RECoN Interoperability

General Description

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Interoperability

Introduction

"After each major event in recent history, the most glaring indication of success or failure by responding agencies has been their ability to effectively communicate with each other. Critical incidents do not know jurisdictional boundaries. Chiefs must think about how their agencies will communicate during a critical incident… But interoperability should also go beyond jurisdictional boundaries by including neighboring jurisdictions and state and federal resources."

Leading from the Front:
Law Enforcement's Role in Combating and Preparing for Domestic Terrorism
IACP Project Response

Analysis of major incidents worldwide, manmade or natural, over the past five years has repeatedly shown that communications is the biggest challenge facing Emergency Management (EM) Response teams.

Communications generally falls into three main categories:

- **Reliable Agency-Specific Voice Communications**

  EM Response teams mission critical every day voice communications

- **Reliable Inter-Agency Voice Communications**

  Commonly referred to as "Interoperability"

- **Reliable Data Communications**

  There is an increasing need for EM Response teams to have access to secure text messaging, documents, photographs, diagrams, architectural drawings and streaming video

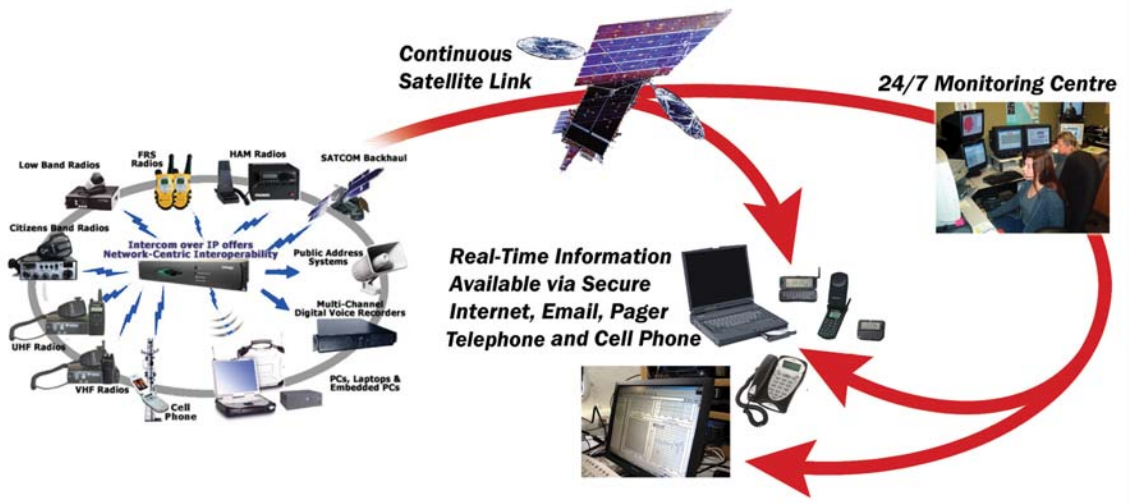
Reliable means that EM Response teams must plan for:

- Every day peak service times and large incidents
- Radio system disruptions such as power outages, tower failures, system interconnect failures
- Personal radio equipment failures (electrical/mechanical problems, battery failure, etc.)
- Catastrophic wide area failures of almost everything

Anvil Technologies is a solutions provider for Emergency Management and integrates "best of class" products and services into a cohesive, functioning solution. Anvil specializes in providing wireless communications at major incident sites, from the site to other sites globally, whether it is an Emergency Operations Centre a few miles away or a Hazmat expert half a world away. Anvil's RECoN (Roaming Emergency Communications Network) incorporates highly secure wireless broadband communications for person-to-person voice and data transmission, and streaming video. The system is highly portable, self-powered and deploys within a few minutes. In addition, RECoN includes a "backhaul" capability that will allow satellite broadband communications from the incident site to anywhere else.

The focus of this document is to describe Anvil's RECoN solution for Interoperability.

Interoperability generally refers to the ability of EM Response teams to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of EM Response teams to share information via voice and data signals on demand, in real time, when needed and as authorized.



