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## Interoperability Gateways/Interconnects

### Key Points

- Interconnect systems, such as gateways, allow for voice interoperability between otherwise incompatible radio communications systems.
- Interoperability is achieved by retransmitting voice over interconnected radio subscriber (mobile/portable) units.
- Linking incompatible radio frequency bands and systems can be relatively easy and effective, but users should consider key factors that can affect performance.
- Interconnect deployment will require new strategies and operational procedures.
- The gateway approach to interoperability has significant potential, considering the ease of gateway deployment and the relatively low cost of gateway retransmission devices compared to the cost of a new wide-area shared radio system.

### THE CHALLENGE

During a disaster, public safety officials need to have immediate radio connection with each other. One solution is an interconnect system that, once set up and activated, can link incompatible radio systems through specialized hardware and software without requiring significant alterations to an agency's radio infrastructure.<sup>1</sup>

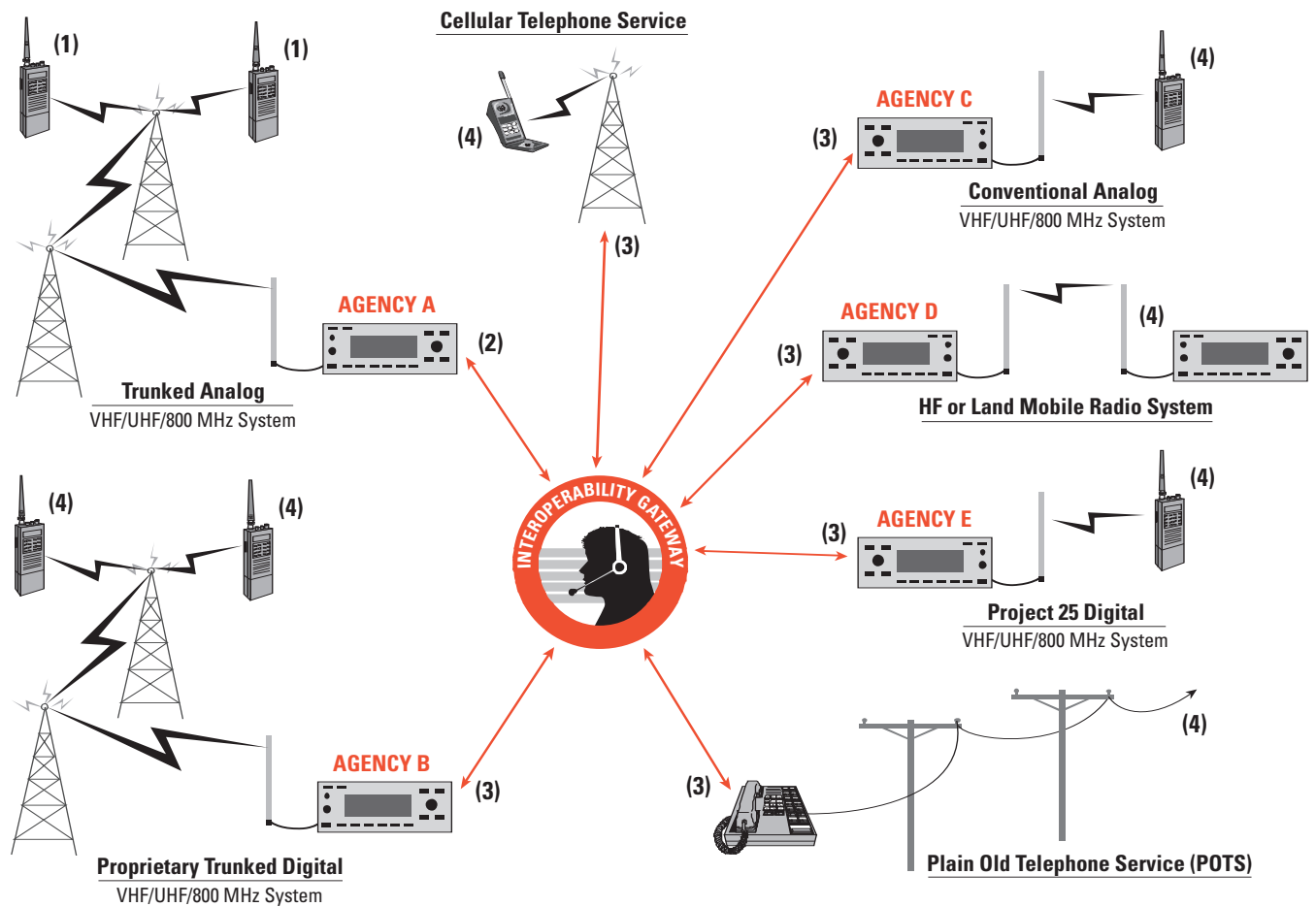
An interconnect system allows radios to communicate even if they are on different frequencies or have the same frequency band but different protocols. This system can link officers using an older radio system with officers using a newer technology or radios from a different vendor. In effect, the

interconnect system establishes a gateway between otherwise incompatible systems.

