



# MCCx

# C3I Control Center Interface Emulator

James R. Mireles

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MISSION CONTROL CENTER

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FLIGHT DIRECTOR

CAPCOM

MCCx

# MCCx Goals

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- 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

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- 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

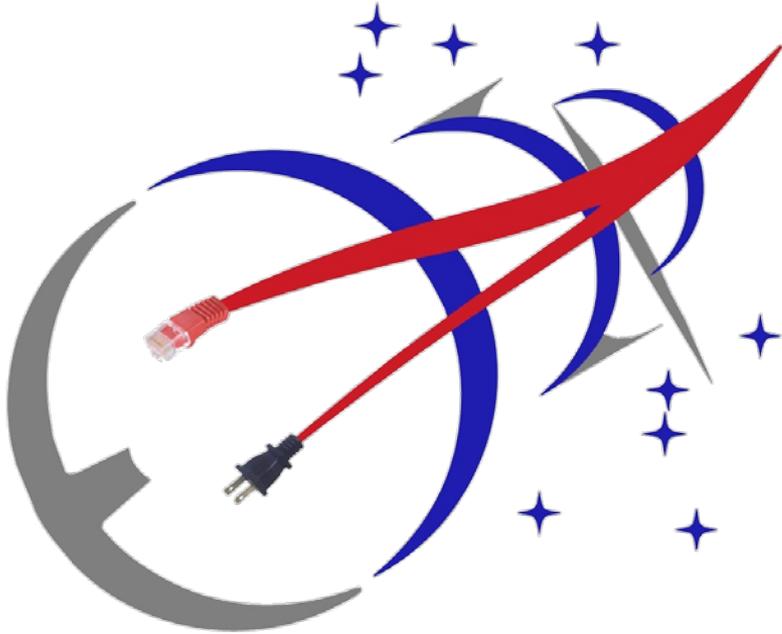
# MCCx Virtual Server Architecture

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- 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

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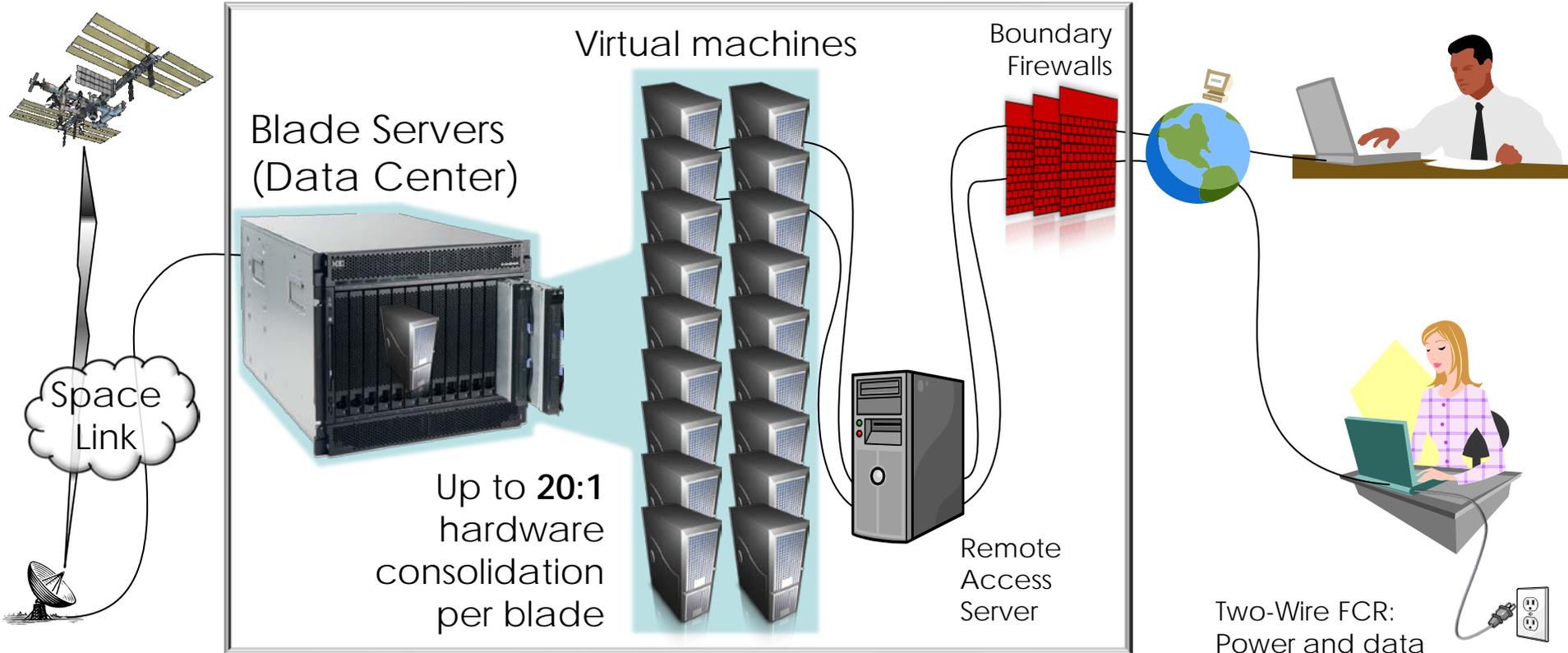
- Power & Data
  - “Everything Over IP” = EOIP
    - IP Based Voice, Video, Audio, Phone and Data
- Consolidates infrastructure Network Types
  - Data Networks
  - Voice (DVIS) and Phone – migrate to COTS VOIP
  - Video (TV, RGB) – Consolidate using IPTV
    - Become consumers of video
  - Audio – Eliminate – 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

