MCCx
C3I Control Center Interface Emulator

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MCCx Goals

• To develop and demonstrate alternate IT technologies and systems for Control Centers that will...
  – Reduce facility development, maintenance and operational costs
  – Enable more efficient and cost effective operations concepts for ground support operations
MCCx Client Architecture

• Single Thin Client (Desktop or Laptop)
  – Standard office computer

• MCC clients move to Virtual Host
  – Replace ~1,100 clients with <100 Virtual Hosts
  – Reduced facility floor space and power cost
  – Reduced maintenance and operations costs

• Access MCC using Secure Remote Access
  – Same approach for FCR, Office, Home, Travel
  – Enabler for Plan/Train/Fly cost reductions
MCCx Virtual Server Architecture

• Delivers reductions in
  – Number of Servers (20:1 or more)
    • Function of server class
  – Facility floor space and power cost
  – Maintenance and operations costs
  – Response time for new requirements implementation

• Many hardware architectures to choose from
  – Blades or workstation-based (We use blades.)
Two-Wire FCR

- Power & Data
  - “Everything Over IP” = EOIP
    - IP Based Voice, Video, Audio, Phone and Data
- Consolidates infrastructure Network Types
  - Data Networks
  - Voice (DVIS) and Phone – migrate to COTS VOIP
  - Video (TV, RGB) – Consolidate using IPTV
    - Become consumers of video
  - Audio – Eliminate – deliver with video over Ethernet (IPTV) system
- Reduces
  - Personnel required to maintain/manage
  - Facility & IT cost
  - Maintenance and operations cost
  - Facility floor space and power cost
MCCx Demo Summary

- MCCx technologies are enablers to allow MOD to meet cost reduction goals for building, maintaining and operating our Control Centers.
  - EOIP
  - Virtualization
  - COTS
  - Secure Remote Access
  - Live ISS data thru legacy apps
MCCx - Demo

Blade Servers (Data Center)

Virtual machines

Boundary Firewalls

Remote Access Server

Up to 20:1 hardware consolidation per blade

Space Link

Two-Wire FCR: Power and data
Created for Integrated Mission Sims

Distributed Simulation Architecture

Participants

- KSC Mobile launcher, launch control system and visuals
- MSFC Ares-1 Simulation
- JPL Communications and tracking network (CTN) and TDRSS constellation
- JSC CEV (including LAS, CM, SM), ISS, graphics, Demonstration Labs (OTF)
C3I Emulator

- Serves as a "stand-in" for a Control Center capability at other System Integration Labs and Control Centers
- Enables those facilities to conduct simulations requiring interactivity with the Control Center when it is offline or unavailable.
- Supports testing of C3I interfaces, for both command and telemetry data exchange messages (DEM's).
  - Internal architecture is C3I
  - Limited C3I command capability
  - Supports G.729 Voice, H.264 Video, CFDP
Emulator Benefits to NASA

• Early CxP telemetry, command, and network integration
• Learned how to work with C3I telemetry and the meta-data files that specify the telemetry packet format
  – Inter-center collaboration
  – Resulting in re-use of existing C3I tools
• Bridges gap between now and when a new Control Center is available for full certification support testing
• Future benefits:
  – Will provide a testbed for merging VoIP, video, file transfer, data, and command streams into the available downlink and uplink signal bandwidths
  – Continued collaboration
  – Start to work with future vehicle emulator hardware
Physical Characteristics

- PC or laptop with Windows XP
- Linux 32-bit RHEL 4.5
- Will process one test set of C3I telemetry packet and command streams
  - One emulator is needed per sim / test rig
Software Characteristics

• Uses the Spacecraft Command Language COTS package from Interface and Control Systems
  – Inexpensive, flexible
• Web interface provided by the COTS package, also from ICS – can share displays outside the OTF
• Sample C3I telemetry engineering displays
  – Easily modifiable – drag & drop widgets
  – Can choose from hundreds of TM symbols, mostly GN&C
  – Can do computations, e.g. unit conversion, limit checking
• Capability to initiate simple C3I commands and process the response
## C3I Emulator - Overview

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<th>Feature</th>
<th>Description</th>
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<td>H.264 Video</td>
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<td>G.729 Voice</td>
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<td>CFDP File Transfer</td>
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<td>C3I Commanding</td>
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<td>C3I Telemetry</td>
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Example SCL Displays