



Enabling Multi-agency Communications

Through the use of IP Gateways/Switches



EXECUTIVE SUMMARY

Citizens and public safety personnel are counting on you. Because the worst does happen and when it does, your mission requires federal, state and local agencies to communicate as one entity so they can respond in a coordinated and effective manner.

Without good interoperable communications, lives can be lost, homes and neighborhoods can be destroyed, and disasters can escalate into tragedies. However, your budget is limited and the legacy systems won't interoperate. You can see the goal, but how will you get there?

Today's newest technologies provide answers. Solutions that were impossible (or impossibly expensive) just a few years ago are now within your grasp. One powerful new tool is the MOTOBRIDGE™ IP Interoperable Solution, which can establish a feature-rich voice gateway between systems that, until now, were incompatible.

This white paper presents the range of options available to organizations seeking to improve the interoperability of their communications systems. Then it looks in greater detail at one of these options: using Motorola's MOTOBRIDGE™ IP Interoperable Solution to make the connection between existing radio systems.

Unlike a traditional IP "gateway," MOTOBRIDGE™ IP has unique capabilities that allow it to play a more advanced role in an organization's strategy for achieving true interoperability.

Despite the challenges and a sometimes daunting array of technology choices, any organization can indeed craft a solution that fits. In many agencies, that solution will include MOTOBRIDGE™ IP technology.

Interoperability is a well-recognized imperative for public safety, homeland security, and law enforcement. Statutes and grant requirements across the nation reflect this need. First responders from multiple agencies and jurisdictions simply must be able to talk to each other so they can share intelligence, coordinate plans, and mount successful joint operations.

Interoperability however is not an easy goal to accomplish. The primary challenge to developing interoperability is the vast number and variety of deployed systems that are in operation today. Specifically, there are conventional, trunked, VHF, UHF, 700 and 800 MHz systems (all made by different manufacturers) in operation in various parts of the country.

Organizations must perform a balancing act between cost and benefit, immediate need and long-term progress. The best choice for any agency or department depends on its current operational procedures, needs and resources, balanced with the needs, operations and resources of the other organizations with which it operates on a regular basis. Each organization must achieve its own balance and set its own timetable.

INTEROPERABILITY-MORE THAN TECHNOLOGY CHALLENGES

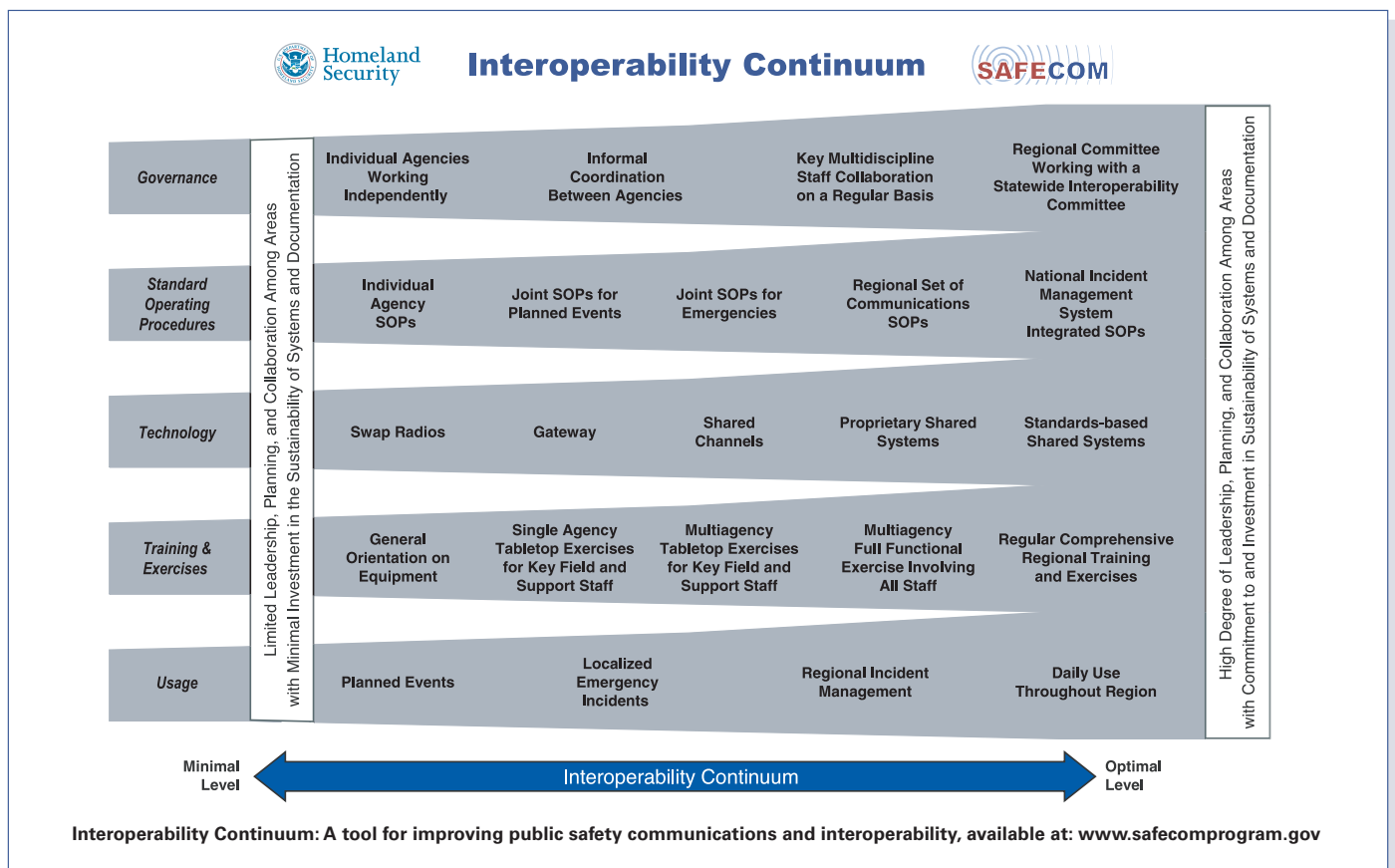
“Interoperability” can mean different things to different agencies. The Office of Homeland Security’s SAFECOM program has charted an “interoperability continuum” of five key considerations to help define the concept and facilitate discussion.

