RED BLACK VoIP
VOICE COMMUNICATION SYSTEM (VCS)

Introduction:

Since 1980 Orion Systems, Inc. has been supplying Secure / Non-Secure Voice Systems. These voice systems are non-blocking voice switch and conference systems which support a wide range of communication needs. Secure / Non-Secure Voice Systems have been deployed in Air Space Control, Space Vehicle, Weapons Test, and Operational Ranges throughout the continental United States and government off-shore locations.

The Secure / Non-Secure Voice Systems voice and data systems developed by Orion Systems are in constant service to support critical command and control operations environments. These systems are used in 24/7 operations for Range Communications, air-to-ground, and ground-to-ground applications

The Orion System VoIP Voice Communication System (VCS) provides high quality voice communications to test personnel required during flight test missions. The Orion Systems VCS is a pure, end-to-end, Voice over IP based telecommunications console system designed for mission-critical applications. Orion Systems VCS employs the latest standards-based Voice over IP protocols and is based on a highly flexible digital architecture which integrates radio and telephone information over a LAN or WAN. Operating on a local-area or wide-area backbone, the VCS can support command and control centers over a dispersed region.

The Orion VCS system also contains external interfaces to legacy Telco circuits such as 4-Wire E&M, 2-Wire FXO, and T1 providing for interconnection to COTS communication devices including UHF/VHF radios, telephone lines, and voice recorders.

The Orion VCS is capable of conferencing both secure (RED) and unsecured (BLACK) audio while maintaining RED-BLACK audio separation in accordance with Department of Defense Information Assurance and TEMPEST regulations.

Overview:

The Orion VoIP Voice Communication System (VCS) is a central communications hub that connects multiple voice communication devices together. The VCS includes a redundant voice conference server interconnected via a Local Area Network (LAN) to the various communication devices. The VCS provides the ability to connect subsets of the communication devices into segregated voice conferences, as determined by a VCS administrator. Audio transmitted on a conference is heard by all conference members, and is isolated from all non-members.
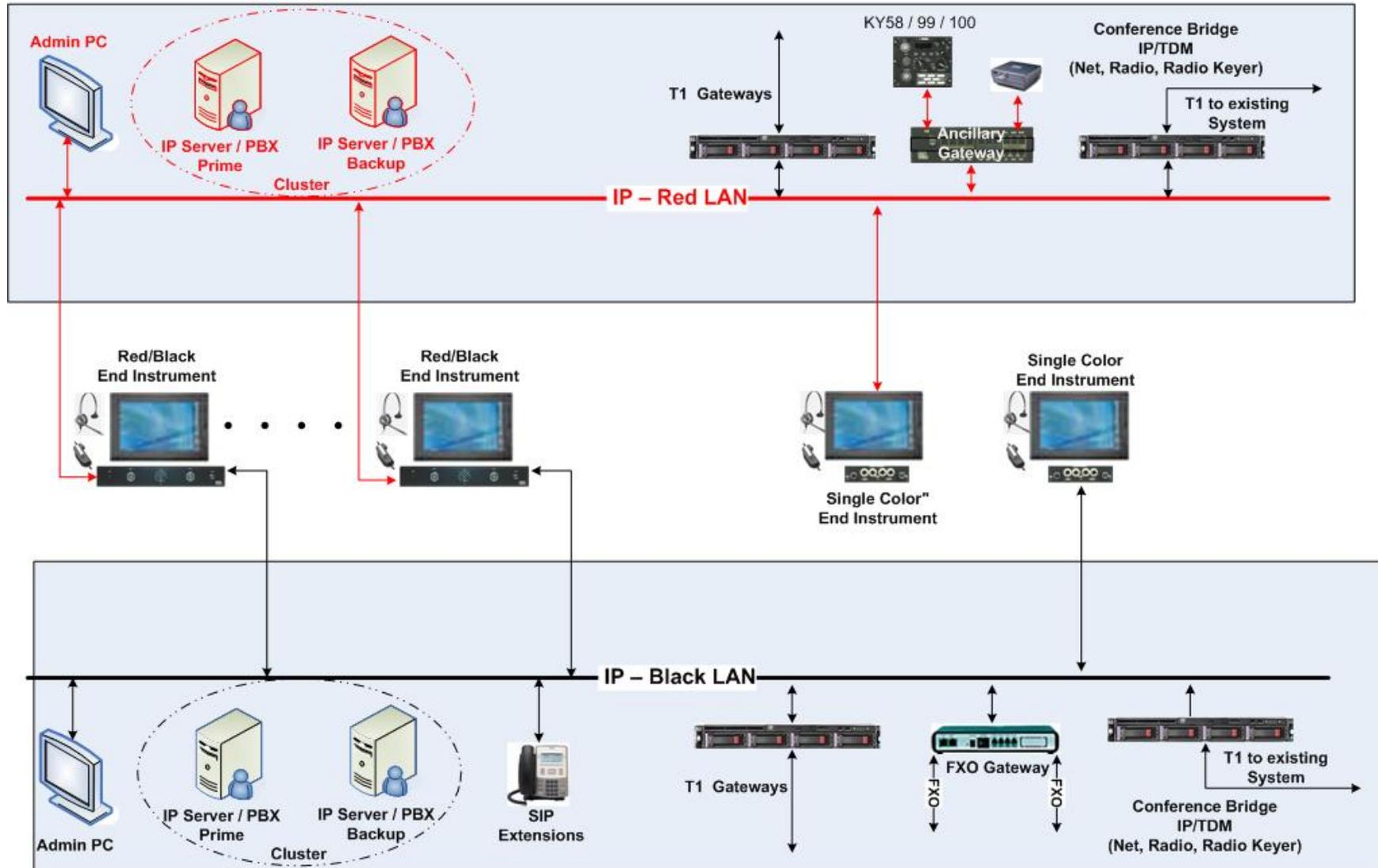
The VCS provides user End Instruments (EIs) that enable operators to be members of multiple conferences simultaneously. Operators select which conference(s) to receive from and which to transmit on. They are also able to make basic conference settings such as receive volume, Push-to-Talk (PTT) selection, and headset/ speaker audio routing. EIs are provided in both single security level and multi-security level types. Single-Level EIs can handle either RED or BLACK conferences, but not both, depending on their network connection. Multi-Level EIs are capable of simultaneously handling both RED and BLACK audio. The EI is implemented so as to keep RED audio isolated from BLACK audio at all times, and under all conditions including equipment failures.

