

INTEROPERABILITY AND ENHANCED COMMUNICATIONS

The Migration to RoIP

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For federal, state and local governments, and other two-way radio system users, and commercial businesses requiring enhanced communications, Critical RF combines its Radio over IP (RoIP) interoperability platform with soft-radios to provide robust communication solutions.

The Need for Interoperability

Individual municipalities have made their own decisions regarding which radio system to purchase for many years. The end result – neighboring fire, EMS, police and other emergency responders are not able to talk to each other because they have incompatible equipment and/or are using different frequencies.

The tragic events of Hurricane Katrina and September 11, 2001, among others, have highlighted the need for interoperability within federal, state and local government. First responders and other emergency providers arrived on the scene without the ability to communicate. Relevant and timely information is vital for making tactical, strategic, and planning decisions when responding to emergencies. In light of the communication failures, the Department of Homeland Security (DHS) has made interoperability a high-priority technology need, particularly in the area of first responders. Ineffective communication risks the lives of responders in the field and can mean the difference between life and death.

DHS has mandated that state and local municipalities focus on resolving interoperability issues

Several of the large radio and equipment suppliers manufacture their own proprietary interoperability solutions which do not work with other manufacturer's radio equipment and are generally quite costly. Other interoperability solutions use a closed-end internet solution. Most solutions require a static IP address while other solutions require the equipment to be placed in a fixed location and do not provide for portability. The failure to resolve these communication issues which have been highlighted over the last ten years has demonstrated a critical need for a seamless, affordable, non-proprietary interoperability solution that can work with any existing radio configuration.

The Need for Enhanced Communications

Today's business environment requires efficient communications in order to be competitive in the marketplace. Businesses need immediate communication to improve coordination and reduce the time required to make decisions. When information is critical to making the right decision, businesses need to connect with the people who matter. Push-to-talk (PTT)

services dramatically shorten the communication cycle for workers spread out geographically, helping businesses make decisions quickly. Seamless PTT communication can enhance performance and increase operational efficiency and provide a distinct competitive advantage to any business.

PTT services exist today, but they are carrier dependent and are not able to be connected to two-way radio systems and computers. A few examples of enhanced communication needs are:

Verizon, Sprint and AT&T each have their own PTT service that is restricted to use only within their respective networks.

- a sales clerk needing to speak with someone in the warehouse regarding inventory availability
- a doctor unnecessarily carrying multiple communication devices in order to stay in contact with home, patients, office, hospital and on-call service
- emergency responders who need to be in communication with support efforts but live or travel outside the boundaries of their land mobile radio systems
- building or campus wide alternatives for wired networks
- federal agencies such as the National Guard and FEMA interested in monitoring the status of emergency operations and response

We believe there is a defined substantial need for enhanced communication services which allow additional connectivity with two-way radio systems as well as nearly unlimited applications of push-to-talk in the commercial environment.

The Remedy – RoIP and the Internet

Critical RF has introduced a suite of solutions that use RoIP and the internet as the common platform to achieve true interoperability.

Interoperability Solutions

Critical RF has developed two devices, SiteCAST and SafetyNET, which combine hardware and software to create the capability for any two-way radio system to communicate with any other two-way radio system. Both devices work with any internet connection, whether its satellite, DSL, cable modem, WAN/LAN, cellular WWAN, WiFi, or a dial-up connection (a minimum 14.4kbps baud or greater connection is required). The result, agencies operating on different systems, such as the local police, fire, and EMS, can now seamlessly communicate with each other at the scene of an incident, regardless of location, network, frequency, or equipment manufacturer.

In addition, the iWalkie and VBS software discussed below provide the ability to connect computers, smart-phones, and PDA's into the two-way radio systems.

SafetyNET - SafetyNET is an integrated node computer with a rugged rack mount housing, front panel controls with security lock, keyboard, mouse and flat panel monitor. It can be interfaced with any repeater, base station, mobile or portable radio from an associated two-way radio system. A single SafetyNET device is capable of connecting up to 4 radios and can be cascaded to facilitate additional radio systems. SafetyNET uses a radio system specific interface cable with a standard 8-pin RJ45 connector to connect to the radio system and uses an Ethernet connection to the internet. There is no IP provisioning for the end points due to the use of dynamic IP addresses. By offering crossband repeater and RoIP functionality, the inherent limitations of legacy LMR and SMR radio can be easily overcome.