The continuum provides a baseline for planning and developing an optimal interoperability solution.

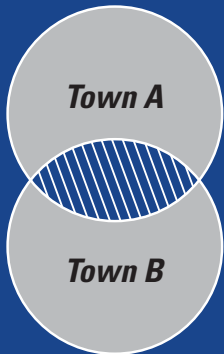
Interoperability can be achieved more quickly and more thoroughly through upfront people and process planning, alignment and mobilization of leaders, evaluation of standard operating procedures, extensive role-based training and readiness reinforcement before, during and after going live with new technology.

Solutions range from being capable of being deployed in hours to solutions which must solve complex wide area roaming needs across vast geographical areas.

Often an organization will deploy a lower-level solution for immediate results while continuing to develop a higher-level solution that will be deployed over the long term.



A gateway can be used to establish interoperable communications between two or more systems in locations where their coverage areas overlap.



WHERE DO GATEWAYS FALL IN THE INTEROPERABILITY CONTINUUM?

Gateways occupy the middle ground. They make it possible to quickly establish reasonably effective interoperability between systems that operate on different frequency bands. Gateways allow organizations to establish connections without replacing their existing systems.

Gateways have proven particularly useful for these applications:

- A simple, economical way to create a voice link between two agencies
- Pre-planned interoperability for special events such as concerts and sports events that require close collaboration among a small number of agencies (two to four agencies)

It is important to note that gateways connect existing networks. The gateway will not expand the coverage area or call capacity of the existing systems.

TRADITIONAL IP GATEWAY SOLUTIONS

In most traditional gateway solutions, the "gateway" itself is a hardware component that patches together two neighboring systems. Usually it is a specialized interface designed to relay information between two particular types of

systems (low band, VHF, UHF, 700 MHz, 800 MHz). The gateway can be connected to radio control stations operating on the systems, or to wireline audio proceeding to the site or dispatch center. The gateway can use either traditional circuit connections, or IP packet connections.

Two general types of gateways are in common use today.

Console Patch Gateways: For two agencies monitored by the same dispatcher, the patch gives the dispatcher the ability to set up a temporary communications link for a specific event or emergency. The patch acts as a switch that routes audio and control signals between the various pieces of equipment on the two networks.

Interface Box Gateways: A hardware component (the interface box) sits between two networks. When activated, the box patches the two networks together with audio-only communications.

MOTOBIDGE™ IP builds upon these traditional offerings for a more powerful and flexible interoperability solution providing a path to true interoperability.

