



Prepared for the Office of Grants and Training

ICTAP-OG&T-HNDBK-002-R0

Audio Gateway Handbook
March 2006

Audio Gateway Handbook

The following information intends to provide comparisons of audio gateways that are available for Public Safety use. This list is not inclusive and prices are the direct result of vendor input given prior to March 2006. ICTAP does not endorse or reject any of the vendor solutions listed. It should also be noted that items captured in this comparison often have several options and features available that can impact the overall price. ICTAP recommends interested parties with vendors to decide on the exact model required for fielding, which will determine the final price.

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1 General Audio Gateway information

The basic function of an audio gateway is to interconnect disparate communications devices (typically two-way radios) and allow audio to be patched between any and all of those devices as needed. These communication devices can be portable and mobile radios, base stations, telephones, cell phones or satellite phones. Each device acts as an access point for transmissions to or from the network to which it is associated. For example, a radio attached to the gateway will be programmed to transmit or receive on a particular channel or talk group. The radio will be configured for a particular modulation scheme or features, such as encryption, as needed for communication on that channel or talk group. The gateway is able to connect the audio provided by a speaker connection on one device and patch this audio to the microphone connection on one or more other devices. Because the gateway connects to these different audio devices, it does not actually transmit or receive any RF itself. Therefore, different modulation schemes or features such as encryption can be supported independently on each audio device without impacting gateway functionality.

Operation of a gateway is also a key element. Some are hardware controlled using basic knobs, switches and/or keypads whereas others provide a separate software application to make and break patches. Some allow for both methods of control. Gateways may offer greater flexibility and capabilities but that typically comes with increased complexity. Sometimes these added capabilities allow the gateway to better interface to a trunked system by adjusting delays, for example. The key is to find the right balance for the need.

Gateways provide great value in establishing connections between disparate communications systems, thus allowing users to communicate that otherwise would not have that ability. However, they do have limitations as well. For one, they do not make efficient use of spectrum. A single conversation requires a separate channel on each recipient's system. In other words, if a VHF channel, UHF channel, and an 800 MHz channel are all patched together, three times the radio resources are being used for a single conversation compared to users operating on a shared system. Additionally, training and operational issues need to be addressed. Standard Operating Procedures (SOPs) and Memorandums of Agreement (MOAs) should be developed for all users with radios connected to the gateway. Training will ensure the system can be used to its potential when needed. Effort should be made wherever possible to pre-configure the gateway for the agencies expected to be interconnected with the system in order to avoid a situation where a gateway operator is trying to setup the system for the first time on-scene during incident. Without proper setup, gateways can be detrimental to operations by degrading communications rather than improving them. Another common misconception is that gateways can extend the radio coverage of a system. This is further discussed in Section 2.

Gateways can come in many different shapes and sizes. They range from something that could fit in a pocket supporting two radios to several racks of equipment supporting thousands of radios. Knowing how the equipment is going to be deployed and how many radios it must interface is an import factor in determining a suitable gateway. The category of gateways compared in this document is considered portable/transportable.

2 Disparate Radio System Coverage

If the gateway is connecting disparate radio systems (i.e. 800MHz trunked to UHF Digital Conventional to VHF Analog Conventional) the interface radio and the remote radios have to be within coverage of their supporting infrastructure in order to work with the gateway. The audio gateway does not extend the coverage of a radio outside its own system even if the gateway has interface radios to support that system. This is the case of the yellow radio shown below in Figure 1. This is especially important for mobile gateways that are deployed to the scene of an incident. If users go beyond the coverage of their home system and still want to participate in patches supported by the gateway, they must switch to a talk-around mode for localized communications as discussed in section 2.1.

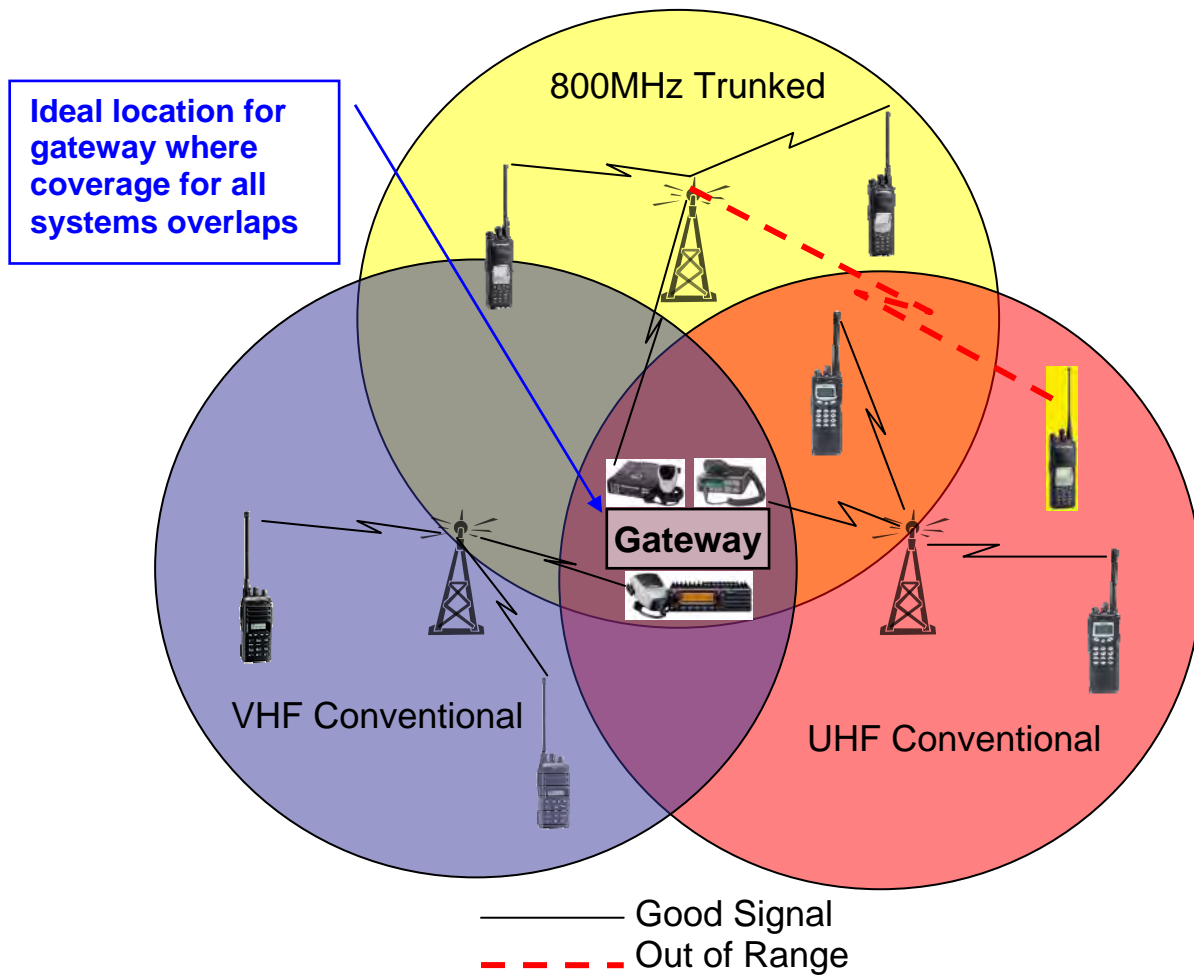


Figure 1 - Disparate Radio System Coverage

2.1 Incident Area Coverage

If a gateway is deployed to an incident where radios are outside the coverage of their normal systems, an incident area network can be formed using talk-around channels to support interoperable communications. This may also be preferable even for radios within coverage of their system as users may want to prevent undue burden on system infrastructure.

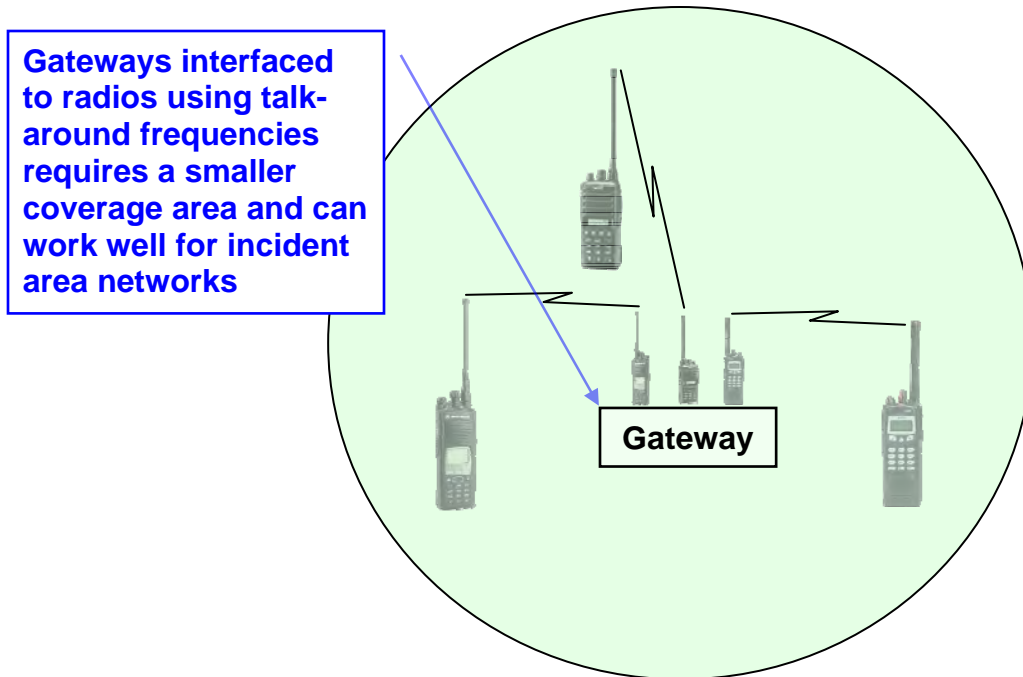


Figure 2 – Incident Area Coverage

3 Best Practices

Below are some recommended best practices when deploying a gateway.