System:
The Orion VCS is a highly configurable communications solution. The basic elements can be combined and administered, installation by installation, to meet various requirements. Communication devices are connected to the LAN and configured using the Automated Control Facility (ACF). A system block diagram detailing the system topology is shown below.

As shown in the Block Diagram, the system is composed of individual elements interconnected by two IP networks, one carrying RED data and the other carrying BLACK data. Both networks interconnect to multi-level End Instruments but there is no interconnection or data flow between the networks. A redundant voice conference server manages data on the Red IP network, while a separate redundant voice conference server manages data on the Black IP network. One or more Administrative terminals connect to the Red IP network to manage its configuration. Similarly, one or more terminals connect to the Black IP network to manage its configuration. All external communications interfaces such as telephone, radio, and remote connections are unclassified such that the external interface devices interconnect only to the Black IP network.

Red / Black System Topology

ORION SYSTEMS INC.

Admin PC

IP Server / PBX Prime

IP Server / PBX Backup

Cluster

T1 Gateways

KY58 / 99 / 100

Conference Bridge IP/TDM (Net, Radio, Radio Keyer)

T1 to existing System

Ancillary Gateway

IP – Red LAN

Red/Black End Instrument

Red/Black End Instrument

Single Color" End Instrument

Single Color End Instrument

IP – Black LAN

Admin PC

IP Server / PBX Prime

IP Server / PBX Backup

Cluster

SIP Extensions

T1 Gateways

FXO Gateway

FXO

FXO

T1 to existing System

Conference Bridge IP/TDM (Net, Radio, Radio Keyer)

The VCS will interface with COTS communication devices external to the system. This interface is accomplished utilizing standard communication protocols that include 4-wire E & M, T1, and 2-wire FXO. These external COTS devices include telephone lines, voice recorders, speakers, UHF/VHF radios, hot mic radios, and 4-wire circuits.

System users communicate with mobile assets by adding a UHF/VHF radio to a conference, tuned to a specific, predetermined frequency. In the event multiple radios at different frequencies are added to a conference, voice will be simultaneously transmitted on all frequencies.

The external COTS users are restricted to a single conference at a given time. Other users are required to join multiple conferences simultaneously. This is accomplished with a multi circuit End Instrument (EI). The EI will allow a single user to be a member of multiple conferences at the same time. Each conference is assigned a pad area on the touch panel. The EI user touches these conference pads to make selections.

The EI user has as his choice the type of access to the conference. "Active" or "Talk/Listen" allows the user to both send and receive information. "Monitor-Only" limits the user to receive-only. While on "Standby" the user cannot send or receive information.

In a typical operation the EI user is a member of multiple conferences. Some of these conferences will be set to "Monitor-Only", allowing the user to listen to mission activity. When the user needs to transmit he/she will select one or more conferences and make it "Active". When the PTT button is activated the user's voice is transmitted on all "Active" conferences.