THE MOTOBIDGE™ IP SYSTEM

KEY

RGU = Radio Gateway Unit

Interface to Radio Systems

WSG = Work Station Gateway Unit

*Interface to Dispatcher Consoles/
Administrator Workstations*

OMC = Operations Management Center

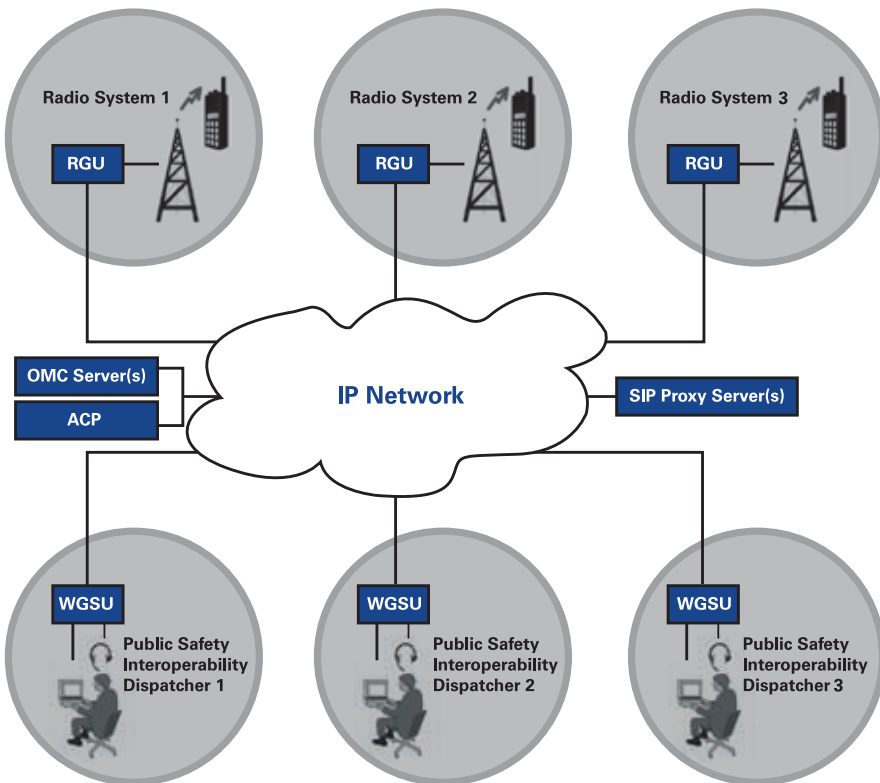
Network Management Servers

ACP = Administrator Control Panel

*Monitors status of entire
MOTOBIDGE network*

SIP = Session Initiation Protocol (SIP) Proxy Server

*Standard Protocol to Interface to
Telephone Network*



MOTOBIDGE™ IP INTEROPERABLE SOLUTION CAPABILITIES

More than a simple audio patch, MOTOBIDGE™ IP functions as an integrated communications system that is:

Intelligent – The system has processing power to support mission critical features such as advanced signaling, digital encryption, remote configuration, a sophisticated administrative user interface, and built-in dispatch capabilities. A MOTOBIDGE IP G4 configuration will recognize and if permitted, affiliate or self form with a GX or MX configuration, expanding the overall network at a time when additional resources are needed.

IP based- Networking solutions such as the Internet Protocol are changing the nature of communications. An IP network provides a common transport for carrying all types of communication messages and uses standard SIP signaling for all call set ups. MOTOBIDGE is based on an IP network allowing for dynamic linking of networks.

Robust – The distributed architecture has no single point of failure

Scalable – There is no limit to the number of agencies, users, and dispatch stations that can be connected.

The MOTOBIDGE™ IP architecture allows integration of disparate networks so that multiple agencies can communicate. It can also be used by agencies to unify internal communications with their existing legacy systems. The network can be used to solve a wide range of interoperability problems involving:

- Digital to analog or to standard based
- Legacy to legacy
- Trunked to conventional
- IP networks to IP networks
- 700/800 MHz to UHF to VHF to Low Band
- IP networks to legacy circuit switched networks
- Radio to Radio
- Different vendor networks to each other
- Radio to telephone (PSTN, IP, and Cellular)

There is no limit to the number of systems that can be linked together. Connections can be activated at any time from any dispatcher position. Dispatchers can activate pre-arranged plans or dynamically open connections and reallocate talkgroups as needed in response to fast-changing events.

The MOTOBIDGE™ IP network can thus provide interoperability over a wide area for multiple systems, and support everyday mutual aid, large-scale planned operations, and emergency response.