- Interface radios should be tested and adjusted with the audio gateway prior to deployment. Some mobile radios may need to be physically modified to work properly with the gateway. Others may require delay settings to avoid audio from being clipped or to allow for hang times and squelch tails to prevent a “ping-pong” effect. If everything is pre-configured prior to deployment, only minor adjustments will need to be made (if any at all) to support any incident.
- When using an audio gateway with a trunked system, it may be necessary to have a high priority talkgroup on a radio dedicated to that gateway. Most audio gateways do not recognize trunked control tones so if a gateway is attempting to key a trunked radio and a busy is received the transmission can be lost without any indication being provided by the gateway to the originator of the transmission. By creating a high priority talkgroup on the trunked system, it provides the best chance for the audio gateway to get access to a channel, thus preventing lost transmissions.

- All gateways require special interface cables to interface to the variety of connectors found on radios. In addition to the cable, some mobile radios require modifications to interface a gateway. If a radio must be added ad hoc, it may be best for the requesting organization to provide a portable radio, additional batteries, and the interface cable. This cuts down on setup time because portable radios do not need modifications and supplying the cable prevents the audio gateway owner from having to buy all the possible interface cables on the off chance someone will need them.
- Training and usage of the equipment are a must. Like most equipment, gateways and their interface radios should have routine maintenance checks and be used for training when ever possible.
- Establish SOPs and MOAs for all agencies that use or may plan to use the gateway.
- If multiple audio gateways using radios from the same systems are to be utilized in close proximity with each other, additional coordination will be required to ensure successful operations. Without this coordination, patches could be created between the two systems causing an unwanted bridge between the two and confusion for all users. For example, a conventional VHF system is patched to an 800MHz trunked system on one gateway and the same VHF conventional channel is connected to a UHF system on another gateway. The VHF system acts as a bridge connecting the 800MHz and UHF users unknowingly. If the gateways are responding to separate incidents, the resulting radio chatter could cause confusion at both incidents.

4 Additional References

Some additional references can be found at the following websites:

Raytheon / JPS Communications – [*Handbook of Patchwork Interoperability*](#)

CommTech (AGILE) – [*Guide to Radio Communications Interoperability Strategies and Products*](#)

5 Explanation of Categories for Product Summary Sheets

Overview Section

This section includes product name and basic information for the vendor.

Deployment Environment

Suggested deployment environments were referenced from SAFECOM's Statement of requirements for Public Safety Wireless Communications & Interoperability. Those include:

1. **Incident Area Network (IAN)** - An incident area network (IAN) is a network created for a specific incident. This network is temporary in nature.
2. **Jurisdiction Area Network (JAN)** - The JAN is the main communications network for first responders. It is responsible for all non-IAN voice and data traffic. It handles any IAN traffic that needs access to the general network, as well as providing the connectivity to the Extended Area Network (EAN).
3. **Extended Area Network (EAN)** - The city systems are in turn linked with county, regional, state, and national systems or extended area networks (EAN).

Those above definitions were reduced for space consideration to the following:

1. **Incident Area Network (IAN)** – Small, temporary network created for a specific incident.
2. **Jurisdiction Area Network (JAN)** - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
3. **Extended Area Network (EAN)** - Links city, county, regional, state, and national systems.

General Product Description

This section provides a description of the product including the basic function, size and components.

Capacity / Configurability / Scalability

Capacity: The number of audio devices that can be connected to a single unit.

Configurability: The maximum number simultaneous patches or talkgroups that can be created per unit.

Scalability: The capability for units to be connected together thus leveraging the total capacity and configurability of multiple units.

** Scalability can be important when there is a potential for a system to be expanded to accommodate new audio devices that need to be added to the system. Although this is usually possible, there are often limitations when connecting multiple units together. For example, if a unit supports 10 audio interfaces with 5 simultaneous patches that doesn't always mean connecting 3 units together will yield 30 usable audio interfaces with 15 simultaneous patches. If a system may need to be expanded beyond its single unit capacity, it is recommended that users consult with the vendors on how their respective systems support this feature.*

Base Cost

This section includes the cost of major components necessary for a single functioning system. In addition to the base cost, this section details other potential costs associated additional requirements, services required or optional features.

Additional Requirements: Items not included in the base cost but required to for the complete system to operate. Specific radio cables are required for each gateway and are often available through the vendor.

Service Required: Systems may require installation and/or integration costs.

Optional Features: This includes the cost of any optional features the vendor offers that are not considered part of the basic system.

**See disclaimer on cover sheet. Prices are the direct result of vendor input given prior to March 2006.*

Network

This section includes any network capabilities, for example support of VoIP to support audio connections or protocols allowing remote control of a system over an IP network. Bandwidth, codecs, and other requirements are listed for each network capability.

Public Safety Technology Lab Product

ACU-T

Date: 06/21/2005
Product: ACU-T
Vendor: Raytheon JPS Communications
Vendor Info: <http://www.jps.com/index.asp?node=88>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.

General Product Description

The ACU-T is a small Audio Switch that enables interoperability of disparate communications devices. It's overall dimensions are 6.75"H X 6.75"W X 10.5"D. The primary means of control is through a software based Graphical User Interface (GUI). The ACU-T can also be controlled through a built in keypad controller and a LED System Connectivity Status display. The system operates on AC/DC input power.

Components: Free standing unit with five internal interface modules that can be chosen by the user (i.e. four internal radio interface modules and one telephone interface module)

Capacity / Configurability / Scalability

Capacity: 5 Interface Modules

Configurability: 3 concurrent patches

Scalability: Through ethernet connections

Base Cost

ACU-T Bundle Kit - Includes ACU-T Tactical Package, 5 Interface Modules, and Case Option Kit with Battery - to qualify for Bundle Kit pricing, each kit must be ordered with 5 Interface Modules, in any combination. - \$8,995.00 (GSA Price)

Additional Requirements: Interface Cables - \$100.00 - \$240.00 each (Radio specific)

Optional Features: \$650.00 - LE-10 4-Wire Audio Remote with Handset & Speaker with adapter

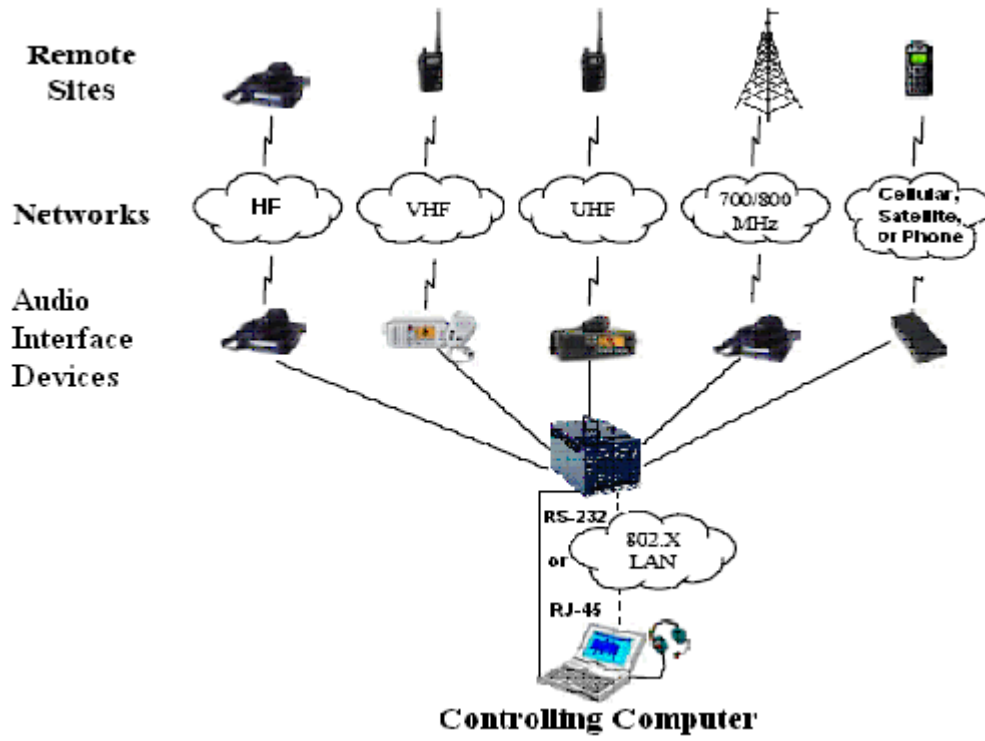
Compatibility

Mobile/Portables, Phones/Cell Phones incl. Sprint/Nextel Direct Connect units, Satellite/INMARSAT, Trunked Systems

Network

VoIP and network control available

Public Safety Technology Lab Product



ACU-T Layout

Public Safety Technology Lab Product

ICRI

Date: 06/21/2005
Product: ICRI
Vendor: Communications-Applied Technology (C-AT)
Vendor Info: <http://www.radiointeroperability.com/>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.

General Product Description

The ICRI (Incident Commanders Radio Interface) is a rugged small audio gateway that enables inter-connectivity of disparate communications devices. It's overall dimensions are 3.5"H X 10.25"W X 6.5"D. User control is through built in talkgroup switches; timing/delay adjustment are internal.