For example, when communications systems are interoperable, police and firefighters responding to a routine incident can talk to each other to coordinate efforts. Communications interoperability also makes it possible for EM Response teams responding to catastrophic accidents or disasters to work effectively together. Finally, it

allows EM Response teams to maximize resources in planning for major predictable events such as the Super Bowl, Calgary Stampede, the Caribana parade, or for disaster relief and recovery efforts.

Anvil has selected the Mercury system (by Trilogy) as the Interoperability component of the RECoN Solution. Anvil's Interoperability solution is rack-mountable and can be installed in fixed infrastructure (Emergency Operations Centres), vehicles (mobile Command Posts) or in shippable rugged cases with shock protection mounts.

Portable Interoperability Unit
Rack mounted with eight radio systems
in a shippable shock-mount rugged case

Overview

Radio Interoperability is a term used to refer to the ability of radios of different types and manufacture to communicate with each other. This capability does not generally exist within the radio platforms themselves. A Mercury system can be used to provide this capability.

Connections between a Mercury system and a radio are comprised of audio and signaling components. Signaling refers to the methods that the Mercury system and the radio use to communicate with each other at a logic level. Typically, these are Push-to-talk (PTT), Carrier Operated Relay (COR), Retransmit and Voice Operated Transmission (VOX). Audio refers to audio input and audio output. These are used to couple the voice signals between a Mercury system and a radio.

Mercury is a real-time intercom communications platform built on VoIP (Voice over Internet Protocol) core technology. The system supports “one touch” full-duplex communications for one-to-one, group and conference communications. The system is scalable over LAN, WAN and Internet using terrestrial or satellite-based network connectivity. Audio, radio and telephone expansion modules provide a communications platform **that is interoperable with virtually any type of audio device.**

A Mercury system is comprised of one or more Mercury Interface Units, Mercury PCI Cards or Mercury USB devices. These devices, known as Mercury hosts, support two to thirty-two users each. Users can choose from a variety of hardware or software panels. These panels provide up to 256 one-touch buttons to support the workflow requirements of each user. Users can participate in or monitor multiple voice conversations simultaneously. This greatly simplifies complex communications workflow and speeds up how users can communicate across the networks. Audio quality is superior to that of typical radio and telephony.

A Mercury system can be assembled using a building block approach. It utilizes peer-to-peer architecture with no central servers or single points of failure required for the system to operate. The maximum capacity for the Mercury system is 64,000 devices to support over two million users. This allows flexible network design to optimize functionality and reliability.

All Mercury products are designed to operate with standards-based IT and network technologies - no special routers, switches or gateways are required. Security is implemented at the network level and standards-based encryption devices, including VPN, can be used transparently. Administration of the Mercury system takes place from centralized or decentralized points anywhere on the network. Administrators are given precise control over all relevant system and network parameters, including bandwidth. Mercury functions as a peer-to-peer run-time system. Continued operation in even the most challenging environments is assured with no central servers or single points of failure.

Mercury is a proven technology for many applications with a large install base in the defense, homeland security and broadcast markets.

User Interfaces

The Mercury system can be exposed to users by a variety Virtual Panels (PC users) or Hardware Panels (non-PC users). These panels can be provided to individual users or dispatch personnel anywhere on the network. Panels for dispatch locations do not require any direct connection to existing dispatch consoles.

EM Response team members can participate in or monitor multiple voice conversations at once. They are not limited to participating in just a single call at a time. All users enjoy a similar experience with “one touch” control. Making calls, participating in talk groups or arranging calls for external devices can be performed with the simple push of a button. All users get real time color coded status indications of active connections. All users get easy to access controls to customize or manage their areas of responsibility.

Users can choose from a wide range of panels:

Virtual Panels are PC applications that provide a GUI for Mercury users. These allow users to communicate with each other or to provide a console for operators to manage talk groups with external devices. These can be configured by the Administrator or customized by the user as appropriate for a wide range of functionality and appearance. Virtual panels can run on Microsoft Windows 98SE, ME, 2000, XP Pro; a Pentium II-450 minimum is recommended.