(19W x 14.1L x 3.4H)

SafetyNET creates instant links anywhere on any frequency band such as UHF, VHF, HF, 700 MHz, 800 MHz, 900 MHz, and Low Band VHF. SafetyNET is not only band agnostic but also mode neutral, creating a common peering structure for SSB, AM, FM, IMBE, P25 I&II, VSELP, DLMR, iDEN, TETRA, LTR, EDACS, SmartNET, OpenSky, NXDN, SmartZone and other legacy wireless communication technologies.

SiteCAST – SiteCAST is a mobile version of the SafetyNET solution which offers a lightweight (approximately the size of a hockey puck), single channel gateway for worldwide radio system linking and interoperability. The use of SiteCAST requires the availability of a computer (PC with 133 MHz or greater) through the supplied USB cable and an internet connection to provide control of PTT, COR/COS and TX/RX radio traffic. A radio specific interface cable with a standard 8-pin RJ45 connector is used between the SiteCAST module and the radio. For example, SiteCAST can be deployed in police cars, taxi cabs, ambulances or other vehicles to create a mobile, internet based vehicular repeater when outside the range of the two-way system or for inbuilding coverage. SiteCAST can also be used to link an unlimited number of two-way systems anywhere in the world instantly for economical backhaul and interoperability purposes.



(3.75W x 4L x 1.75H)

Using RoIP technology with unique TCP unicast architecture, voice traffic to and from the radio system is converted to IP data and sent over the internet or a private WAN/LAN to a server (see Server Communication below). Client software which accompanies each device controls the communication sessions and provides secure authorization to gain access to

the server. Each device creates its own secure, manageable identification to the server which is registered with the server administrator after completing the security authorization procedures. There is no IP provisioning for the end points due to the use of dynamic IP addresses. Security procedures include a valid server address, port and password. Once connected to the server, the user can select various talk groups or chat rooms to experience one-to-one or one-to-many conversations with other connected users.

The software allows for the adjustment of both mic and output volumes at the user level. The software also contains automatic gain control (AGC) for automatic level adjustment. As other members of the soft-channel participate in a conversation, their respective soft-radio id or SiteCAST/SafetyNET RF link information is highlighted to identify the party speaking and their location.

Each user connected to the same soft-channel is listed in the channel presence window or chat room. A note field allows for on-the-fly silent text messaging between soft-radio users, and it is typically used for a user description. One entry in the chat room may reflect either an individual on a computer, a smart-phone device or a two-way radio channel via SiteCAST/SafetyNET RF link with many radios. For example, a talk group established on the server can consist of one soft-radio client id communicating to a two-way radio system using SafetyNET with 100 radios, an individual using VBS and 5 individuals using iWalkie. Although there would be 7 client id's in the chat room, the conversation is being broadcast to all 106 radio and soft-radios.

Enhanced Communications Solutions

iWalkie and Virtual Base Station (VBS) turn computers, smart-phones, and PDA's and other handhelds such as barcode terminals into soft-radios. These soft-radios have the power to communicate anywhere and/or be connected to legacy two-way radio system(s) to provide vertically integrated enterprise-based communications.



iWalkie – iWalkie is thin client software used to convert internet-enabled handheld devices into soft-radios with worldwide PTT. iWalkie can be loaded onto Blackberry, iPhone or Windows Mobile smart-phones to provide push-to talk (PTT) communication over any cellular WWAN, WiFi or wireless data network – public or private. Users can be on any combination of wireless data networks anywhere in the world, eliminating the need for expensive and less flexible carrier-centric based PTT. It uses the 2G/3G/4G data mode of your device rather than the cellular voice

telephone mode. With iWalkie, when used in conjunction with the SiteCAST and SafetyNET hardware suite, users are able to seamlessly communicate with all makes and models of two-way radio systems.

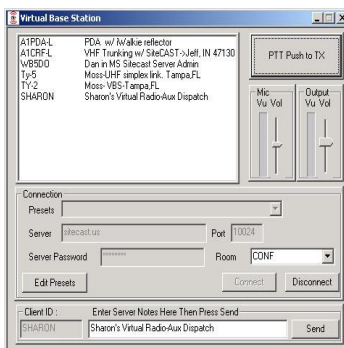
Since they can communicate across the 2G/3G/4G data mode of the cellular network, iWalkie users avoid costly minute-based airtime charges. Call set up time for PTT communications can consistently be made at approximately 250 ms. When using a private WWAN or 802.11 network, call set up times are approximately 15 ms end to end. The user may define the PTT button to a side button of the device or often the space bar which operates the push-to-talk functionality. Communication is in half-duplex mode similar to a two-way radio system. When a call is received over the cellular network while the iWalkie application is active, the application is closed while the call is received, and relaunched when the cellular call is terminated.