EASE OF GROWTH AND SCALABILITY: Expandability and scalability have been planned into the MOTOBIDGE™ IP solution design. There is no limit to the number of agencies, users, and dispatch stations that can be added. Available in four configurations so you can expand city, county or statewide as your true interoperability needs grow.

| MOTOBIDGE Configuration | Gateway Units | Ideal For |
|---------------------------------|--|--|
| G1 (Deployable Solution) | 1 gateway (8 radio resources) | Daily operations with neighbors/partnerships. Quick deployment for short distance/local communications with minimal pre-planning. Key Application: <ul style="list-style-type: none"> • Small Scale Emergency Response • Small Event Management |
| G4 (Deployable/Mobile Solution) | Up to 4 gateways (24 resources 1 dispatch application) | Rapid replacement when responding agencies need to have a full communications package in a remote, low capacity area. Self-forming technology enables responders to instantly form a robust network at an incident. Key Application: <ul style="list-style-type: none"> • Search and Rescue • Disaster Management • Medium Event Management |
| GX (Fixed Regional Solution) | Up to 50 gateways | Emergencies which impact responders from multi-county, multi-state agencies. Key Application: <ul style="list-style-type: none"> • Disaster Management • Hurricane, wildfires • Interstate speed chases |
| MX (Fixed Wide Area Solution) | Up to 4,000 gateways | Ideal for emergencies over a large geographic area. Onsite communications can involve federal, state and local agencies (FBI, state patrol and ATF, fire). Key Application: <ul style="list-style-type: none"> • Large Natural Disasters • Terrorism |

ADVANCED FEATURES

The MOTOBRIDGE™ IP Distributed Architecture

The MOTOBRIDGE IP solution uses a distributed architecture for better disaster survival. If one piece of equipment is damaged, or if the power goes out at a given location, all other components of the network will continue to operate.

The unique peer-to-peer (gateway-to-gateway) architecture of MOTOBRIDGE means there is no central point through which communication and commands must route. Established talk-paths between radio, telephone, and PC users are sustained by the MOTOBRIDGE gateways. Each gateway contains a robust set of features designed for public safety communications, including independent processors which handle all of the audio vocoding, buffering, filtering, tone generation/detection, etc. in real time. This allows the MOTOBRIDGE solution to meet Mission Critical time constraints for establishing communication paths, with unsurpassed audio quality.

In larger MOTOBRIDGE systems, a standards-based SIP Proxy Server and an Operations Management Server are used to help manage the network resources across the IP network. These servers allow the whole MOTOBRIDGE system to be more survivable and scalable. However, MOTOBRIDGE is designed with no single point of failure. The SIP Server functionality can be automatically picked up by the Operations Management Server, and even by the individual gateways in case of unexpected failures. Servers can also be set up in redundant configurations as an extra level of assurance.

NON-PROPRIETARY VoIP STANDARD PROTOCOLS

The MOTOBRIDGE™ IP solution converts all radio messages to Voice over Internet Protocol (VoIP), an evolving standard for communications in the public and private sector. This digitized information can then

be sent over the customer's IP network. This could include T1's, microwave, fiber or any IP-based network infrastructure. Use of a standard protocol allows agencies to use existing equipment when available.

DISPATCH CAPABILITIES AND CONFERENCING

The dispatch application allows designated personnel to communicate directly with any communication centers or interoperability resources on the network. Dispatchers can monitor and participate in calls no matter where they originate. Full conference bridges can be opened between dispatch centers so users can talk/listed directly with the public safety agencies involved. Any number of dispatch facilities can be included in the full-duplex conference, allowing numerous agencies and locations to coordinate their dispatching during large-scale incidents.

DIGITAL ENCRYPTION AND ADVANCED SIGNALING

A traditional analog radio network carries just one type of information: the audio signal. Newer digital networks make use of signaling alongside voice calls that can be used to provide additional information about the call.

This information might include:

- Digital encryption to prevent unauthorized interception of sensitive information
- Emergency signals that alert others on the network when a user has requested assistance
- Unit ID / Caller ID
- Other advanced features

With a MOTOBRIDGE™ IP solution, this information is carried across the system to all users. Of particular importance, emergency alerts are broadcast to all connected users. This could facilitate rescue operations. Knowing when someone is in trouble is always the first step in assisting that person.