Hardware Panels do not require a PC GUI to operate. They are dedicated devices available in a range of offerings with choice of form factor and size. Stylish desktop panels as well as console panels are available. All panels have integral microphone and speaker, headset connector and display.

16-key Panel

External Interfaces

LMR Interfaces

The Mercury system can integrate with all types of LMR devices including:

- Military
- Conventional Analog
- Conventional Digital
- Analog Trunked
- Digital Trunked
- Hybrid/Mixed Mode Analog/Digital Conventional
- Hybrid/Mixed Mode Analog/Digital Trunked

Mercury uses analog audio input and output to support LMR voice signals. It can use PTT, COR, E&M or VOX to support LMR signaling. The Mercury system has an assortment of adjustable parameters to facilitate integrating each LMR device into the system.

Radio Interoperability Board

The Radio Interoperability Board (RIB) is an 8-channel radio expansion board for the Mercury Interface Unit (MIU) that features:

- Interconnection of radio PTT, COR and audio directly on each RJ45 connector
- Audio delay on all inputs and outputs (25-1000ms)
- Balanced and unbalanced audio
- Selectable -20dB output pad built in to drive the mic inputs of radios directly.
- Selectable +20dB input boost
- Up to four RIBs can be fit into a Mercury Interface Unit to support 32 radios

Radio Interface Board

PSTN

The Mercury 500-19-53 Dual Channel Telephone Interface is a 1RU x 19” frame that houses 2 channels of PSTN (POTS) interface. These can be connected to PBXs or POTS lines and can be directly connected to a Mercury Interface Unit fitted with an AEB to provide PSTN interface to the Mercury system.

In first quarter 2006 Trilogy released the 700-15-00 PSTN FXO card. This is a 4 channel expansion board for the Mercury Interface Unit. It provides 4-channels of FXO for telephone lines. Up to four cards can be fitted in the Mercury Interface Unit increasing its total capacity to 16-ports of FXO.

In second quarter 2006 Trilogy will release the 700-15-01 PSTN FXS card. This is a 4 channel expansion board for the Mercury Interface Unit. It provides 4-channels of FXS for telephone hand sets. Up to four cards can be fitted in the Mercury Interface Unit increasing its total capacity to 16-ports of FXS.

Cell phones & Walkie Talkie Phones

Cellular handsets and cellular base stations can be interfaced to the Mercury system through a cradle or special cable. This enables direct connection to a Mercury port where the device can then be appropriately configured to interoperate with other devices on the Mercury system. Additionally, third-party interfaces are available that can adapt cellular handsets to PSTN and then connect to the Mercury system through PSTN interface.

Hard-wire Interface

The Mercury system has analog audio inputs and outputs readily available on the Audio Expansion Board (AEB) for universal interconnection to external devices. It also supports a wide range of configurable parameters to integrate each device into the Mercury system.

Satellite Phones

Satellite phones can be interfaced to the Mercury system by special cable. This enables direct connection to a Mercury port where the device can then be appropriately configured to interoperate with other devices on the Mercury system.

E&M

The most common form of analog trunking is the E&M interface. E&M Signaling is commonly referred to as "ear & mouth" or "recEive and transMit", but its origin comes from the term earth and magnet. Earth represents electrical ground and magnet represents the electromagnet used to generate tone.

The Mercury 700-80-00 E&M Interface is a 1RU x 19” frame that houses 16 channels of E&M interface. It has selectable E&M signaling types I, II, III, IV and V and 600ohm

transformer coupled balanced audio I/O. These can be connected to radio or telephone E&M circuits and can be directly connected to a Mercury Interface Unit equipped with a 700-12-00 General Purpose Interface (GPI) module and an Audio Expansion Board (AEB) to provide E&M interface for the Mercury system.

In second quarter 2006 Trilogy will release the 700-15-02 E&M card. This is a 4 channel expansion board for the Mercury Interface Unit. It provides 4-channels of E&M for external connection to a range of devices. Up to four cards can be fitted in the Mercury Interface Unit increasing its total capacity to 16-ports of E&M.