Components: Waterproof case, external power adapter, AA battery adapter

Capacity / Configurability / Scalability

Capacity: 5 - 11 interfaces plus POTS/PSTN and satellite telephone

Configurability: 1, 2 or 4 concurrent patch versions (switch-selectable for 2 and 4 patch versions)

Scalability: Possible with use of ICRI-to-ICRI link port or Ethernet bridge

Base Cost

\$4,500.00 - ICRI (5 ports)

\$7,500 - ICRI w/ selectable talk groups (5 ports)

\$15,000 - Rackmount ICRI (10 ports)

\$250.00 - Audio buffer delay for trunked radio system

Additional Requirements: \$75.00 - \$230.00 each - Radio specific interface cables

Optional Features:
\$120.00 - 115/220V AC adapter
\$75.00 - 6 to 20V DC input cable
\$275.00 - \$300.00 Waterproof transit case
\$150.00 - ICRI-to-ICRI link port (RJ-45)

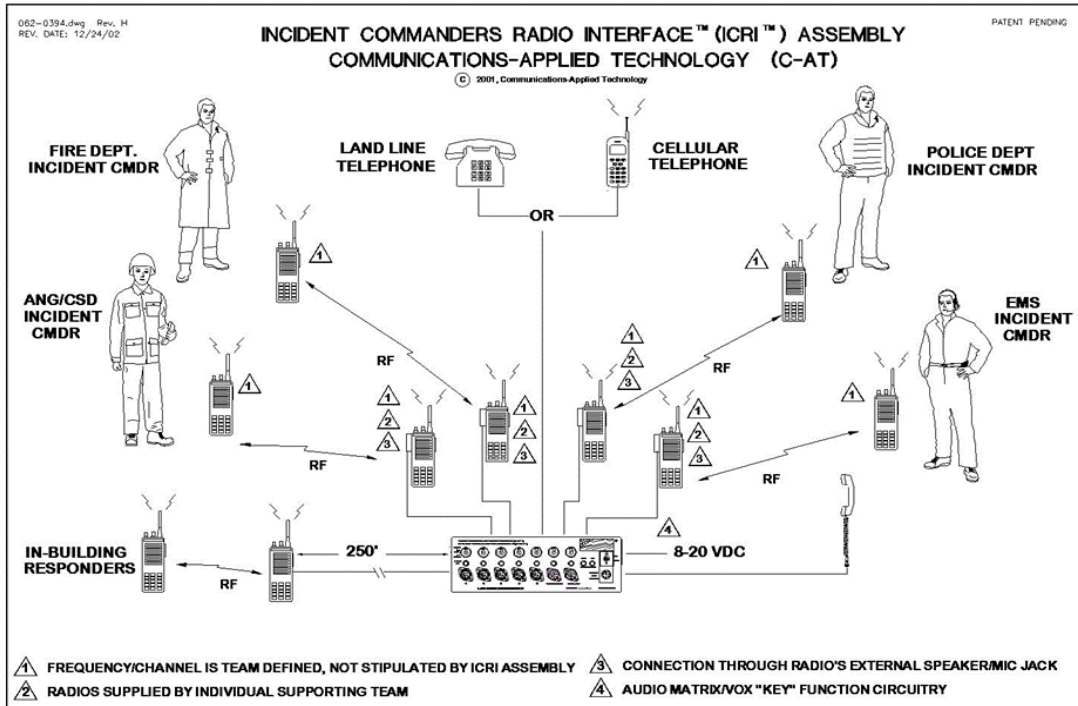
Compatibility

Portables, Phone/Cell Phone, Trunked Systems, Satellite phones, Military radios

Network

Optional VoIP Port available for Version 2

Public Safety Technology Lab Product



Typical ICRI Layout

Public Safety Technology Lab Product

InfiniMUX G4 Portable

Date: 06/21/2005
Product: InfiniMUX G4 Portable
Vendor: Infinimode Systems Inc.
Vendor Info: <http://www.infinimode.com/>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.

General Product Description

InfiniMUX G4 Portable is a small Audio Switch that enables inter-connectivity of disparate communications devices and comes in two versions (Basic and Plus). It's overall dimensions are 5.25" H X 13"W X 7"D. There are two means of control, the primary is through a built in keypad controller and the second is through a software based Graphical User Interface. The unit contains an LED System to display its operational and connectivity status. The G4 Portable includes a ruggedized case, power supply and available slots for modules.

Components: Portable chassis (including local user interface and audio module, CPU module), interface modules (radio, PSTN, mixed)

Capacity / Configurability / Scalability

Capacity: Basic version - 8 radios and 2 PSTN interfaces
Plus version - 12 radio interfaces, 4 PSTN interfaces

Configurability: 128 Networks (radios can participate in multiple nets), 1 GlobalNet (connect all)

Scalability: Possible

Base Cost

Portable G4 Basic (without modules) \$6,600

Portable G4 Plus \$9,900

Quad Radio/PSTN Module \$2,000

Mixed I/O Module \$850

Radio interface cable \$195

Additional Requirements: PC for remote configuration / monitoring

Optional Features: External recording device, can be pre-packaged as part of a G4 Lite configuration with carrying case, radios, power supply, etc

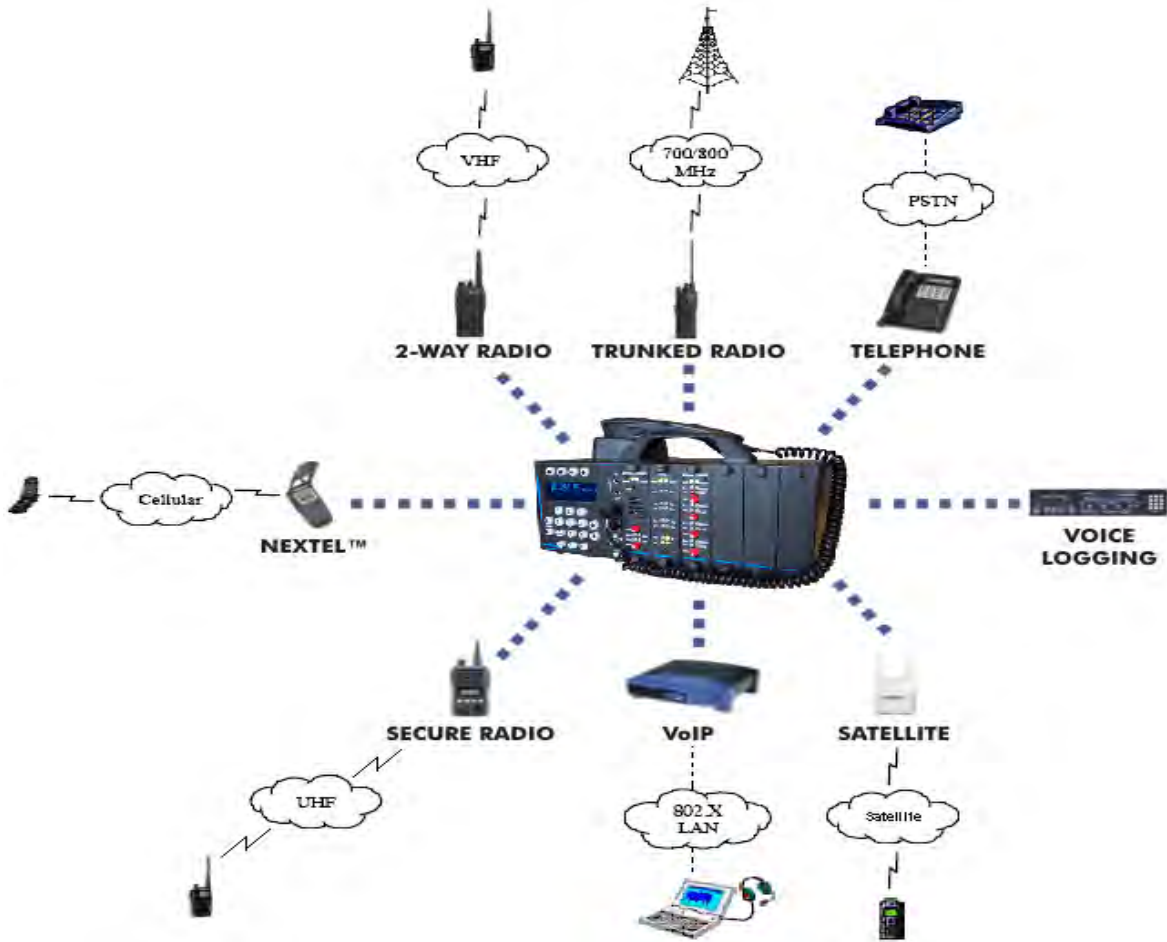
Compatibility

Mobile/Portables, Phone/Cell Phone, Trunked Systems, Satellite Phones, PC Users

Network

LAN/WAN if extended remote control

Public Safety Technology Lab Product



Network Diagram

Public Safety Technology Lab Product

Radio Inter-Operability System (RIOS) - Portable

Date: 05/15/2005
Product: Radio Inter-Operability System (RIOS) - Portable
Vendor: SyTech Corporation
Vendor Info: <http://www.sytechcorp.com/>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.
Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
Extended Area Network (EAN) - Links city, county, regional, state, and national systems.

General Product Description

This RIOS model is a portable audio switch that enables inter-connectivity of disparate communications devices. The control is through a software based Graphical User Interface (remote client). The RIOS interfaces with TCP/IP networks and can be remotely controlled.

