War-Winning Capabilities … On Time, On Cost

MISSION VOICE COMMUNICATIONS

for Distributed Flight Test Operations on the Next Generation Range

U.S. AIR FORCE

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OVERVIEW

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- Commonality of Systems
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INTRODUCTION

The first half of this presentation takes a brief look at the major technological change that has occurred within modern mission voice communication system design in recent years. The second half follows up by reviewing some of the potential issues that will be encountered and must be adequately addressed in order to provide reliable and repeatable voice communications service across test range boundaries for the successful support of Distributed Mission Control Room flight test operations in the future.

VOICE OVER INTERNET PROTOCOL

VoIP technology is replacing TDM technology in modern Mission Voice Communications Systems

- Advantages
  - Directly transportable over IP networks without format conversion
  - More efficient use of network bandwidth
  - Easily deployable and scalable
  - Potential for adding enhanced capabilities to the End User
- Disadvantages
  - Latency
  - Real-time data requiring high “Quality of Service” circuit paths through the transport network
  - Possible IA concerns
  - More complexity required to integrate existing legacy TDM circuits
  - Learning curve for system troubleshooting

VoIP System Architecture

- **Hybrid Switch Based System Design**
  - If done correctly, allows the system to easily, efficiently, and seamlessly accommodate both VoIP and legacy TDM circuits
  - Dedicated hardware platform for efficient processing of all conferencing tasks throughout the system.
  - Does require more hardware than server based and fully distributed systems
  - More traditional architecture may be easier to troubleshoot
  - Easy to upgrade and/or tech refresh as VoIP technology improves over time
  - Homogenous System – Bulk of the equipment is provided by a single vendor and designed to operate as a single integrated system
  - Be cautious of vendors that just “glue” VoIP capabilities onto legacy TDM switching systems

VoIP System Architecture (Continued)

- **Server Based System Design**
  - Less equipment required for VoIP only support
  - Requires extra (often times 3rd party) hardware for support of legacy TDM circuits
  - Less homogenous system – Relies on third party vendors for the server equipment and possibly equipment used to support legacy circuits (e.g. TDM Gateways, Analogue-to-VoIP, etc.)
  - Larger capacity systems place heavy processing demands on server(s) thereby demanding more robust server platforms
    - More frequent tech refresh intervals for Server equipment may be required
  - Higher latency characteristics
  - Easy to tech refresh as VoIP technology improves over time
  - May be a more challenging architecture to troubleshoot

VoIP System Architecture (Continued)

- **Fully Distributed System Design**
  - Processing power is accomplished at each User Station, thereby distributing the effort throughout the system as needed.
  - System Server(s) is used primarily for configuration database application and circuit setup/teardown operations. Circuit connections are managed and distributed throughout the system at each individual User Station.
  - Simple and easily scalable system architecture
  - Change in OAM&P philosophy
    - Conference connection capability is pushed out to the End User
  - Multicast-centric system design may present some challenges
    - Possibility of compatibility issues with gateway equipment used for legacy circuit support
    - Secure circuits requiring encryption using certain key types
  - Less homogenous system – Relies on third party vendors for the server equipment and possibly equipment used to support legacy circuits (e.g. TDM Gateways, Analogue-to-VoIP, etc.)
  - May be a difficult system to troubleshoot
  - Upgrades and/or tech refresh efforts as VoIP technology continues to mature may be more difficult and time consuming to implement.

System-to-System Interface Requirements

- Common system interface standards are required
  - Establishment of reliable voice communication capabilities between multiple “User” locations supported by comm systems that are technologically and geographically dissimilar.
  - Impact to distributed mission control room operations
    - Adequate capacity
    - Adequate functional characteristics

- Technology
  - Currently in use
    - TDM
    - TDM over IP
  - Future
    - VoIP

COMMONALITY OF SYSTEMS

- Interface compatibilities
  - TDM
  - VoIP
    - Compatible Protocol(s)
- Similar “User Station” characteristics and capabilities
- Similar system “Operations and Maintenance” characteristics and capabilities
- Highly desirable for seamless distributed mission control room operations

IP Transport Network Considerations for VoIP

- Quality of Service
  - Real-time priority
    - Voice circuits competing for bandwidth with TM and Video circuits
- Latency
  - Bigger buffer/packet size = Lower bandwidth usage at the cost of higher latency
  - Smaller buffer/packet size = Lower latency at the cost of higher bandwidth usage
    - More packets = more overhead
  - Public Switch Telephone Network standard is 150ms for VoIP circuits.
    - Why is this an acceptable value?
  - Mission voice communications requires latency to be 100ms or less.
    - Why is this a requirement?
    - 50ms is the “magic” number
      - Why?

SECURITY

- Possible IA Issues.
  - Vendor compliance
  - Local installation compliance
  - Enclave boundaries
- Securing VoIP circuits.
  - Firewalls
    - Session Border Control
  - Secure Session Initiation Protocol (SIPS)
  - Secure Real-time Transport Protocol (SRTP)
- Requirements for Secure (Red) communications between sites.
  - Bulk encryption between secure locations

Coordinating Efforts Between Locations

- Thorough understanding of the test projects communications requirements
  - Will become extremely important for distributed mission control room operations support
- Scheduling of resources
  - Local test range
  - Across multiple test locations
- Establishing viable communication plans
  - Standardized operating procedures
  - Standardized naming conventions

POSSIBLE FUTURE CAPABILITIES

- Display of real-time streaming video at the End User Station
- Video Conferencing
- Expanded system topology boundaries beyond physical test range boundaries

QUESTIONS