FEATURES OF THE MOTOBRIDGE™ IP SOLUTION

| | | | |
|--|--|--|--|
| Ease of growth and scalability for cost-effective and flexible deployment in applications of all sizes | Emergency Signals and Unit IDs are broadcast to all users so everyone knows when a user needs help | Digital encryption prevents unauthorized access to sensitive information | Basic joint-dispatch capabilities with full duplex intercom included at no additional cost |
| Administrators/dispatchers can remotely manage talkgroups as needed for quick response to unpredictable events | Compatibility with a wide range of systems including Nextel and cell phones | Distributed architecture has no single point of failure | VoIP coding yields improved audio quality for more reliable communication even when background noise is loud |

A COMPARISON AMONG VENDORS. When comparing other solutions, here are some of the features to consider.

| Feature | MOTOBIDGE™ IP Solution | Other Vendors |
|---|---|---|
| Distributed Architecture | YES peer-to-peer communication means no single point of failure, and bandwidth costs are limited because there's no need for expensive high-bandwidth links back to a central switch. | Most rely on a central audio switch or central routing server which can be a single point of failure. Since most traffic is routed through a central point, the cumulative traffic can drive up connectivity costs. |
| Advanced Signaling Including Emergency ID and Unit ID | YES digital signals are passed through the gateway to all users | Most do not pass digital signals, meaning that calls for help will not reach everyone |
| Encryption | 3 DES and AES hardware encryptions for complete audio security (as used by the Federal Government) and IPSecurity (IPSec) for data command security | Some may provide limited capabilities by providing audio or data command overlays |
| Standard VoIP signaling | YES Session Initiated Protocol (SIP) is used for telephony connections and call setup and teardown | Other vendors use proprietary protocols that may present compatibility problems with legacy equipment and/or require purchasing specialized equipment from a single vendor |
| Network Interface (Ethernet) | YES Ethernet connection is built into the gateway unit, requiring no further investment | Other vendors use external serial-to-IP conversion boxes or specific, expensive, modular routers |
| Telephone Interface | YES Nextel cell phone users can be incorporated into the network | NO support for cell phones |
| Dispatch Conference Bridges | YES Dispatchers have full duplex communications with other dispatchers and/or telephone users | Some vendors only provide dispatch signaling for their own proprietary dispatch systems. Some support for call setup only and not emergency coordination |
| Virtual Control Head | YES supports capable Motorola radios on all types of systems, giving dispatchers more control and allowing fewer gateways to access more resources | Others can only control basic station functions through tone remote control (TRC) with no signaling features |
| Price and Scalability | Very scalable due to the distributed architecture. Expansion is easy to implement with affordable up-front costs and minimal cost for additions and redundancy. A solution can be cost-effective at any size, whether it's connecting just two systems, or thousands. | Centralized (star) architectures require expensive up-front investment with limited overall expansion capabilities. Numerous central switches may be required to support large networks, |

CONCLUSION

When looking at IP 'gateway' solutions, it is important to remember that interoperability is a process, not a simple endpoint. Interoperability involves much more than just technology. It requires agencies to rethink their policies and procedures. It requires working together through a long process of research and discussion. And it requires making difficult choices.

Some regions establish interagency councils to take up the interoperability banner. Others create commissions with the sole duty of planning, securing funding and implementing interoperable solutions. Whoever is charged with making the decisions, the only proven path to good results is to seek extensive input from every agency and every stakeholder group.

Gateways are an important part of many, if not most, interoperability plans. When considering a gateway solution, consider today's next-generation solutions with capabilities far beyond those of traditional gateways. Today, a gateway can serve an entire community, linking dozens or hundreds of radio systems.

Any gateway solution you invest in should:

- Be scaled to fit your current needs with expansion capability for the future
- Have Emergency ID and Unit ID capabilities to protect your personnel, and to ensure that users benefit from the features their departments have invested in on their home systems
- Support dispatchers with full duplex intercom and remote talkgroup control so they can coordinate joint response and manage the network for optimal communication during both planned and unpredicted events

Of the vendors offering next-generation gateway solutions, only Motorola has the experience and expertise that come from helping the public sector meet its communication and information needs for more than 70 years. The MOTOBRIDGE™ IP Interoperable Solution reflects our experience in public safety. It is a mission critical solution, robust, scalable, intelligent, and flexible. Because when lives are at risk, interoperability is not an option, it's a requirement.

To learn more about MOTOBRIDGE™ IP

contact your local Motorola Sales Representative or call us at 1-800-367-2346, or visit www.motorola.com/motobridge



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