Components: 16-port I/O module, power module, notebook server, server software, remote client software

Capacity / Configurability / Scalability

Capacity: 16 port capacity

Configurability: Any combination of ports may be connected

Scalability: Possible - multiple RIOS systems can be linked over TCP/IP network allowing remote communication devices to be added to local talkgroups

Base Cost

Portable 16 port unit - \$17,500 (SR-3001-PTB)

Additional Requirements: Interface cables for each gateway device \$250 ea

Services Required: Antenna installation for fixed site

Optional Features: Additional 16 port I/O module (SR-3001-RMT only) \$10,000
Audio recorder \$5,000; Audio Archiving to DVD-RAM drive \$2,500
Traffic analysis software \$5,000
Additional PC or audio clients \$2,500

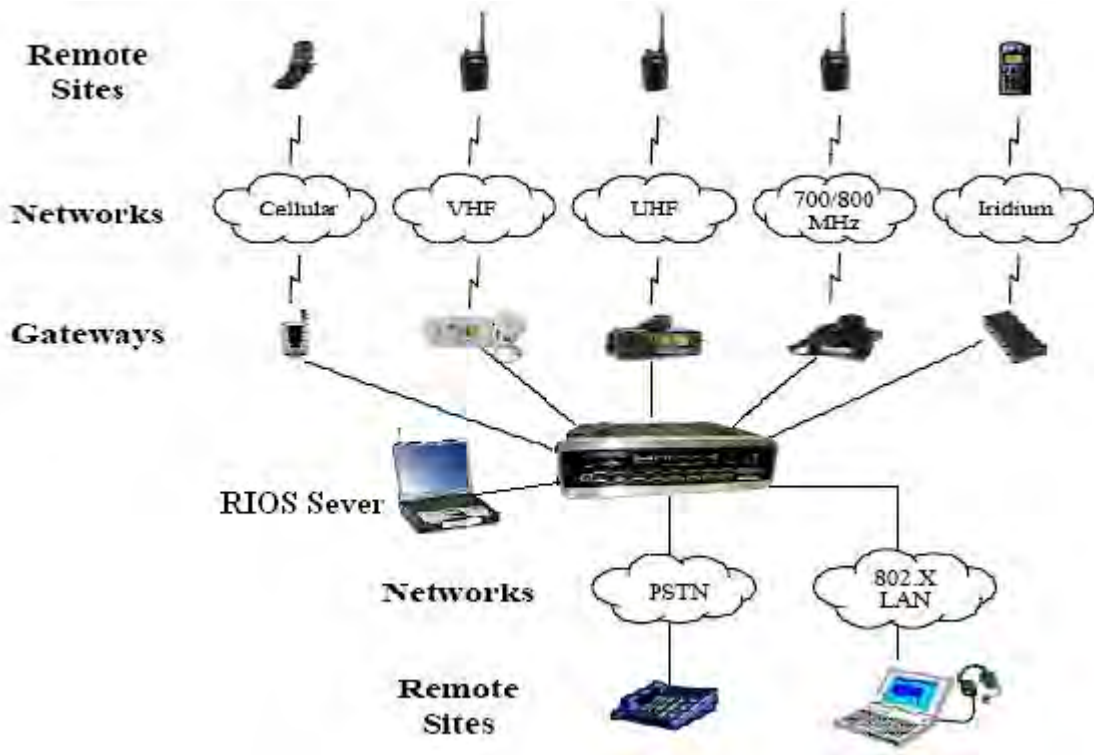
Compatibility

Mobile/Portables, Phones/Cell Phones, Satellite / INMARSAT / Iridium Phones, Trunked Systems

Network

56 Kbps per remote audio or PC client

Public Safety Technology Lab Product



RIOS Functional Diagram

Public Safety Technology Lab Product

SafetyNet RadioBridge System

Date: 03/26/2004
Product: SafetyNet RadioBridge System
Vendor: Aegis Assessments, Inc
Vendor Info: <http://www.aegiscorporate.com/SafetyNet.htm>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.

General Product Description

Ruggedized, weatherproof case contains built-in 48 hour battery with all radio interfaces. A control knob for each radio interface allows user to choose between 4 individual groups or an all-call group. A headset connection is available for the operator.

Components: Self-contained case

Capacity / Configurability / Scalability

Capacity: 8 channels

Configurability: 4 selectable groups, 1 all-call group

Scalability: None

Base Cost

\$12,545 - 8 Channel (includes charger)

Additional Requirements: \$150-\$200 - per radio cable

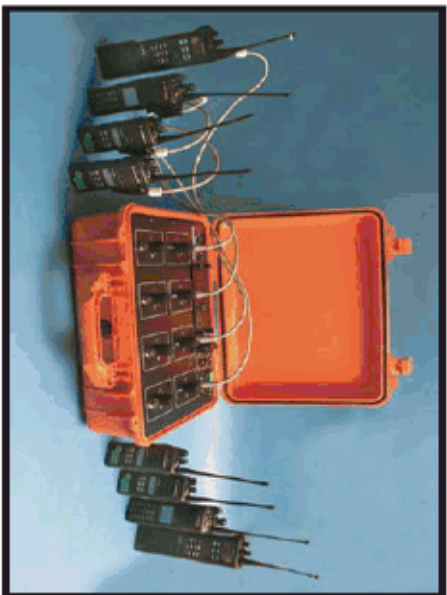
Optional Features: Audio output available for external recorder

Compatibility

Mobiles/Portables, Phone/Cell Phone

Network

None



8-Channel SafetyNet™ Radiobridge™

Step 1



Turn On

Step 2



Connect Radio

Step 3



Plug in Cable

Step 4



Adjust Volume

Setup Procedures

Public Safety Technology Lab Product

SmartMSG Version 5.1

Date: 11/04/2005
Product: SmartMSG Version 5.1
Vendor: CODESPEAR
Vendor Info: www.codespear.com
Functionality: VoIP/Network



Deployment Environment

Incident Area Network (IAN) - An incident area network (IAN) is a network created for a specific incident. This network is temporary in nature.

Jurisdiction Area Network (JAN) - The JAN is the main communications network for first responders. It is responsible for all non-IAN voice and data traffic. It handles any IAN traffic that needs access to the general network, as well as providing the connectivity to the EAN.

Extended Area Network (EAN) - The city systems are in turn linked with county, regional, state, and national systems or extended area networks (EAN)), through pre-authorized and secure firewall ports between entities.

General Product Description

This real-time communications interoperability system can be deployed as an enterprise-wide urgent notification and secure messaging platform. The product supports Data, Video, and Audio messaging. All audio traffic is converted to IP packets by the Radio Interoperability Module which is connected to each radio system. All IP packets are routed to a controller server (consisting of the SmartMSG software running on any computer), encrypted with a 128 or 256 bit key that is FIPS level 1 or 2 compliant and then redistributed to necessary participants based on the talk-path established.

Talk-paths can be predetermined or created dynamically by any SmartMSG server connected to the system. An additional feature of the product is its ability to convert text to audio. Text that is typed on a server and patched to a radio is electronically converted to voice and then transmitted. If the original text message is sent to a computer, text pager, or PDA the message appears on the screen in text form. All transmissions are logged, time stamped, and recordable.

Components: SmartMSG Server software, VoIP Module, Multi-Lingual Module, SmartMSG Client software, Computer, and Radio Interoperability Modules

Capacity / Configurability / Scalability

Capacity: Each server can connect to four quad-port radio interface modules for a total of 16 interfaces. The quad-port radio interface is powered from the USB port on the server. If a laptop is used as a server, the radio interface is powered by the laptop battery. Servers can be interconnected by a wired connection or using various wireless network protocols to allow for virtually unlimited regional cross-agency communications interoperability between geographically dispersed radio interface modules.

Configurability: Talk-paths can be predetermined or dynamically configured; only limited by the number of interfaced systems.

Scalability: Highly scalable. There is theoretically no limit to the number of servers that can be connected through LAN/WAN networks.

Base Cost

\$17,500 for a SmartMsg Application Server w/ Four (4) USB Radio Interoperability Interface Units, including a Ruggedized Mobile Laptop (Capacity of 16 Ports for Radios, Base Stations, or PTT Capable Phones).

\$2,500 for a mandatory Enterprise Server Fee (unlimited Server rights provided).

\$2,500 for each additional USB Radio Interoperability Interface Unit (4 Ports per unit). Each USB Radio Interoperability Unit includes four (4) User Licenses and four (4) Cables. Additional Cables are charged at \$150.00 per cable. Additional User Licenses start at \$50.00 per User for Unlimited Devices

Public Safety Technology Lab Product

(PC's, PDA's, Pagers, Cell Phones, SAT Phones, Office Phones, IP Phones, IP Camera, etc.).

\$5,000 for the VoIP Module (provides bridge for calls to PSTN, Cellular & SAT networks).

Note: All License Fees are charged as a One-Time Fee, including the first year Annual Support & Maintenance Fees. Annual Maintenance & Support Fees are required to remain eligible for customer support, updates, and new product releases.

The Multi-Lingual Alert Notification and Two-Way Translation options are priced at approximately 10-15% of the base modules and user license fees paid (12 languages currently supported). 3rd Party COTS Foreign Language Text-to-Speech Modules can be installed into the SmartMsg Text-to-Speech Library to provide multilingual voice alerting and two-way chat between radios, phones, and computers.