VOX

VOX is available on any device connected to the input of a Mercury Interface Unit. This can be configured on any input by the Mercury Configuration and Editing software. This allows for the adjustment of multiple parameters including VOX threshold, delay hold off, sustain, and triggers for GPI events. Adjustable parameters include VOX threshold, attack and release.

PTT

Push-to-talk (PTT) is available on each channel of the Mercury Interface Unit Radio Interface Board and on each channel of the Mercury GPI module. PTT is also available on PCI cards and USB Adapters. Additionally, a serial port connection on any PC running a Mercury Virtual Panel application can be used for PTT. This allows any device to communicate a PTT command to the Mercury system or conversely, for the Mercury system to communicate a PTT command to the external device. Interfaces can be configured variously for opto-isolator, TTL, serial and open collector.

COR

Carrier Operated Relay (COR) is available on each channel of the Mercury Interface Unit Radio Interface Board and on each channel of the Mercury GPI module. COR is also available on PCI cards and USB Adapters. This allows any device to communicate a COR command to the Mercury system for retransmission, event triggers and user indicators. Interfaces can be configured variously for opto-isolator or TTL. Adjustable parameters include COR attack and release.

Combinations

Mercury is scalable to support a wide range of subscribers. Within a single Mercury Interface Unit, up to four optional cards can be mixed and matched to provide interface for up to 32 external devices or connections. Any combination of cards can be used with the following maximums:

1) 16-ports for hardware intercom panels (2ea AEB cards)
2) 32-ports analog audio (4ea AEB cards)
3) 32-ports for radios (4ea RIB cards)
4) 16-port for PSTN FXO (4ea FXO cards)
5) 16-ports for PSTN FXS (4ea FXS cards)
6) 16-ports for E&M (4ea E&M cards)

Types of Calls

"One touch" calls between any combination of Mercury Panels and external devices can be pre-programmed by the Administrator for each user. There is a wide range of functionality that can be custom tailored to meet each user's needs. Calls can be full duplex or semi duplex. Typical call types include:

- Individual calls – direct point-to-point calls between users. Multiple calls can be made at a time.
- Group calls – from one user to many users. This allows "one touch" action to reach a predefined set of users. This can be extended to make announcements and "all calls". Multiple group calls can be made at a time.
- Talk Groups – conferences that can be joined by multiple users. Panel users can join themselves into talk groups. External devices can be joined into talk groups by dispatch operators or other users that have the necessary privileges. The Mercury system can be configured by the Administrator to support a virtually unlimited number of talk groups. These can support a wide range of business rules. Users' priorities can be developed by arranging users into suitable talk groups, by allowing users to participate in multiple talk groups simultaneously and by assigning user levels of priority. The Mercury system can support FIFO for radio users of similar priority in talk groups. Call priority permits a call originating from a dispatch operator to interrupt a call by a normal member of the same talk group, overriding the call so that other members of the talk group only hear the dispatcher.

Easily Manage Talk Groups

- Assign talk groups on-the-fly
- Separate speak/listen assign
- Real time status indications
- Color coded talk and listen indications
- Any number of sources and groups
- Customize the layout

Routes

The Mercury system can support a wide range of static and dynamic routing types over the IP network. The routes can be defined by the Administrator in the Configuration and Editing software and deployed as permanent routes or exposed to operator(s) for dynamic routes. Disparate external devices can be integrated into the Mercury system with suitable interfaces and appropriate Configuration and Editing parameters.

Simulcast LMR transmissions

These are usually associated with multi-site cross-band repeater applications. Setting up these types of applications is similar to setting up talk groups in general. There is typically one speaker at a time to the talk group and many listeners. There are two special concerns with simulcast LMR transmissions:

- A portable radio listener who is in an RF reception area that is overlapped by more than one simulcast repeater transmitter on the same frequency where the RF signals are within 6db of each other can demodulate both signals simultaneously. In this case the signals need to be synchronized within a fine tolerance in order to prevent an echo from being perceived by the listener. The Mercury 700-16-00 Radio Interoperability Board has independent audio delay on each input and output. The audio delay range is 25-1000ms (can be extended to 2000ms if required). Resolution is down to 1ms increments.

