Control & Data Management System (CDMS)

Control and Data Management System for Payloads

Overview

CDMS combines state-of-the-art, commercially available internet protocol (IP) technology solutions to enable the on-board collection and processing, as well as the ground distribution of large amounts of data from payloads and facilities.

Payloads and facilities can use the CDMS as a router for their TM/TC, for direct point to point IP connections with their Principal Investigators. The payloads also use the CDMS software services for data processing, security keys management and data storage.

The CDMS includes state-of-the-art COTS, with limited proprietary software. It provides redundancy, scalability, flexible upgrades and low-cost maintenance and remote management. The CDMS is offered as COTS product with customization options available to meet specific user requests.

Flight Segment Architecture

The main components are:

- Modular main computer ("Gateway") in high availability configuration
- Ethernet Switches
- Wireless Access Point (WAP)
- Processing and Virtualisation Nodes
- Network Attached Storage (CDMI-NAS)
- Power Conditioning and Distribution Unit (PCDU)

Communication, Data and Software Services

The on-board CDMS provides a reliable networking and computation platform as a hyper converged infrastructure.

It provides the management of space to ground communications over IP for on-board systems and payloads.

Supported communication protocols include:

- Standard TCP and UDP protocols
- Point to point IP communication from ground users to assigned on-board payloads:
- CCSDS CFDP file transfer protocol
- Space to ground Audio and Video

The on-board CDMS also offers a persistent on-board data storage services, with redundancy, replication and data segregation.

The core of the CDMS platforms offers a virtualization infrastructure providing computation resources to the payloads, at the edge, before any data downlink to ground. A number of predefined services are provided:

- Proxmox High Availability Cluster
- Data storage
- Data synchronisation with ground
- Key Management (Cryptography)
- Binary Data Sampling towards ground
- Video Transcoding towards ground
- Telemetry Out-of-Limit Monitoring
- Import of custom virtual machines
- Import of custom container services

Power

The CDMS PCDU provides power conversion for CDMS components as well as control and monitoring capability for power distribution to payloads. IT also provides filtering, isolation and over-current protection.

APPLICATIONS

- In-orbit payloads interfaces
- Payload software virtualization
- Payload data storage and processing
- Future Commercial LEO Destinations

FEATURES

- IP-based
- COTS-based
- Redundancy, scalability, upgradeability
- Security and data integrity
- Efficient payload/user integration

SERVICES AVAILABLE

- System operation
- Customization
- Virtualization
- Algorithm development
- Special data processing

For more information:
spaceapplications.com
aerospaceapplications-na.com

or contact us:
flightproducts@spaceapplications.com

ABOUT SPACE APPLICATIONS SERVICES

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Our aim is to research and develop innovative systems, solutions and products and provide services to the aerospace and security markets and related industries. Our activities cover manned and unmanned spacecraft, launch/re-entry vehicles, control centres, robotics and a wide range of information systems.

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Ground Segment Architecture

The CDMS ground software is designed as a Virtual Private Cloud environment, providing flexibility in terms of hardware requirements and infrastructure.

The CDMS can be deployed in a data centre or in an on-premised infrastructure.

The main components are:

- Operations and Administration workstations
- Network
- Virtual Private Cloud infrastructure
- Firewall Gateway

User Interfaces

A user on ground (end-user, principle investigator) I can access the following user interfaces to manage his/her payload:

- Interfaces to the Yamcs server for TM/TC data:
    o Yamcs-Studio
    o Yamcs Web Interface
    o REST API + WebSocket
    o Python Client
- Access to data distribution server:
    o sftp, Filezilla
- Point to point connection to the payload:
    o SSH connection
    o custom ground software.

Security

The security, data segregation and authentication are managed by an anti-malware / anti-virus software, firewall, intrusion detection system (IDS), VPN and 2-factor of authentication against an LDAP database. The system makes use of SmartCards and eToken.

Specifications

- ITAR/EAR free
- COTS-based
- Qualified for ISS

Launch

- Mass: < 85 kg / 178 lbs (including cold-plate)
- Volume: < 0.6 m3 / 21.2 ft^3
- Power consumption (on-board): <600 W

Architecture

- CompactPCI architecture
- MultiCore CPU + GPU

Data Processing and Storage

- On-board Processing: >1 TFLOP
- 70 TB of storage in RAIDZ NAS system

Network and Data

- 10/100/1000 Megabit Ethernet interfaces
- 10 Gigabit Ethernet interfaces
- Internal full-duplex peripheral transfer: up to 35Gb/s

Interfaces for payloads

- Wireless (IEEE 802.11 b/g/n/ac/ad/ax,) and Wired (IEEE 802.3)
- MIL-STD-1553, Ethernet, USB, RS232, RS422/485, SSDs

CDMS for Ground Segment