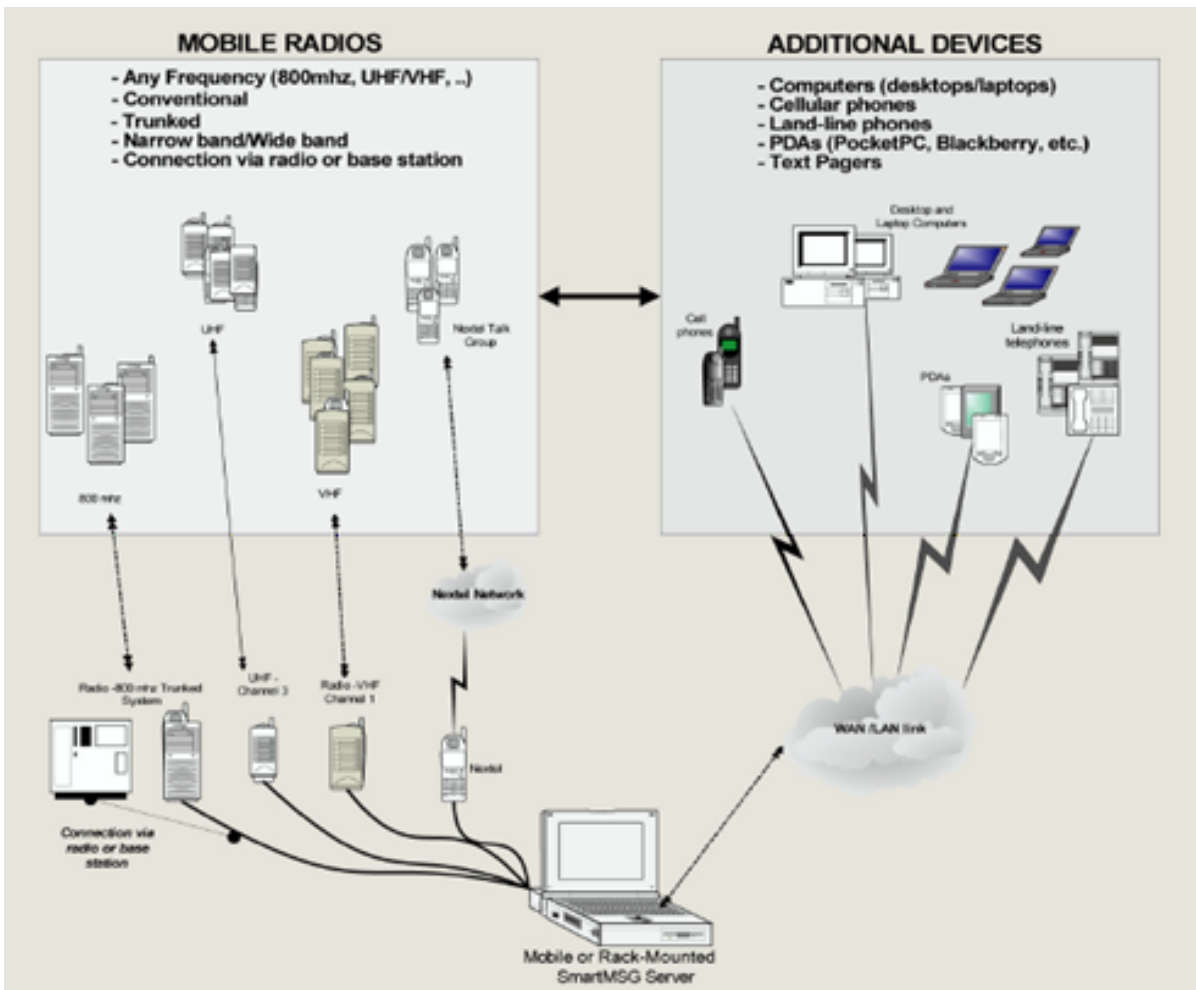
Additional Requirements: Computer to act as server; Interface Radios.

Services Required: If configured across a network, the customer will be responsible for setup and configuration of the network to properly support operational needs.

Optional Features: Additional client licenses to connect individuals to the system through their pagers, office/cell/home phone, or computer.

Network

Codespear has several utilities designed within the distributed architecture to address the regulation of frame rates for data, video, and voice communication based on the connection speeds of the various possible network links that could be used to connect multiple SmartMsg Servers. Proprietary compression algorithms address both voice and video over low bandwidth connections. Voice communication across distributed servers ranges between 4 to 5 kbps. Codespear deploys a pure IP architecture with no forms of communication running "on top" or outside of native IP.



Network Diagram

Public Safety Technology Lab Product

Transpeater III Portable Repeater Unit

Date: 10/17/2005
Product: Transpeater III Portable Repeater Unit
Vendor: Transcript International
Vendor Info: www.transcrypt.com
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.

General Product Description

The Transpeater III is a small audio gateway. When used in relay mode it enables inter-connectivity of disparate communications devices. It's overall dimensions are 4.4 X 2.4 X 1.4 and only weighs 6 oz.

Components: Transpeater unit, power adaptor, interface cables

Capacity / Configurability / Scalability

Capacity: 2-3 interface radios

Configurability: 1 patch

Scalability: N/A

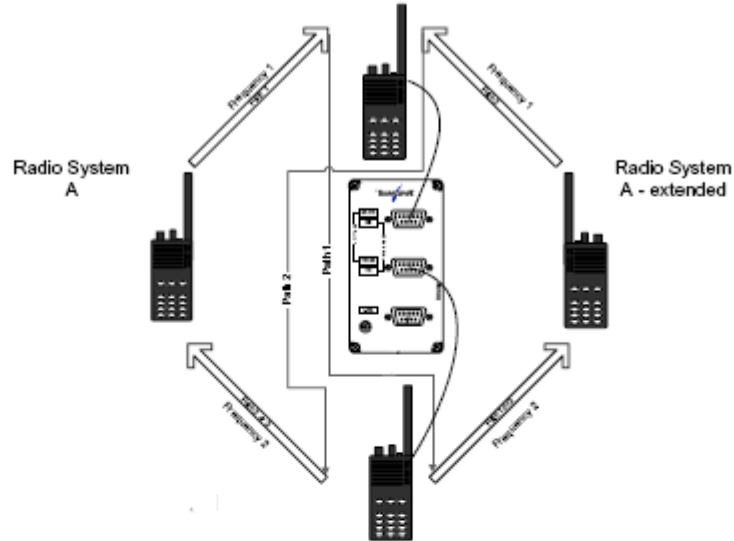
Base Cost

Transpeater III - \$599.00

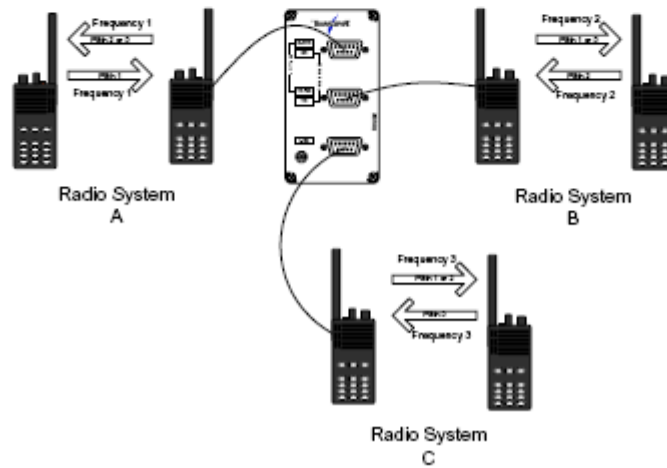
Additional Requirements: Generic cables \$45.96 ea

Optional Features: Power adaptor
Radio Specific Cables - call for pricing

Repeater Mode



Relay Mode



System Layout

Public Safety Technology Lab Product

ACU-1000

Date: 06/21/2005
Product: ACU-1000
Vendor: Raytheon JPS Communications
Vendor Info: <http://www.jps.com/index.asp?node=88>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.
Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
Extended Area Network (EAN) - Links city, county, regional, state, and national systems.

General Product Description

The ACU-1000 is a rack mounted audio switch that enables interoperability of disparate communications devices. The primary means of control is through a software based Graphical User Interface (GUI) but it can also be keypad controlled. It interfaces with TCP/IP networks and can be remotely controlled. The system operates on AC/DC input power

Components: Rack mount unit, radio interface modules and telephone interface modules

Capacity / Configurability / Scalability

Capacity: 12 Interface Modules

Configurability: Maximum 7 concurrent patches (6 on a single unit)

Scalability: 16 radios through 2 units in Primary/Extension configuration

Base Cost

ACU-1000 without interface modules 1-12 - \$ 6,984.00 (GSA Price)

Unit price per DSP-2 or PSTN module, 12 modules per unit - \$ 1119.00 ea (GSA Price)

Additional Requirements: Interface cables \$ 100.00 - \$ 240.00 each (radio dependent)

Optional Features: \$11,203.00 - Recording via EXACOM recorders (12 port)
\$650.00 - LE-10 4-Wire Audio Remote with Handset & Speaker with adapter

