same RF footprint.

The other advantage of Network Interoperability over Radio Gateway interoperability is that Radio Gateway interoperability is only able to pass voice between the two systems whereas Network Level Interoperability can pass any form of digital data. Examples of digital data that can be passed between the two systems includes voice, caller ID information, textual messages, telemetry information such as biological or environmental sensors, data from applications, images, and motion video.

CrossComm is a product that facilitates Network Level Interoperability between any two communication systems using standards-based protocols, and also adapts to the proprietary interfaces of most LMR systems. CrossComm works for LMR from different vendors, different technology LMR systems, private or public communication systems, cellular or push-to-talk, and so on. CrossComm takes many heterogeneous communication systems, systems of disparate type, and makes them function as one homogeneous communication system, one large system with different types of endpoints.

In the remodeling context, CrossComm can take two systems of different type, say a legacy LMR system and a new LMR system, and join them together so that they operate seamlessly. Typically legacy systems are conventional analog, and this assumption is made in the scenarios below. The following scenarios summarize how to use CrossComm to augment an existing legacy LMR system:

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1) Add Coverage With A Conventional Analog LMR System From A Different Vendor

In this example, we will add additional analog coverage to an existing conventional analog LMR system. We start by deploying the new conventional analog LMR equipment in the uncovered areas, and then use CrossComm to seamlessly interoperate the new equipment with the existing infrastructure so that they appear to the users as a single system. Since both systems are analog conventional, a user that moves into the new coverage area will receive service from the new equipment and CrossComm with interwork this new equipment with the existing infrastructure for seamless operations. In this example, the new LMR equipment does not have to be from the same vendor as the existing infrastructure since crosscomm will perform the interworking. The new coverage was added without having to replace existing equipment which provides an incremental upgrade path.

2) Add Coverage With A Conventional Digital LMR System From A Different Vendor

In this case, we are adding new digital radio infrastructure to an existing analog system. First, we deploy the new conventional digital LMR equipment in the uncovered areas, and then use CrossComm to seamlessly interoperate the new digital equipment with the old analog infrastructure so that the entire system appears to the users as a single system. We will need to upgrade the subscriber devices so that they can support both analog and digital base stations. When a user is in the old analog coverage area, they use the analog mode of the radio. When the user moves to the new coverage area, they switch the radio to the digital mode. The CrossComm system will seamlessly interwork the old and new infrastructure equipment to provide the user with complete service in all coverage areas.

3) Add Capacity To The Legacy Conventional Digital LMR System With A Trunked Digital LMR System

In this example, we are increasing capacity of a legacy conventional digital LMR system by replacing high traffic areas with trunked LMR radios. The trunked radios greatly increase the overall capacity by sharing precious frequency resources. In this case, we deploy the new trunked digital LMR system at the same towers where the legacy base stations are deployed. We upgrade the subscriber units with units that can support both conventional digital LMR and trunked digital LMR. We create a set of talk groups on the trunked equipment to off load users from the conventional system. When users of the transitioned talk groups move into the trunked coverage area, they switch their radios to the trunked talk group mode and utilize the new infrastructure. Users on channels that have not been transitioned continue to use the existing conventional channels. CrossComm interworks the trunked equipment with the conventional system to provide seamless functionality across the entire system. When the legacy system is retired, all users will be transitioned to the trunked equipment. Equipment that is outside of the high utilization areas don't need to be upgraded to the trunking technology unless dictated by usage needs. Overall, CrossComm allows you to replace only the equipment in high utilization areas and does not force your to replace the entire system.

4) Augment The Legacy LMR System With Broadband Capability

In this example, we want to deploy broadband voice and data as an overlay in certain areas, but not necessarily within the entire coverage footprint. Here, we deploy broadband base stations at the desired locations to support the coverage needed. We use CrossComm to map talkgroups from the broadband system to channels in the legacy conventional system thereby interworking the LMR and broadband systems together into a unified system. CrossComm allows the new broadband system to operate in concert with the existing legacy system.

Summary

General Dynamics has invested significant R&D to create a product called CrossComm that facilitates Network Level Interoperability between heterogeneous communication systems. In addition to being used to solve interoperability between agencies, CrossComm can be used to augment legacy LMR system with additional capacity, coverage, or features. Doing so helps agencies preserve the investment of their legacy system, providing service over and above the legacy system, and provides a risk reduced path to new technology. CrossComm means that you no longer have to replace your entire LMR system but can simply upgrade it, as needed, with new capacity and capabilities in a simple, seamless manner.

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For more information on CrossComm and solving the Public Safety interoperability problem please contact Jeff Osman of General Dynamics at jeff.osman@gdc4s.com.

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