End Instrument:
The Red/Black EI is a touch panel computer terminal based user communications device, providing access to multiple conferences. It can sit on a desktop, or mounted to a VESA compatible articulating arm. This EI provides simultaneous access to seventy two (24 RED and 48 BLACK) conference networks via an array of Conference Select pads.

The Red/Black EI is composed of two elements a touch panel monitor display, and an enclosed aluminum chassis housing the switch network interfaces, headset connectors, audio processing, and RED/BLACK isolation circuitry. The EI chassis element is multi-chambered, designed to support RED / BLACK circuit access. Red circuitry, interfacing the classified network is housed in one of the EMI shielded chambers with treated power and optically isolated control links. Headset interface and audio processing circuitry is located in a second chamber, also provided with treated power and optically isolated control links. The third black chamber houses the unclassified network interface and touch panel interface circuitry.

Depending on user conference access, a status-verified transfer switch directs microphone audio to only the active (talk selected) network. While talking on an unclassified conference, cutoff switches prevent classified audio from entering the headset chamber. Multiple cutoffs are provided such that even under failure condition, classified audio can never leak into the unclassified circuit path.

The EI chassis element has two 10 pin Lemo connectors for attachment of handsets. The chassis houses headset interface circuitry. Each headset interface includes an individual microphone bias source with push to talk (PTT) detection. Transmit audio from active sources is summed to produce the transmit signal sent to the active network.

A serial interface cable connects the EI chassis element to the touch panel. This interface carries only control information

Communication Services:
VCS provides a variety of communication services including voice networks, radio networks with Push-to-Talk (PTT) radio keying, intercom, and telephone access service. Below is the description of the network types available and their operational concept.

Conference Network – provides non-blocking capability for multiple users to communicate. The Orion VCS system provides true two-way conferences where all users accessing a conference network hear all the audio from all other users transmitting on the network. Individual channels (circuits) and End Instrument users access the conference in one of two ways, Active (Talk/Listen) or Monitor-Only (user can only listen and not talk on the conference). Network access is controlled by user Push-to-Talk. For circuits without Push-to-Talk capability, VOX can be activated to provide a substitute Push-to-Talk.

Radio Network – is a non-blocking conference network with radio channels and channel circuits or End Instrument users assigned as keyers. When an End Instrument user Talk/Listen selects a radio network, user push to talk activations are transmitted thru the radio network to activate the M-lead of connected 4-wire circuits (switch circuits or T1 / E1 channels) assigned for radio keying. As with the Conference Network users access the conference in one of two ways, Talk/Listen (T/L) or Monitor-Only.

Telephone Service – provides End Instrument users the capability to access external dial networks such as the SIP extensions, Public Switching Network (PSN) or a PBX. When an End Instrument user T/L-selects a telephone service circuit, the connected FXO interface causes an off hook on the telephone line. The caller hears telephone line dial tone and can use the End Instrument keypad to access allowed PSN/PBX services and features. A Hold key allows the T/L-selected telephone circuit to be placed on hold. A HOOK-SW key causes a timed on-hook

(hook flash) on the telephone line for PBX feature access. A MUTE key disables Intercom Station transmit providing Receive-Only telephone line access.

Call Feature and Signaling Capabilities:

Orion Systems has incorporated an extensive call feature and signaling package into the MT32. These features have been designed in and are part of Orion's standard offering. Below is a partial list of the most common features.

Feature	Description
Direct inward dialing	Individual extension per End Instrument (EI).
Direct out dialing	Individual or Common hunt group.
Abbreviated dialing	Storage and dialing of commonly used numbers.
Intercom	Communication between End Instruments.
Conference – Preset	Pre-established connectivity.
Conference – Progressive	Additive conferencing by initiator.
Conference – Meet Me	Accessed by dialing conference number.
Single T/L (interlocked)	Can only T/L on one key at any one time at EI.
Multi T/L	Multiple T/L capability at EI. Listen always active. With or without limits on number of active T/L's.
Multi-Monitor	Simultaneous listen on multiple keys at EI. With individual volume setting per key.
Shoutdown	Voice call with no signaling.
Radio	Transmitter, Receiver, & Transceiver. With or without in band control of radio parameters.
Follow Me	Portable EI mapping.

Administrative Control:

Administrative Control is accomplished using a Web browser. The Web browser interface uses point and click functions executed by a mouse and/or keyboard. The Web browser interface provides the configuration control, status reporting, current connectivity and future mission configuration functions used to maintain the day to day operations.

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