### GATEWAYS

A gateway is one type of interconnect system. Most gateways are typically dedicated stand-alone devices that allow users to connect multiple HF, VHF low band, VHF high band, UHF, and 700 and 800 MHz radios. They can also connect trunked talk groups, encrypted networks, public telephone systems, and cellular or satellite phone connections. Most gateway devices are mobile and portable, but many are used in permanent configurations. Gateways transmit and receive audio among multiple externally connected communications devices, as illustrated in figure 1.

Figure 1. Gateway interconnect system



Agency A, which uses a trunked analog system, needs to communicate with its own officers as well as Agencies B, C, D, and E, all of which use different systems. Agency A's message (1) goes to the gateway (2) and is then simultaneously retransmitted to the various systems (3), which then transmit the message to each agency's personnel in the field (4).

It is important to note, however, that a gateway system does not extend the coverage of any individual agency. Rather, the system's coverage is limited to the common overlapping area of the participating agencies.

## DEPLOYING A GATEWAY

From a technical perspective, linking radio channels via a gateway can be relatively easy, but a few preliminary steps are essential:

1. Develop a well-planned operational strategy to avoid overwhelming interconnected channels with intermixed and incompatible departmental radio conversations.
2. Have the installation inspected by a qualified technician.
3. Ensure that each radio transmitter associated with the gateway is properly authorized for Federal use through the National Telecommunications and Information Administration or licensed through the Federal Communications Commission for non-Federal use.

On conventional or nontrunked systems, linking radio channels via a gateway can tie up the system needlessly, resulting in inefficient use of radio spectrum.<sup>2</sup> The process requires that each linked system use a dedicated channel in each of the bands being interconnected throughout the duration of a transmission, regardless of the actual volume of radio traffic. This prevents other users from using these channels during that time.

On trunked system links, however, it is possible to maximize efficiency on the trunked system by dedicating a specific interoperability talk group to an interoperability gateway link. This allows users in other talk groups to continue to share limited system frequencies, unlike the conventional or non-trunked system, where all linked frequencies are tied up for the duration of the link, regardless of the actual radio traffic volume.

## MANAGING A GATEWAY

Consider the following two primary aspects of management:

- Great care must be taken when transmissions involve encryption so that messages are not inadvertently transmitted without the required encryption.
- Specialized training is required to manage a gateway, especially if multiple or parallel interconnections by several gateways are active in the same geographic area or at an incident scene. Ongoing training of people in the field who use the gateway and handle the interconnect devices is critical.

## OUTLOOK

Gateway devices are particularly effective when considered as a near-term solution or as part of a transitional strategy when deploying a new wide-area radio system. Nevertheless, the cost of an entire gateway system and all its associated components (e.g., radios, antennas, towers, engineering) can be significant.

To contain costs, gateway systems can be built around small, portable, and relatively inexpensive devices for tactical operations, or around large, more sophisticated devices in a fixed installation. The cost can be as little as a few hundred dollars for a simple unit without dedicated radios to well over \$200,000 for a large fixed installation with multiple dedicated radio units. Cost will be determined by local operational needs, radio equipment resources, and construction requirements or constraints. Costs can be lowered if local in-house expertise is available for actual design and construction activities, reducing the need for outside consultant assistance.

## FOR MORE INFORMATION

- NIJ's Communications Technologies (CommTech) Web site:  
[www.ojp.usdoj.gov/nij/topics/commtech](http://www.ojp.usdoj.gov/nij/topics/commtech)
- Regional National Law Enforcement and Corrections Technology Centers:
  - Northeast (Rome, NY) 888-338-0584
  - Southeast (Charleston, SC) 800-292-4385
  - Rocky Mountain (Denver, CO) 800-416-8086
  - Western (El Segundo, CA) 888-548-1618
  - Northwest (Anchorage, AK) 866-569-2969
  - Rural Law Enforcement Technology Center  
866-787-2553

## NOTES

1. See NIJ InShort, *Communications Interoperability: Basics for Practitioners*, NCJ 212978, March 2006.
2. See NIJ InShort, *Radio Spectrum*, NCJ 214962, August 2006.



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