- Full duplex operation – Each repeater may be either a listening member of the talk group or a speaking and listening member of the talk group. Therefore, the system must be capable of dynamically reassigning each repeater's input and output to correspond to different portable radios becoming speaking members to the talk

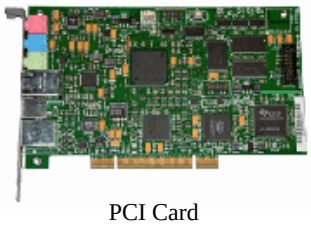
group across a multi-site cross-band repeater system. This entails being able to divorce a particular repeater's speak circuit from the listen circuit in a manner that automatically responds to the changing conditions. This type of facility is supported with the Mercury system in the Configuration and Editing software.

Architecture

Mercury has a range of products that can be deployed on LAN, WAN and Internet. These include the Mercury Interface Unit, PCI cards and USB Adapters. Each product can host Mercury user interfaces and connect to external devices. These are all similar in design and differ mainly in their capacity. The Mercury Interface Unit can host many user interfaces and external devices. It is suitable in areas that support multiple users. The PCI cards and USB adapters can host two user interfaces or external devices. These are appropriate in areas that support one or two users.

USB Adaptor

The Mercury Interface Unit is at the heart of the Mercury system for providing interoperability and gateway solutions. It is a 2U x 19" frame that provides an interoperable gateway to the IP network. Each Mercury Interface Unit is equipped for direct connection to the IP network with a single 10/100 Base-T Ethernet connector (RJ45). Any standard IP connection to the IP network can be utilized – no special routers or switches are required.



PCI Card

Each Mercury Interface Unit is equipped with a 66 x 66 non-blocking TDM matrix. This provides mixing, switching and routing of a wide range of voice and audio signals. Each Mercury Interface Unit accepts a variety of expansion boards that can be appropriately fitted to suit application requirements.

The Mercury Interface Unit may be fitted with up to four optional expansion boards. The Mercury 700-11-01 Audio Expansion Board (AEB) provides eight RJ45 connectors for eight channels of 4-wire audio or intercom panels. The 700-16-00 Radio Interoperability Board (RIB) provides eight RJ45 connectors for direct connection to eight radios. The 700-15-00 PSTN FXO card provides 4-channels of FXO for telephone lines. The 700-15-01 PSTN FXS card provides 4-channels of FXS for telephone hand sets. The 700-15-02 E&M card provides 4-channels of E&M for external connection to a range of devices. Any mix of these expansion boards may be combined to support up to 32 channels of interface to external devices per Mercury Interface Unit. As more channels are needed, simply add another Mercury Interface Unit fitted with the appropriate expansion boards. In this manner the system can be scaled out with a building block approach.

Mercury Interface Unit

The Mercury VoIP Interoperable System is comprised of one or more Mercury Interface Units, PCI cards or USB Adapters located at each site. These units provide the IP gateways for the required external devices (i.e. radios, telephones, intercom panels, user stations, etc) to be combined into talk groups across the IP network. This allows for static or dynamic assembly of any combination of real time interoperable voice or audio assets across the IP network. These assets can be managed by Virtual Panels (PC GUI control surface) or Hardware Panels (non-PC control surface) connected anywhere on the IP network. This allows individual users to participate in or to monitor voice conversations and dispatch operators to control any range of interoperable assets.

Administration

Configuration and Editing software is used by the Administrator(s) to manage the peer-to-peer Mercury devices. The Configuration and Editing software allows for secure centralized administration. Single or multiple administrators can make configuration changes from anywhere on the IP network. These changes can be transmitted to all the Mercury devices on the IP network from a central point or from within zones. This permits flexible administration design for a range of security, reliability and resource criteria.

Administration of the Mercury system is performed by an Administrator or group of Administrators using the Configuration and Editing software. The application can be securely installed and run on a Windows PC or multiple PCs. The PCs can be operated on or off line from the network. The application is a comprehensive tool kit that provides the Administrator with tools to manage IP network and Mercury system parameters. It allows

the creation and management of files that can be used to update and configure the Mercury devices on the network. It provides the user with a familiar Windows experience using hierarchical presentation with drill downs for edits. These files can be synchronized with a network database server or servers to transmit any changes to the Mercury system devices.

