REDUCING THE COST OF MISSION-UNIQUE DATA SYSTEMS FOR DEEP SPACE MISSIONS

SUSAN C. MURPHY
JOHN J. LOUIE
JPL Multimission Ground Systems Office
Telemetry, Command and Data Management
Program Element

Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
MS 525-3630
Pasadena, California 91109-8099
818-306-6281
FAX: (818) 306-6959
Susan. C. Murphy @jpl.nasa.gov

ABSTRACT

The Multimission Ground Data System (MGDS) at NASA's Jet Propulsion Laboratory has brought cost reductions and new technologies to support deep space missions, from early design through flight operations. The MGDS was designed as a generic data system to be easily adapted for multiple missions in various test and flight environments. It is based on a distributed client/server architecture, with powerful Unix workstations, incorporating standards and open system architectures. The distributed architecture allows remote science and mission operations, while also providing capabilities for centralized system control with reliable fault-tolerant configurations. The MGDS has been scaled to handle a spectrum of missions from large planetary flight projects with high data volumes to providing ground support equipment for small instruments in assembly and test.

Our end-to-end mission experience, from early design through test to flight operations, has provided a unique opportunity to work directly with the spacecraft and instrument development and operations teams and understand their requirements and how the MGDS can be adapted and customized to minimize operations costs. By streamlining our development process, we have been able to integrate new capabilities and changes literally overnight in a concurrent engineering approach, even as our system has grown to over two million lines of code.

The design methodology is based on the adaptation and integration of a set of core building blocks into various system configurations with a customized user interface for different deep space missions and operations interfaces. The experience obtained in adapting the MGDS for eleven JPL deep space missions and instrument projects has evolved our ability to build a mission-unique data system at a very low cost. Cost reductions have come from leveraging the engineering knowledge base of a multimission development and operations team, reusing multimission software, and engineering centralized system configurations with fault-tolerant hardware components.

This paper will discuss the development, adaptation, and operation of the MGDS in providing low-cost mission-unique information systems for testing and operating JPL deep space missions. It will focus on the system architecture and engineering of the spacecraft telemetry and command components of MGDS including mission-unique telemetry data processing, storage, and distribution; data simulation and engineering data analysis; and spacecraft

command generation, tracking and verification.

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