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- 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

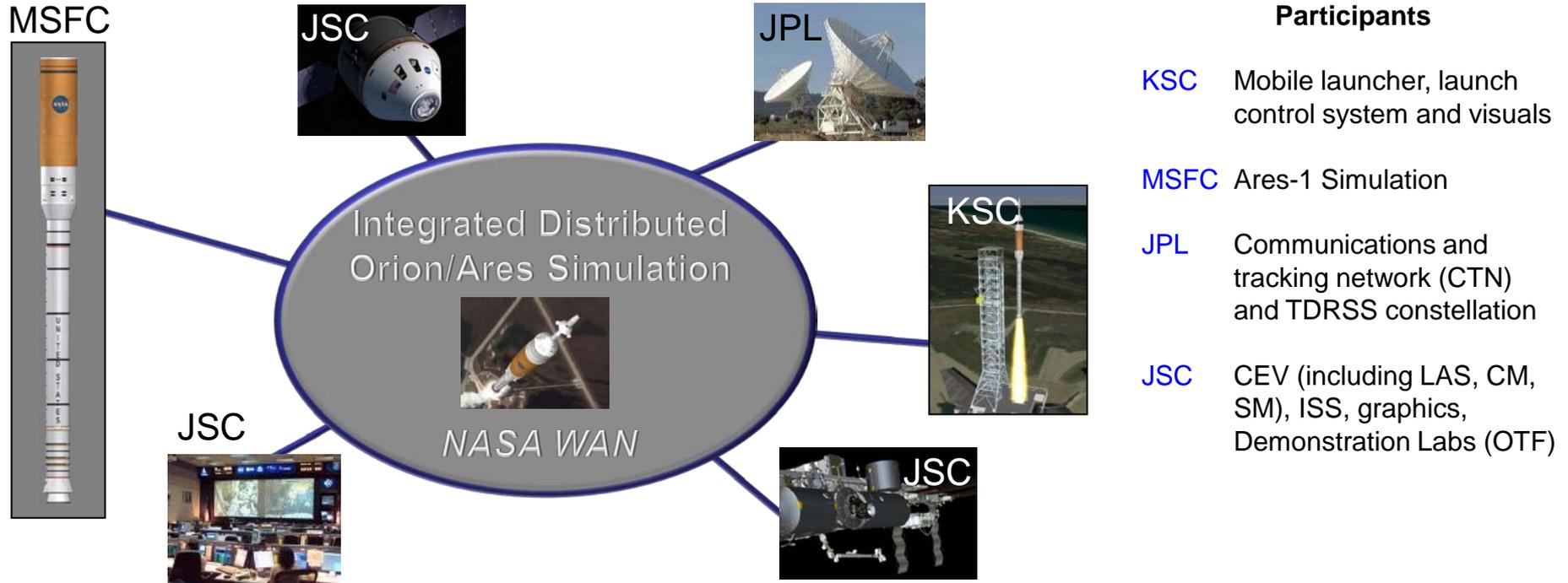




C3I Control Center Interface Emulator

# Created for Integrated Mission Sims

## *Distributed Simulation Architecture*



# C3I Emulator

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- 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 (DEMs).
  - Internal architecture is C3I
  - Limited C3I command capability
  - Supports G.729 Voice, H.264 Video, CFDP