(enlarged screen view)

iWalkie significantly expands the potential user base of the two-way radio system by converting smart-phones and PDA's into soft-radios. iWalkie can also be used to provide a lower cost replacement for expensive legacy two-way radios. Legacy two-way LMR radios may cost between \$500-\$6,000 and require a significant investment in RF infrastructure. iWalkie can provide identical radio system access, but may also provide data, GPS, and other desired functionality.

Virtual Base Station (VBS) – VBS software (1MB) turns your desktop, laptop or UMPC computer into a soft two-way radio. With the VBS program running and an active internet or WAN/LAN connection, the user presses the computer's space bar to operate the push-to-talk capability. Like the iWalkie, the communication is in half-duplex mode. The minimum computer requirements include Windows 95, sound card, 16MB of RAM, 1MB of free hard disk space, speakers and a microphone.



VBS operates seamlessly with SiteCAST, SafetyNET, iWalkie or other VBS users to provide PTT communication. Like other internet applications, it can be launched on your computer and left running all day; thus allowing you to monitor the communication at all times.

VBS utilizes thin client software to provide virtual, on-screen talk groups (or chat rooms) with other connected users. VBS users can establish one-to-one conversations or group conversations, depending on the talk groups which have been pre-established. VBS also allows you to set up new talk groups on-the-go, add new users or change pre-established groups as needed. Similar to the SiteCAST functionality, users control both their mic

and output levels. Like iWalkie, VBS significantly expands the potential user base of the two-way radio system by converting fixed and mobile computers into soft-radios.