Some items that the administrator(s) can control are:

- Call types
- Talk groups
- How calls are exposed to users
- Static or dynamic routes
- System levels
- System bandwidth
- Coding profiles

VoIP

Mercury natively supports standards based VoIP technology. This permits seamless integration of IP voice communications over LAN, WAN, Internet and Satellite. It does not require any special routers, switches or gateways. It can be used with wireless networks. It is scalable over a distributed architecture and can traverse different bandwidth segments automatically. It supports NAT and can go through firewalls. Standards based encryption devices including VPN can be used transparently. The Mercury system is designed to provide robust performance on a shared common network with other services, including data and video.

IP over satellite is becoming popular and is growing rapidly. Innovative technologies and competitive pricing have made this transmission platform widely available for remote operations, back up operations as well as primary operations. Mercury's exciting new FastPipes® technology allows systems to take advantage of these advancements in powerful ways.

Sometimes a satellite connection can take a while to get established. This is because any handshaking that the connection requires is greatly exaggerated due to the latency of the satellite link. To overcome this limitation Trilogy has developed its unique FastPipes® technology. This allows connections to be prepared in advance and to persist once made. This greatly improves the experience of the users and makes satellite communications consistent with "one touch" operation. This also greatly improves the interoperability with radios and alleviates unnecessary PTT latencies. Mercury's proven track record in IP over satellite applications has developed to the extent that voice communication over multiple satellite hops is now possible.

Security can be implemented in the Mercury system at the network level. The VoIP signals are part of the network traffic and can be viewed within the overall network security policies set by the network Administrator. Any standards based IP encryption device (VPN or otherwise) can be utilized.

External encryption devices like radios and phones can be used. All audio and voice signals that are interfaced to external devices are mixed, switched and routed at the audio base band level. The Mercury system does not encode or decode these signals. It passes them through transparently as they arrive.

With the Mercury system bandwidth is only consumed or required when routes have active audio on them. The system is capable of fast connections so that a large number of users can share a relatively small pool of bandwidth. It is not necessary to reserve bandwidth for all possible connections. The routes can be set up and torn down dynamically on demand.

The Mercury system allows the Administrator to customize the overall system bandwidth requirements as well as any local bandwidth requirements. The Administrator can choose from a variety of coding profiles (or create a custom coding profile), which allows precise control over bandwidth and voice quality in a distributed network environment. The parameters include the CODEC (industry standard G.722, G.711, G.723, G.726 and G.729), the jitter buffer size and the amount of audio to stuff into packets. This provides an operating range from 10Kbps to 100Kbps that can be selected for IP payloads of each active talking channel. Silence suppression can be utilized to further reduce IP payload by not sending out empty packets when audio falls below a prescribed threshold. Multicast can be utilized to better manage IP bandwidth in a distributed architecture. This allows large numbers of users to participate in talk groups with bandwidth only required for the speaking member(s).

Low latency is characteristic of the Mercury system compared to other platforms. Broadly speaking, latency falls into two categories:

- Propagation Delay – This is the latency that is caused at the IP transmission level. This will vary depending mainly on how many IP routers the signal traverses. Typically these latencies are within 20ms on LAN segments, 20 ~ 40ms on WAN segments and 20 ~ 80ms on VPN segments inside the continental US. Fixed orbit satellite hops are typically 600ms.

- LMR Delay –With trunked radio systems and repeaters it is usually necessary to add some delay to the audio signal that is being transmitted by those systems. Latency must be artificially induced to prevent leading edges of voice messages from being clipped. This can be accomplished on any Mercury input/output of the Radio Interface Board. The Administrator has adjustable parameters in the Configuration and Editing software.

Reliability

The Mercury system components are peer-to-peer devices that can be flexibly deployed over a distributed architecture. Peer-to-peer operation of the Mercury system allows for centralized and decentralized operation. Each Mercury device is self-contained and has everything that it needs to operate independently of other devices. If a portion of the network or its devices is unavailable, the rest of the system operates without them. If different segments of the network are disconnected the devices within each segment of the network continue to operate. This can extend right down to a single Mercury device that has no network connectivity at all. The device will still operate normally for any user interfaces or external interfaces that are connected directly to it.