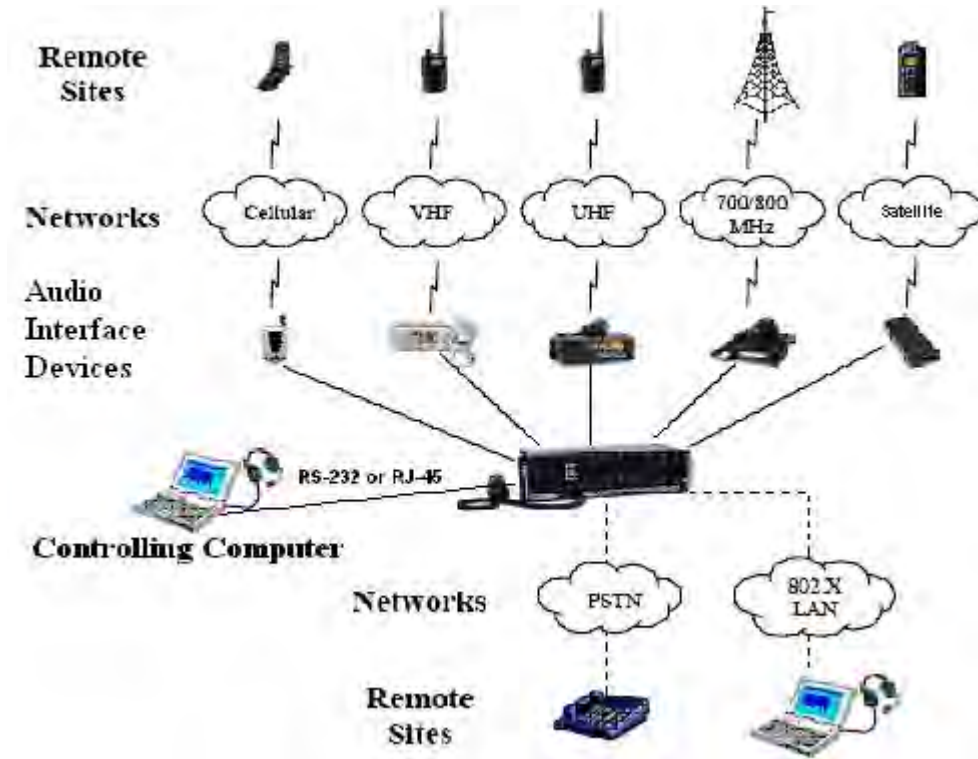
Compatibility

Mobile/Portables, Phones/Cell Phones incl. Sprint/Nextel Direct Connect units, Satellite/INMARSAT, Trunked Systems

Network

16 to 56 kbps per channel depending on Vocoder used and 36 kbps for each controller utilized

Public Safety Technology Lab Product



ACU-1000 Equipment Layout

Public Safety Technology Lab Product

InfiniMUX G4 Rackmount

Date: 06/21/2005
Product: InfiniMUX G4 Rackmount
Vendor: Infinimode Systems Inc.
Vendor Info: <http://www.infinimode.com/>
Functionality: Audio Gateway



Deployment Environment

Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).

General Product Description

InfiniMUX G4 Rack Mount is a small Audio Switch that enables inter-connectivity of disparate communications devices and comes in two versions (Basic and Plus). It's overall dimensions are 5.25" H X 17"W X 7"D. There are two means of control, the primary is through a built in keypad controller and the second is through a software based Graphical User Interface. The unit contains an LED System to display its operational and connectivity status. The G4 Rack Mount includes a rack mountable case, power supply and available slots for modules.

Components: Rackmount chassis (including local user interface and audio module, CPU module), interface modules (radio, PSTN, mixed)

Capacity / Configurability / Scalability

Capacity: Basic version - 16 radio interfaces, 2 PSTN interfaces
Plus version - 24 radio interfaces, 4 PSTN interfaces

Configurability: 128 Networks (radios can participate in multiple nets), 1 GlobalNet (connect all)

Scalability: Possible

Base Cost

G4 Basic version (without modules) \$9,500

G4 Plus version \$13,500

Quad Radio/PSTN Module \$2,000

Mixed I/O Module \$850

Radio interface cable \$195

Additional Requirements: PC for remote configuration / monitoring

Optional Features: External recording device, can be prepackaged as part of a Transportable configuration with radios, power supply, etc

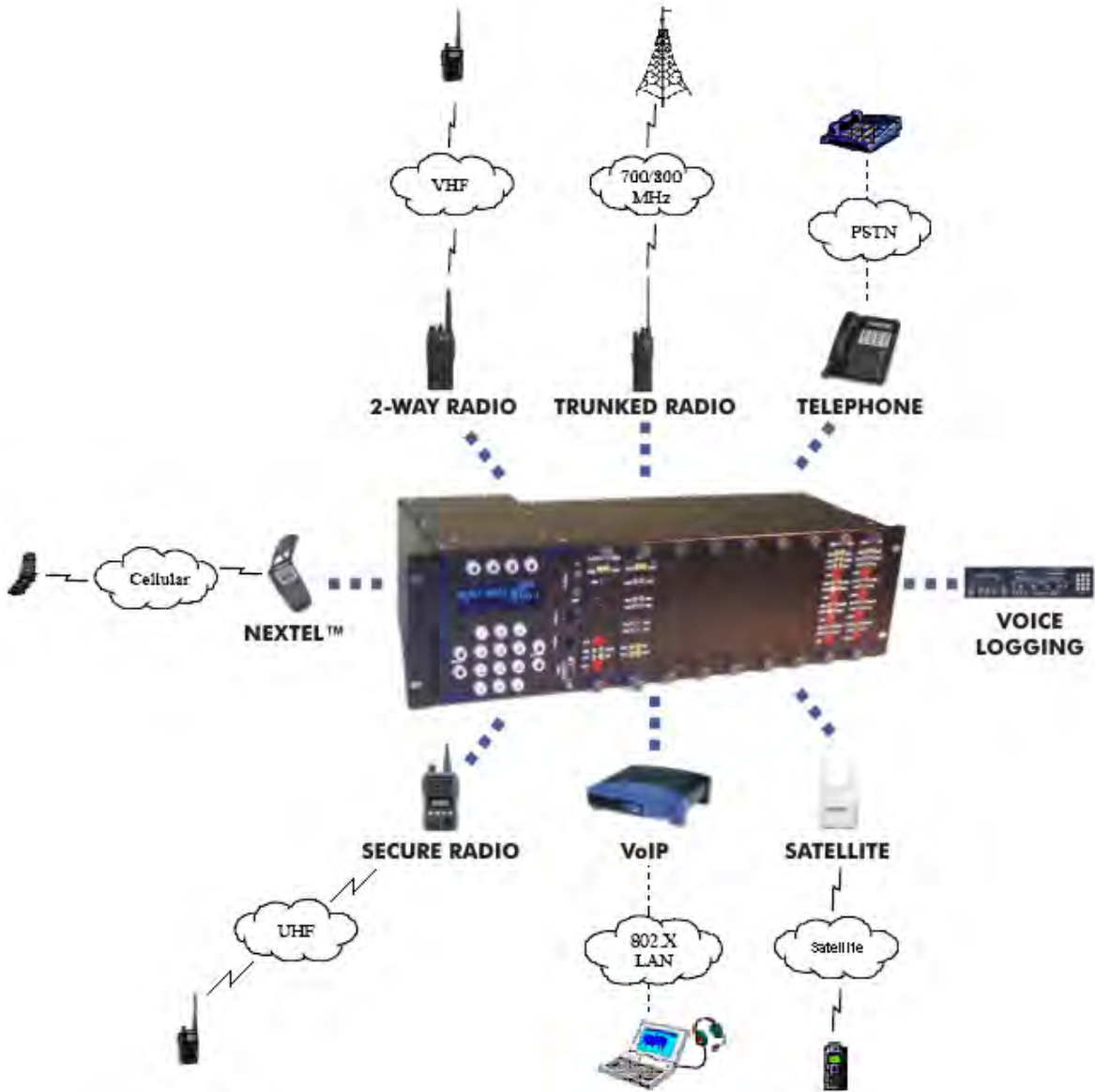
Compatibility

Mobile/Portables, Phone/Cell Phone, Trunked Systems, Satellite Phones, PC Users

Network

LAN/WAN if extended remote control

Public Safety Technology Lab Product



Infinimode G4 System Architecture

Public Safety Technology Lab Product

Interop-9

Date: 06/22/2005
Product: Interop-9
Vendor: K.R. Nida Corp
Vendor Info: <http://www.krnida.com/kninterop9.htm>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.

General Product Description

A mobile tactical Audio Switch and Cross Band Repeater that allows radio interoperability for a maximum of three disparate communications device per link controller. The system is controlled through the front control panel or through DTMF tones. Each link controller provides repeater functionality, in-band, cross-band, or tri-band patching or it can work as a remote base station with the use of a tone remote control. Dimensions are 28.88"L X 17.88"W X 8.62"D and weight is 70 lbs per link controller.