Sample Communication Architecture

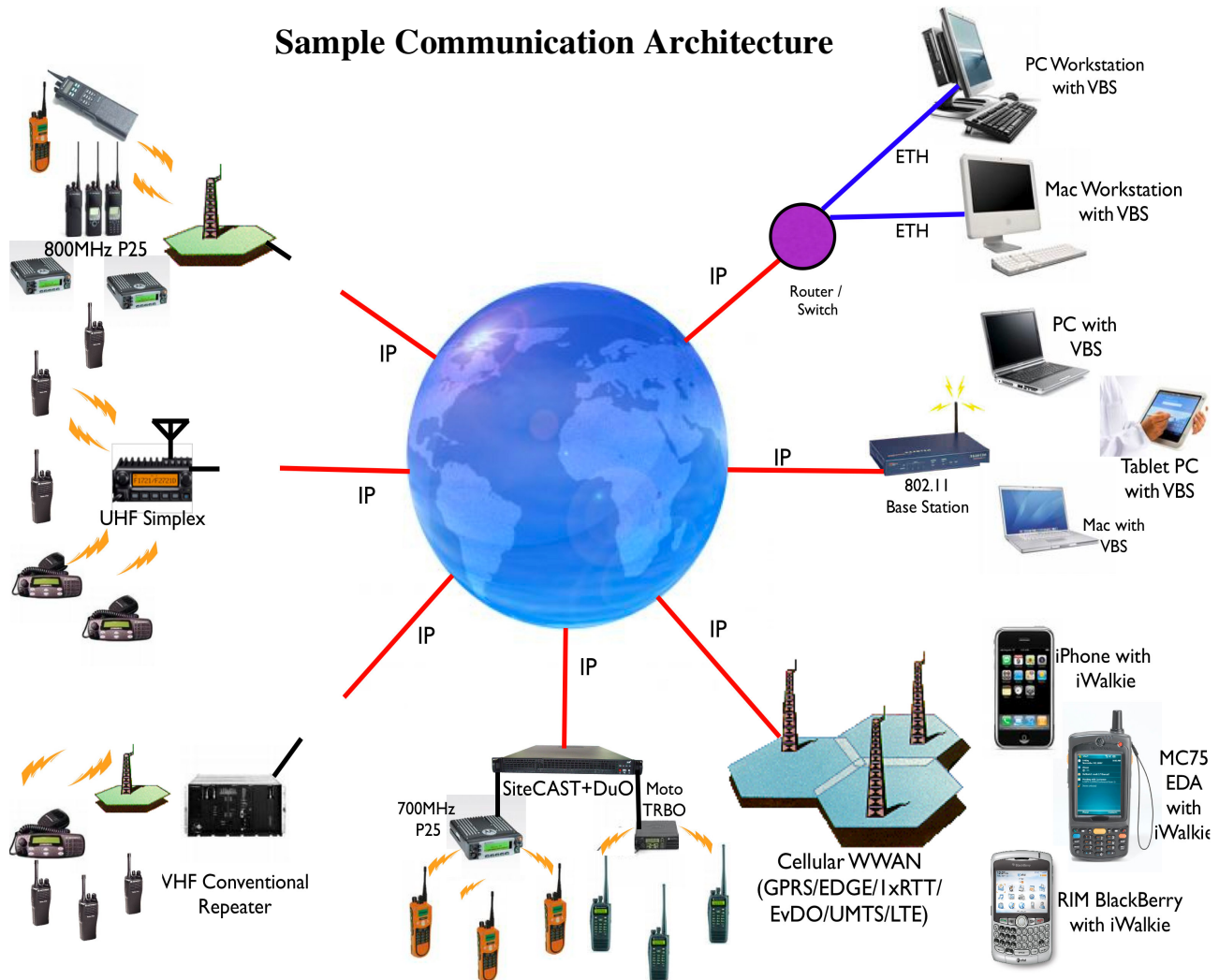


Fig. 1 – Interoperability Options (note left side of diagram does not have IP access)

Server Communication -All RoIP data is sent to the conference server via real-time TCP unicast over a TCP/IP socket connection. Each user connected to the server requires 9KB of server band width for encoding and decoding, 1 KB when idle. The process uses GSM 6.10EFR W/LPC error correction to maintain quality control of session conversations and toll quality speech. This provides the advantage of being able to provide

99.999% reliability and fidelity with no QoS needed. GPRS, 1xRTT, dialup, SAT, EvDO, EDGE, UMTS, DSL, CBL, LAN, WAN, and MAN are all suitable connections. Dialup speeds of as low as 14.4k can be utilized.

The enterprise server software, which can be either hosted by Critical RF or directly hosted by the end user on any public or private network, is included in all enterprise-class solutions. The server admin program lets you create or remove soft-channels on the fly, delete or add users, stun and mute users.

The Benefits of RoIP Technology

Critical RF interoperability and enhanced communication solutions based on RoIP technology provide a host of benefits to its users.

Reduced costs – Our systems generally require far less capital and resources to deploy than other commercially available solutions. By enhancing the existing legacy system rather than replacing it, the life of the legacy system is extended and the need for a major capital equipment expenditure is eliminated. By utilizing commercial off-the-shelf broadband, mobile and fixed devices, equipment costs can be better managed. Monthly operating costs are typically reduced on average by a factor of 16:1. PTT services incur no cellular, roaming or long distance per-minute charges. Interoperability solutions also eliminate the need for multiple radios for cross-jurisdictional support.



Greater coverage – Use of SiteCAST or SafetyNET extends the PTT coverage anywhere a broadband or dial-up connection is available, fixed or mobile. In addition, in building coverage is enhanced where a two-way radio system may otherwise operate intermittently or not at all.

Better use of existing resources – The use of SiteCAST or SafetyNET extends the life of the legacy LMR system by using the existing equipment and removing the need for replacement. Laptop and desktop workstations and mobile devices are converted into soft-radios, offering greater access to the two-way radio system.

Increased safety – By expanding the coverage area of existing two-way radio systems, no one is ever out of range. For example, a policeman involved in a car chase that takes him out of range of his two-way radio system may still have access. The increased user-base of two-way radio systems which results from adding mobile and computer users as soft-radios allows for a greater number of potential responders and increased

coordination in the event of an emergency. The instant interoperability creates enhanced capability to collaborate and respond to an emergency situation.



Saves time – Critical RF solutions are easy to setup and install and intuitive to use. Statewide and regional interoperability can be achieved in hours instead of weeks or months. Interoperability solutions are often stored and only brought out during an emergency. First responders and emergency personnel want to use a system that is familiar to them in an emergency, not something new. Our solutions are designed to be used everyday. The increased use of everyday interoperability means greater efficiency, value and discipline during an actual emergency.

Flexibility – Our solutions provide mobile PTT communications anytime, worldwide through the use of the internet as a backbone. Our solutions are vendor, frequency and network neutral meaning they can be deployed with any existing radio configuration. In addition, they will operate on any mobile broadband assets. No static IP address is required. Use of an iWalkie loaded handset versus a two-way radio provides the additional benefits of being able to access critical data, send and receive pictures, use GPS and other critical applications. Our hardware devices are not required to be located in a specific location, they can be placed anywhere there is an internet connection.

Conclusion

For public safety or other industries that depend on interoperable PTT communications, Critical RF overcomes the inherent limitations by providing a solution using the internet as the common thread. We believe our solutions are the natural evolution of today's communication systems to provide a seamless, mobile, communication available anytime, anywhere.