No single point of failure is fundamental to the Mercury system architecture. Peer-to-peer Mercury system devices do not depend on any central server or device for normal run time operation. There is no wide area controller in the Mercury system architecture.

All Mercury system devices use network keep alive signals and reconnect mechanisms to insure that connections are maintained or restored automatically after an interruption.

Logging

The Mercury system provides open architecture access for third-party recording and logging systems. Analog outputs can be made available anywhere on the network for universal interface to most external devices. The recording mix can be created for any combination of devices on the network that are connected to Mercury. This mix can then be routed to any recording device located anywhere on the network.

The Mercury system integrates seamlessly with the Stancil Multi Channel Voice Logging Recorder System. The Stancil system can receive Mercury IP multicasts anywhere on the IP network. Therefore, there is no hard wire requirement between the Mercury system and the Stancil system. Additionally, there is no hard wire requirement between the required external devices (i.e. radios, telephones, intercom panels, user stations, etc) and the Stancil system. The Mercury system can provide the appropriate source audio to the Stancil system anywhere on the IP network. This facilitates a flexible, cost effective approach to voice logging requirements.

The Stancil system has as standard an 80G hard drive that can store 12,000 channels of recordings at 13.3GSM. The hard drive can be increased for additional storage. Recordings are automatically downloaded to DVD-RAM drives for long-term storage. The clients access the recordings from TEN-4 clients running on a standard Windows 2000/XP network machine. The network remote client attaches to the recording system and finds the recordings by the users' preferred search criteria. This is typically by channel and data/time. The result set is presented to the user in a graphical manner.

System Management

The Mercury Database Supervisor shows all connected Mercury devices and applications. It can be viewed from any properly configured PC on the network. Additional status and diagnostic information about individual Mercury devices, software applications and external equipment status information (e.g. PTT, COR, E&M states and other logic states) can be viewed in separate windows. All Mercury devices have log files that can be activated to produce a text file of detailed operational parameters. This includes status of connections and devices. All Mercury control panels support real time status of active connections. The Mercury Interface Unit has a rear connector panel that can be connected to an enunciator panel or higher order Network Management System to indicate status and provide remote alarming.

All of these tools can be utilized by the Administrator or maintenance staff to isolate or troubleshoot problems. This can even be used to deduce the status of devices that are not directly managed.

The Trilogy product roadmap includes the development of a Connections Visibility and Performance Measurement (centralized status/failure monitoring capabilities) software upgrade scheduled for release in 2006. This will further enhance the System Management capabilities by aggregating data from the networked Mercury devices.

SDK

The Mercury system has an open API at the sockets layer. An SDK is available for developers. This allows third-party software and higher order Communication Management Systems to automate the Mercury system from the IP network. In this way the Mercury system can be utilized to manage the required external devices (i.e. radios, telephones, intercom panels, user stations, etc) and to provide the infrastructure for VoIP talk groups. This provides compatibility for advanced features like channelization and integrated scenario actuation. This provides a means for other applications to consume the Mercury functionality and offer an integrated GUI.

Standards

The Mercury system uses the following standards:
IP, TCP, UDP, IGMP, TFTP, RTP

The Mercury system will add the following standards by second quarter 2006 by software updates:
802.1P & Q, Diffserv, IPV6

References

Trilogy has delivered Mercury systems to approximately fifty customers in the US as of this writing. These range across markets such as Homeland Defense, Military, Broadcast, and Industrial. Applications include:

- ✓ Tactical Military Operations
- ✓ Mobile Command Vehicles
- ✓ Operations Centers
- ✓ International News Operations
- ✓ News networks
- ✓ Training and Simulation
- ✓ Teleports
- ✓ Electronic Courtrooms
- ✓ Biometric Access Panels
- ✓ Radiation Screening Portals
- ✓ Interactive Distance Learning

References are available upon request.