Components: 10 radios in various bands, tone remote box, 3 water proof cases, 26 amp battery, 3 radio/link controllers, programming software, mapping and RF engineering software, radio service laptop, 12 VDC and 110 VAC power cabling, and magnetic mount antenna

Capacity / Configurability / Scalability

Capacity: 3 interface radios per link controller

Configurability: 1 patches per link controller

Scalability: 27 interface radios by joining a maximum of nine (9) link controllers together

Base Cost

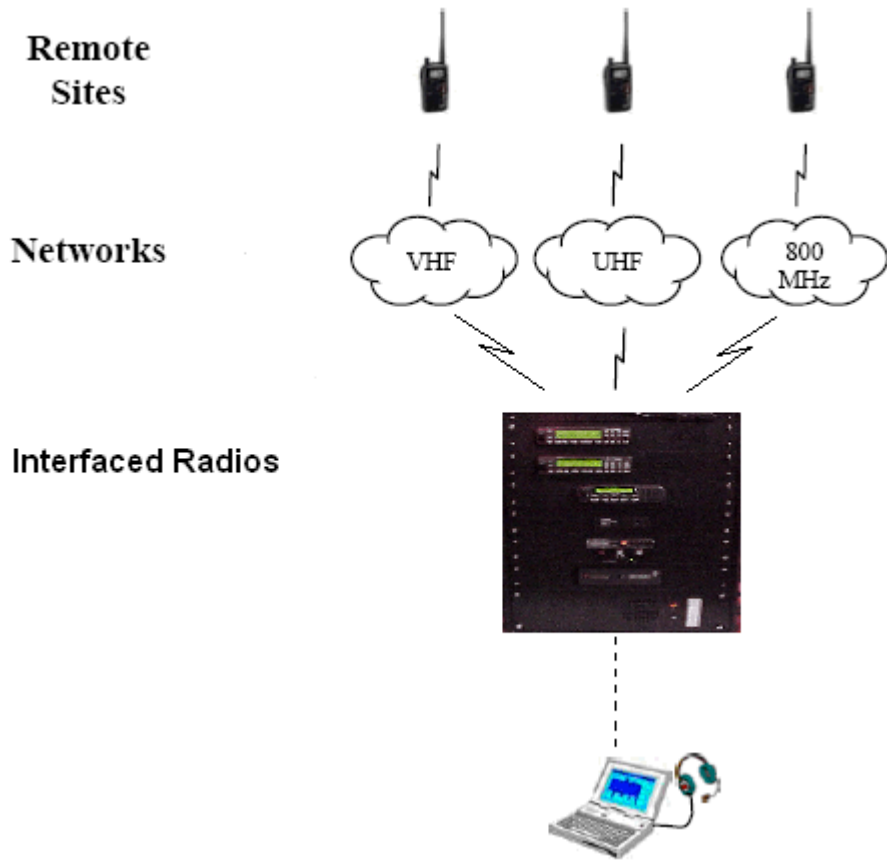
\$67,496 - per unit

Additional Requirements: N/A the radios are provided with the system

Compatibility

Mobiles/portables, phone/cell phone, Trunked Systems, Tone control for radios

Public Safety Technology Lab Product



Interop - 9 Network Diagram

Public Safety Technology Lab Product

Radio Inter-Operability System (RIOS) - Rackmount

Date: 05/15/2005
Product: Radio Inter-Operability System (RIOS) - Rackmount
Vendor: SyTech Corporation
Vendor Info: <http://www.sytechcorp.com/>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.
Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
Extended Area Network (EAN) - Links city, county, regional, state, and national systems.

General Product Description

This RIOS is a rack mounted switch that enables inter-connectivity of disparate communications devices. The control is through a software based Graphical User Interface (remote client). The RIOS interfaces with TCP/IP networks and can be remotely controlled.

Components: Rank Mount Version - One or two 16-port I/O module, power module, 2-U server, server software, remote client software

Capacity / Configurability / Scalability

Capacity: 32 port capacity

Configurability: Any combination of ports may be connected

Scalability: Possible - multiple RIOS systems can be linked over TCP/IP network allowing remote communication devices to be added to local talkgroups

Base Cost

Rank Mount 16 port unit - \$15,000 (SR-3001-RMT)

Additional Requirements: Interface cables for each gateway device \$250 ea

Services Required: Antenna installation for fixed site

Optional Features: Additional 16 port I/O module (SR-3001-RMT only) \$10,000
Audio recorder \$5,000; Audio Archiving to DVD-RAM drive \$2,500
Traffic analysis software \$5,000
Additional PC or audio clients \$2,500

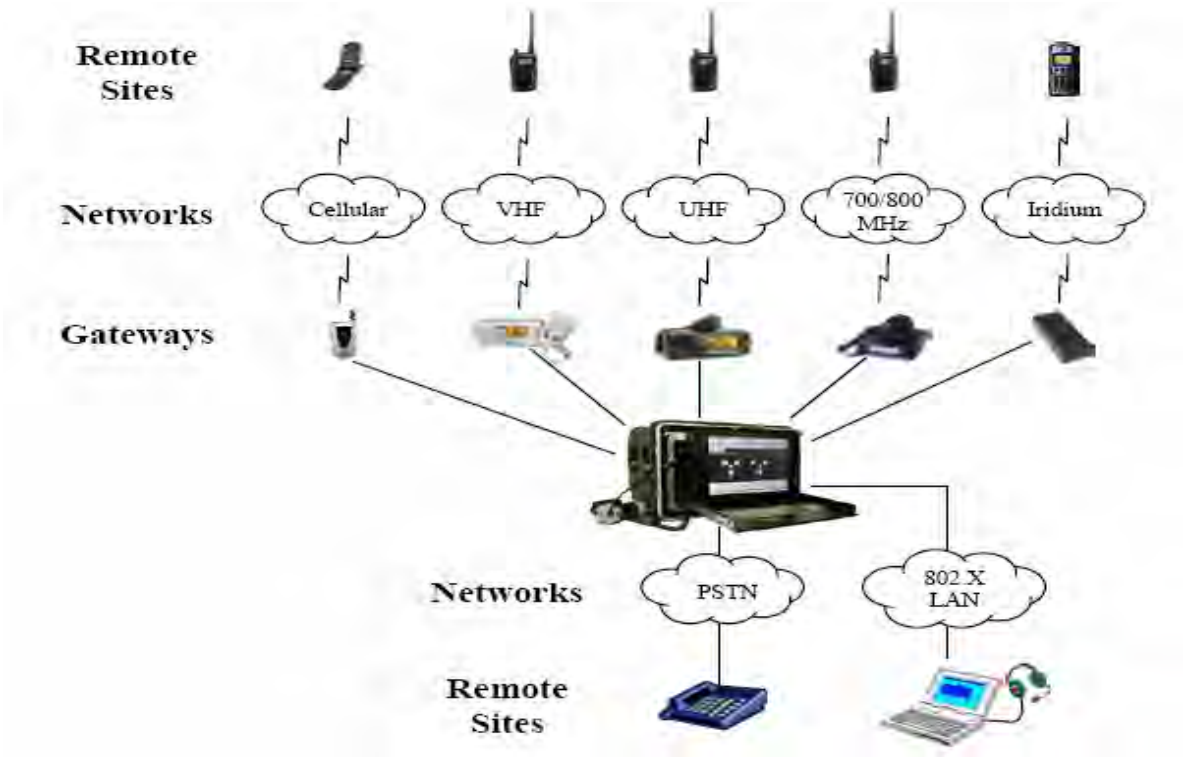
Compatibility

Mobile/Portables, Phones/Cell Phones, Satellite / INMARSAT / Iridium Phones, Trunked Systems

Network

56 Kbps per remote audio or PC client

Public Safety Technology Lab Product



RIOS Functional Diagram

Public Safety Technology Lab Product

Tactical Communications Bridge 3 (TCB-3)

Date: 09/15/2005
Product: Tactical Communications Bridge 3 (TCB-3)
Vendor: Link Communications Inc.
Vendor Info: <http://www.link-comm.com/security/tcb3.htm>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.
Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
Extended Area Network (EAN) - Links city, county, regional, state, and national systems.

General Product Description

The TCB-3 can interconnect up to 16 radios on a slim-line (1U) unit (32 radios on a 2 rack unit option). Each port for the radio interface can be controlled using DTMF tones through a radio with a built-in 12 key keypad, or through a graphical user interface software on a controlling computer running Windows NT, 2000 or XP. The TCB-3 contains a radio database with all necessary predefined audio level settings.

Components: TCB-3 16 port (1 rack unit) or 24-32 port (2 rack units), optional Telephone Interface Module (TIM) and Reverse TIM

Capacity / Configurability / Scalability

Capacity: 16 interface radios for the Slim-line version (1 rack unit)
16-32 interface radios for a Full-size version (2 rack unit)
16-32 interface radios for the Graphical User Enclosure (4 rack unit)

Configurability: 16 concurrent patches, one RS-232 and up to 4 remote sessions for control

Scalability: Limited Scalability

Base Cost

\$12,500.00 - Slim-line version Tactical Communications Bridge 3 (TCB-3) (16 port maximum)
\$12,750.00 - Full-size version TCB-3 (32 port maximum-16 ports provided base cost)
\$14,750.00 - Graphical User Enclosure TCB-3 (32 port maximum-16 ports, and controlling computer provided base cost)