# Emulator Benefits to NASA

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- 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

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- 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

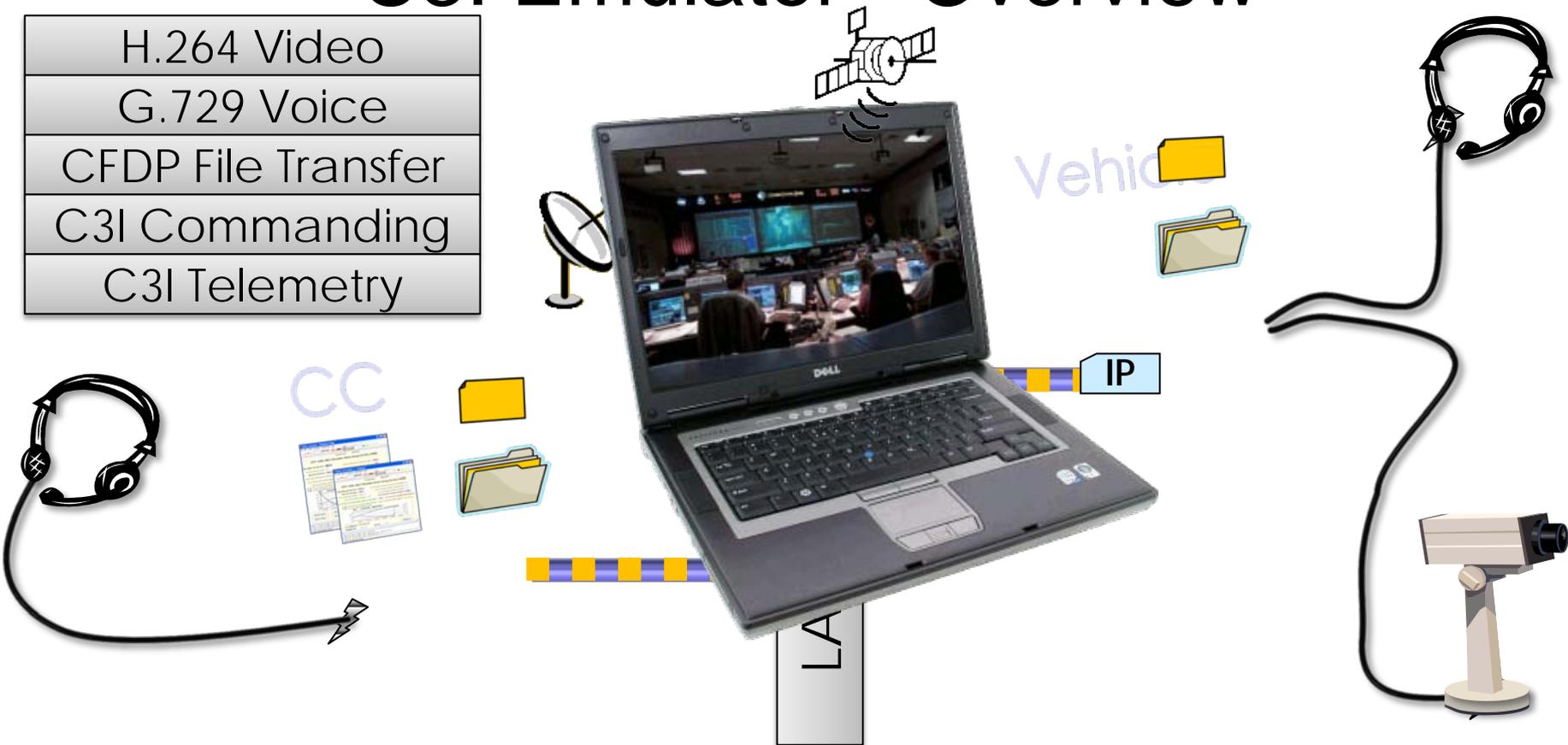
# Software Characteristics

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- 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

H.264 Video
G.729 Voice
CFDP File Transfer
C3I Commanding
C3I Telemetry



# Example SCL Displays