Additional Requirements: Interface radios, Interface cables

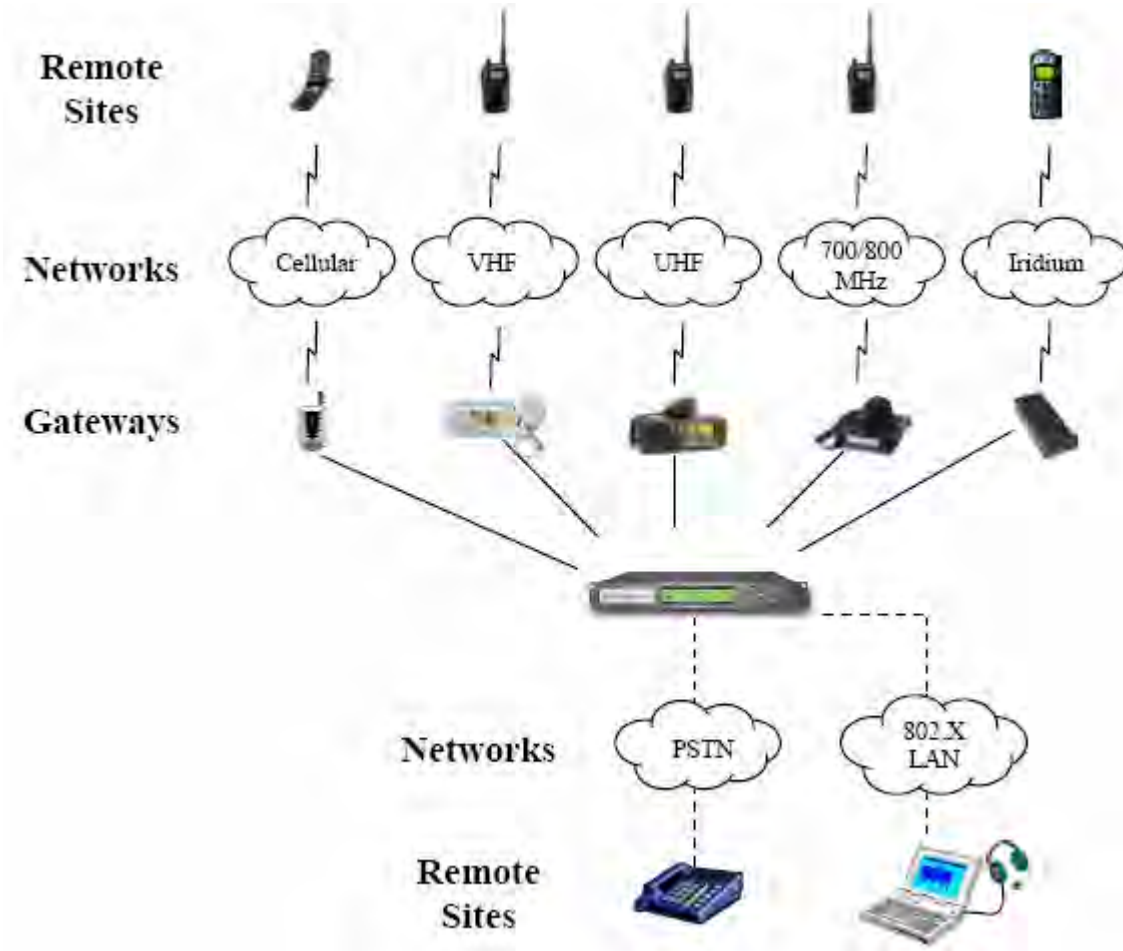
Services Required: Antenna installation

Optional Features: Controlling computer (optional but recommended) (included with the Graphic user Enclosure)

Network

Not required but if used, 10/100 Ethernet with available bandwidth for Audio CODEC 16 Bit @ 16 KHz sample rate, 8 KHz input/output bandwidth, VoIP 16 bit @ 8 KHz PCM

Public Safety Technology Lab Product



TCB-3 Network Diagram

Public Safety Technology Lab Product

Telecom Interoperability Gateway for Radios (TIGER)

Date: 03/10/2006
Product: Telecom Interoperability Gateway for Radios (TIGER)
Vendor: Microvoice Corporation
Vendor Info: <http://www.microvoice.com>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.
Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
Extended Area Network (EAN) - Links city, county, regional, state, and national systems.

General Product Description

The TIGER is a portable audio switch that employs Voice over Internet Protocol (VoIP) and Digital Signal Processing (DSP) technology to enable inter-connectivity of disparate communications devices. The control is through a web based Graphical User Interface (GUI) configuration and operating screens that support VoIP networked workstations and command/control consoles. Voice prompts can simplify both mobile and console user control of call routing, cross-patching, conferencing and monitoring. The TIGER interfaces with TCP/IP networks and can be remotely controlled.

Components: Digital Radio Interface, Analog Headset Interfaces, Analog Radio Interfaces, Ethernet LANS

Capacity / Configurability / Scalability

Capacity: T2 provides 24 Port Capacity, T4 provides 48 Port Capacity

Configurability: Any combination of ports may be connected

Scalability: Individually limited but when combined with a Constellation Command Center multiple Tiger systems can be linked over TCP/IP for a combination of 4,096/system radio channels

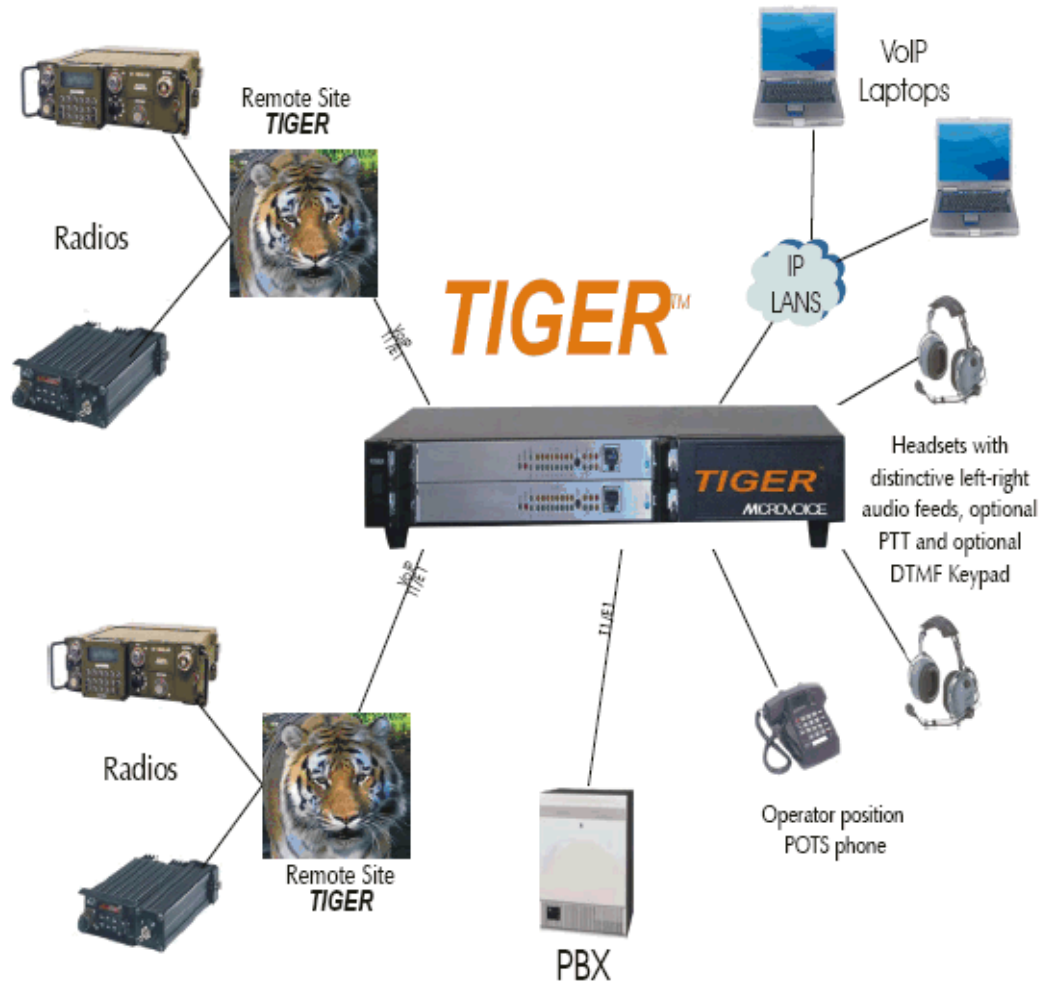
Base Cost

Not available

Network

VoIP protocols supported include SIP and H.323

Public Safety Technology Lab Product



TIGER Functional Diagram

Public Safety Technology Lab Product

Vega Interoperability Portable Emergency Response (V.I.P.E.R.)

Date: 06/15/2005
Product: Vega Interoperability Portable Emergency Response (V.I.P.E.R.)
Vendor: Telex Communications
Vendor Info: <http://www.telex.com/radiodispatch/>
Functionality: Audio Gateway



Deployment Environment

Incident Area Network (IAN) - Small, temporary network created for a specific incident.
Jurisdiction Area Network (JAN) - Main communications network for first responders; provides connectivity to the Extended Area Network (EAN).
Extended Area Network (EAN) - Links city, county, regional, state, and national systems.

General Product Description

Telex Vega V.I.P.E.R. MCU is a preconfigured transportable self-contained communications center. It is a rack mounted audio switch that enables inter-connectivity of disparate communications devices. The control is through a software based Graphical User Interface (remote client). The V.I.P.E.R. interfaces with TCP/IP networks and can be remotely controlled. Because of the modular approach, the same components utilized in the V.I.P.E.R. can also be incorporated into a larger scale installation.

Components: IP-223 Modules, C-Soft Dispatch Console Software

Capacity / Configurability / Scalability

Capacity: 200 connections limited by C-Soft Console

Configurability: 30 concurrent patches per C-Soft Console

Scalability: Possible using IP Connectivity for IP-223 Modules, C-Soft limit of 200 connections

Base Cost

V.I.P.E.R. MCU - \$26,000

V.I.P.E.R. Eight - \$13,500

C-Soft Console (2 to 200 line clients) - \$1,295 - \$14,995

Additional Requirements: Computer for C-Soft Console, network equipment to interconnect IP-223 modules, radios can be ordered as part of the preconfigured package

Optional Features: Network recorder, specialized interface modules

Compatibility

Mobile/Portables, Phone/iDen (through phone interface PIB223 and iDen interface NI223 respectively), Trunked Systems, Base Station/Repeater Control, P25 Vocoder

Network

Multicast, QoS, Up to 50 kbps per channel

Public Safety Technology Lab Product



V.I.P.E.R. MCU Network Diagram